TARANAKI REGIONAL COUNCIL

TARANAKI
WHERE WE STAND

STATE OF THE ENVIRONMENT REPORT 2009

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State of the Environment Report 2009

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David MacLeod (Chairman) and Basil Chamberlain (Chief Executive), Taranaki Regional Council.

MESSAGE FROM THE CHAIRMAN AND CHIEF EXECUTIVE

We have great pleasure in presenting to you, the third state of the environment report for Taranaki. It reports on current environmental conditions and trends since monitoring programmes began.

It is not that many years ago, at the time of the creation of the Taranaki Catchment Commission in 1970 in fact, that most wastes from dairy farms discharged directly into the nearest watercourse. That meant that the untreated waste generated by tens of thousands of cows was washed into the region's rivers and streams every day. Not only that, there were no fewer than 43 dairy factories around the region, almost all of them built alongside rivers which they both drew water from, and discharged wastes into.

Today, every dairy farm in Taranaki operates under a regularly monitored discharge permit that does not allow discharge of untreated waste directly into any stream, and the rationalisation of the dairy industry means that there is now just one (large) dairy factory that discharges a strictly-controlled discharge of treated waste into the Tasman Sea through a long outfall.

Equally, it's not that many years ago, that possum numbers in Taranaki were high – competing with cattle for grass and posing a risk of Bovine TB, and severely impacting on biodiversity. Today, possum numbers, particularly on the ring plain, are very low, thanks to the joint efforts of all the landowners in the Council's self-help possum programme and the Department of Conservation.

The information contained in this report draws on comprehensive state of the environment monitoring programmes put in place by the Taranaki Regional Council mainly in the mid 1990s. It also draws on information from other agencies involved in environmental management in Taranaki: the three district councils, the Department of Conservation, the Ministry for Fisheries and many other agencies and community-based groups. This highlights that managing the environment takes a collective response from a whole range of agencies and individuals.

Many state of environment monitoring programmes have now been in place for a sufficiently long period of time that the data can be analysed for statistically significant trends. This is important because it provides us with scientifically robust measures of how the environment is changing.

Overall, the report shows that the health of our rivers and streams – an important issue for Taranaki – does decrease down catchments, as would be expected in an intensively farmed region, but significantly, over time, it is either not changing or has measurably improved. This is despite expansion and intensification of our agricultural sector over the past five to 10 years. Positive movements towards sustainability continue in our erosion-prone inland hill country. Improvements in air emissions from our major industries have continued over the last five years and, by all measures, we in Taranaki enjoy excellent air quality. The report shows similar results for coastal waters and bathing beaches.

Biodiversity, on land, in fresh water and on the coast, is an emerging issue, and much good work is being undertaken by many people from all corners of the region to combat the pressures on our biodiversity from land development and invasive pest plants and pest animals. Residents and visitors to Taranaki enjoy marvellous landscapes and natural and physical amenities. Our historic heritage is well preserved in many fine buildings and other historic places. Taranaki is working hard to manage the waste it generates, although there is always scope for innovative solutions. Energy production and efficiency are key features of Taranaki, the energy province of New Zealand.

The science is one thing, and basing decisions on sound, robust scientific monitoring is crucial, but equally important is the perception of people out and about in the environment, living their lives, every day. Almost nine in 10 residents (87%) of Taranaki recently surveyed are satisfied with the management of the natural environment. This is an overwhelming endorsement indeed.

The positive outcomes in this report towards achieving sustainable management have

not come about by mere good fortune or by accident. The Taranaki community can feel justifiably proud of the efforts it has made in recent years to ensure that Taranaki's natural resources – vital to our economic and social well-being – are managed for the benefit of present and future generations. These efforts have come at some considerable effort, hard work and serious money. It has been conservatively estimated that over the past five years environmental capital investments on water resources, air and noise, land management, energy efficiency and environmental services totalled $216.7 million – almost two and a half times the expenditure identified in 2002 for the previous five-year period. Local actions by the community, both proactive and reactive, are perhaps the single most important change towards sustainable development in Taranaki. These are illustrated in this report through dozens of stories highlighting individuals doing their bit for the environment. We know they are just the tip of the iceberg.

However, Taranaki's clean, green image must never be taken for granted. This report does raise concerns regarding the effects of continued intensification of our dairying industry on soil compaction, modification of stream and wetland habitats for land development, and nutrient run-off from pasture with effects on water quality in the lower reaches of our rivers and streams. These pressures will intensify with continued growth in our agricultural sector. They will require ongoing attention and responses. Restoring the riparian vegetation along the length of our rivers and streams is our biggest challenge – to fence and plant along waterways that cumulatively could stretch from Auckland to Sydney and back again.

The Taranaki Regional Council is greatly heartened by the extent to which the Taranaki community has moved to embrace environmental stewardship and the concept of sustainability. This bodes well for meeting future issues that will almost certainly challenge us.

The Council believes that sustainable development – a balanced, integrated approach to development that ensures we look after people and the environment in the long term – is the key to prosperity. This will involve working alongside other environmental agencies, farmers, landowners, industries and businesses to bring about practical, positive and permanent results over the next five years and in the decades beyond.

ACKNOWLEDGEMENTS

Many people and organisations have assisted in the production of this report. The Taranaki Regional Council would like to thank the following organisations and individuals for their assistance.

Contributions for the report were provided by staff from: Stratford District Council; South Taranaki District Council; New Plymouth District Council; Department of Conservation; Ministry of Fisheries; and the Queen Elizabeth II National Trust.

Research was commissioned for the report from Landcare Research and Business and Economic Research Limited. Many of the photos were taken by Rob Tucker, with others sourced from the Taranaki Regional Council, Department of Conservation, The Taranaki Daily News and other groups and individuals.

Susette Goldsmith provided editorial services.

Graham McBride, from NIWA is specifically acknowledged for undertaking a peer review of the Fresh Water chapter.

The following agencies and individuals provided information for the research undertaken by Business and Economic Research Limited: Methanex New Zealand Limited; Swift Energy (New Zealand) Limited; Shell Todd Oil Services Limited; Tasman Oil Tools Ltd; Olex New Zealand Limited; Ravensdown Fertiliser Limited; Taranaki By-Products Limited; Riverlands Eltham Limited; Clelands Timber Limited; Ballance Agri-Nutrients (Kapuni) Limited; PCL Industries Limited; MCK Metals Pacific Ltd; ABB Limited; C&O Concrete Products Ltd; Technix Group Limited; Firth Industries Ltd; Taranaki Galvanizers Ltd; Fitzroy Engineering Group Limited; Allied Concrete; Bulk Storage Terminals Limited; Stratford High School; Weatherford New Zealand Limited; Fonterra Co-operative Group Limited; Liquigas Limited; New Zealand Oil & Gas Limited; Hooker Bros Holdings Ltd; Sandford Bros Limited; New Plymouth New World; Pak N Save; Hawera Rewinds; Independent Blast Services; Inglewood Metal Limited; Gough Gough & Hamer Limited; Hurlstone Earthmoving Limited; Inglewood Golf Club; La Nuova Ltd; Vector Gas Ltd; Kibby Metal Pressing Limited; Stresscrete; Graham Harris (2000) Limited; Austral Pacific Energy Ltd; Mainfreight Transport Ltd; Manukorihi Golf Club; G R & L J Jones; Taranaki Jockey Club; Gully Rock Limited; Powerco Limited; Matador Meats; Toll NZ Consolidated Ltd; Osflo Spreading Industries Limited; Dow AgroSciences (NZ) Limited; Shaun Pattinson; Oaonui Water Supply; Vid Pro Services Ltd; Taranaki Drum and Pallet Recycling; South Road Quarries; Tyco Flow Maintenance; The New Zealand Transport Agency; Downer EDi Works Limited; Auto Lodge Motor Inn; Plymouth Hotel; Falcon Engineering Ltd; Brian Crawford Contracting Limited; Ferndene Quarries Limited; Greymouth Petroleum Limited; Fulton Hogan Limited; Blast It; Clark & Rogers Limited; Halliburton New Zealand Limited; B J & L B Bishop; Berridge Pet Food; D M & D L Bourke; Chevron New Zealand; AB & DM Sybrandy Contracting Limited; Dick Sybrandy Limited; ALSCO NZTS New Zealand; New Plymouth Quarries Ltd; Meadowvale Stud Farm Limited; TrustPower Limited; New Zealand Oil Services Ltd; AA Contracting Ltd; Winstone Aggregates Limited; Pacific Natural Gut String Company Ltd; A J Cowley Ltd; Howard Wright Limited; Port Taranaki Limited; Taranaki Sawmills Ltd; L A Chatterton (Waitara) Ltd; The Kiwi Butcher; BTW Company Ltd; Dan Cosgrove Ltd; Mountain House Motor Lodge; Egmont Seafoods Limited; Te Ngutu Golf Club (Inc); M-I New Zealand Ltd; PEL Waste Services Limited; Vector Gas Limited; Zelam Limited; Waitara Golf Club; Silver Fern Farms Limited; Whitaker Civil Engineering Limited; New Zealand Energy Limited; Westwill Properties Limited; Origin Energy Resources (Kupe) Limited; Wai-iti Beach Camp Limited; Vickers Quarries Ltd; Hawera Golf Club (Inc); Summit Quinphos (NZ) Limited; Contact Energy Limited and TBS Farnworth Ltd.

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EXECUTIVE SUMMARY

Pukearuhe and Whitecliffs, North Taranaki.

Under the Resource Management Act 1991, regional councils are required to monitor the overall state of the environment of the region. Monitoring the state of the environment is important because it tells the Council and the wider community how successful we have been as a community in promoting the sole purpose of the Resource Management Act – the sustainable management of our natural and physical resources.

This is the third state of the environment report for Taranaki – the earlier reports were prepared in 1996 and 2003. Such reports help us answer questions such as: 'Is the quality of our environment improving or deteriorating?' 'Have our policies and programmes been effective in promoting sustainable management?' 'What standard of environmental quality do we want in Taranaki and what changes, if any, are required?'

The Taranaki environment is managed by a number of organisations, not just the Taranaki Regional Council. For that reason this report has attempted to incorporate monitoring from other agencies, such as the Department of Conservation (DOC), the New Plymouth, Stratford and South Taranaki district councils, the Ministry for Fisheries and the Ministry of Agriculture and Forestry, and from community groups.

The report is organised around the core resources of land, fresh water, coast and air as well as landscape, natural and built heritage and amenity values, natural hazards, waste and energy.

Chapter 1 introduces the report. It describes the purpose and content of the report and how information is organised and presented.

Chapter 2 describes the physical, economic and social characteristics of the region. This is important because managing natural and physical resources and the environment takes place within, and is influenced by, these wider physical, economic and social circumstances.

Each of the chapters that follow covers each section of the environment such as land, fresh water, coast and air. Biodiversity is considered under each of these environment types. Additional chapters consider landscape, historic heritage and amenity values, natural hazards, waste and energy. Each chapter:

- begins with an opening scene-setting introduction which explains why this part of the environment is significant for Taranaki people and what the major pressures on the environment are;
- describes the current state of each aspect of the environment – core information is presented on the state of the environment and key trends or changes over time;
- outlines the management responses to environmental conditions now and in the future. Information is presented on what is being done now to address issues raised in the preceding text and what might be done in the future;
- provides a summary of progress in implementing regional objectives and policies in relation to the chapter topic; and
- provides regional comparisons where relevant information is available. This information enables comparisons to be made between environmental conditions and trends in Taranaki and other parts of New Zealand.

Much of the information contained in the report is based on comprehensive state of the environment monitoring programmes established by the Council in the mid-1990s. These programmes have been purpose-built for state of the environment monitoring and have now been running for sufficient lengths of time to enable statistical testing of trends in the data.

The report generally presents Taranaki as having a high-quality environment, which is valued and well-managed by the community.

Like any report card there are positives and negatives. In summary, the report concludes that:

- 87.4% of the hill country is being used sustainably with no significant soil erosion problems. Sustainability in the hill country has increased by 2.4% over the past 5 years, with less land in sheep and beef farming, and 30.8% of hillcountry land now reverting to scrub.
- 58% of privately-owned hillcountry land, and 41% of privately-owned sand country, is now included in the Council's sustainable land management programme;
- 97% of Taranaki soils have only low to moderate vulnerability to soil compaction and while there is evidence of soil compaction on some Taranaki farms this is usually only under wet winter conditions and is generally reversible with appropriate pasture and stock management. There do not appear to be any significant problems with soil carbon content, phosphate, nitrogen, cadmium or residual or cumulative agrichemicals in the soils of the region;
- 757 potentially contaminated sites have been investigated with no contamination found to be present, 16 sites have been remediated and 480 sites contain hazardous substances, but not at levels that would pose an unacceptable environmental risk, or are currently being managed so that there is no unacceptable risk;
- in terms of biodiversity protection, 20% of the region is in public conservation land and managed by the Department of Conservation to safeguard biodiversity values. Furthermore, predator control programmes, aimed at protecting threatened birds, are undertaken by a range of agencies and community groups. Possum numbers are maintained at low levels through both the Taranaki Regional Council's self-help possum control programme on the ring plain, and the Department of Conservation programmes in priority conservation areas;
- restoration of riparian vegetation has been shown to result in increased plant and bird biodiversity;
- measures of freshwater ecological health, such as the communities of invertebrates living in streams, are good to excellent in the upper catchments where there is more stream bank vegetation cover, but only fair further down catchments where land use is more intense. However, over the past 12 years, ecological health has demonstrably improved at a number of sites, including in the middle and lower reaches of catchments, and has not demonstrably deteriorated at any sites.
- the region's fresh water usually meets the bacteriological guidelines for swimming, except after floods or in some intensively farmed catchments. Taranaki rivers are naturally high in phosphorus and so do not meet national guidelines, and furthermore, phosphorus levels are generally increasing. Nitrogen levels meet guidelines in the upper reaches of catchments, but not further down, where impacts of agriculture are more intense.
- the Council's riparian management programme is designed to address these issues with the preparation of 2,009 riparian plans covering 10,818 km of stream bank. Landowners have fenced 504 km of stream bank and planted 426 km, which, added to exisiting fencing and planting means 60% of stream bank on the ring plain is fenced, and 43% is vegetated. Council will continue to work with landowners to fence and plant streams to meet the 2015 target of 90% of riparian plans implemented.
- measures of levels of organic pollution (BOD), bacteriological pollution (faecal coliforms and enterococci) and toxicity (ammonia) are now stable regionally, after past improvements.
- most of Taranaki's 530 streams and rivers are not under any allocation pressure although interest in water abstraction for irrigation has increased in recent years. More than 20% of the average low flow is allocated for use in the nine most highly allocated catchments, but flows at which abstraction must cease are set to safeguard ecological values;
- although there has been an increase in the amount of groundwater abstracted, there is not a significant pressure on groundwater levels;
- groundwater quality in Taranaki is generally high with no problems associated with pesticide residues, microbial contamination or saltwater intrusion, and groundwater quality, in terms of nitrate levels, is generally improving;
- in terms of freshwater biodiversity, regionally significant wetlands have on the whole been adequately protected through formal mechanisms and proactive protection works such as fencing and planting, but small wetlands and streams are under pressure from land improvement. Of 108 structures that have the potential to impede fish passage, 49 provide adequate fish passage, two have been removed and the others need remedial work;
- coastal water quality for swimming is excellent, the product of an exposed coastal environment and few direct point source discharges;
- with the reduction in the number of point source discharges and better treatment of wastewater, the greater influence on coastal water quality is from rivers and streams discharging the cumulative effects of land use within their catchments to the sea;
- rocky shore ecological health is reasonably stable at most sites monitored;
- the rugged high-energy nature of the Taranaki coastal environment means that much of the coastal area has retained its distinct natural character and so far levels of development are not impacting on that character;
- biodiversity protection on the coast has been enhanced over the past five years with the establishment of two new marine reserves;
- ecological conditions in both the Tongaporutu and Waitōtara estuaries, where long term monitoring is carried out, are generally stable although they can be affected by severe floods;
- the legally protected subtidal habitats around the Sugar Loaf (Ngā Motu) Islands provide shelter for a greater diversity and higher numbers of fish and other organisms than neighbouring areas of reef;
- there is a range of disparate views on trends in local fish stocks;
- public access to both freshwater and coastal environments is generally good, as illustrated by the popular New Plymouth coastal walkway;

- overall air quality in the region is excellent enabling the Taranaki community to enjoy one of the healthiest regions in New Zealand. Significant improvements have been made in the quality of point source discharges;
- natural features and landscapes, and amenity and heritage values are of a high quality;
- over the past five years there has been continued provision, development or upgrading of a number of community recreational and cultural facilities;
- over the past five years there have been four significant flood events, a number of minor events and one period of significant drought over the summer of 2007-08;
- the swarm of tornadoes that hit Taranaki in July 2007 triggered a state of emergency. The emergency response systems functioned well;
- while the whole region is now serviced by just one well managed landfill, at Colson Road in New Plymouth, the quantity of waste discharged has increased by 20%; and
- Taranaki produces all of the oil and gas produced in New Zealand and uses 3.2% of the total energy used, with industry using 38% of all energy consumed in Taranaki, and households using the next greatest proportion (28%).

The report finds that the Taranaki community has made a substantial investment in protecting and enhancing the environment. Capital investment by the Taranaki community has been estimated in excess of $216 million in the period 2002-2007 compared with $91 million in the preceding five-year period. Annual operating costs are of the order of $41.8 million ($28.8 million in the preceding four year period). Total spending on the environment by the Taranaki community has been conservatively estimated at $85.1 million per annum. This is an increase of $28 million per annum from the $57.1 million per annum reported in our 2003 report. The high quality environment enjoyed by residents and visitors alike has therefore not come about by accident but by the co-operative and increasingly proactive actions of the community.

The combined effort of all of the policies, programmes and actions described in this report, representing the combined effort of the Taranaki Regional Council, district councils, the Department of Conservation, the Ministry of Fisheries, community groups, iwi and landowners, is a significant step along the path to sustainable management in Taranaki. The Council's slogan of 'working with people, caring for our environment' summarises the approach believed to be critical to successful environmental programmes in the future.

CHAPTER 1

INTRODUCTION

Photo: Rob Tucker

THE PURPOSE OF THE REPORT

Under the Resource Management Act 1991 (RMA) regional councils like the Taranaki Regional Council are required to monitor the overall state of the environment of the region. Monitoring the state of the environment is important because it tells the Council and the wider community how successful we have been as a community in promoting the sole purpose of the RMA – the sustainable management of our natural and physical resources. While the report looks back on environmental trends and changes over the past five to 10 years or more, its fundamental outlook is forward looking. It will help us answer such questions as:

- in what direction is our environment heading?;
- have our policies and programmes been effective in promoting sustainable management and will they continue to be effective in the future?; and
- what changes are required and what standard of environmental quality do we wish to see in Taranaki?

The purpose of this report is therefore to provide high quality environmental information that is accessible and understandable to the Taranaki community at large, and upon which sound resource management decisions can be based in future.

THE CONTENT OF THE REPORT

The content of this report primarily reflects the responsibilities that local government has under the RMA. Under the RMA regional councils are responsible for:

- the control and management of water, air and land (in relation to land for the purposes of soil conservation and the avoidance or mitigation of natural hazards);
- the control of the coastal marine area (in conjunction with the Minister of Conservation);
- the control of the discharge of contaminants into the environment;
- the control of the use of river and lake beds; and
- the establishment and implementation of policies and methods for maintaining indigenous biological diversity.

District councils are responsible for:

- the integrated management of the effects of the use, development or protection of land such as development and subdivision;
- the avoidance or mitigation of natural hazards;
- the management of storing, using, disposing and transporting hazardous substances; and
- the maintenance of indigenous biological diversity.

Objectives and policies for managing resource management issues and land use effects that are of regional significance ie: issues of importance to the region as a whole are set out in the *Regional Policy Statement for Taranaki 1994* and the reviewed *Proposed Regional Policy Statement for Taranaki* released in 2006. Some of these issues, such as those dealing with natural features and landscapes, historic heritage and amenity values and the natural character of the coast, arise from the effects of land use which are dealt with largely by district councils. However, the Taranaki Regional Council has adopted policy on these issues in accordance with its statutory functions.

While Local Government manages a diverse range of responsibilities in relation to the environment as a whole, some aspects are managed by central government agencies such as the Ministry for Agriculture and Forestry, the Ministry of Fisheries and the Department of Conservation. Where information was easily obtained on environmental matters that are not strictly under the management of Local Government, such as the management of fish stocks, or changes in the condition of the conservation estate, this has been included in this report. However, the primary focus is reporting on the state of those aspects of the environment managed under the Resource Management Act.

The report has 11 chapters as follows:

1. INTRODUCTION

The Introduction provides an outline of the purpose, content and organisation of the report.

2. TARANAKI – THE PEOPLE AND THE PLACE

This chapter contains a brief outline of the natural and physical features of the region, its human history and development and social and economic characteristics. Such information provides a context vital for understanding environmental conditions, pressures and responses in Taranaki.

3. LAND, SOIL AND BIODIVERSITY

This chapter addresses soil erosion and soil health issues and the management of contaminated sites and hazardous substances. Biodiversity, or biological diversity, means the variability among living organisms and the ecological complexes of which they are a part. The biodiversity section of this chapter looks at biodiversity on land.

4. FRESH WATER

The chapter on fresh water considers a wide range of issues relating to fresh water, rivers and lakes. Reporting on water quality considers the effects of point and diffuse source discharges on water quality in rivers, streams and lakes and forms a major part of this chapter. Water quantity is addressed from the point of view of water flows, use and availability. Also reported on are groundwater quantity and quality. Fresh water biodiversity, in terms of ecosystems (rivers and wetlands), invertebrates and fish, is considered. Finally, public use and access to rivers and lakes are examined.

5. COASTAL AND MARINE ENVIRONMENT

This chapter discusses coastal water quality, natural character of the coast, biodiversity of the coastal marine area and public use and access to the coast. Coastal erosion is addressed in the Natural Hazards chapter.

6. ATMOSPHERE

This chapter addresses overall air quality in Taranaki as well as issues surrounding greenhouse gases and climate change.

7. LANDSCAPE, HERITAGE AND AMENITY VALUES

This chapter looks at Taranaki's natural landscape features, historic heritage resources such as our historic buildings and places and archaeological sites and amenity values – those things that make up or detract from an enjoyable and pleasant living environment.

8. NATURAL HAZARDS

The chapter on natural hazards reports on the main natural hazards in Taranaki – flooding, volcanic activity, earthquakes, high winds and land instability and erosion, including coastal erosion.

9. WASTE

This chapter looks at the situation with regard to waste and how it is managed in Taranaki.

10.ENERGY

This chapter looks at energy production, distribution and use in Taranaki. It looks at both renewable and non-renewable sources of energy.

11.TOWARDS SUSTAINABLE DEVELOPMENT

This concluding chapter draws together the underlying directions of and approaches to managing the environment described in the previous chapters and comments on what this means for sustainable development in future.

HOW THE REPORT IS ORGANISED

Each of the chapters 3 to 10 covers particular aspects of the environment, for example, land and soil, fresh water and the coastal and marine environment. Each chapter:

- begins with an opening scene-setting introduction which explains why this part of the environment is significant for Taranaki people, and what the major pressures on the environment are;
- describes the current state of each aspect of the environment – core information is presented on the state of the environment and key trends or changes over time;
- outlines the management responses to environmental conditions now and in the future. Information is presented on what is being done now to address issues raised in the preceding text and what might be done in future;
- provides a summary of progress in implementing regional objectives and policies in relation to the chapter topic; and
- provides regional comparisons where relevant information is available. This information enables comparisons to be made between environmental conditions and trends in Taranaki and other parts of New Zealand.

The organisation of the report follows the Pressure-State-Response model widely adopted overseas in state of the environment reporting. The report format is similar to that adopted for the Council's previous state of the environment reports in 2003 and 1996. However, the format has been revised slightly by bringing to the front of each chapter, the values of and pressures on that aspect of the environment, that in previous reports were spread throughout each subsection of each chapter. This provides readers with a broad context for each chapter, for example on fresh water, before information is presented on the state or condition of the environment and management responses.

PRESENTATION OF INFORMATION

The Taranaki Regional Council has had the benefit of another five years of data collection and analysis since it last reported in 2003. In a number of cases data has now been collected over a sufficiently long time period specifically for state of the environment monitoring purposes to enable statistically robust, long-term trend analysis to be undertaken. This was generally not the case for the Council's 2003 report. Trend analysis can indicate with a high degree of certainty whether the data collected is showing an improvement or deterioration (or no change) in environmental conditions.

The New Plymouth, Stratford and South Taranaki district councils have assisted in the preparation of this report by providing information on environmental conditions and trends for which they are responsible. Other agencies or organisations such as the Department of Conservation and Ministry of Fisheries have similarly assisted in this way. Dozens of businesses, industries, individuals and community groups have contributed information on their environmental work including information for case studies and information on their level of spending on environmental improvements over the last five years.

Information provided from all such sources has been a valuable addition to the report enabling the Council to present relevant and up-to-date information to the community. Those who have contributed to this report through providing information or in other ways are acknowledged at the beginning of the report.

Every attempt has been made to present the information in a form that is understandable to the community. At the beginning of most chapters there is a box entitled 'At a glance'. This provides a very short summary of the key points contained in the chapter. Throughout the chapters, information is provided with a reference (footnote) to reports or databases containing more detailed information for those who want it. Wherever possible, maps, diagrams and photographs have been used to demonstrate environmental conditions and trends. Case studies of particular programmes or examples are presented for added interest and to showcase practical examples of the Taranaki community 'at work' on protecting and enhancing the environment in which we live.

SUMMARY REPORT

Much of the information presented in the following report is of technical and scientific nature. Furthermore, the report has endeavoured to be comprehensive, covering environmental issues of interest or concern to the Taranaki community. It is therefore a relatively large document. The Council has also summarised the main findings of the report to present to a wide audience including schools and community groups.

WEBSITE

The full report and summary document are available on the Taranaki Regional Council website www.trc.govt.nz.

CONTACTING THE TARANAKI REGIONAL COUNCIL

If you wish to contact the Council on matters raised in the report you can do so by

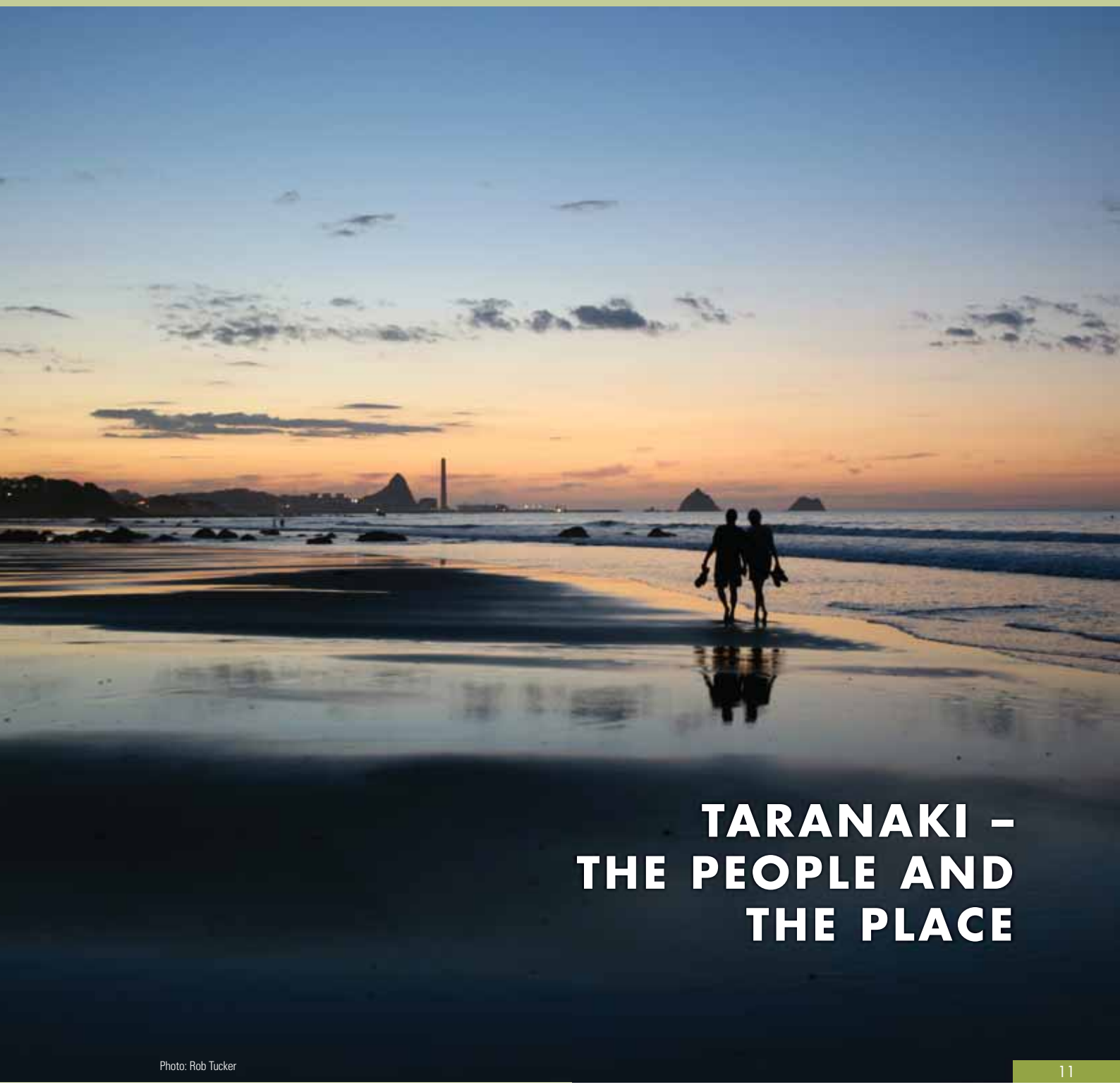
Phone: 06 765 7127 or 0800 736 222
Fax: 06 765 5097
Email: publications@trc.govt.nz

by writing to the Council at:

Taranaki Regional Council
Private Bag 713
Stratford

or by calling into the Council offices at 47 Cloten Road, Stratford.

CHAPTER 2



TARANAKI – THE PEOPLE AND THE PLACE

Photo: Rob Tucker

2.1 NATURAL AND PHYSICAL FEATURES

The Taranaki region lies on the west coast of the North Island of New Zealand. It extends from the Mohakatino catchment in the north to the Waitōtara catchment in the south and inland to the boundary of, but not including, the Whanganui catchment. The region extends 12 nautical miles (approximately 22 km) offshore to include the waters of the territorial sea. There are three districts within the region: the New Plymouth, Stratford and South Taranaki districts (Figure 2.1).

The land area of the Taranaki region comprises 723,610 ha, which is approximately 3% of New Zealand's total land area.

LANDFORMS, SOILS AND RIVERS

The Taranaki region consists of four distinct landforms, each of which requires a different type of environmental management (Figure 2.2). These are:

- the volcanic landscape and ring plain centred on Mount Taranaki;
- the dissected Taranaki hill country;
- the coastal and inland marine terraces of the North and South Taranaki coast; and
- the coastal and marine environment.

Many rivers and streams flow across the landscape. Of these, some 530 are named. The main rivers and streams in Taranaki are shown in Figure 2.3.

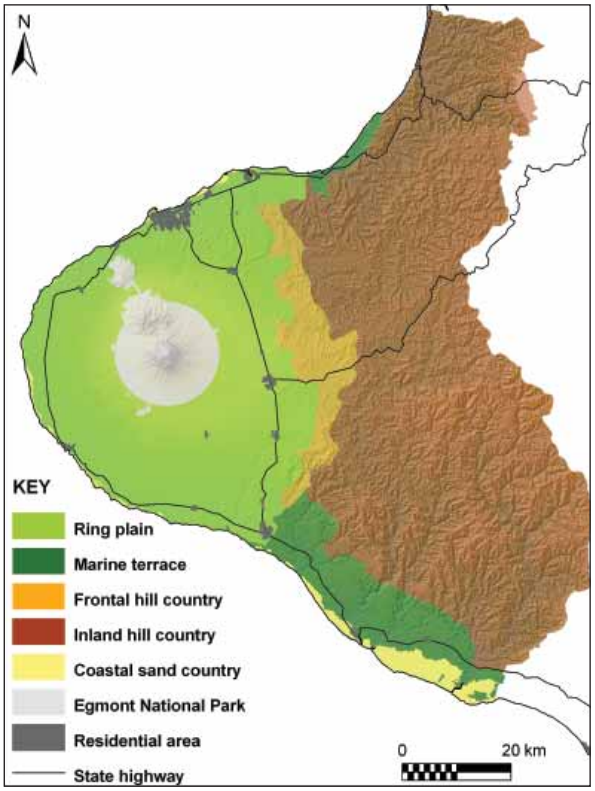


Figure 2.2: Landforms of the Taranaki region.

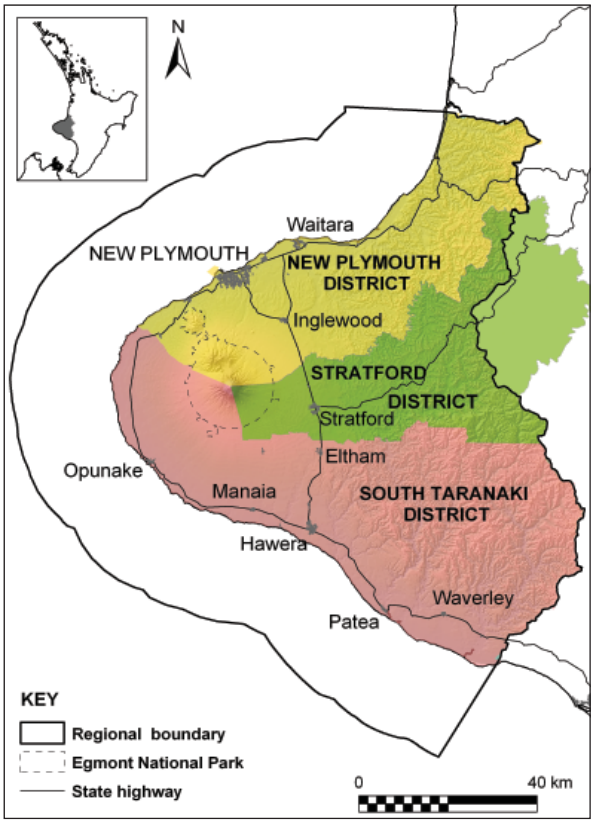


Figure 2.1: The Taranaki region: location and local government boundaries.

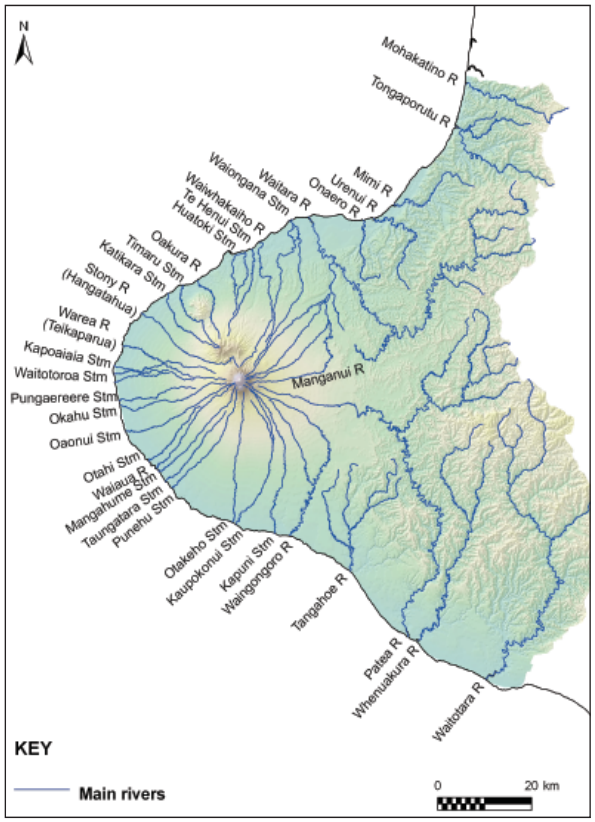


Figure 2.3: Main rivers and streams of the Taranaki region.

VOLCANIC LANDSCAPE AND RING PLAIN

The volcanic cone of Mount Taranaki (2,518 m) dominates the Taranaki landscape. It is the most recent of a number of andesitic volcanoes that have developed in western Taranaki over the past two million years. The Sugar Loaf Islands, Pouakai and Kaitake ranges are the remnants of older volcanoes which are now extinct. Mount Taranaki is, however, still considered (in geological terms) to be active, even though it has not erupted in the past 250 years.

Over the past 50,000 years the cone of Mount Taranaki has collapsed intermittently causing very large and mobile debris avalanches and lahars (mudflows) to sweep down the mountain. As each volcanic cone was built up by successive eruptions, natural erosion has stripped away the volcanic debris and redistributed it in a 'ring' around the volcano base creating the Taranaki ring plain.

The soils of the ring plain are mostly deep, free-draining, fertile, volcanic ash soils known as yellow-brown loams. These soils support intensive pastoral farming, particularly dairying, which is most intensive on the flatter land in South Taranaki.

Over 300 rivers and streams flow from the flanks of Mount Taranaki in a distinctive radial pattern. These streams are characterised by short narrow catchments of steep gradient, normally well incised into the volcanic ash and debris flow material of the ring plain. Egmont National Park acts as a huge reservoir, supplying a steady flow of water to the ring plain streams, even during prolonged dry periods, as well as maintaining high water quality in those streams. The rivers that flow from the mountain are extensively used by the community for agriculture, industry and community water supplies, and for a wide range of recreational purposes.

Mount Taranaki dominates the Taranaki landscape.

HILL COUNTRY

The Taranaki hill country lies to the east of the ring plain. The inland terraces and frontal hill country are of strongly rolling topography and largely retain the volcanic ash soils, while the inland hill country is steeper and more deeply dissected. The underlying geology of the Taranaki hill country is not volcanic, but consists of older sedimentary rocks – mudstones, siltstones and sandstones known locally as 'papa'.

The soils of the inland hill country are mostly shallow soils that have developed on steep, relatively unstable slopes. The composition and depth of soils are extremely variable, and often erosion has prevented the development of a mature soil. While the hill country is more prone to erosion it can support both pastoral farming and commercial forestry when managed in accordance with the physical limitations of the land.

Eastern hill country from the Mangamingi Saddle.

The rivers of the hill country have short tributaries contained by narrow valleys. In general, these rivers carry high sediment loads.

MARINE TERRACES

Marine terraces raised by tectonic activity extend along the North and South Taranaki coasts. In the far north only a narrow strip of coastal plain is preserved, but between Waitara and Lepperton in the north and from Hāwera south, the terraces extend up to 20 km inland. Along the coastline, cliffs ranging from three to 60 m in height have formed from high energy wave action. In the Whitecliffs area of North Taranaki, some cliffs are over 200 m high.

The volcanic deposits on the old terrace surfaces are deep and, because they are further from the volcanic centre, are finely textured. The soils of these areas are classic volcanic loams and are among the most versatile and productive in the region.

Sand accumulation is concentrated near river mouths, particularly along the southern coastline, where dunefields extend inland for several kilometres. Less than 2% of the Taranaki region is classified as coastal sand country. Because of their weak structure these soils are susceptible to wind erosion if the vegetation cover is disturbed.

COASTAL ENVIRONMENT

The Taranaki coastline is exposed to the west, and as a consequence, high energy wave and wind conditions dominate the coastal environment. There are few areas of sheltered water beyond the estuaries, such as those of the Tongaporutu, Waitara and Pātea rivers, and the confines of Port Taranaki.

Almost the entire Taranaki coastline is subject to varying rates of erosion from waves and wind. This has resulted in a predominantly cliffed coastline, with the western coast characterised by boulder cliffs and offshore reefs derived from erosion of lahar and other volcanic material. In North and South Taranaki, erosion of marine sediments has resulted in a coastline of almost continuous papa cliffs and the famous black sand beaches.

Rugged North Taranaki coast and marine terrace.

CLIMATE

Taranaki's climate is determined by its westerly position, its mid-latitude location, and its topography. Taranaki lies in the path of weather systems moving east from the Tasman Sea. The region's climate is generally sunny and windy, with moderate temperatures and regular rainfall throughout the year.

Rainfall varies markedly throughout the region, ranging from less than 1,400 mm in the coastal areas to in excess of 8,000 mm at the summit of Mount Taranaki. Rainfall also increases with elevation in the Taranaki hill country (Figure 2.4).

Taranaki may experience heavy rainfall events, particularly from warm, moist westerly and northerly air masses moving on to the region. In the past six years 2002-03 to 2007-08, Taranaki received 102 'special weather warnings' from the Meteorological Service, mostly for heavy rain. Significant heavy rains caused flooding in Waitōtara township in February 2004. Other heavy rainfall events in the Waitōtara and neighbouring catchments in July and October 2006 threatened farmland and roading infrastructure.

Very heavy rain in New Plymouth and surrounding areas in May 2007 caused localised flooding, and heavy rain and flooding in April 2008 caused damage to rural properties, bridges and roads in coastal Taranaki. Generally however, heavy rain does not result in major flooding or property damage as the region's river catchment networks are well adapted to periodic heavy rain events.

The mean (average) daily temperatures for Taranaki in January and July are shown in Figure 2.5 and Figure 2.6.

Minimum temperatures are lower at inland locations than at coastal locations due to higher elevations inland and their greater distance from the sea - with its moderating effect on extreme temperatures. At sheltered inland sites the daily temperature variation is larger than in coastal areas.

Taranaki's generally moderate summer and winter temperatures are combined with average to high sunshine hours. Average sunshine hours at New Plymouth Airport total 2,173[1], which are higher than many other New Zealand centres. Centres with higher sunshine hours than New Plymouth include Tauranga, Nelson and Blenheim.

Taranaki is windy, but wind strength varies greatly because of the range of topographical features in the region which influence the extent to which different areas are exposed (Figure 2.7).

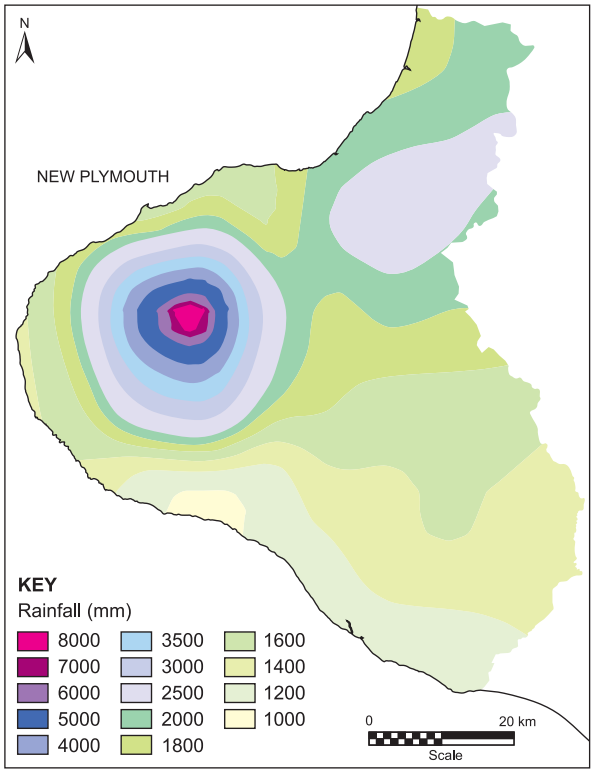


Figure 2.4: Mean annual rainfall (mm).

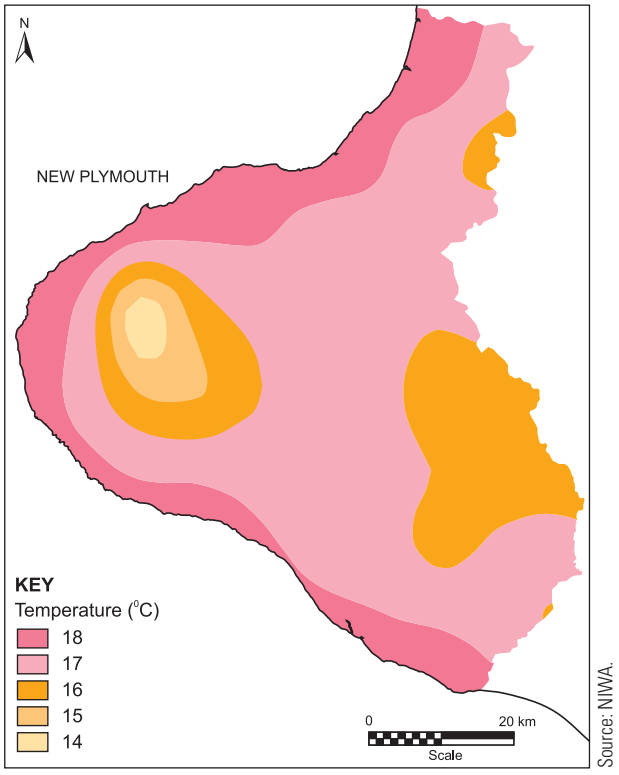


Figure 2.5: Mean temperature (°C), January.

1 Taranaki Weather Services, 2008.

Westerly winds generally predominate in spring and summer, bringing unsettled and showery weather. South-easterlies are often predominant in coastal and exposed areas and bring generally fine weather in Taranaki due to the sheltering effect of the ranges to the east. About 40% of New Plymouth's rain comes with winds from the north or north-east, and high rainfalls about Mount Taranaki are common. However, much of South Taranaki may remain relatively sheltered, with scattered showers or dry conditions. South-westerly winds are common in the cooler months.

The 2007 year produced a number of notable weather patterns or events - being drier, warmer and sunnier than usual. Total rainfall at New Plymouth airport was 1,051 mm, 27% below normal, and the lowest annual total since official records started there in 1944. Stratford's total rainfall of 1,501 mm in 2007 was also the lowest annual total since records began in 1961[2]. At the same time, sunshine hours were 4.5% above average totalling 2,271 hours at New Plymouth Airport.

Across the region, the summer of 2007-08 was one of the driest, warmest and sunniest summers on record. It developed from a strengthening La Nina weather pattern evident from September 2007 onwards, with increasingly dry anticyclonic conditions and north-easterly winds. The temperature in New Plymouth on Sunday 20 January 2008 was 30.2°C, one of the highest recorded in 114 years, and 3.7°C short of the record 33.9°C in January 1865[3].

The average daily maximum temperature in New Plymouth during January 2008 was 24°C, the highest average since 1911.

In the four-month period from 1 November 2007 to 29 February 2008, all Taranaki Regional Council rainfall recorder stations recorded rainfall levels at well below average. Areas south and east of Mount Taranaki, and on the coast, had rainfalls ranging from 42% to 59% of average over the four month period[4]. Significant or severe soil moisture deficits developed in many parts of the region, particularly in South Taranaki, which persisted into March 2008[5]. The prolonged dry spell, the most severe in 30 years, led to the declaration of drought conditions over a large part of the region. Estimates of the financial impact of the 2007-08 drought on the region's economy range from $100 million to $150 million[6].

Near the summit, Mount Taranaki.

Taranaki may occasionally experience high winds or tornadoes. The most significant event in recent years was the swarm of tornadoes that swept across Taranaki on 4 and 5 July 2007, the first of which struck New Plymouth on 4 July 2007. Multiple damaging tornadoes affected coastal and inland Taranaki on 5 July 2007, resulting in a state of emergency being declared. Damage from the tornadoes was estimated at $7 million. The National Institute of Water and Atmosphere's (NIWA) climate summary for 2007 records the Taranaki tornadoes as New Zealand's most significant extreme weather event of the year[7].

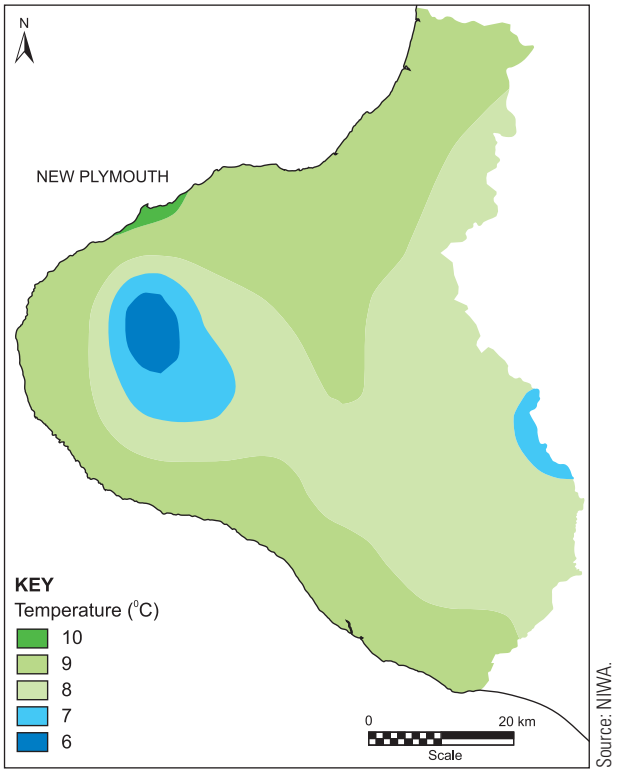


Figure 2.6: Mean temperature (°C), July.

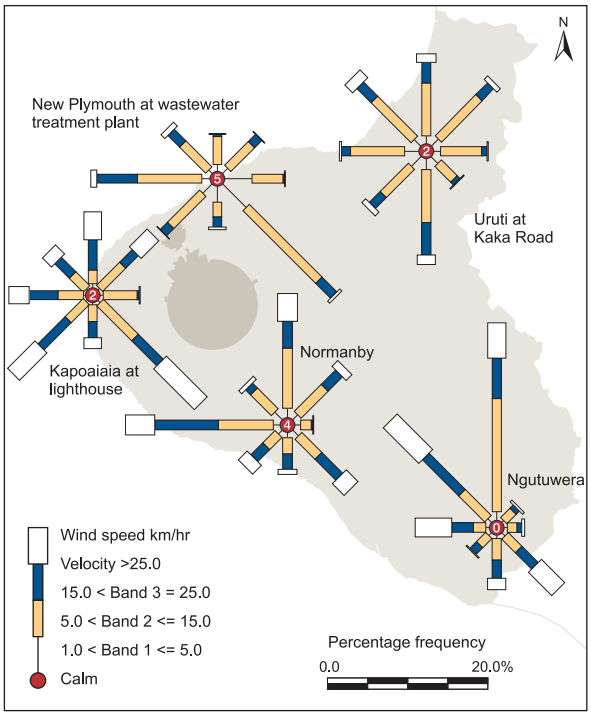


Figure 2.7: Wind roses for five sites in Taranaki.

2 NIWA, 2008. *Climate Summary for 2007.*
3 *Taranaki Daily News,* March 7 2008.
4 Taranaki Regional Council, 2008. *Recount* April 2008 No. 64.
5 NIWA, 2008. *Climate Summary for March 2008.*
6 *Dominion Post,* April 3 2008, page C8.
7 NIWA, 2008. *Climate Summary for 2007.*

LAND COVER

High sunshine hours, coupled with abundant moisture and mild temperatures, foster vegetation growth throughout the region. The climate and subsoils are suited to high producing pastures, with about 60% of the region used for high intensity pastoral farming.

Approximately 40% of the region is in indigenous forest and shrubland, mostly within Egmont National Park and areas of the inland hill country.

2.2 HISTORY AND DEVELOPMENT

The human occupation of Taranaki dates back to at least 800 AD, which is when settlement by ancestors of the present Māori people is thought to have begun. Significant populations settled in coastal areas between Urenui and Waitara. Eight iwi are currently recognised in Taranaki. These are Ngāti Tama, Ngāti Mutunga, Te Ātiawa, Ngāti Maru, Taranaki, Ngā Ruahine, Ngāti Ruanui and Ngā Rauru.

European settlers began arriving from the early 1840s. In 1841, the New Zealand Company purchased a large block of land in what was to become New Plymouth. Settlement was initially concentrated near the coast and land was cleared for cropping and small-scale mixed livestock farming.

Increasing European settlement pressures led to disputes over land ownership and eventually to the Taranaki Wars of the 1860s. In response to Māori 'rebellion' against the Crown, the Government confiscated large tracts of land under the terms of the New Zealand Settlements Act 1863.

From the 1870s, after hostilities had ceased, settlement increased rapidly and began to encroach inland. Coastal areas were easily cleared of the light cover of tutu, flax, toetoe and fern and converted to grazing land. Indigenous forest cover further inland was also cleared and under ideal physical and climatic conditions, dairying became the dominant land use. Surplus dairy products were initially used for local bartering but with the development of refrigerated shipping and new export markets in the 1880s, milk was collected from farms and processed in bulk at creameries and factories scattered throughout the region. By the end of the nineteenth century Taranaki was developing into a highly productive agricultural province.

Agriculture, particularly dairying (and to a lesser extent, sheep and beef farming), was extended and intensified during the first half of the twentieth century, and continues to dominate the local economy. However, in the second half of the twentieth century, oil and gas exploration and development became increasingly important.

Children at play, Ngāmotu Beach.

The Kāpuni gas field was discovered in 1959 and the much larger offshore Māui field was discovered in 1969. These discoveries led to the development of major petrochemical industries in the early 1980s, which continue to operate today. Taranaki remains New Zealand's only commercially producing oil and gas area and an area of continuing exploration activity.

2.3 THE TARANAKI COMMUNITY

Taranaki's population was 104,127 (Table 2.1) at the March 2006 census. This represents a 1.2% increase in population since 2001. This increase in population reversed a 3.5% decline in population between 1996 and 2001, reflecting buoyant economic conditions between 2001 and 2006. Over the past 10 years however, the population of Taranaki has decreased slightly from 106,590 to 104,127 (Table 2.1). Taranaki accounts for 2.6% of New Zealand's population.

Population changes have also varied within the region. The most notable feature has been the continued concentration of population in the New Plymouth District, which in 2006 contained approximately 66% of the region's total population. New Plymouth District's population increased by 3.5% during the 2001-2006 period, after experiencing a population decrease over the previous five years. The 2006 census results show that Stratford District had maintained its 2001 census night population, after experiencing a 6.9% decline in population between 1996 and 2001. South Taranaki District experienced a 3.8% decrease in population between 2001 and 2006 which followed a 5.5% decrease between 1996 and 2001 (Table 2.1).

The general trend has been for a decrease in the population of smaller rural towns and an increase in concentration of population in North Taranaki. This is the result of several factors, including reduced

Table 2.1 Population changes in Taranaki 1996-2006[8].

Local authority	Total population				
	1996	2001	% change 1996-2001	2006	% change 2001-2006
New Plymouth District	68,112	66,603	-2.2	68,901	3.5%
Stratford District	9,543	8,883	-6.9	8,889	0.0%
South Taranaki District	29,133	27,537	-5.5	26,484	-3.8%
Taranaki region	106,590	102,858	-3.5	104,127	1.2%

8 www.stats.govt.nz 2006 *Census of Population and Dwellings, Final Counts.*

employment opportunities in rural areas and small towns through farm amalgamations, closure of dairy processing factories and reduced employment in servicing and other industries, combined with land diversification, lifestyle and retirement opportunities in North Taranaki.

The Taranaki population is both older and younger than the national average, with a higher proportion of children under 15 years of age (21.8%) and adults over 65 years of age (14.8%). This may be due to lifestyle factors, with Taranaki being seen as an attractive and desirable area for family living with good facilities and amenities and affordable housing. The proportion of those in the 20–29 years age group is also lower than the national average (10.5% compared to 12.7% nationally) and may reflect young adults leaving the region for further tertiary education or employment opportunities.

Taranaki's population is less ethnically diverse than the population of New Zealand as a whole. At the 2006 census 77% of Taranaki residents indicated that they belonged to the European ethnic group compared with 67.6% for New Zealand as a whole.

The percentage of Māori within the Taranaki population continues to increase - from 11.9% in 1991, 14.7% in 2001 and 15.8% in 2006. Nationally, Māori make up 14.6% of the population. Those belonging to Pacific (1.4%) and Asian (2.2%) ethnic groups are much lower than for New Zealand as a whole (6.9% and 9.2%, respectively). Those in Taranaki who indicated their ethnicity as New Zealander totalled 13.6% compared to 11.1% nationally[9].

2.4 THE TARANAKI ECONOMY

A notable feature of the Taranaki region is its reliance on the region's natural and physical resources for its economic and social well-being. Farming and other land-based activities continue to play a prominent role in employment and wealth creation while the oil and gas industry is a significant contributor to the regional economy. Since 2004, economic growth in Taranaki has been consistently above the national growth rate with the rate of growth slowing from early 2007. From 2004 to 2006 Taranaki recorded among the highest rates of economic growth in the country[10].

Overall, Taranaki makes up 2.5% of national employment and contributes 2.8% of National Gross Domestic Product (GDP)[11].

Fonterra's milk processing site at Whareroa, near Hāwera.

Modern farm dairy.

AGRICULTURE AND FORESTRY

Over 16% of Taranaki's full-time equivalent labour force is employed in agriculture, compared with 7.5% nationally[12].

Dairying dominates farming in Taranaki, particularly on the ring plain. There are 1,870 dairy herds in Taranaki – 16% of all New Zealand dairy herds with 480,000 dairy cows making up 12.2% of all New Zealand's dairy cows[13]. Milk processing in Taranaki is now concentrated at one site – Fonterra's Whareroa site near Hāwera. At peak production this facility processes over 14 million litres of milk per day. Other major agricultural processing industries are based at Kāpuni (Fonterra Kāpuni), and Eltham (Mainland Products and Pastoral Foods). In addition to direct farm income from milk production, the added value resulting from the processing of milk, whey and cheese manufacturing is a significant contributor to employment.

Sheep and beef farming, concentrated in the hill country, has an important role in the regional economy. Approximately 880 sheep and beef farms in Taranaki stock approximately 679,000 sheep and 131,000 beef cattle. Meat processing works are located at Eltham (Riverlands Eltham Ltd), Hāwera and Waitōtara (Silver Fern Farms Ltd, formerly PPCS).

Overall, agriculture and associated food processing industries contribute almost 20% to regional GDP generating around $850 million in GDP in 2006[14]. The future economic outlook for the agriculture and forestry sectors is positive with rising demands from developing economies overseas for food and forestry products and increasing global food prices.

Exotic forest plantations continue to expand. The region has a suitable climate, good forestry sites and a well-established roading system and port. There has been a marked increase in planted production forestry – from 9,700 ha in 1990 to an estimated 19,350 ha in 2002[15].

PIG AND POULTRY FARMING

Taranaki has some 25 piggeries and 46 poultry farms. The number of pig farms has declined from 35 in 1996. Most pig farming is concentrated in the New Plymouth district.

Taranaki has a significant and expanding poultry industry and is the major poultry meat producing region in New Zealand involving all

9 Statistics New Zealand, 2008. *QuickStats about Taranaki Region.*
10 National Bank Regional Trend Reports.
11 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
12 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
13 Livestock Improvement Corporation, 2007. 2006/2007 dairy statistics.
14 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
15 Statistics, New Zealand, 2004. 2002 *Agricultural Production Census.*

Poultry production operation, Bell Block.

aspects of the industry from breeding and growing to production and distribution. Operations are concentrated in North Taranaki with the major processing facility at Bell Block. The poultry industry has undergone significant expansion in Taranaki in the past 10 years with the closure of Tegel production operations at Te Horo near Levin and their shift to Taranaki and Auckland in 1998.

HORTICULTURE AND CROPPING

Horticulture and cropping are not significant land uses in Taranaki. The crops grown include flowers, asparagus and roses. Maize crops (a supplementary feed stock for dairy cattle) have expanded significantly.

Taranaki is self-sufficient in most crops. Small local growers produce apples, tamarillos, kiwifruit, feijoas, berryfruits, some citrus fruits, strawberries and tomatoes for both the local and export markets.

OIL AND GAS INDUSTRY

The Taranaki Basin is currently New Zealand's only commercial hydrocarbon producing area. The onshore Kāpuni and the offshore Māui fields make up the major part of New Zealand's natural gas resources. Figure 2.8 shows the location of the major oil and gas fields in Taranaki.

The Kāpuni and Māui gas fields are the oldest of the currently producing oil and gas fields. In the past 10 years new oil or gas fields such as the Mangahewa, Maari, Rimu, Kauri, Tūī and Pohokura fields have been

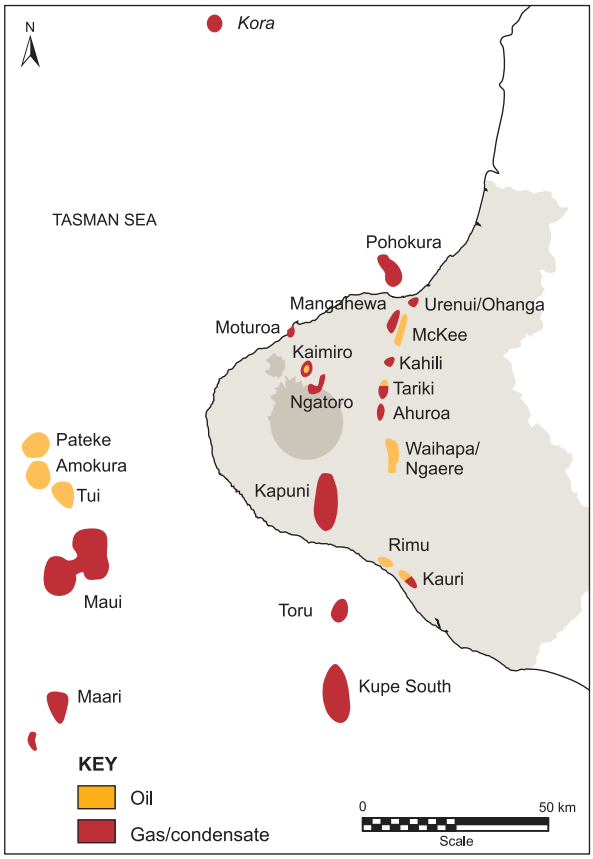


Figure 2.8 Main oil and gas fields in Taranaki.

discovered. The Kupe field, first discovered in 1986, is being developed with gas expected to flow from the field by the middle of 2009.

By world standards, however, Taranaki is under-explored and exploration interest in the region remains high. There is also considered to be potential for very large oil and gas reserves in deep water further off the Taranaki coast[16,17].

The presence of oil and gas in the region has given rise to further 'downstream' industries involved in the processing, distribution, use and export of hydrocarbons. Production stations or gas treatment plants are found at Oaonui, Kāpuni, Waihapa, Rimu, Pohukura, Kaimiro and the

The Ōaonui Production Station processes gas from the Maui field.

The production vessel Umaroa transfers oil from the Tui field.

16 www.crownminerals.govt.nz.
17 *Taranaki Daily News*, 26 April 2008, page 7.

McKee oil and gas fields. Two methanol plants are located at Motunui and the Waitara Valley respectively. An ammonia urea plant is located at Kāpuni, a UF resin plant at Waitara and gas-fired power stations at Stratford and New Plymouth.

The oil and gas industry makes a significant contribution to the Taranaki economy. In the year ended March 2006, the oil and gas industry employed 817 fulltime workers (1.8% of the region's fulltime employment) and generated $741 million - almost 17% of the region's GDP[18]. The proportion of GDP accounted for by the mining sector (oil and gas) is unique in New Zealand. When spin offs to other industries such as engineering and construction are added, the contribution to regional GDP exceeds $1 billion and 3,000 jobs[19].

Boat building, Fitzroy Yachts New Plymouth.

MANUFACTURING

Taranaki has a relatively small but distinctive manufacturing base. The region has also developed a national and international reputation for its expertise in food processing, particularly of dairy products and speciality dough production. Further, the special servicing needs of the dairy and petrochemical sectors (and to a lesser extent the meat, energy, industrial, chemical and timber processing sectors) have contributed to the development of both heavy and light engineering industries. In total, manufacturing (including food processing), engineering and other manufacturing (chemical, wood and paper products, textiles, printing and publishing etc.) provide over 18% of all employment in Taranaki.

CONSTRUCTION

Construction activity, as shown by the number of building consents issued by the three district councils, and the value of the building work done, provides an indication of general economic conditions and potential pressures on the environment. Table 2.2 shows the number and value of building consents issued in the New Plymouth, Stratford and South Taranaki district council areas between December 2003 and December 2007.

Table 2.2 shows that the number and value of building consents issued in the five years between 2003 and 2007 was highest in the New Plymouth District with the total value of building consents issued being over $800 million, and averaging over $160 million per year. All three district council areas, however, have shown significant increases in both the number and value of building consents issued since 2003. Furthermore there have been substantial increases in the number and value of building consents issued in all district council areas in the past five years compared to the previous five years[21].

The increases seen in the past five years have been the result of very strong economic growth and business and consumer confidence which have seen consistent increases in both residential and non-residential building activity. In addition to new residential development throughout the region, major building work in New Plymouth has been associated with the new large-scale retailing development in the Waiwhakaiho Valley and industrial developments in Bell Block and the Mangati catchment. New industrial developments have occurred in the southern and northern part of the Stratford township while considerable expansion of commercial big-box retail has occurred along Glover Road in Hāwera.

New residential development, Bell Block.

Table 2.2 Number and value of building consents 2003 - 2007[20].

	2003		2004		2005		2006		2007	
	No.	$Value (000)	No.	$Value (000)	No.	$Value (000)	No.	$Value (000)	No.	$Value (000)
New Plymouth	1317	98,100	1566	137,500	1648	165,200	1741	213,200	1635	193,100
Stratford	167	9,600	198	11,900	226	13,600	235	16,100	277	21,500
South Taranaki	459	27,000	623	62,100	625	50,500	640	52,500	683	55,400

Note: data comprises residential building consents for new dwelling units and alterations to existing dwellings and non-residential building consents for construction and alteration of non-residential buildings. All figures are to December of each year.

18 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
19 *Taranaki Daily News,* 12 September 2007, page 6.
20 Statistics New Zealand.
21 Taranaki Regional Council, 2003. *Taranaki - Our Place, Our Future. Report on the State of the Taranaki Environment - 2003.*

Table 2.3 Number of subdivision consents 2003 -2007[22].

District	2003	2004	2005	2006	2007
New Plymouth District	208	261	313	295	301
Stratford District	32	36	59	65	65
South Taranaki District	52	102	121	107	142

There have also been new house and farm dairy construction throughout Taranaki as a result of continuing farm amalgamations, and expenditure associated with energy developments. Of all industry sectors in the region, the construction sector has experienced the fastest employment growth (in percentage terms) over the past five years with an increase in employment of 8.4% per annum[23].

The number of subdivision consents issued also provides an indicator of economic activity and development pressures. Table 2.3 shows that the number of subdivision consents issued by the three district councils has increased significantly since 2003.

The New Plymouth District has experienced relatively high levels of greenfields residential development in the past five years, particularly in Bell Block, and around the periphery of New Plymouth in the Highlands Park and Barrett Road areas. The rate of greenfields development has slowed since 2006, with subdivisions becoming more predominant for infill housing or small lot, rural lifestyle developments[24].

Subdivision in Stratford and South Taranaki districts in recent years has been running at levels more than double that seen in the late 1990s and early 2000s. In Stratford the increase has been mainly due to lifestyle block development initially and subsequently infill residential development, as demand for residential property and associated house prices have increased[25]. In South Taranaki District, infill subdivision has occurred throughout Hāwera with new multi-lot development occurring to the west and north of the town. There has also been an increase in subdivision of coastal land, particularly in the north of the district[26].

RETAIL AND SERVICE INDUSTRIES

Wholesale and retail industries are the second largest employer in Taranaki, after agriculture, employing 15% of full-time employees in Taranaki. Other significant employers are business, finance and property services - the third largest employer group (11.6%), and health and community services (8.1%)[27].

Business, finance and property services and wholesale and retail trade are the largest contributors to regional GDP (16.4% and 10.5%, respectively) after mining (oil and gas).

Smaller service industries such as hospitality and cultural and recreational services, which are important in the tourism industry, have shown strong growth in employment over the past five years[28].

TOURISM AND EVENTS

Tourism is playing an increasingly important role in the Taranaki economy. The region's mountain, coast, surf, forests, gardens and parks, festivals and events are attracting growing numbers of visitors. In 2007 there were 274, 738 visitor arrivals[29] in Taranaki, an increase of 5.6% over 2006. These visitors spent a total of 556,660 guest nights in the region, an increase of 3.9% over 2006[30]. Taranaki performed better than the national average in 2007 in both guest nights and visitor numbers. Domestic visitors (from within New Zealand) account for approximately 85% of total guest nights spent in the region.

The Taranaki region is also becoming increasingly popular and recognised for organised cultural, sporting and other events. These

Retail development in the Waiwhakaiho Valley, New Plymouth.

New Plymouth hosts the international WOMAD festival every year.

22 New Plymouth, Stratford and South Taranaki district councils.
23 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
24 New Plymouth District Council.
25 Stratford District Council.
26 South Taranaki District Council.
27 Business and Economic Research Ltd, 2007. *Taranaki Industry Projections 2006-2016.* Report to Venture Taranaki .

Mount Taranaki attracts visitors throughout the year.

The 2008 Americarna festival, New Plymouth.

include the Festival of Lights, Rhododendron and Fringe garden festivals, the World of Music, Arts and Dance (WOMAD) festival, the biennial Taranaki International Festival of the Arts, Parihaka International Peace festival, Paepae in the Park, Americarna festival, Urenui Rodeo, the Around the Mountain Cycle Challenge, the Taranaki Wine and Food Festival, Whangamomona Republic Day, various exhibitions at Puke Ariki and the Govett-Brewster Art Gallery, national and international music concerts and numerous sports events including the International Triathlon Union (ITU).

The various events bring large numbers of visitors to the region with significant benefits for the local economy. For example, the WOMAD festival, held annually for the first time in 2008, attracted more than 43,700 festival-goers over three days with 66% coming from out of town [31]. The 2008 festival had a direct economic impact of $2.89 million and an estimated flow-on economic impact of $6.43 million for the region.

2.5 TANGATA WHENUA

There are eight iwi whose rohe or tribal area falls either wholly or partially within the Taranaki region (Figure 2.9).

The rohe of Ngāti Ruanui, Ngā Ruahine, Taranaki, Te Ātiawa and Ngāti Mutunga are located entirely within the region, while that of Ngāti Tama overlaps the Waikato region in the north and those of Ngāti Maru and Ngā Rauru overlap the Manawatu-Wanganui region to the east and south.

The 2006 Census indicates that 15.8% of Taranaki's population is Māori.

TANGATA WHENUA AND THE ENVIRONMENT

Māori view themselves as an integral part of the natural world. The spiritual beliefs held by all Māori link tangata whenua to their original parents Papa-tū-ā-nuku (Earth Mother) and Ranginui (Sky Father) as part of a complete living system. The close attachment of tangata whenua to their ancestral lands and resources stems from this belief in their common origins and from occupation and use. This relationship of Māori with the environment provides links with both ancestors and future generations, and establishes tribal identity and continuity. Some of the relationships of Māori and their culture and traditions to land, water, air and the coast are briefly outlined below.

When exercising their functions and powers under the Resource Management Act, the regional and district councils must recognise and provide for the relationship of Māori and their culture and traditions with their ancestral land, water, air, sites, wāhi tapu and other taonga as a matter of national importance. Councils are also required to have

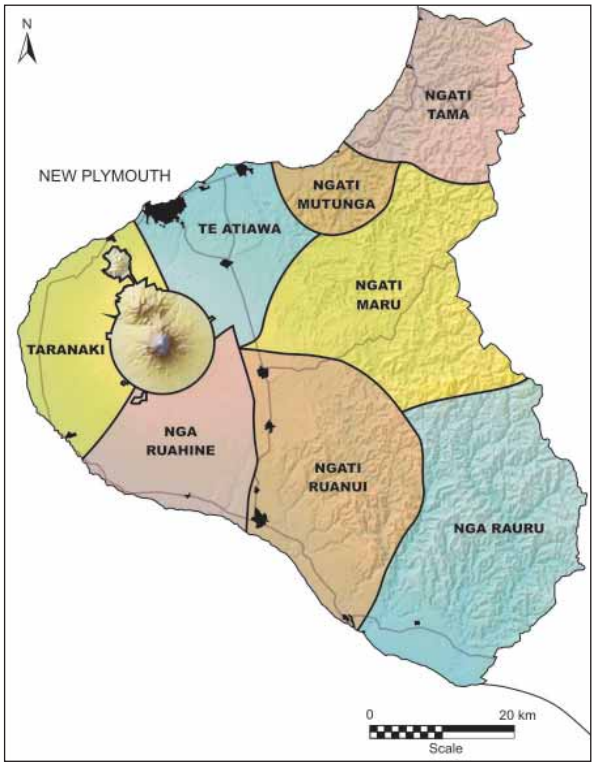


Figure 2.9: Iwi boundaries.

28 Business and Economic Research Ltd 2007. *Taranaki Industry Projections 2006-2026.* Report to Venture Taranaki.
29 Includes only those staying in commercial accommodation and recorded in the Commercial Accommodation Monitor administered by Statistics New Zealand for the Ministry of Tourism. A large number of visitors to Taranaki stay with relatives and friends and these are not recorded in the Commercial Accommodation Monitor.
30 Venture Taranaki, 2008. *Taranaki Trends. Taranaki economic report.*
31 *Taranaki Daily News* 26 April 2008.

Young members of the Owae Marae concert group performing a Kapa Haka.

The Aotearoa Marae, Ōkaiawa South Taranaki.

particular regard to kaitiakitanga and to take into account the principles of the Treaty of Waitangi.

Other agencies operating under other pieces of legislation, such as the Conservation Act and the Fisheries legislation, are also required to provide for the relationship of Māori with the natural environment.

LAND

Ancestral lands are not restricted to land currently owned by Māori but also include lands traditionally occupied by iwi and hapū. In managing the effects of the use of land resources in Taranaki, recognition must be given to the relationship Māori have with their ancestral lands, and of the need to protect sites and resources of particular cultural and spiritual value from the adverse effects of land use and development.

Mount Taranaki is of particular significance to all iwi in Taranaki.

WATER

To Māori, water (wai) in all its forms is descended from Papa-tū-ā-nuku and Ranginui. Rivers (awa) represent the tūpuna (ancestors) of the tangata whenua. Water and every river therefore have their own mana. Water also has its own mauri (life force) and wairua (spirituality) which are linked to mana. If the mauri or wairua of a waterbody is interfered with through over-exploitation, pollution or desecration, then the spirits of the tūpuna are affected and the waterbody loses its mana. Spiritual qualities can be adversely affected by the taking, use or diversion of water, and discharges of contaminants to land or water.

Tangata whenua also value water for the provision of physical sustenance through the gathering of kai - for example, watercress, tuna (eel), piharau (lamprey), kahawai, inanga and other whitebait species.

Particular rivers have special significance to those iwi and hapū in whose rohe they are located. For example, the Stony (Hangatahua) River has special value for the Taranaki iwi, the Waiwhakaiho and Waiongana rivers are of particular significance to Te Ātiawa, the Kāpuni Stream is of special value to Ngā Ruahine and the Manganui and Waitara rivers are of special value to Ngāti Maru.

AIR

According to Māori, the sky is Ranginui, father of Papa-tū-ā-nuku's earthly progeny, and is therefore tapu or sacred. The emission of contaminants to air may therefore have adverse effects on the spiritual values associated with the sky, atmosphere and associated celestial bodies which are the source of light and life. Air contaminants may also affect wāhi tapu. Because the sacredness of wāhi tapu extends upwards towards Ranginui, objectionable odours or visible contaminants may violate the sacredness of these sites.

THE COAST

The coastal environment and its resources are of great cultural, spiritual and economic value to all Taranaki iwi. As kaitiaki (guardians) of traditional fishing grounds and reefs, iwi and hapū have a responsibility to safeguard these resources for the future. This guardianship role is reflected in customary practices such as rotational or seasonal harvesting, the use of rāhui (prohibition) on seafood gathering to prevent over-exploitation, and the avoidance of contamination of coastal waters and habitat from human and other wastes.

Considerable tribal mana and standing is derived from providing locally obtained food for manuhiri (guests) on the marae.

Taranaki's coast is rich in tribal history and many sites and features are of particular significance to tangata whenua. These include coastal wāhi tapu, battlegrounds, urupā (burial sites), tauranga waka (ancestral canoe landing and launching sites), taonga raranga (plants valued for weaving),

toko taunga ika (rocks marking fishing grounds), and landscape features signifying iwi and hapū boundaries and other sites of importance.

THE TREATY OF WAITANGI

After extensive discussions with iwi, the Council, together with the Council's Iwi Liaison Committee, Te Putahitanga o Taranaki, developed a Declaration of Understanding and Code of Conduct in relation to the principles of the Treaty of Waitangi.

The Declaration of Understanding establishes and records a basis of mutual understanding about the relationship between the devolved kawanatanga (governorship) responsibilities of the Council, and the rangatiratanga (chieftainship) rights of iwi.

The Code of Conduct is an expression of the Council's commitment to take into account the principles of the Treaty of Waitangi in the exercise of its resource management functions. Both the Declaration of Understanding and Code of Conduct were incorporated into the *Regional Policy Statement for Taranaki*[32], which, following a lengthy public consultation procedure became operative in 1994. The declaration and code have also been incorporated into the reviewed *Proposed Regional Policy Statement for Taranaki 2006*[33]. The declaration and code have continued to guide the development of all Council statutory resource management policies and plans.

In 1996 the Waitangi Tribunal reported on historic Treaty claims in Taranaki. The report on the Taranaki claims[34] (Wai 143) sets out a long history of tension, warfare, land confiscation and expropriation and other injustices, since the earliest times of European settlement. The Tribunal noted that the effects of the many breaches of the Treaty that occurred in Taranaki continue to this day and concluded that the Taranaki claims are likely to be the largest in the country.

Taranaki iwi are at various stages of negotiation with the Crown regarding the settlement of their Treaty claims. Settlements will introduce a new phase in the development of relationships with iwi and hapū in Taranaki.

To date, Treaty settlement claims between Taranaki iwi and the Crown have been signed with four iwi - Ngāti Ruanui, Ngāti Tama, Ngā Rauru and Ngāti Mutunga.

The progressive settlement of historic Treaty claims will further develop relationships between iwi, the Taranaki Regional Council and district councils. Formal protocols between councils and iwi governance bodies, regarding the interactions between them, will be developed. For its part the Council has already commenced discussions with iwi who have finalised deeds of settlement, in order to develop such protocols. In addition, statutory acknowledgements which set out areas, locations or sites of particular significance to iwi have been included in the Council's statutory planning documents.

As claims are settled, iwi may also become more active in resource use and development activities.

2.6 OUR VISION FOR THE FUTURE

The role of the Council and other local authorities in Taranaki is to give effect to the purpose of Local Government as set out in the Local Government Act 2002. An important part of this purpose is to promote the social, economic, environmental and cultural well-being of communities both in the present and for the future[35]. In achieving this purpose, councils are required to identify 'community outcomes' i.e., the things that the community thinks are important for its well-being and want to see as the desired end result or 'state of affairs' in the district or region in the future.

The coastal environment and its resources are of great importance to iwi and hapū.

Taranaki people value their natural environment.

32 Taranaki Regional Council, 1994. *Regional Policy Statement for Taranaki.*
33 Taranaki Regional Council, 2006. *Proposed Regional Policy Statement for Taranaki.*
34 Waitangi Tribunal, 1996. *The Taranaki Report, Kaupapa Tuatahi, Waitangi Tribunal Report 1991.*
35 Refer section 10 Local Government Act 2002.

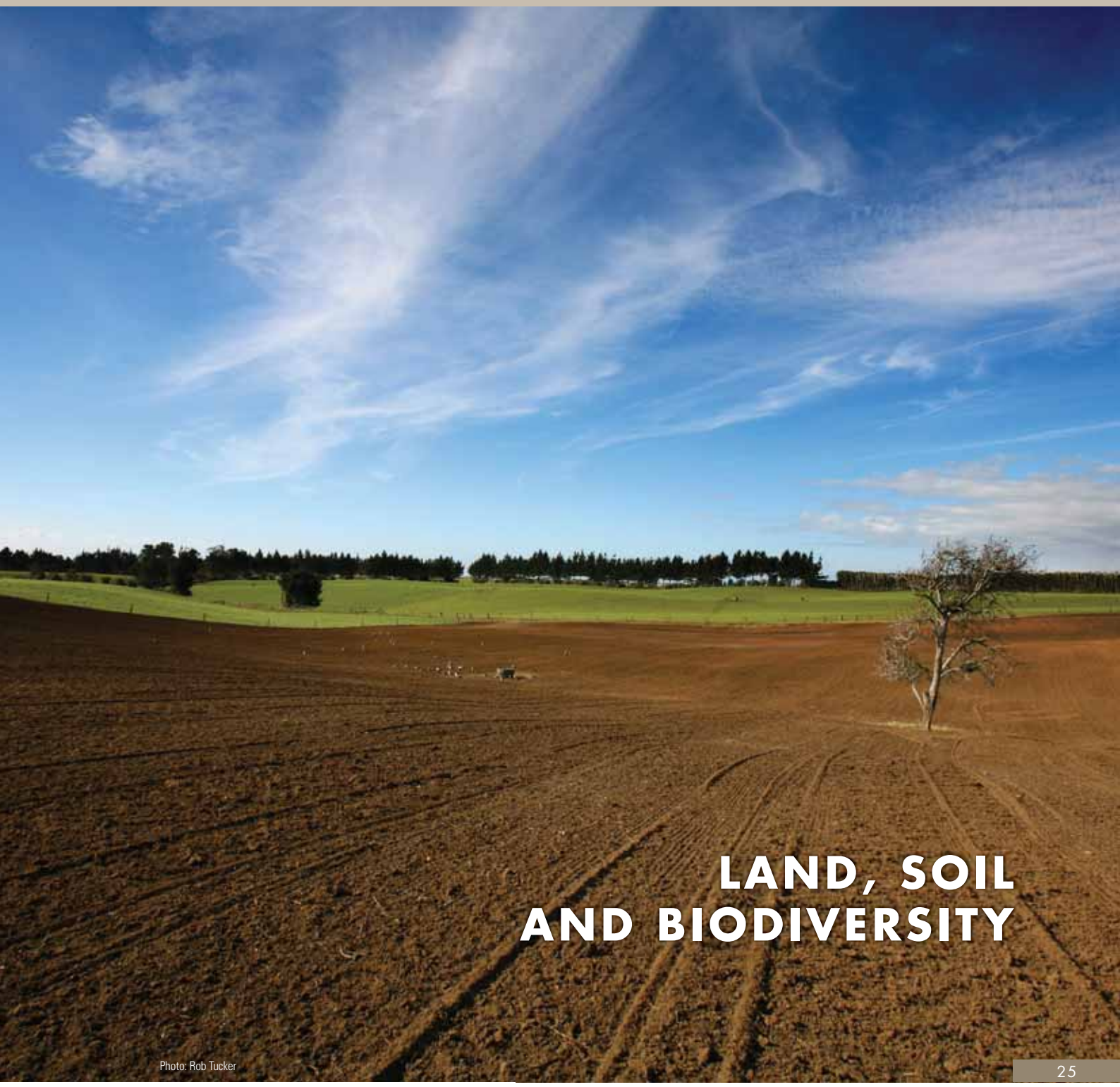
The four local authorities in the Taranaki region, the New Plymouth, Stratford and South Taranaki district councils and the Taranaki Regional Council, have undertaken extensive consultation with the people of Taranaki to identify the desired 'outcomes' for the future of the region[36]. The outcomes that the people of Taranaki wanted for the present and future well-being of the community were:

- **A secure and healthy Taranaki.**
  A region that provides a safe, healthy, and friendly place to live, work or visit.
- **A prosperous Taranaki.**
  A region that boasts a sustainable, resilient and innovative economy that prospers within the natural and social environment.
- **A skilled Taranaki.**
  A region that values and supports learning so that all people can play a full and active role in its social, cultural and economic life.
- **A connected Taranaki.**
  A region that delivers accessible and integrated infrastructure, transport and communication systems which meet the needs of residents, businesses and visitors.
- **A sustainable Taranaki.**
  A region that appreciates its natural environment and its physical and human resources in planning, delivery and protection.
- **A together Taranaki.**
  A region that is caring and inclusive, works together, and enables people to have a strong and distinctive sense of identity.
- **A vibrant Taranaki.**
  A region that provides high quality and diverse cultural and recreational experiences and encourages independence and creativity.

The state of the environment reported on in this document has an important influence on the achievement of a number of the community outcomes described above.

36 Community Outcomes Project Team, 2004. *Future Taranaki: A Report on Community Outcomes for Taranaki.*

CHAPTER 3



LAND, SOIL AND BIODIVERSITY

Photo: Rob Tucker

SOIL EROSION

Soil is one of Taranaki's most important resources sustaining the region's agricultural industries. Soil erosion rates vary throughout the region according to geology, slope, vegetation cover and land use. Land uses that are sustainable are those that match the capabilities of the land class. Monitoring undertaken by the Taranaki Regional Council shows that:

- 87.4% of the hill country is being used sustainably with no significant soil erosion problems;
- there has been a 2.4% increase in sustainability over the past five years;
- the area of land in sheep and beef farming has continued to decline;
- 30.8% of hill country land is now reverting to scrub;
- the area in plantation forestry has doubled since 1994;
- a total of 269 comprehensive farm plans and 24 agroforestry plans have been prepared; and
- 178,580 ha, or 58% of privately-owned hill country land, and 5,233 ha, or 41% of privately-owned sand country, are now included in the Council's sustainable land management programme.

The *Regional Soil Plan*, made operative in 2001, addresses soil erosion issues in Taranaki. The sustainable land management programme involves supporting hill country farmers to farm in a sustainable way, including identifying areas where forestry (plantation or reversion) are preferred over pastoral farming. The Council will continue to monitor soil erosion in Taranaki.

SOIL HEALTH

Soil health refers to the biological, chemical and physical state of the soil. The region is fortunate in that soil types commonly found here are naturally robust and able to retain nutrients and organic material. The Council has continued soil quality investigations and monitoring projects to ascertain whether there are any emerging trends in Taranaki relating to soil compaction, depletion of soil nutrients, and residual soil contamination, each of which would affect soil health. This research shows that:

- 97% of Taranaki soils are of very low to moderate vulnerability to soil compaction;
- there is evidence of soil compaction on some Taranaki farms during wet weather, but this compaction is generally reversible with appropriate pasture and stock management;
- the carbon content of Taranaki soils is not changing, suggesting that soils are not becoming depleted of their organic content;
- phosphate levels, whilst increasing, are considered appropriate;
- total nitrogen levels are higher than optimal on all dairy farms surveyed, although most nitrogen is in the organic form which does not so readily leach out of the soil;
- nitrogen levels indicate vigorous pasture growth and have only minor implications for nutrient balancing;
- levels of cadmium available for uptake by plants are well below levels that would give rise to environmental concerns although they are increasing slowly;
- there is no evidence of any issue of residual or cumulative agrichemicals in the soils of the region; and
- baseline studies have been undertaken to explore soil fauna diversity.

The *Regional Soil Plan*, includes policies and methods to address soil health issues in Taranaki. Actions include working with landowners on sustainability issues. The Council will continue to monitor soil health.

CONTAMINATED SITES AND HAZARDOUS SUBSTANCES

Contaminated sites are those that result from historical activities and industries where hazardous substances have been inappropriately stored, used or disposed of. The Council's register of selected land uses records 1,281 sites where past or current activities could have resulted in contamination. Of these:

- 757 sites (59%) have been investigated and no contamination found to be present;
- 16 sites have been remediated, so levels of contamination no longer pose an unacceptable environmental risk;
- 480 sites contain hazardous substances, but based on current knowledge, not at levels that would pose an unacceptable environmental risk, or they are currently being managed so that there is no unacceptable risk (e.g. such as the Pātea site case-studied in this report);
- 28 sites have been classified as being low-risk, but require further investigation to complete classification; and
- No sites have been deemed 'contaminated', i.e. found to pose an unacceptable risk.

The *Regional Fresh Water Plan* and *Regional Air Quality Plan* contain rules controlling the discharge of contaminants, thus avoiding new sites being contaminated. Hazardous substances are managed under the Hazardous Substances and New Organisms Act 1996, and discharges under the RMA. Council inspects industries and businesses to assess compliance with regulations under these acts. Potentially contaminated sites are managed through the register of selected land use and through district plans.

BIODIVERSITY

The Taranaki region, despite its modest size, is a biologically diverse region. It has four distinctive ecological districts which give it its biodiversity characteristics. In summary:

- Over 140,000 ha, or 20% of the region, is set aside as public conservation land;
- 3,374 ha of indigenous vegetation on private land is protected by landowners through Queen Elizabeth II National Trust (QEII) covenants, and this area is increasing;
- 57% of remaining indigenous vegetation is either in public conservation land or private land protected by a QEII covenant;
- 40 birds, mammals, reptiles and invertebrates have been identified as threatened in Taranaki, about seven of these are either stable or improving;
- predator control programmes, aimed at protecting threatened birds, are undertaken by a range of agencies, landowners and community groups;
- research into kererū and tūī in New Plymouth highlighted the importance of both native and exotic flowering and fruiting trees in the city;
- threatened plants often occupy coastal cliff edge habitats and are threatened by weed species such as giant gunnera;
- possum levels are kept low by landowners through the Taranaki Regional Council's self-help possum control programme on the ring plain and by Department of Conservation programmes in priority conservation areas;
- areas with goat control are healthier with higher numbers of regenerating seedlings of plant species vulnerable to goat browse;
- restoration of riparian (or stream side) vegetation results in an increase of both plant and bird biodiversity; and
- the number of community-led biodiversity projects is increasing.

Biodiversity on land is managed by a number of agencies. The Department of Conservation is the key agency and sets out its programmes in its *Conservancy Management Strategy*. District Plans and the *Proposed Regional Policy Statement* contain policies about biodiversity on private land. The Taranaki Regional Council has prepared a *Biodiversity Strategy* to guide all the various biodiversity actions undertaken by the Council for working alongside landowners to maintain and enhance biodiversity on private land.

Mount Taranaki and ring plain, South Taranaki.

OUR LAND, SOIL AND BIODIVERSITY

Soil is one of Taranaki's most important resources. The region's rural -based wealth depends on the amount of grass produced which is dependent on the sustainable management of our soils. The region is fortunate to have naturally robust soils that retain their structure, nutrients and organic matter, a product of their volcanic nature. However, good land and soil management is still required to retain this advantage and this has been recognised by the community as a vital step towards seeing a 'prosperous Taranaki', a region that boasts a sustainable, resilient and innovative economy. A prosperous Taranaki was considered as one of the top priorities that Taranaki needs to work on over the next 10 years[1].

Taranaki has a wide range of soil types, from the fertile well-drained soils on the ring plain and coastal terraces to the steep, erodible and relatively infertile soils of the inland hill country and on the upper slopes of Mount Taranaki. While erosion is a natural process, human activities may increase its rate. Accelerated erosion leads to the loss of the topsoil, and so reduces the land's productivity and capability, as well as lowering water quality, degrading aquatic habitat and increasing the risks of floods from river beds filling up with silt and gravels.

Retaining soil on the land is one thing, but safeguarding the health of our soils is equally important. Soil health refers to the biological, chemical and physical state of the soil and the maintenance of soil ecosystems. Unlike the impact of accelerated erosion, soil health problems are not immediately evident, but are no less important.

Market forces and policies from both central and local governments have influenced changes in land use patterns. Vegetation change and land use pressures are driven largely by economics and have fluctuated with export prices and past government subsidies – land clearance occurred more frequently in past years when such land development was subsidised. Encouragingly, some of that cleared land, that was never going to be feasible to farm sustainably (economically or environmentally), has been allowed to revert back to scrub, even during times when the market was relatively buoyant. Current government policies may further accelerate this trend to retire unsustainable land or convert it to plantation forestry through carbon emissions trading schemes which may make economic the retiring or reforesting of steep hill country.

Livestock farming is one example of a land use that has the potential to cause pressures on soil health of the region through soil compaction, nutrient depletion and residual soil contamination. Council investigations confirm that Taranaki has no evident significant or immediate soil health problems with respect to these matters. This is largely attributed to the resilient nature of the volcanic soils of the ring plain, although they can still be susceptible to the long-term effects of soil compaction. The environmental impacts can be short-term and reversible if appropriate stock and land management practices are in place.

Wise management of the land includes not only the management of soil erosion and soil health, but also the management of biological diversity, or 'biodiversity'. Biodiversity describes the variety of all biological life large and small, including micro-organisms, fungi, ferns, trees, plants, insects, and the ecosystems they come from - forests to grass lands as well as the genetic diversity within species.

Biodiversity is important not only from an intrinsic perspective, but also from economic, social and cultural perspectives. Biodiversity provides economic benefits in the form of ecosystem services (such as pollination, soil stability and fertility, and maintaining water

Umutekai bush, a remnant swamp forest, managed within a productive landscape.

1 Community Outcomes Project Team, 2004. *Future Taranaki: A report on Community Outcomes for Taranaki.*

quality), tourism opportunities, and potential commercial and medical uses. Biodiversity, is significant to the people of Taranaki. It is a key component of a 'sustainable Taranaki', a community outcome which includes the importance of understanding, valuing, maintaining and enhancing biodiversity for future generations. Protecting native bush and wildlife was considered as very important by 70% of people across the region[2].

Biodiversity is particularly significant to tangata whenua who, through their long occupation of New Zealand prior to European settlement, have a strong relationship to native plants and animals, and to their habitats. This relationship with biodiversity is woven into Māori culture and traditions.

Safeguarding Taranaki's biodiversity is considered important for Taranaki people because some species, habitats and ecosystems exist here and no where else in New Zealand. For example, a native land snail that lives only on Mount Taranaki. Protecting Taranaki's biodiversity is up to Taranaki people who either actively support actions that will safeguard or restore that local biodiversity or conversely, support or make decisions to place pressure on our biodiversity.

The pressures placed on Taranaki's biodiversity stem from a history of human use of our native biodiversity. Before human settlement, native forest covered almost the entire region. The clearance and development of land for farming, particularly on the Taranaki ring plain and fertile river valleys elsewhere, led to the loss of large areas of indigenous vegetation. The most significant loss in indigenous habitat in Taranaki occurred on the ring plain and coastal terraces. Damage to our biodiversity goes well beyond habitat loss. The condition (or quality) of remaining areas of indigenous biodiversity has suffered from the introduction of pest plants, such as old man's beard, and animals such as possums, goats, rats, cats and stoats.

The challenge is to find ways to manage Taranaki's biodiversity within the context of a productive landscape. A carefully managed farm, for instance, with wetlands and forest remnants protected, animal pest species controlled, streams fenced and planted with riparian buffer zones, erosion -prone soils protected and with stocking rates matching the land's carrying capacity, can both restore and enhance biodiversity and be economically and socially sustainable.

3.1 SOIL EROSION

3.1.1 WHAT IS THE CURRENT STATE OF SOIL EROSION IN TARANAKI ?

The extent and rate of soil erosion in Taranaki is determined by geology, slope, climate and vegetation cover. Different levels of natural erosion rates in the region are set out in Table 3.1[3].

Soil erosion impacts on water quality, increases flood risk through rivers filling up with silts and gravels, as well as reducing the general health and productivity of the soil. Land that is susceptible to severe erosion in Taranaki is illustrated in Figure 3.1. The erosion potential of land

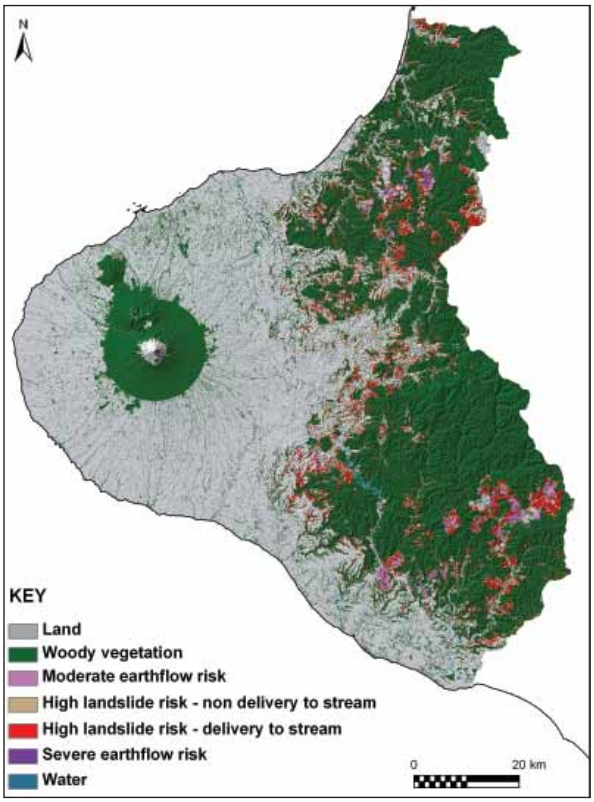


Figure 3.1: Land susceptible to severe erosion in Taranaki.

Table 3.1: Natural erosion rates in the region.

Part of the region	Natural erosion rates	Reasons for accelerated erosion rates
Mount Taranaki	High	Erosion rates may be accelerated where animal pests damage vegetation, although this is managed through the animal pest control programme in Egmont National Park.
Taranaki ring plain and western fringe of the hill country	Low	Any accelerated erosion is insignificant when compared with the long-term soil accumulation beneath vegetation that has occurred in the past, and which has been augmented by volcanic ash during eruptions of the Taranaki volcanoes.
Inland hill country	High	Erosion rates can be accelerated by land use activities – highest in areas cleared for pasture, less in areas planted in plantation forestry and even less in areas that remain bush-clad.
Coastal sand country	Moderate	Erosion rates can be exacerbated by land use activities that expose topsoil to wind causing blow-out and the re-deposition of the underlying sand in localised areas.

2 Community Outcomes Project Team, 2004. *Future Taranaki: A report on Community Outcomes for Taranaki.*
3 Hicks, D.L, 1998. *Soil Erosion in Taranaki – A summary of research findings.* Prepared by Ecological Research Associates for the Taranaki Regional Council.

depends on its geology, slope and vegetation cover. Hill country makes up 414,260 ha, or 57% of the region. Of this, 306,060 ha are privately-owned with the remainder managed by the Department of Conservation.

(A) SUSTAINABILITY IN THE HILL COUNTRY

Land that is used sustainably is less susceptible to erosion. Changes in the sustainability of land use in the eastern Taranaki hill country is monitored by the Taranaki Regional Council. Every five years, aerial photographs of the region are taken, and vegetation and land use are mapped for 25 representative sites, each 900 hectares in area, spread evenly throughout the hill country.

The monitoring has now been completed in 1996[4], 2000[5] and 2008[6] using aerial photos taken in 1994, 2000 and 2007 respectively. The 2008 exercise involved bringing the 1996 and 2000 mapping into line with the latest digital aerial photos. This enabled the 2008 work to continue comparing sites between years, despite the inferior accuracy of the aerial photos in earlier years. The information obtained provides a representative picture of private land use in the hill country and the way that land use has changed over time.

Changes in vegetation over the 25 monitoring sites have seen a reduction in the area of pasture (from 49.0% in 1994 to 47.6% in 2000 to 46.3% in 2007) and an increase in the area of plantation forestry, which increased from 2.4% to 4.7% over the 13 years. The total area of indigenous forest decreased slightly in the monitored sites from 3,380 ha in 1994 to 3,295 ha in 2007.

Land use changes between 1994 and 2000 were dominated by a reduction in the area of meat and wool farming from 53.9% to 51.1%, which continued to fall to 45.1% in 2007. Meat and wool farming land use shifted to either scrub (classified as 'revegetated meat and wool farming land' in the report) or plantation forestry. Land reverting to scrub increased from 24.1% to 25.5% and then to 30.8% over the three monitoring periods. The area of land changing in land use from 1994 to 2007 is illustrated in Figure 3.2.

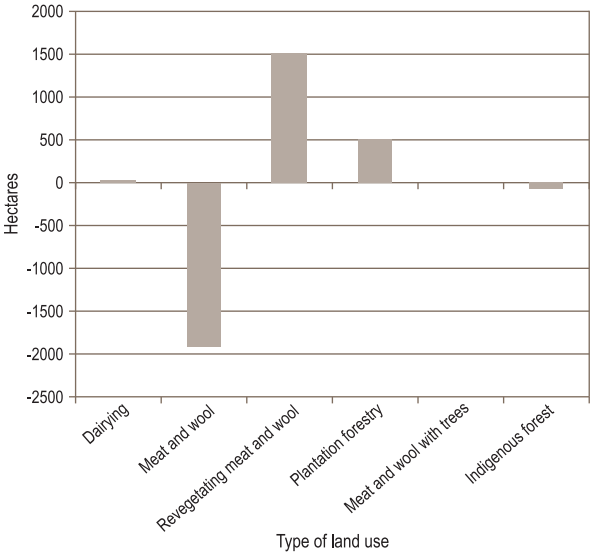


Figure 3.2: Changes in land use from 1994 to 2007.

Land is described as physically sustainable if the use of that land carries only a moderate or low risk of accelerated erosion. Unsustainable land use is that which carries a severe or higher risk of accelerated erosion into the long term. The sustainability of land use is measured by comparing the type of land use that can be physically supported by that land with what it is actually being used for.

From 1994 to 2000, overall sustainability of land use improved by about 1.1 ±0.7%. In 1994, 83.9% of the area was used sustainably, that is, almost 84% of the hill country was being used for the land use that suited its geology, slope and soil type. Land use sustainability improved to 85.0% in 2000 and to 87.4% by 2007 (an increase in land use sustainability of 2.4 ±1.5%). This means there has been a 3.5 ± 1.6% increase in land use sustainability since 1994. The improvement in sustainability of land use was the result of a move away from the meat and wool farming land use after 2000, and a reversion of that land to scrub or to forestry. The report noted that increases in the area under plantation forestry also contributed to improve land use sustainability.

Sheep farming, Taranaki hill country.

Erosion in the Waitōtara catchment after the 2004 storm.

4 O'Leary, S.M.; Stephens, P.R.; Willoughby, E.J.; DeRose, R.C.; Gibb, R.G.; White, M.F.; Sutherland, A. 1996. *Land Use Monitoring in the Eastern Taranaki Hill Country.* Prepared by Landcare Research for the Taranaki Regional Council.

5 Jessen, M.R.; .Betts, H.D.; Sutherland, A.; Willoughby, E.J. 2000. *Sustainable Land Use Monitoring in the Eastern Taranaki Hill Country and Coastal Sand Country.* Prepared by Landcare Research for the Taranaki Regional Council.

6 Betts, H.D.; Lynn, I.H. 2008. *Sustainable Land Use Monitoring in the Eastern Taranaki Hill Country and Coastal Sand Country – 2007 Re-survey.* Prepared by Landcare Research for the Taranaki Regional Council.

Of significance also in this result is the fact that the trend towards increasing sustainability is accelerating, from the 1.1% improvement in sustainability between 1994 and 2000 to an increase of 2.4% in sustainability between 2000 and 2007. This is a very positive and encouraging result, particularly given that there had been good economic years for the meat and wool sector during the monitoring period which have in the past encouraged some unsustainable land use practices such as the clearing of steep land.

(B) SUSTAINABILITY IN THE SAND COUNTRY

Coastal sand country makes up 12,648 ha, less than 2% of the region. This type of land is mainly pasture land, but 428 ha have been identified as consisting of bare sand. The majority of sand country in the region is in South Taranaki with other areas around Cape Egmont and in North Taranaki. Almost all of this area is susceptible to wind erosion.

To measure changes in sustainability in the sand country, the Council has monitored changes in the area of bare sand at four widely separated representative sites from near Cape Egmont in the north, to north of Wanganui in the south[7]. The sites combined represent 25% of the coastal sand country, and capture the range of conditions along the coast. Aerial photos have been used since 1994 to map any change in the amount of bare sand at those sites.

Between 1994 and 2000, the area of bare sand increased at two of the sites, possibly due to tracking and treading damage, while replanting of forest at the site near the Waitōtara River mouth helped reduce the amount of bare sand at that site. Between 2000 and 2007, no significant change was recorded in the area of bare sand at any of the sites. Most of the changes noted after 2000, albeit insignificant, appeared to be related to natural causes such as blowouts of unstable dunes near the beach rather than to land management ones.

Quite aside from being a soil erosion issue, bare sand does occur naturally and can form an important habitat for threatened species such as katipō spiders and pīngao grass.

3.1.2 HOW IS SOIL EROSION MANAGED IN TARANAKI ?

(A) REGIONAL SOIL PLAN FOR TARANAKI

Soil erosion is addressed in the *Regional Soil Plan for Taranaki.* The plan contains policies, methods and rules addressing accelerated erosion, with the objective of maintaining and enhancing the soil resource in the region. The plan is now half way through its statutory life and will be formally reviewed in 2011.

Objectives, policies and methods set out in the plan build on the success of past experiences and involve the Council addressing soil loss in partnership with farmers. The plan focuses on non-regulatory methods, such as the Council's sustainable land management programme, to achieve sustainable land management.

Non-regulatory methods are complemented by two regional rules that target vegetation disturbance over 5 ha in area, on land that has a slope greater than 28 degrees. In these circumstances, vegetation disturbance, for example forest clearance or harvesting, is permitted only if certain conditions can be met. These conditions deal with the prevention or mitigation of soil erosion, and effects on water quality. If these conditions cannot be met, a resource consent is required and an erosion and sediment control management plan must be prepared.

Since the *Regional Soil Plan* was made operative in 2001, only one consent has been granted under it. This was for vegetation disturbances for the extraction of logs from Te Wera Forest.

(B) SUSTAINABLE LAND MANAGEMENT PROGRAMME IN THE HILL COUNTRY

The objectives of the *Regional Soil Plan for Taranaki* are delivered through the Council's sustainable land management programme. When requested, the Council will prepare comprehensive farm plans that set out options and recommendations for individual hill country properties. The plans are prepared in close consultation with landowners and are offered free of charge.

David Pearce farms to the potential of his coastal property near Waitōtara.

Land Management officers support landowners to implement their farm plans.

7 Betts, H.D and Lynn, I.H. 2008. *Sustainable Land-Use Monitoring in the Eastern Taranaki Hill Country and Coastal Sand Country – 2007 Re-survey.* Prepared by Landcare Research for the Taranaki Regional Council.

A comprehensive farm plan covers all soil conservation aspects of a farming operation, including land and stock management, while maximising the property's productive capability. These plans are based on land use capability through a detailed land resource inventory, derived from soil type, geology, vegetation, slope and present erosion. Recommendations may include planting of erosion control species or exotic forestry on slopes not suited to pastoral use, or retirement of very steep land to enable regeneration of native vegetation. Agroforestry plans are prepared for farmers interested in diversification by establishing woodlots or plantations.

In the past 10 years or so the Council has achieved good coverage of property plans and has maintained ongoing liaison with plan holders to assist with implementation of plan recommendations and work programmes over time. The extent of farm plans prepared by the Council to the end of June 1995 was only 42,000 ha or 13% of privately-owned land in the hill country (Figure 3.3a). This has quadrupled to 178,580 ha or 58 % of privately-owned hill country land by June 2008 (Figure 3.3b). A total of 269 comprehensive farm plans and 24 agroforestry plans have been prepared by the Council.

Land management officers from the Council support landowners to implement their farm plans. Areas where recommendations have been implemented are noted in a database and will be analysed in the future to monitor the rate of implementation of farm plans.

A recent review of the level of community investment in environmental improvements found that the average farmer expenditure is over $13,400 per year on implementation of sustainable land management practices such as environmental planting, forestry/ agroforestry development, or fencing and retirement of erosion-prone land[8]. The annual cost was adjusted according to the *Farm Expenses Price Index* published by Statistics New Zealand. Thus the total annual farmer expenditure under this programme is $2.2 million per annum on hill country protection.

The Council intends to continue its sustainable land management programme into the future. Further improvements in land use sustainability will be required to meet the *Regional Soil Plan* target of 89% sustainability by 2011 – a further increase of 1.6% by 2011. Given the increase in sustainability over the most recent monitoring period, and economic disincentives for farming unsustainable land (such as rising fertiliser costs) there is a good basis for optimism that this target can be achieved.

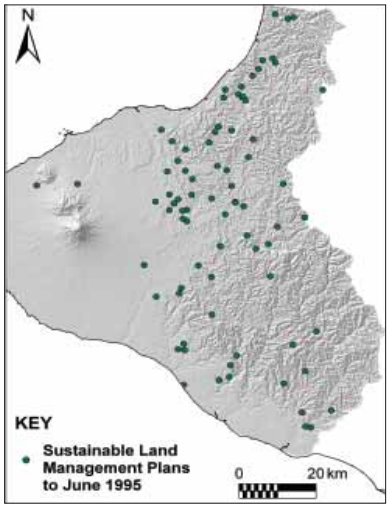


Figure 3.3(a): Number of sustainable land management plans prepared up to June 1995.

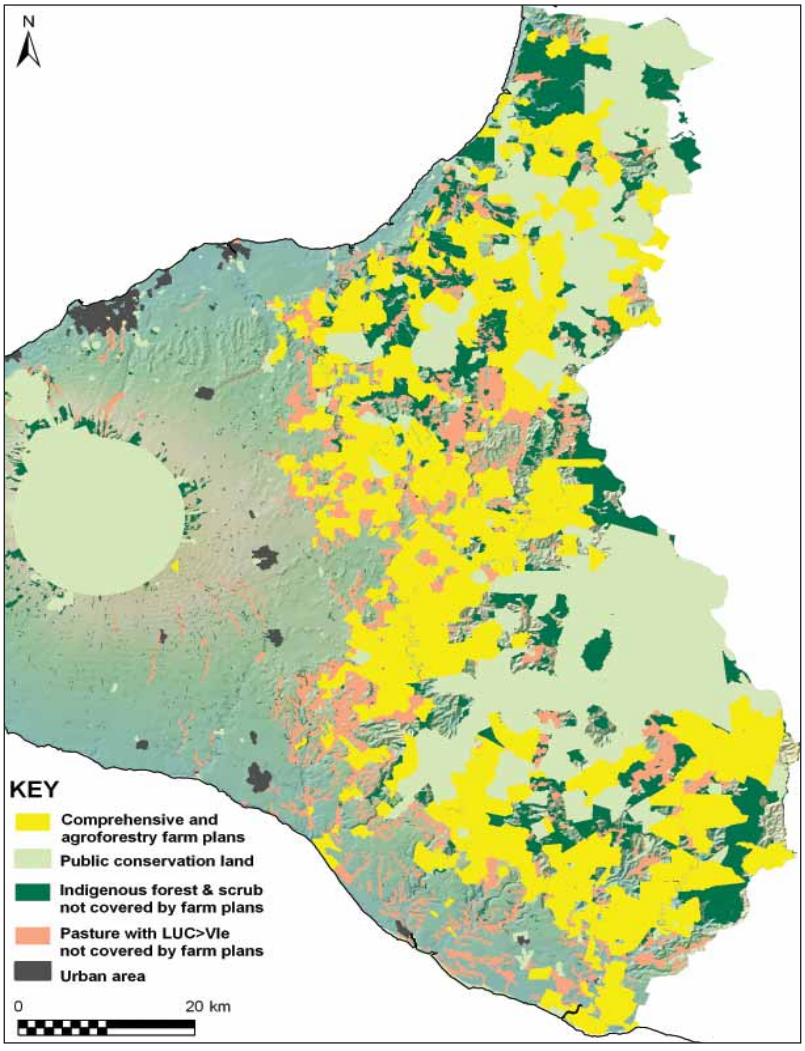


Figure 3.3(b): Coverage of comprehensive and agroforestry farm plans in the hill country up to June 2008.

8 Wu, J; Sanderson, K. June 2008. *Community Investment in Environmental Improvements in Taranaki.* Prepared by Business and Economic Research Limited for the Taranaki Regional Council..

Land Services Manager Don Shearman with Cam and Sarah Collier.

POLES WITH A PURPOSE

Their aim has always been simple: controlling erosion and providing shade and shelter. But along the way, sheep and beef farmers Cam and Sarah Collier have become award-winners and role models for sustainable land management.

With nearly two-thirds of their Mangamingi property identified as susceptible to accelerated erosion, the Colliers have established exotic forest on 480 ha of the steeper land and planted hundreds of poplar poles – 50 to 150 a year for the past two decades – on the more productive pasture land.

The poles are young tree stems 3 m long, which root and sprout when planted. Planting so many has been a big effort but Cam is pleased with the result – "they've been good".

The poles anchor soil with their roots, effectively controlling hill slope erosion and reducing the sediment entering watercourses. By keeping soil on hillsides, they maintain pasture production at a good level, and by helping to prevent slips and gullies, they reduce damage to farm assets, and the cost of repairing damage after storms.

The pole planting is among sustainable land management measures the Colliers are carrying out under a Comprehensive Farm Plan prepared for them by the Taranaki Regional Council. They also have an Agroforestry Plan, under which their exotic forest was developed.

All this work continues soil conservation work started by Cam's father in the 1970s, when a 223 ha block of near pristine lowland, podocarp-hardwood native forest on the property was protected with a QEII National Trust covenant.

Annual pest control operations aimed at possums and goats are carried out in this block in conjunction with Forest and Bird. Cam said the dividend is the increased birdlife and rejuvenation of native species.

And the Colliers' efforts haven't stopped there. Another 10 ha of the property have been enhanced with amenity plantings, the establishment of blackwoods, wetland retirement and riparian planting, and shelter belt establishment.

Cam believes fencing and planting waterways, even on the flat, not only make the property safer for stock but are also more economic in the long run than trying to keep these areas drained.

"Once the initial cost is out of the way, it's cheaper than getting a digger in every few years to keep the drains clear."

The Colliers were recognised in the 2008 Taranaki Regional Council Environmental Awards, the award's citation noting their commitment to sustainable land management.

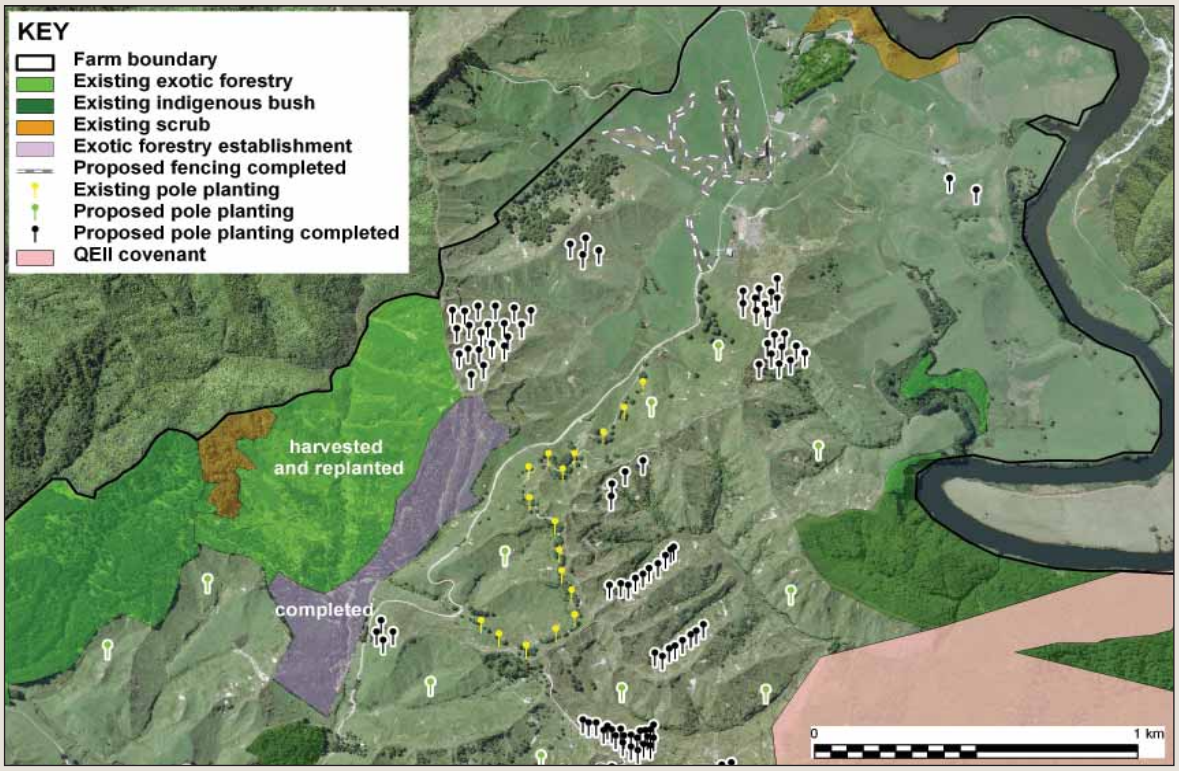


Figure 3.4: An extract from the Colliers' farm plan showing recommended and implemented works.

A comprehensive farm plan is one of the tools Rod Pearce uses to sustainably farm his Waitōtara sheep and beef property.

HINTS TAKEN IN THE HINTERLAND

When Mother Nature speaks, it pays to listen. And landowners and Taranaki Regional Council staff have been all ears in the Waitōtara Valley following successive floods that highlighted some hard geological facts.

And soft geological facts. The valley varies from consolidated sandstone in the upper reaches where erosion is related to rock hardness, to mudstone, siltstone and moderately consolidated sandstone throughout the catchment – where the erosion potential is governed by the type of vegetation and a soft sandstone belt further down which are highly vulnerable to erosion. There's also a mixture of slump-prone hill country.

After the flood in 2004, Landcare Research analysed satellite imagery to find 465 ha of landslides in the Waitōtara catchment. Of this, 20% to 25% was made up of slip scars and the rest was trails of debris spread approximately 10-20 cm thick. Compared to pasture, closed canopy forest (both exotic and indigenous) reduced landslides by 90%, while scrub reduced the incidence by about 80% and space-planted trees by 60%.

On the ground, the Council's land management staff and landowners could see there was more erosion on the northerly (sunny) faces of steep, moderate to hard sandstone country higher in the valley.

Gully erosion was also severe throughout the catchment, regardless of geology or vegetation type, and resulted in many culverts or bridges blowing out, and logs and debris forming log jams in confined channels or being widely scattered on flood plains. There were also large areas of deep-seated slumps in the mid to upper catchment.

With the land speaking so eloquently, there was clearly a need to do more than listen. The Council took an action plan to landowners, built around the assistance available through its sustainable land management programme.

The Council draws up comprehensive farm plans at no cost to landowners, and also supplies at-cost poplar and willow material to help stabilise land.

The plans are based on a detailed land resource inventory and include an analysis of the property's soils, geology, vegetation, slope and erosion. This gives landowners a good indication of the options for using their land sustainably, and the plans also recommend measures to stabilise and protect the soil's productive capability. More recent plans also indicate production potentials for different parts of the property and provide some basic economic analyses. The idea is to match land use to the potential of the land.

By understanding the land's potential for sustained production, inputs can be increased on better classes of land and soil conservation measures can be implemented so that pastoral farming can continue where suitable. Land that is not sustainable under pastoral farming can be assessed for alternative land uses such as forestry, or retired if only suitable for conservation purposes. Generally, farm plans highlight sustainable land management practices without an overall loss of productivity on the farm.

It's an approach that has found ready acceptance in Waitōtara Valley, and Figure 3.5 shows how well the farm planning services have been taken up.

After another heavy downpour in July 2006 resulted in significant flooding and silt deposition, particularly in the Moumahaki and mid to lower Waitōtara catchments, landowners were offered a Council relief package of up to $8,000 for plants to promote land stability and up to $10,000 for half the cost of grass seed.

The plants to promote land stability were mainly 3 m poplar and willow poles and grass seed for the revegetation of slip erosion debris trails - not for the re-sowing of flats covered in silt. The 2006 flood also resulted in more demand for information on soil conservation options.

This sustainability option involves working with Mother Nature so she is less prone to angry outbursts in the form of erosion and floods.

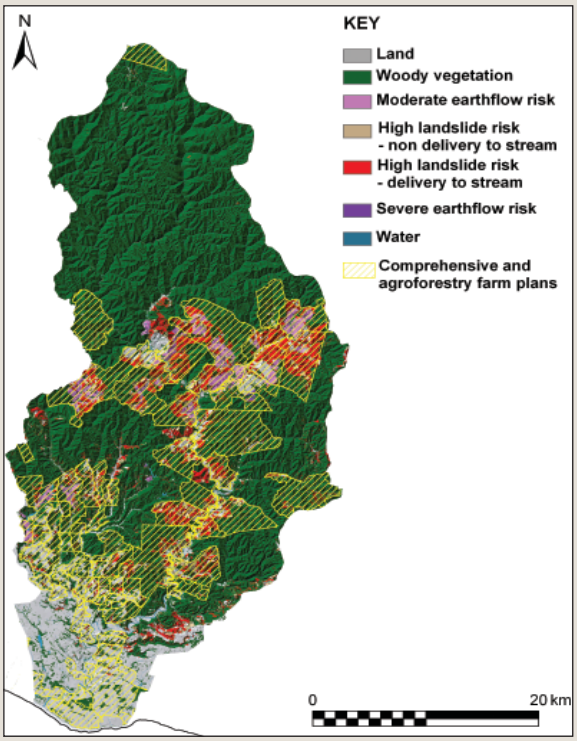


Figure 3.5: Coverage of farm plans in the Waitōtara catchment in relation to land susceptible to erosion.

(C) CARBON FARMING IN THE HILL COUNTRY

The previous Government introduced policies to promote the removal of carbon from the atmosphere including several schemes to encourage landowners to retain land in trees or grow in new trees, and thus earn carbon credits (see case study in Chapter 6: Atmosphere). While the emission trading scheme is being reviewed, schemes which encourage the retirement or planting of marginal hill country, making its land use more environmentally sustainable, will complement the Council's sustainable land management programme.

(D) SUSTAINABLE LAND MANAGEMENT IN THE SAND COUNTRY

The Council also works with landowners of sand country by preparing property plans to provide information and advice on managing sand country sustainably. Conservation plans specifically addressing sand blow problems and riparian plans make recommendations for the retiring and planting of waterways and for the provision of shelter belts which can minimise the risk of sand blow outs. The Council has prepared property plans covering 5,233 ha, or 41% of the region's coastal sand country, the extent of which in South Taranaki are illustrated in Figure 3.6.

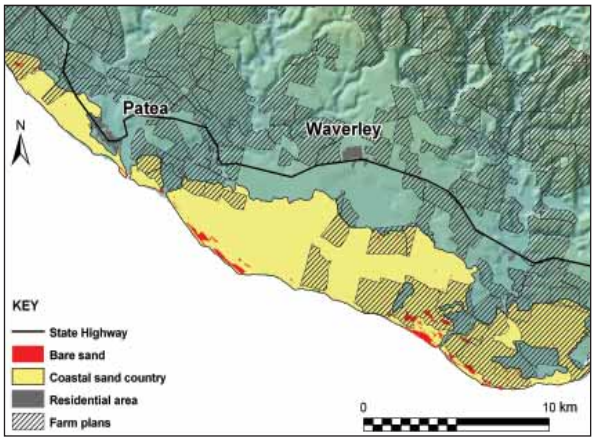


Figure 3.6: South Taranaki showing coverage of property plans and extent of bare sand.

(E) INFORMATION, EDUCATION AND ADVICE

The Council receives and responds to numerous requests from the public for information on sustainable land management and has prepared a number of pamphlets and other educational material. By way of example, in 2007-08, the Council liaised with existing property plan holders on 2,487 occasions (over twice the number in 2000-01) and received and responded to 554 requests for advice and assistance on a wide variety of land management related issues. The Council will continue to provide the community with information on sustainable land management.

(F) PLANTING MATERIAL

The Council operates a scheme involving the supply to property plan holders of low cost poplar and willow plants for soil stability purposes. During the 2007-08 year the Council provided 12,569 poplars and willows to 73 landholders. Over the past 10 years, the Council has supplied over 90,000 poplars and willows to landholders (Figure 3.7). The provision of planting material at cost is a key component in the success of the Council's sustainable land management programmes.

(G) SUMMARY OF PROGRESS

A summary of progress in implementing regional objectives and policies on soil erosion is given in Table 3.2 below.

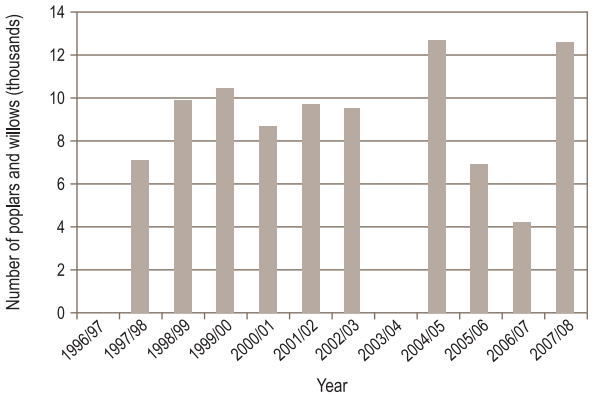


Figure 3.7: Plants provided to landowners at cost for soil stability planting over the past 10 years.

Table 3.2: Summary of progress: implementing regional objectives and policies on soil erosion.

Issue	What do we want to achieve?	What are we doing about it ?	Where are we at ?
Accelerated erosion	• 89% of privately-owned hill country sustainably managed. • A 50% increase in forestry or plantings on steep land (Class VIe and VIIe). • No net loss in the area of indigenous forest on steep hill country land. • A 5% reduction in the area of bare sand in the coastal sand country. • 50% of privately-owned hill country and sand country covered by farm plan. • 70% of property plans implemented in whole or in part.	• Implementing the *Regional Soil Plan*. • Preparing property plans through the sustainable land management programme. • Hill country and sand country monitoring. • Providing advice and information. • Providing planting material. • Developing methods for monitoring implementation of property plans.	• 87.4% of the hill country is managed sustainably. • Area of plantation forestry in the hill country has doubled. • 3% decrease in area of indigenous forest on monitored sites. • Overall decrease in area of bare sand at monitoring sites. • 58% of privately-owned land in the hill country is in the sustainable land management programme. • 41% of privately-owned land in the coastal sand country is in the sustainable land management programme. • 269 comprehensive farm plans and 24 agroforestry plans have been prepared.

Table 3.3: Area of pasture on erosion-prone hill country by region between 1997 and 2002.

Region	Erosion-prone area (ha) in pasture in 1997 (LCDB1)	Erosion-prone area (ha) in pasture in 2002 (LCDB2)	Percentage of total regional land area (%)	Area (ha) change from pasture (LCDB2)	Percentage change (%)
Northland	67.723	65.832	5.10	-1.691	-2.50
Auckland	13.101	12.988	2.49	-53	-0.40
Bay of Plenty	27.000	25.855	2.20	-1.104	-4.09
Waikato	116.049	112.315	4.58	-3.680	-3.17
Gisborne	169.141	158.382	19.01	-8.151	-4.88
Hawke's Bay	113.128	110.416	7.80	-2.537	-2.24
Manawatu	230.585	223.535	10.08	-6.793	-2.95
Taranaki	40.580	38.444	5.30	-2.136	-5.26
Wellington	54.281	51.387	6.33	-2.794	-5.15
Nelson	1.612	1.535	3.52	-76	-4.74
Tasman	24.249	22.697	2.39	-1.012	-4.17
Marlborough	75.042	71.946	6.84	-3.107	-4.14
Canterbury	113.995	113.770	2.52	-220	-0.19
West Coast	4.623	4.592	0.20	-16	-0.35
Otago	101.531	101.236	3.17	-294	-0.29
Southland	26.083	25.437	0.80	-646	-2.48
North Island	829.587	799.154	N/A	30.433	-3.67
South Island	347.134	341.213	N/A	-5.291	-1.71
Total	**1.176.721**	**1.140.367**	**N/A**	**-36.354**	**-3.09**

Notes:
1. Figures rounded to the nearest 200 hectares.
2. Pasture classes from the erosion risk data used for this analysis limited to the Land Cover Database 'Primarily Pastoral' classes for reporting.
Data: Landcare Research, from MFE, 2007.

3.1.3 HOW DO WE COMPARE?

The Ministry for the Environment has compared areas of erosion susceptible land in New Zealand and the at-risk area being farmed by region by comparing satellite images between 1997 (LCDB1) and 2002 (LCDB2)[9]. According to the Ministry's analysis, Taranaki has 5.3% of its region in erosion-prone land in pasture, compared to neighbouring regions such as Waikato (4.6%) or Manawatu-Wanganui (10%) (Table 3.3). The amount of erosion-prone land in pasture recorded in 2002 decreased nationally by 36,000 hectares. In Taranaki there was a 5.4% reduction in the amount of erosion-prone pasture land between 1997 and 2002 (this figure differs to that determined through the Council's own monitoring due to the different methodology used but is still of a similar magnitude and in the same direction). This was the highest percentage of change recorded for all the regions, followed by the Wellington region (showing 5.2% reduction in erosion-prone pasture land) and the Gisborne region (which demonstrated a 4.9% reduction).

East Taranaki hill country.

3.2 SOIL HEALTH

3.2.1 WHAT IS THE CURRENT STATE OF SOIL HEALTH IN TARANAKI?

(A) INDICATORS

Soil health refers to the biological, chemical and physical state of the soil and the maintenance of soil ecosystems. It includes aspects such as the structure of the soil, the levels of organic matter, nutrients and trace elements and levels of any contaminants. Ecological processes

9 Ministry for the Environment. 2007. *Environment New Zealand 2007*. Note: LCDB = Land Cover Database.

Table 3.4: Indicators used for soil quality assessment.

	Measures	What this tells us about soil health
Physical properties	Dry bulk density	Compaction
	Particle density	Porosity and available water
	Macroporosity	Soil compaction, root environment, aeration
Chemical properties	Total carbon content	Organic matter status
	Total nitrogen content	Organic nitrogen reserves
	Olsen P	Plant available phosphate
	Cadmium and zinc concentration	Level of trace metal contaminants
Biological properties	Mineralisable nitrogen	Organic nitrogen that can be mineralised to a plant available form
	Microbial biomass	Amount of living microbes in soil
	Soil respiration	Total activity of aerobic soil organisms
	Soil nematode populations	Diversity and numbers of soil nematodes

SOURCE: Sparling and Stevenson, 2008.

are important for productive soil, such as the breakdown of organic material and the release of nutrients for plant growth. Other indicators of soil health include concentrations of various chemicals – indicators of nutrients available for plant growth, and various biological properties that provide an indication of the 'healthy' functioning of the soil (Table 3.4).

Since the last state of the environment report[10] the Council has continued soil quality investigations and monitoring projects to ascertain whether there are any threats or emerging trends in Taranaki relating to soil compaction, depletion of soil nutrients and residual soil contamination. Results from the following studies inform us of the state of soil health and will be discussed further below:

1. 2008 soil study: A study was repeated into the biological, chemical and physical characteristics of soil on properties representative of the major agricultural land uses and soil types within Taranaki[11]. This study updated a national monitoring project implemented in 1999-2001 (the '500 Soils' project). Sites are illustrated in Figure 3.8.
2. 2007 long term study: A separate study looked at how soil health has changed over a longer time frame[12]. This involved re-sampling seven sites sampled 20-30 years ago, and included data from eight additional sites re-sampled in 2005. All sites were dairy farms except for one beef farm.
3. Two new trials explored the possible effects of livestock intensification upon soil and pasture quality for several years. The locations of these research farms are illustrated in Figure 3.8.

(B) PHYSICAL PROPERTIES OF SOIL

Taranaki's soils, particularly its volcanic and organic soils, are generally more resistant to compaction than other soil types, although they are not altogether immune to damage. In relation to soil compaction, 97% of Taranaki soils are in the moderately vulnerable to very resistant categories, with 52% in the very resistant category[13]. Taranaki's volcanically-based soils have a naturally high resistance to structural damage and are generally able to withstand intensive land uses while maintaining essential soil physical qualities. Other types of soils such as those found on river and stream margins, coastal sandy soils, or alpine and sub-alpine soils are very vulnerable to soil compaction but comprise only 3% of Taranaki soils.

Soil compaction leads to reduced aeration, a tendency for soils to turn 'sour', decreased water infiltration and retention capacity, and accelerated run-off. It is linked to adverse effects on pasture productivity. Other short-term effects of compacted soil include increased erosion potential, emissions of nitrous oxide (a greenhouse gas), and leaching of nitrate.

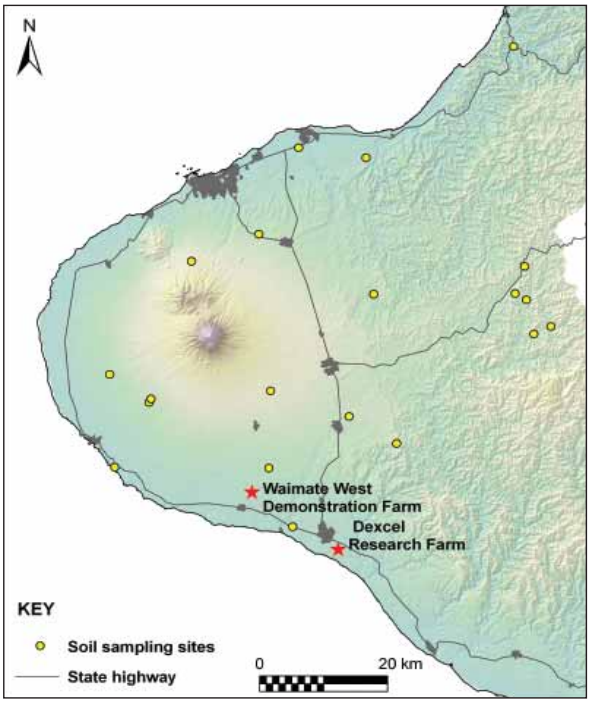


Figure 3.8: Sites sampled for soil health monitoring and the location of research farms, the sites of trials.

10 Taranaki Regional Council. 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region.*
11 Sparling, G; Stevenson, B. 2008. *Soil Quality in Taranaki Region: Characteristics of new sites, and current status of previously sampled sites.* Prepared by Landcare Research for the Taranaki Regional Council.
12 Parfitt, R,L and Ross C. 2007. *Soil Profile Resampling for Carbon, Nitrogen and Phosphorus after 21 to 31 years.* Prepared by Landcare Research for the Taranaki Regional Council.
13 Hewitt, AE, 1998. *Structural Vulnerability of Taranaki Soils.* Prepared by Landcare Research for the Taranaki Regional Council.

Taranaki soils are naturally resilient to compaction.

Notwithstanding the generally good soil structure found in Taranaki soils, the original '500 soils' study identified some evidence of soil compaction at 16 of the 32 dairy farm sites investigated[14]. In the 2008 soil study, 60% of the sites sampled showed soil compaction problems with six of seven dairying sites and four of five drystock sites showing soil compaction over target levels. However, it should be noted sites were sampled at the end of winter, a 'worst case' situation.

The most likely cause of increased soil compaction has been identified as the 'pugging' of soil by cattle during wet weather (when the soil is saturated), with paddocks either excessively stocked or left stocked for extended periods. Compaction is generally reversible. The rate of recovery depends on subsequent pasture and stock management, climate and soil type factors[14].

The stocking rate intensification trial showed that paddocks left unstocked had the best soil health in terms of soil compaction. Interestingly, different stocking rates did not show any difference in compaction rates. One trial showed soil structure improving regardless of stocking rate as good pasture management was put in place. The biggest effect on soil compaction, irrespective of stocking rate, occurred when paddocks were grazed during heavy rainfall. Under these circumstances, moderate pasture damage occurred as a result. These trials indicate that pasture management regimes had a far greater potential effect on pasture quality and soil health than stocking intensity. It was noted during the experiment that increased stocking rates led to increased loss of vegetative cover on the pasture[15]. This affects the potential for soil erosion and sedimentation due to run-off.

Thus soil health can be mitigated by adopting appropriate farm management techniques such as rapid movement of cattle from susceptible paddocks, grazing cattle on higher ground during heavy rain fall and not over-grazing paddocks.

(C) CHEMICAL PROPERTIES OF SOIL

Organic matter

Organic matter in the soil is important for soil moisture and nutrient retention, soil structure, availability of trace elements, and plant growth. Popular perception is that pastoral farming depletes the organic content and nutrient levels of soil.

However, the 2008 soil study showed that the carbon content of the dairying soils was actually overall higher than for the two sites in native bush, indicating that no or little 'carbon mining' is taking place and that the reverse may actually be occurring, and that there was no overall trend of decreasing carbon values for pasture as has been observed in some other regions of New Zealand with different soil types[16].

The 2007 long-term soil study of sites first analysed 30 and 20 years ago, found that on average, the total soil organic matter and the carbon:nitrogen ratio had not changed. The common soil type in Taranaki is derived from volcanic rocks. The soil particles with volcanic content may bind to the organic matter and so prevent the loss of organic matter from the soil. The finding that levels of organic carbon in soil in Taranaki are being maintained under pastoral livestock management, has implications not only for the aim of protecting the quality and fertility of these soils, but also for 'carbon crediting' in greenhouse gas emission inventories.

Phosphate levels

Phosphates are nutrients important for plant growth. The 2008 soil study found that phosphate levels were below levels recommended for productivity at forestry and drystock sites surveyed, indicating production is likely to be sub-optimal at such sites, and that productivity on Taranaki's hill country farms could be enhanced by judicious use of phosphate fertilisers[16].

While the studies show that over a 20-30 year time frame phosphate levels have increased significantly in Taranaki soils (68% average), over the past ten years the increase has in fact been negligible. This is consistent with fertiliser sales data showing a sharp decline in recent years. Phosphate levels on almost all dairy farms reported on in the two studies are considered appropriate.

Nitrogen levels

Nitrogen is another nutrient important for plant growth. Soil nutrient depletion can be an issue. However, excessive nitrogen levels (which may arise through excessive fertiliser application or importation of feed) can lead to nitrate leaching into either surface water or groundwater. It is also an economic cost to farmers.

Nutrient levels are important for pasture production.

14 Sparling, G. 2001. *Interpretation of Taranaki Region Soil Health Data from the 500 Soils Project, 1998-2000.* Prepared by Landcare Research for the Taranaki Regional Council.
15 Unpublished data.
16 Sparling, G and Stevenson, B 2008. *Soil Quality in Taranaki Region.* Prepared by Landcare Research for the Taranaki Regional Council.

The 2008 study found that total nitrogen levels were above recommended levels on almost all dairy farms and that the average total nitrogen level on dairy farms had slightly increased over the past 10 years[16]. While soluble nitrogen fell, this may reflect the influence of the timing of the sampling (winter's end). However, the 2007 long-term soil study found that total soil nitrogen in the dairy farm sites probably has not changed when assessed against 30 or 20 years ago[17].

Nitrogen in soil is predominantly in the organic form. When it decomposes it may contribute to increased nitrate leaching but the majority of nitrate leaching comes from fertiliser and animal excreta, not the decomposition of organic nitrogen. High total nitrogen reflects conditions with vigorous root growth of pasture, which is to be encouraged. Nutrient levels in cropping/gardening soils were generally among the highest of all land use classes.

The stocking rate intensification trials found there was no significant difference in loss of nutrients and trace elements (total nitrogen, calcium, and magnesium) via leaching, even though stocking rates and the amount of feed imported increased. For the duration of these trials it was apparent that higher stocking rates do not necessarily lead to an increase in leaching to groundwater, but rather the issue is more one of balancing nutrient application and uptake by pasture. The studies showed that appropriate farm management could improve soil quality (structure and chemistry) even at higher stocking rates, and that more highly stocked soils can be as good as those stocked at a lower rate[18].

(D) RESIDUAL SOIL CONTAMINATION

Cadmium and zinc

There is considerable interest in the question of whether cadmium (a contaminant found in phosphate rock) and zinc (an animal remedy) are accumulating in pasture soils to an extent that poses an environmental risk such as toxicity in produce. To this end, the Council has reviewed data from national and specific Taranaki studies[19,20].

In these studies, the average cadmium concentration in dairying soils in Taranaki was in the range 0.52-0.66 mg/kg, and for all soils the averages were 0.47-0.66 mg/kg. Very few results lay above 1.0 mg/kg,

Pip Gerard, of AgResearch, with one of the mites brought to Taranaki.

IRISH ALIEN TACKLES ROOT WEEVIL

It's the stuff of horror movies – but in terms of the health of Taranaki's soil, it's a story that has a happy ending in sight.

The protagonist, an Irish wasp called *Microctonus aethiopoides*, injects its egg into the target, the clover root weevil called *Sitona lepidus*. When the egg hatches, the weevil is firstly sterilised then dies as the mature larva bursts out of the abdomen.

The stakes here rival a blockbuster's box-office takings. Healthy clover is a low-cost, natural source of nitrogen, with the value of its fixed nitrogen pasture yield, high-quality forage, seed production and honey production put at $3 billion nationally. The root weevil can cut clover pasture production by a third or more. This not only takes a direct economic toll, but forces farmers to apply more nitrogen fertiliser which can potentially compromise the health of both soil and waterways.

The weevil, a native of Europe and North America, was first discovered in New Zealand in 1996. By the early part of this decade it had made its way into Taranaki and had also won infamy as one of the nation's worst pasture pests.

Enter the *Microctonus aethiopoides*, a natural enemy of the weevil and brought to New Zealand by AgResearch in 2005 to fight the weevil under an overall programme funded through Dairy NZ and Meat and Wool NZ. It was introduced to this region in the summer of 2006-07, under a project funded by the Taranaki Regional Council.

It got off to a roaring start at two Taranaki trial sites. After the release of 5,000 weevils carrying the wasp egg, parasitism rates of 64% had been established at Lepperton and 23% at Stratford within six months.

That was encouraging evidence that the Irish wasp would be able to increase its numbers rapidly in Taranaki, and plans were made for widespread dispersal of parasitised weevils among the region's famers during the summer of 2007-08.

Nature intervened, however, with the summer drought hitting pastures hard. While parasitism levels were good, only one site produced enough weevils for collection, and dispersal sites were limited to a couple of farms with good irrigation and plenty of clover.

Another 58 vials of infected weevils have been given to Taranaki farmers in 2008, along with background information and instructions for release.

With more favourable weather expected for the summer of 2008-09, wider dispersal of the weevils is planned, along with a publicity campaign.

It may not be an Oscar-winner, but the wasp-versus-weevil story is a gripping one for Taranaki landowners.

17 Parfitt, R,L and Ross C. 2007. *Soil Profile Resampling for Carbon, Nitrogen and Phosphorus after 21 to 31 years.* Prepared by Landcare Research for the Taranaki Regional Council.
18 Unpublished data.
19 Taranaki Regional Council. 2005. *Cadmium in Taranaki Soils: An assessment of cadmium in Taranaki soils from the application of superphosphate fertiliser.*
20 Sparling, G. 2001. *Interpretation of Taranaki Region Soil Health Data from the 500 Soils Project, 1998-2000.* Prepared by Landcare Research for the Taranaki Regional Council.

Aerial topdressing.

with the highest reported in any study 1.7 mg/kg. Generally cadmium levels were highest on grazed pastures (but there was little distinction between pastoral soils and plantation soils), and lowest within indigenous forestry soils. Internationally, guideline values for cadmium in agricultural soils (including beef, sheep, and horticultural soils) are in the range 1-12 mg/kg, with the lower values being used for triggering the need for further investigation (1.0-1.4 mg/kg). The majority of Taranaki sites were about half the lower guideline values.

At the average rate of increase found in some of these studies, it would be approximately 100 years before the average for dairy sites exceeds the guideline values and triggers the need for further investigation. Modelling of cadmium accumulation predicts that soil concentrations of cadmium will in fact reach a limiting value around 1.3 mg/kg or a little higher, depending upon phosphate fertiliser application rates[21]. It should also be noted that the current rate of application of superphosphate (2007) is now less than what it was in the preceding four decades (Figure 3.9)[22], and the current cadmium concentration in superphosphate is less than half of what it was over that period. These factors would considerably extend the period before levels were reached that would necessitate further investigations. A national working party is examining options for controlling cadmium accumulation in agricultural soils. The working party also advises that, in any case, 'dairy (milk), muscle meat and fruit products are unlikely to be at risk of high cadmium levels, due to the low capacity of these products to store cadmium'[23].

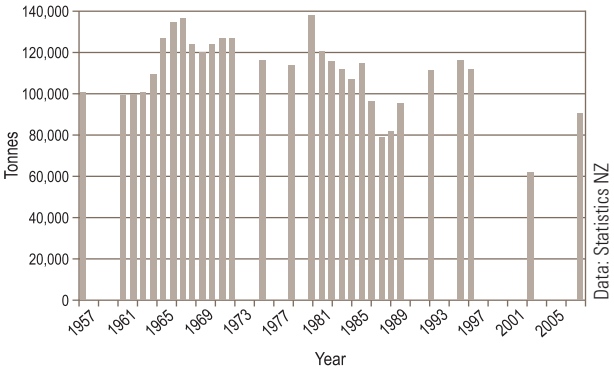


Figure 3.9: Tonnes of superphosphate-based fertiliser used in Taranaki (see note below on data used).

Zinc concentrations at all sites were far below guideline limits. While the highest soil concentration was found in one dairy pasture site, generally levels were similar in all land uses surveyed: indigenous bush, plantation forest and beef pasture sites.

Of note is that the forms of both cadmium and zinc that are readily available for uptake or ingestion by plants or animals were several orders of magnitude or more lower in concentrations than the total concentrations of these elements. This highlights that in Taranaki soils these metals are simply not readily available for plants or animals.

Agrichemicals

As part of the 2008 soil survey, samples were also collected for evidence of residual contamination by agrichemicals. All sites were tested for a suite of 18 different acidic herbicides (including acetochlor, chlorpyalid, dicamba, 2,4-D, haloxyfop, MCPA, MCPB, pentachlorophenol, picloram, 2,4,5-T, 2,4,5-TP, and triclopyr). Sites were also tested for a suite of 72 different chemicals that are used to control insects or fungus. These included acephate, atrazine and its derivatives, captan, chlorpyrifos, cyfluthrin, diazinon, dichlorvos, malathion, parathion, permethrin, simazine, trifluralin, and vinclozolin.

The limits of detection for the herbicides were in the range 0.008-0.02 mg/kg. The limits of detection for the pesticides were in the range 0.009-0.04 mg/kg.

Out of 72 pesticides tested for in 20 samples (1,440 results), 12 results returned a positive result (in each case, just on the limit of detection). That is, 99.17% of all results were negative for the presence of any pesticide. One sample had five positive detections, while a second had two. Perhaps unsurprisingly, these two sites were the two cropping sites tested. Otherwise each of the remaining five results occurred in a different sample, i.e. none of these five latter sites (two drystock farms and three forestry plots) had more than a single pesticide (out of 72) confirmed present.

No agrichemicals were detected in the soil at any dairy farm site, the predominant land use on the ring plain of Taranaki.

The herbicide acetochlor was detected at five sites (some drystock, market gardening, and indigenous forest sites), otherwise no agrichemical was detected at more than one site. Acetochlor is used for pre-emergent weed control in cropping. It is strongly absorbed by soil, with little leaching, and a half life of 8-18 days i.e. it degrades rapidly and is not persistent or cumulative.

On the basis of these results, there is no evidence of any issue of residual or cumulative agrichemicals in the soils of the region.

(E) BIOLOGICAL HEALTH

Soil biological health can be assessed from the soil microbial biomass and soil respiration. The diversity of the soil invertebrate community can be assessed by counting the numbers and types of soil nematodes (small worm-like animals). However, research on using these measures as indicators of soil health is in its preliminary stage and there is still

21 Taylor M et al, 2007. *Soil Maps of Cadmium in New Zealand.* Published by Landcare Research.
22 Note: Data on tonnes of superphosphate not available for all years. For 1957, and 1961-1980 Statistics New Zealand just records fertiliser used and tonnes of lime. Given that the main fertiliser used during those years, the graph uses this figure as the estimate for quantities of superphosphate used.
23 Cadmium Working Group. November 2007. *Summary of Risks from Cadmium in Agricultural Soils.*

little understanding of the consequences of changes in soil biodiversity[24]. The Council still chose to pursue this component of soil assessment because of the growing awareness of the need to safeguard ecological diversity within soil communities, and that soil health has a biological, as well as structural and chemical, component.

Popular perception is that soils under pastoral management tend to have lower diversity and ecological richness than plantation forestry and indigenous bush soils. The results of the 2008 soil survey do not bear this out. Soil biodiversity was poor only in cropped soils. These sites were also among those with the lowest quantity of microbial biomass. The report notes that cropping sites frequently have lower microbial biomass than pastures, because of repeated soil disturbance and reduced returns to soil. Forestry sites had invertebrate communities that reflected a damp environment with a high rate of organic decomposition.

The study findings will be used as a baseline for future studies and can also be revisited as expertise and experience in interpretation develops.

3.2.2 HOW IS SOIL HEALTH MANAGED IN TARANAKI?

(A) REGIONAL PLANS

The Council addresses soil health through the *Regional Soil Plan for Taranaki* and the *Regional Fresh Water Plan for Taranaki*. The Soil Plan's soil health objective, policies and methods focus on non-regulatory methods. Through the plan, monitoring systems have also been put in place to monitor and gather information on the long-term effects of land use activities on soil health. The *Regional Fresh Water Plan* includes objectives, policies, and methods (including rules) addressing the effects of discharges of contaminants to land, whether from animals, effluent treatment, or applications of fertiliser and pesticides.

In implementing the plans the Council seeks to raise public awareness of soil health issues, optimise soil productivity and promote the adoption of practices by farmers that will avoid or minimise soil structure degradation, soil nutrient depletion, or residual soil contamination problems.

(B) RESOURCE CONSENTS

The Taranaki Regional Council issues consents for discharges to land, in accordance with the rules set out in the *Regional Fresh Water Plan*. At the end of June 2008, there were 875 consents for the discharge of agricultural wastes to land, 817 from farm dairy discharges, and 298 for the discharge of non-agricultural wastes to land. 75% of all discharges to land, were for the land application of farm dairy effluent. The total number and the proportion of such discharges directly to land instead of to water is steadily increasing in the region – a product of increased amalgamation of dairy farms, increased environmental awareness and recognition of the fertiliser benefit of discharging to land.

Over half of all the consents for the discharge to land of non-agricultural wastes have been granted within the past five years.

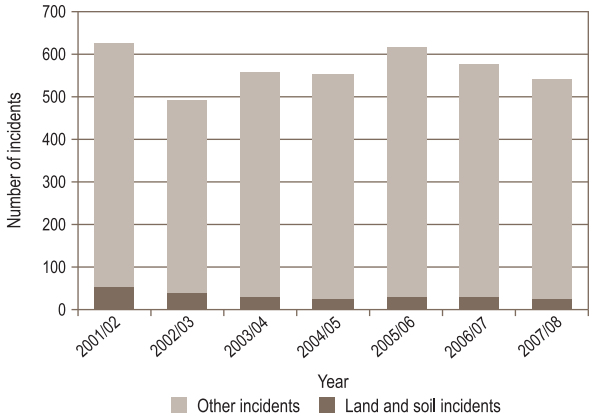


Figure 3.10: Number of land related incidents over time compared to the number of incidents reported each year.

These predominantly relate to discharges of sediments associated with earthworks, septic tank soakage systems, cleanfills, stormwater and hydrocarbon exploration sites discharging to land soakage, and the land incorporation of drilling wastes and fluids.

(C) UNAUTHORISED INCIDENTS

The Council maintains a register of complaints, and follows these up. The number of incidents related to land compared with the total number of other complaints is illustrated in Figure 3.10. Over the past six years these have largely arisen from complaints about dairy farms (29%), cleanfills (15%), meatworks and transport operators.

(D) INFORMATION, EDUCATION AND ADVICE

The Council responds to all requests from the public for information on soil health. The provision of information and advice can raise awareness of issues and problems and provide simple cost-effective solutions enabling land users to make well-informed decisions to prevent or minimise the effects of their land use practices on soil health.

The Council also promotes the use of guidelines, codes of practice, and standards, particularly on the application of pesticides, fertilisers and other agricultural compounds. This applies especially for those developed by the industry for the agricultural sector such as the *Code of Practice for Nutrient Management*[25] and the *Spreadmark Programme*[26].

The *Dairying and Clean Streams Accord*[27] is part of a range of activities to promote sustainable dairy farming in New Zealand. One of the six priorities for action adopted by the region includes the effective management of nutrients[28]. The *Regional Action Plan for Taranaki* sets a target of 100% of dairy farms to have a nutrient budget in place by 2007. By June 2008, 99.1% of dairy farms had a nutrient budget in place. This was up from 22% in 2004-05[29]. With Fonterra proposing financial penalties for farms that do not have a nutrient budget, it is anticipated that by the 2008-09 dairy season all supply farms will have nutrient budgets, a quadrupling within four years and a very positive situation for the health of Taranaki's soil resources.

24 Sparling, G and Stevenson, B 2008. *Soil Quality in Taranaki Region*. Prepared by Landcare Research for the Taranaki Regional Council.
25 Fert Research, 2007. *Code of Practice for Nutrient Management*.
26 New Zealand Groundspread Fertilisers Association. 1994. *Spreadmark Programme*.
27 Fonterra Co-operative Group, regional councils, unitary authorities, the Ministry for the Environment, and the Ministry of Agriculture and Forestry, 2003. *Dairying and Clean Streams Accord*.
28 Taranaki Regional Council, 2004. *Regional Action Plan for Taranaki*.
29 Taranaki Regional Council, 2008. *Dairying and Clean Streams Accord. Annual Report 2007-08*.

Taking soil samples.

(E) MONITORING AND INVESTIGATIONS

Since its *1996 State of the Environment Report*, the Taranaki Regional Council has undertaken investigative monitoring and participated in the national '500 soils' project (including its own continuing investigations based on the '500 soils' methodology) in order to first 'benchmark' and then track trends in soil health indicators. Future monitoring will be based on the '500 soils' Project (which, subject to review, will be continued at five-yearly intervals).

The Council supports work investigating the effects on soil health of different stocking rates with supplementary feeding regimes at two research farms. Research into the biodiversity and ecological richness associated with the varying stocking intensities, the effects on soil characteristics of nitrogen inhibitors, validation of soil nutrient modeling and the effects on soil structure from cropping and pasture renewal has been commissioned.

For example, during 2007-08, the Council investigated the impacts of higher dairy stocking rates on soil biodiversity. Plant, nematode, earthworm and invertebrate abundance and diversity were compared between paddocks with different stocking intensities. This found that higher stocking rates led to paddocks with higher proportions of bare ground. Higher stocking rates had little impact on overall nematode density or on species diversity, probably because the higher stocking rates had little effect on soil bulk density as Taranaki soil is generally resistant to soil compaction damage. There were no significant effects of increased stocking rates on earthworm species' richness, or on earthworm densities, with the exception of *Aporrectodea longa*, a useful deep burrowing species, which was found to be more abundant in the highly stocked paddocks. This increase was not surprising as this species of earthworm feeds on the surface where there was more food (more dung from the higher stocking rate). It might even be that this earthworm helped offset impacts of stock compacting the soil to a small extent.

During the 2007-08 year the Council also investigated the effects of disposing of oil drilling wastes onto land on the soil biology. Earthworm densities were compared between areas that had and had not been subject to various types of drilling waste application. Preliminary results indicate that applying drilling wastes to land in a manner that complies with consent conditions does have negative impacts on earthworm numbers, but these impacts subside with time and populations are able to recover over the long term. Further studies are planned to investigate the reasons for these negative impacts and to investigate ways to improve the ways in which drilling wastes are disposed to land.

(F) SUMMARY OF PROGRESS

Progress on implementing regional objectives and policies on soil health is summarised in Table 3.5.

3.2.3 HOW DO WE COMPARE?

Two studies have recently been completed looking at soils across New Zealand. One study looked at changes in total carbon and nitrogen in pastoral soils over the past 17-30 years[30]. It found that on average, soils had lost statistically significant amounts of both carbon and nitrogen. This loss of organic material from soils was attributed primarily to grazing, distinct from erosion or leaching. Of the Taranaki sites in the study, half showed increases in carbon and nitrogen in contrast with the national trends, and those sites that did show a loss of carbon or nitrogen showed smaller losses than sites elsewhere in the country.

As part of the '500 soils' Project, six key measures of soil health were monitored across seven major land-use categories in New Zealand[31,32]. These were reported on in the national state of the environment report[33]. Interestingly, of all land use types, the soil used for dairying and drystock

Table 3.5: Summary of progress: implementing regional objectives and policies on soil health.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Soil health	• No adverse change in soil structure on privately-owned land. • No adverse depletion in the nutrient levels of soils on privately-owned land. • No adverse increase in residual contaminant levels in soils on privately -owned land.	• Implementing the *Regional Soil Plan*. • Providing advice and information. • Advocacy. • Soil health investigations and research. • Monitoring.	• *Regional Soil Plan* made operative in October 2001 • Monitoring shows soil compaction at some sites but no evidence to date of long term change in soil structure. • Further research into soil structure and nutrient soil levels management commissioned. • No adverse depletion of soil nutrients or organic content. • No adverse increase in residual contamination from diffuse activities.

30 Schipper, L et al. 2007. Large losses of soil C and N from soil profiles under pasture in New Zealand during the past 20 years. *Global Change Biology* 13:6 pp.1138-1144
31 Sparling, G, and Schipper, L. 2004. Soil quality monitoring in New Zealand: trends and issues arising from a broad scale survey 1995–2001. *Agriculture, Ecosystems and Environment* vol 104, pp 545–552.
32 Sparling, G. 2007. *Land: Soil Quality Assessed from the 500 Soils Project*, unpublished, prepared for the Ministry for the Environment. Wellington: Ministry for the Environment.
33 Ministry for the Environment. 2007. *Environment 2007*.

had the highest carbon and nitrogen levels of all land use types, well above (for example) native forestry or tussock. In this work, the average levels of carbon and nitrogen in Taranaki's dairying soils were 22% and 24%, respectively, higher than the national average for dairying soils.

However, this same study showed that soil compaction in Taranaki's dairying soils was worse than the average, scoring only 6.1% on the soil compaction measure used, compared to an average of 10.1% across the whole country, although it is worth noting that these were sampled at the end of winter, the worst-case timing. Nationwide, half of all dairy soil sites scored below 10% which is the threshold of adverse effects upon productivity.

In terms of cadmium levels, nationwide, the highest single soil cadmium level has been found in Waikato, with Bay of Plenty also having a high average along with Taranaki[34]. The highest results are associated with dairying, but orcharding had similar average values. Peat soils were found to have the highest potential for cadmium accumulation. These soils are rare in Taranaki. Beef and sheep farming sites had values very close to the national average.

3.3 CONTAMINATED SITES

Contaminated sites result from historical activities and industries where hazardous substances were inappropriately stored, used or disposed of, although these activities may well have been lawful at the time. Contamination may remain on-site in soil and/or move off site in surface water, groundwater or air discharges, posing a wider risk to both public health and the environment. Examples of land uses that could result in site contamination include landfills, engineering workshops, timber treatment sites, rail yards, gasworks, scrap metal yards and stock dips.

Present day activities and industries are much less likely to result in contaminated land, as those involving discharges to the environment are controlled under the RMA, while the storage and use of hazardous substances is controlled under the Hazardous Substances and New Organisms Act 1996 (HSNO).

3.3.1 WHAT IS THE STATE OF CONTAMINATED SITES IN TARANAKI?

In 1992 a report on potentially contaminated sites in New Zealand[35] was released, suggesting there might be 272 potentially contaminated sites in Taranaki. Given the desirability of a degree of certainty about the extent of any site contamination in the region, the Taranaki Regional Council embarked on a programme to investigate sites of interest, particularly timber treatment sites, sawmilling sites, landfills and rubbish dumps. This resulted in a number of extensive and thorough investigations and reports[36].

No national environmental standard currently exists on contaminants in soil. Sites are therefore classified on the basis of inspections and investigations carried out by the Council and a variety of currently available guidelines from both New Zealand and overseas.

The Council also developed a database, called the Register of Selected Land Uses (RSLU), to record information about sites in the region, where past or current activities may have resulted in contamination.

The RSLU includes information on sites which have been investigated for various reasons, including allegations of contamination. The total number of sites on the database does not indicate the number of contaminated sites, but rather the number of sites that have been investigated. There are 1,281 sites currently on the RSLU database (Table 3.6). The majority of sites (757), almost 60% of the total, have been investigated and no contamination has been found. A further 480 sites, or 37%, have had hazardous substances detected, but they pose no risk. Sixteen sites have been remediated, and there are no sites where the risk of the contamination means they are unable to be used.

Twenty eight sites remaining on the database require further investigation. These are generally low-risk sites, such as sites where notification has been received from the New Zealand Police regarding clandestine drug laboratories (previous investigations have shown that the land at such properties is not usually contaminated). The 28 sites also include those identified in the Moturoa oil field investigation[37],

Table 3.6: Status of sites on the Register of Selected Land Uses (RSLU).

No. of sites	Status	Comments
757	Hazardous substances not present - No identified contamination	Investigations have shown no contamination is present
480	Hazardous substances present - Risk acceptable for land use	Includes managed and remediated sites
16	Hazardous substances not present - Remediation undertaken	Remediated to background levels
0*	Hazardous substances present - Risk unacceptable for land use	Contaminated sites
28	Verified history of hazardous activity/industry	Low-risk sites unlikely to be contaminated, where further investigation is required to confirm status

*At the time of preparing this report, asbestos at the Pātea freezing works site had been stabilised, and so the site in the interim does not pose an unacceptable risk environmentally. Long-term remediation is still necessary.

34 Taylor M et al. 2007. *Soil Maps of Cadmium in New Zealand.* Published by Landcare Research.
35 Ministry for the Environment 1992. *Potentially Contaminated Sites in New Zealand: A broadscale assessment.* Prepared by Worley Consultants Ltd
36 Taranaki Regional Council. *Investigation of Possible Dieldrin Storage and Disposal Sites in Taranaki*, (1993); *Investigations of Past Refuse Dumping Sites in Taranaki*, (1995); *Investigations of Past Refuse Dumping Sites in Taranaki*, (1996); *Investigation of Timber Treatment and Sawmilling Sites in Taranaki*, (1995); *Site Investigations: Drycleaners, scrap metal yards, rail yards and gasworks*, (2000); and *Investigation of Alleged Agrichemical Waste Disposal Sites in New Plymouth*, (2001).
37 Taranaki Regional Council, Feb 2003. *Moturoa Oil Field Investigation: Stage 1*. Prepared by Transfield Worley Ltd

where any risk is due to the presence of the abandoned oil wells rather than the presence of hazardous substances. The Council has completed a follow-up investigation of one well which showed no evidence of any leaking from the well head. Investigations of other wells are planned.

3.3.2 HOW ARE CONTAMINATED SITES MANAGED IN TARANAKI?

(A) REGIONAL POLICY STATEMENT AND PLANS

The *Proposed Regional Policy Statement for Taranaki, 2008* states that all known and potentially contaminated sites are to be identified and managed in a manner that avoids or mitigates actual and potential adverse effects on both the environment and human health. Priority actions are determined by the type of contaminants, the degree of contamination, existing and future uses of the site and the potential for adverse environmental and public health effects. The *Regional Air Quality Plan* and *Regional Fresh Water Plan* contain rules to regulate the discharge of hazardous substances.

(B) DISTRICT PLANS

The *New Plymouth District Plan*, the *South Taranaki District Plan* and the *Stratford District Plan* all contain policies and methods that recognise the importance of managing hazardous substances to avoid contaminating the environment, and aim to facilitate the clean-up and rehabilitation of contaminated sites. District councils work closely with the Taranaki Regional Council to ensure that information about known contaminated sites is readily available to interested parties, such as landowners, potential purchasers and developers. Subdivisions and uses of rehabilitated sites are managed under district plans.

(C) PROPERTY DATABASE

The RSLU database is continually updated as new information is received. Information may be obtained from the Council's own activities, including investigations, regular monitoring and inspection programmes, and responses to unauthorised incidents. Information may also be provided by consultants carrying out site investigations, property owners, and members of the public.

Sites on the RSLU database are identified on www.trc.govt.nz through the Regional Xplorer. The information available includes the historical and current land uses, site status and a link to inspection data. A full site report can be made available on request from the Taranaki Regional Council. Real estate agents, land valuers, and solicitors have been advised of the RSLU and regularly make use of it.

Future development and subdivision of former agricultural or industrial land for residential use has the potential to lead to an increase in the number of sites considered contaminated as land uses change.

(D) MONITORING AND INSPECTIONS

The Hazardous Activities and Industries List (HAIL) is a compilation of activities and industries that are considered likely to cause land contamination resulting from hazardous substance use, storage or disposal[38]. The list includes industries such as abrasive blasters, cement works, garages/workshops, light engineering, paint sprayers, sawmills and other industries. The Council regularly monitors these industries for their compliance with consent conditions or permitted activity standards. Where industries fail to meet consent conditions or standards in regional plans they are re-inspected and if required, enforcement action is undertaken (including requirements for remediation).

(E) INVESTIGATIONS AND REMEDIATION

The Council has been proactive in the investigation of sites where past or current activities may have resulted in contamination. Some of these investigations have identified site contamination that poses unacceptable risks to the environment. A number of sites, with no apparent owner, have successfully been remediated in co-operation with the region's district councils. In 2003-04 this included four scrap metal yards, a garage, and two former gasworks sites.

In May 2008 the Council reported on the investigation undertaken of the former Pātea freezing works[39] (see case study). The report concluded that asbestos and electrical equipment containing PCBs are the only contamination issues remaining on the site.

Due to the careful and strategic use of resources the Council has devoted to the issue of contaminated land since the early 1990s, only a small number of low-risk sites now require further investigation.

Dangerous goods storage.

Taranaki Sawmills, Bell Block.

38 Ministry for the Environment, 2003. *Contaminated Land Management Guidelines No. 1. Reporting on Contaminated Sites in New Zealand.*
39 Taranaki Regional Council, 2008. *Patea Freezing Works Detailed Site Investigation Report.*

Fire raged through the abandoned Pātea Freezing Works, 6 February 2008.

AFTER THE HEAT CAME THE LIGHT

The heat went on – literally – in the midst of a lengthy site contamination investigation at the abandoned Pātea freezing works.

Interrupted by a major fire, the investigation was one of the most extensive and complicated ever carried out by the Taranaki Regional Council. But it has helped to define a positive way forward in dealing with the site.

Asbestos, hydrocarbons, PCBs and a range of other chemicals including nitric acid were on the list of possibilities in 2007 as Council staff began preparing to assess the site, which has lain disused for 20 years.

On-site work began in January 2008 but was dramatically interrupted on Ash Wednesday, 6 February, when a major fire at the old works caused the evacuation of hundreds of townsfolk because of fears of airborne asbestos in the smoke.

While subsequent air sampling indicated no asbestos contamination in the township, it was obvious that as a priority, urgent measures were needed to stabilise asbestos fibres left in the ruins of the site. Taranaki Regional Council technical and compliance staff suggested the use of a polymer dust suppressant of the type they are familiar with at construction sites and transport yards.

This succeeded beyond expectations, adhering to hard surfaces and soaking into the fine material and forming a thick spongy layer that bound ash and other fire debris, and ensured dust from the site wouldn't go anywhere. Subsequent air sampling has confirmed this.

The tangled mess left at the site posed more challenges for Council staff as they resumed their site assessment. PCBs were removed where possible, and old drums of acid were removed or neutralised on-site.

In the meantime, the publicity around the big fire highlighted uncertainty over ownership of the site, with several parties involved.

On-site investigations continued for four more months, covering soil, groundwater, air quality, and the ecology of the adjacent estuary. As a result of the site investigation, the Taranaki Regional Council's report concluded that concentrations of all on-site contaminants are below relevant guidelines except for asbestos, which has been stabilised with the polymer binder.

Surface water discharging from the site has elevated levels of metals. This goes directly into the estuary where it is immediately diluted many times over, and would not exceed guidelines or pose a significant risk to human health, or to the Pātea River ecosystem.

The Council's Director-Environment Quality, Gary Bedford, said he was pleased the investigation carried out by the Council had provided encouraging answers to many questions about the state of the site.

The South Taranaki District Mayor, Ross Dunlop, said that now his Council knows what contaminants it is dealing with, it can make plans for moving forward. He says the next step will be talks with central Government, land owners and iwi aimed at getting the site cleaned up.

The then Minister for the Environment, Trevor Mallard, announced Government funding of $1.5 million to help with cleaning up the site. The clean-up was expected to take place over a period of up to 40 weeks in 2009.

Taranaki Regional Council staff prepare to move hazardous waste after the fire.

(F) HAZARDOUS SUBSTANCES AND NEW ORGANISMS ACT

The Council inspects industries and businesses to check compliance with the Hazardous Substances and New Organisms Act. Businesses are not charged for the HSNO inspections which are done in conjunction with other inspections or monitoring wherever possible. The inspections are done under a contract with the Department of Labour.

The Environmental Risk Management Authority assigns various controls for sites based on the risk of hazardous substances that are stored or used. Controls may include 'Location Test Certificates' (similar to the old dangerous goods licences), 'Approved Handlers Registrations' for people handling hazardous substances, and tracking of hazardous substances. Compliance with these controls is assessed during inspections.

(G) SUMMARY OF PROGRESS

Progress on implementing regional objectives and policies on contaminated sites is summarised in Table 3.7.

3.3.3 HOW DO WE COMPARE?

In the *Environment New Zealand 2007*[40] report, 10 regions in New Zealand self-reported on contaminated sites. The data are shown in Table 3.8.

Since this report was released, remediation has occurred at additional sites in the Taranaki region. The figures show that as expected, most reported and confirmed contaminated sites are in the more populated regions that have high levels of industrial and agricultural activity.

As discussed earlier, Taranaki has no contaminated sites - all sites have either been remediated or are actively managed to ensure there are no significant adverse effects on the environment, such as the Pātea freezing works site.

Table 3.7: Summary of progress: implementing regional objectives and policies on contaminated sites.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Management of hazardous substances	Improvement in management	• RMA and HSNO advice, controls and monitoring are provided by the Regional Council.	• Inspections of businesses are undertaken by the Regional Council in conjunction with RMA monitoring. There is a high level of compliance.
Investigation and management of contaminated sites	Information on potentially contaminated sites, provision of accessible public information, and appropriate management of sites where there is an environmental or public health risk.	• All identified high-risk contaminated sites have been remediated and by December 2008 all identified medium risk contaminated sites will be effectively managed or remediated by the Council. • The Council contaminated sites database will conform to the Ministry for the Environment Classification and Management Protocols and district councils will have access to this database and subsequent updates. • The district councils will acknowledge within five working days an enquiry for information concerning contaminated sites.	• All contaminated sites in Taranaki remediated or effectively managed. 1,281 sites recorded on the database. • MfE proposing a National Environmental Standard for database requirements. Register of selected land uses incorporates current MfE guidelines. • Enquiries regarding the database come directly from the public.

Table 3.8: Self-reported information on contaminated sites in 10 regions, 2006–2007.

Region	Total number of sites that have been found to be contaminated	Number of contaminated sites not yet cleaned up or actively managed1	Number of cleaned up sites	Number of actively managed sites
Auckland	368	93	109	166
Waikato	258	118	140	See note 2
Wellington	149	77	46	26
Canterbury	134	10	124	See note 2
Otago	93	35	21	37
Bay of Plenty	85	42	4	39
Hawke's Bay	65	8	57	See note 2
Taranaki	39	0	10	29
Marlborough	24	5	15	4
Tasman	23	4	19	See note 2
Total	1,238	392	545	301

Notes:
(1) This column includes only sites that have not yet been cleaned up or managed, except for the Auckland figure, which includes some sites that have resource consents (and are therefore managed).
(2) The number of managed sites in this region is included under the column for confirmed cleaned up sites.
Data source: Listed regional councils.

40 Ministry for the Environment, 2007. *Environment 2007.*

Indigenous vegetation in Egmont National Park.

3.4 BIODIVERSITY ON LAND

The Taranaki region, despite its modest size, is a biologically diverse region. It has five distinctive ecological districts which give it its biodiversity characteristics (Figure 3.11). Each of these has its own character and supports different forest types, reflecting differences in geology, latitude and distance from the coast.

The Egmont ecological district is dominated by Mount Taranaki, volcanic soils, hundreds of ring plain rivers and streams, and would have once been covered with indigenous vegetation dominated by kāmahi, with a notable absence of beech species[41]. Altitude changes up the mountain lead to distinctive zones of vegetation. In this ecological district are threatened coastal species, threatened forest species and species found only on Mount Taranaki.

The Matemateāonga ecological district was once part of the ocean floor. Geological forces pushed up the landscape, and erosion of the soft papa rock has created deeply entrenched waterways, sharp ridges and steep hillsides. The area is characterised by extensive lowland forests of tawa and kāmahi. The inland Taranaki hill country forests have been described as lacking diversity, but close inspection reveals a fine scale mosaic of forest types with species occupying particular areas depending on soil and slope. For example, Hall's tōtara is the main species on dry ridges, whereas kahikatea occupies flat, poorly drained sites[42].

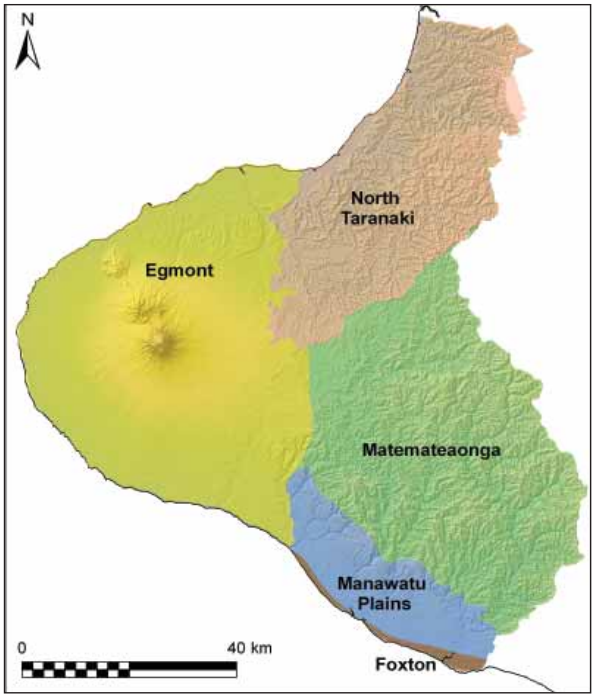


Figure 3.11: Map of ecological districts.

The North Taranaki ecological district was also formed from sedimentary rock, folded into steep hillsides and deeply incised streams and rivers. From a biodiversity perspective, its coastal areas are most significant with cabbage trees, mānuka, marsh ribbonwood, karaka, and ngaio[43]. North Taranaki forests support a range of northern species close to their distributional limits such as pūriri and various rare or threatened species such as king fern found at Whitecliffs.

Inland and coastal South Taranaki is made up of sections of the Foxton and Manawatu ecological districts. The coastal areas are the result of sand movement, under the influence of prevailing westerly winds. Moving sand is important habitat for threatened species such as katipo and pīngao.

3.4.1 WHAT IS THE STATE OF TARANAKI'S TERRESTRIAL BIODIVERSITY?

(A) INDICATORS

It is neither practical nor possible to measure the distribution and health of every native plant and animal species or ecosystem to assess the state of Taranaki's terrestrial biodiversity. Instead, a number of indicators are appropriate to use as surrogates, such as the amount of indigenous vegetation remaining in the region, the amount that is legally protected and the status of some threatened species. This section describes the status of Taranaki's terrestrial biodiversity according to these indicators.

(B) REMAINING INDIGENOUS VEGETATION

Approximately 40% of the Taranaki region is in native forest and shrubland (225,566 ha). The majority of this is in the eastern and northern hill country. The development of the Taranaki ring plain

Native forest covers 40% of Taranaki.

41 Bayfield, M.A.; Benson, M.A. 1986. *Egmont Ecological Region. Survey Report for the Protected Natural Areas Programme.* Department of Lands and Survey, Wellington.
42 Ravine, D.A. 1996. *Matemateaonga Ecological District. Survey Report for the Protected Natural Areas Programme.* Wanganui Conservancy, Department of Conservation, Wanganui.
43 Bayfield, M.A.; Courtney, S.P.; Wiessing, M.I. 1991. *North Taranaki Ecological District. New Zealand Protected Natural Areas Programme.* Department of Conservation, Wanganui.

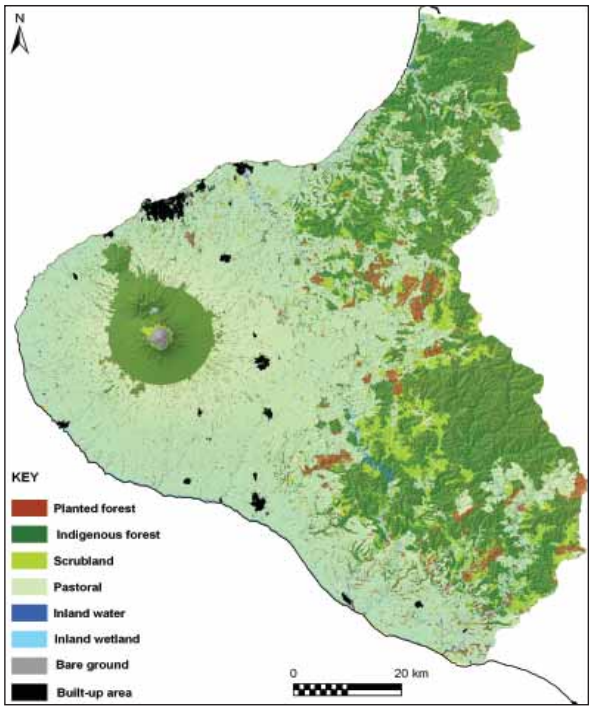


Figure 3.12: Taranaki's land cover.

and coastal areas for intensive farming has led to the reduction of indigenous habitats and the disproportionate loss of some types of terrestrial habitats such as lowland forests and coastal dune vegetation. The extent of land cover types is illustrated in Figure 3.12.

Changes in the extent of indigenous vegetation in Taranaki have been measured for the hill country through the Council's sustainable land monitoring programme (see section 3.1). The total area of indigenous forest decreased in the monitored sites from 3,380 ha in 1994 to 3,295 ha in 2007, a decrease of 3%. Research undertaken by the New Plymouth District Council of changes in indigenous forests (from analysis of satellite images) showed that between 1990 and 2000, 246.2 ha of native bush was cleared, most (197.4 ha) on the mountain adjacent to the national park. Interestingly, forest re-growth of 397.4 ha was recorded in the northern hill country[44].

Umutekai wetland and lowland forest near New Plymouth.

(C) PROTECTED INDIGENOUS VEGETATION

Land Environments of New Zealand (LENZ) is a national classification system used to map areas that are similar to each other, regardless of where they occur. LENZ uses 15 climate, landform and soil variables that can influence the distribution of species to identify areas with similar environment or ecosystem character. These are known as 'land environments'.

By then combining these land environments with information about where indigenous vegetation remains, and where vegetation is legally protected, it is possible to divide the region into threatened land environment categories according to the amount of indigenous vegetation remaining, and how much of that is legally protected[45]. The categories are illustrated in Figure 3.13 and include land where there is:

- now less than 10% indigenous vegetation remaining;
- between 10-20% indigenous vegetation remaining;
- between 20-30% indigenous vegetation remaining;
- still more than 30% indigenous vegetation remaining but less than 10% is legally protected;
- more than 30% indigenous vegetation remaining but between 10-20% legally protected; and
- more than 30% indigenous vegetation and more than 20% is legally protected.

On the ring plain and South Taranaki coastal terraces the areas of remaining indigenous vegetation are only small remnants of what they would have been historically. These areas now support less than 10% of the original indigenous vegetation (the 'red zones' in Figure 3.13). In the

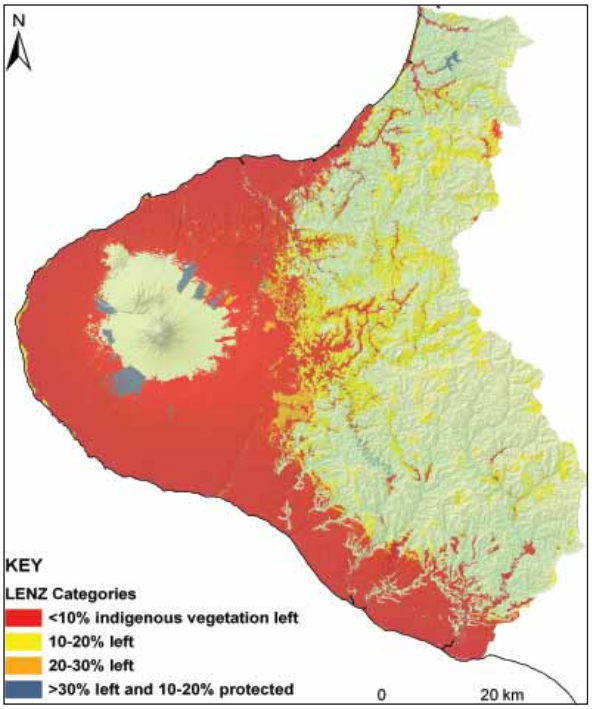


Figure 3.13: Threatened land environment categories in Taranaki according to the amount of indigenous vegetation remaining and how much is legally protected.

44 Wells, T. 2003. Letter to New Plymouth District Council accompanying CD of images of satellite images. Prepared for the New Plymouth District Council by Becca Consultants.
45 Walker, S; Cieraad, E; Grove, P; Lloyd, K; Myers, S; Park T; Porteous, T. 2007. *Guide for Users of the Threatened Environment Classification.* Landcare Research Environlink Report.

Neill Phillips, QEII National Trust, works with landowners to voluntarily covenant areas of indigenous vegetation.

eastern hill country however, there is a far greater proportion of remaining indigenous vegetation and a significant proportion of that is legally protected. Protection of indigenous vegetation in the first two categories (the red and yellow areas on Figure 3.13) is a national priority[46].

The area of indigenous vegetation remaining in each of these categories is set out in Table 3.9 for the three districts in Taranaki. For example almost 4,000 ha of indigenous vegetation remains unprotected in the New Plymouth District in the threatened land environment category which nationally has now less than 10% of the indigenous vegetation cover (the 'red zone'). There are just over 1,000 ha in this category in the Stratford District and about 6,000 ha remaining in South Taranaki. However, these areas are made up of small fragments of indigenous vegetation (and the areas are derived from the *land cover database* which used satellite imagery and so may not be as accurate as say an analysis of aerial photographs might be). Table 3.9 also shows the

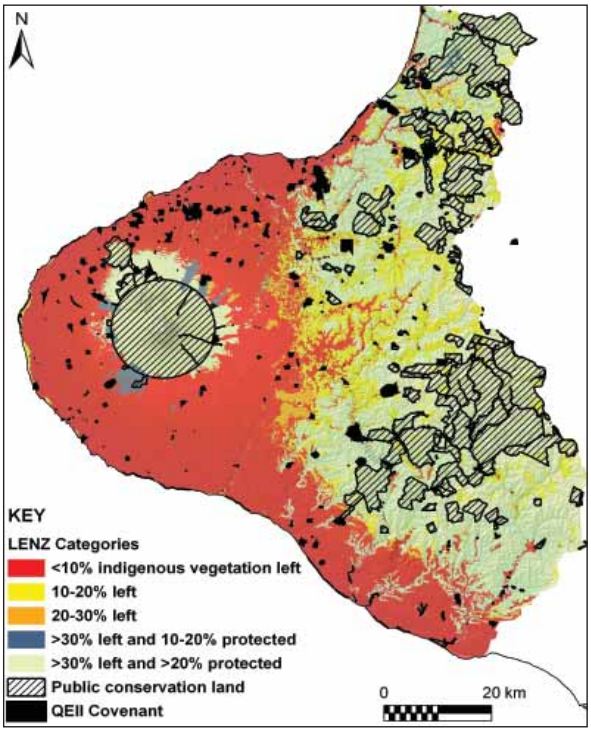


Figure 3.14: Areas of Taranaki legally protected through being public conservation land or private QEII covenants in relation to the threatened land environment categories.

area of indigenous vegetation formally protected through either being public conservation land, or in private QEII covenant. These areas are illustrated in Figure 3.14.

In summary, across the whole region, 57% of the remaining indigenous vegetation is either in public conservation land or private land protected by a QEII covenant (Figure 3.14).

Table 3.9: Extent of remaining indigenous vegetation and legal protection by land environment type.

	Total area (ha)	Threatened land environment category				
		<10% indigenous cover left	10-20% indigenous cover left	20-30% indigenous cover left	>30% left and <10% protected	>30% left and 10-20% protected
		Area of indigenous vegetation remaining that is unprotected[47]				
New Plymouth District	221,207	3,960	147	4,797	0	479
Stratford District	213,951	1,089	133	14,767	0	0
South Taranaki District	357,185	6,003	146	4,083	0	401
		Area of indigenous vegetation that is under formal protection				
Area (ha) administered by Department of Conservation (Taranaki region)		2,068	8,695	69	0	130,356
Area (ha) in QEII covenant (Taranaki region)		414	279	8	0	1,832

46 Ministry for the Environment. 2007. *The National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land.*
47 Data from Walker, S. Price, R and Rutledge, D. 2004. *New Zealand's Remaining Indigenous Cover: Recent changes and biodiversity protection needs.* Prepared by Landcare Research for Department of Conservation.

North Island brown kiwi.

Pittosporum Kirkii, a threatened plant found on Mount Taranaki, and a favourite possum food.

(D) THREATENED FAUNA

New Zealand has some of the most ancient and fascinating species in the world (e.g. the tuatara). Many of New Zealand's plants and animals are found nowhere else. However, a large number of them are threatened - a legacy of a history of unsustainable harvest, habitat destruction and introductions of pest plants and animals.

A system has been developed for classifying New Zealand species according to the threat of them becoming extinct. The threat status has been established for 2,788 species of birds, mammals, plants and plants[48].

The most threatened categories are: 'nationally critical', followed by 'nationally endangered', and 'nationally vulnerable', for species at high risk of extinction in the wild. These are species with small remaining numbers, which occur in only a small area or in very few places, and may be declining rapidly. Species in the 'serious decline' and 'gradual decline' categories are not yet seriously threatened with extinction but are likely to become so over time given their current rate of loss. There are also species classified as being at risk due to their restricted distribution, or low densities. These are classified as 'range restricted' and 'sparse' respectively. In some cases, so little is known about a species its threat status can not be determined, and these are classified as 'data deficient'.

The threat classification list is periodically updated using any new information available. Very recently the threat status of the kererū was reclassified from gradual decline to not threatened. This is thought to have resulted largely from increased control of predators, such as possums, rats, cats and stoats over many thousands of hectares of forest throughout New Zealand on public and private land.

The Department of Conservation has recognised 40 threatened birds, mammals, reptiles and invertebrates that occur in Taranaki as threatened. Table 3.10 illustrates the threat status of these species, if the populations are increasing or decreasing, and the possible reasons why.

The table of threatened species highlights the importance of Taranaki as home to threatened lizards. These animals can be hard to find, meaning new populations are still being discovered around Taranaki today. The rarest lizard found is the 'southern North Island' species of speckled skink (considered nationally endangered). Another locally found species is the striped skink, classified as data deficient because so little is known about its lifestyle or how to find it. It seems likely to be a tree top specialist but there are no good methods for locating it. The few populations known in Taranaki, among rotting logs or pampas, may be the stranded and grounded descendants of lizards that once lived in those places years before, when trees were still present.

Kiwi found in Taranaki are of the western North Island brown kiwi group, found also in the Tongariro, Wanganui, and King Country regions[49]. Large populations have been recorded from the forests and shrublands of inland Wanganui and Taranaki with the Matemateāonga ecological district estimated to support about 6,000-11,800 adults[50], although anecdotal reports suggest that this population is declining. The population in North Taranaki is estimated at about 2,000 individuals. The North Island brown kiwi is declining in all unmanaged parts of its range, due largely to predators, especially stoats. While the western North Island population as a whole is not believed to be in immediate danger of extinction, if nothing is done, sub-populations of kiwi are predicted to halve in size every 24 years and finally disappear altogether in about 130 years.

Taranaki's goldstripe gecko is sometimes found in urban habitats.

48 Hitchmough, R; Bull, L and Cromarty, P. (compilers). 2005. *New Zealand Threat Classification System Lists.* Science & Technical Publishing, Department of Conservation, Wellington
49 Department of Conservation. 2007. *Draft Taxon Management Plan for Western North Island Brown Kiwi (Apteryx mantelli).* Published by Department of Conservation, Wanganui.
50 Campbell, J. Dijkgraaf, A. 2001. *Kiwi Call Survey in the Waitotara Conservation Area/Whanganui National Park.* Department of Conservation Monitoring Report, Wanganui Conservancy.

Table 3.10: Trends in the status of some threatened fauna in Taranaki.

Threat status	Threatened species	How are Taranaki populations going ?	Why ?
Nationally endangered	Black-fronted tern	Unknown.	Unknown.
	Brown teal	No individuals remaining in wild in Taranaki.	No sightings confirmed in Taranaki in recent years. The opportunity to reintroduce depends on adequate predator control.
	North Island kōkako	No or isolated individuals remaining in Taranaki. Managed in captivity and elsewhere.	No sightings confirmed in Taranaki in recent years. The opportunity to reintroduce descendents of Taranaki kōkako depends on adequate predator-control (see case studies).
	North Island kākā	Stable but small.	Predation (especially by mustelids).
	Australasian bittern	Unknown.	Loss and damage to wetland habitat.
	Southern North Island speckled skink	Probably declining but recent discoveries of further populations is encouraging and may provide opportunities for protection.	Loss of habitat, few populations, probably vulnerable to predation.
	Whio (blue duck)	Mount Taranaki population increasing (see case study), others declining.	Predation (especially by mustelids), requires clean streams with good insect food supply.
Nationally vulnerable	Long-tailed bat	Possibly stable.	Large areas of forest remaining - vulnerable to loss of roost trees, predation, habitat damage.
	Bush falcon	Small, possibly stable.	Poor information. Loss of habitat.
	Reef heron	Unknown.	This is a national trend.
	Wrybill, ngutu-parore	Unknown.	Unknown.
	Northern New Zealand dotterel	Small and vulnerable.	Dependent on predator control, prone to vehicle, animal and storm/tide damage. Breeding started here relatively recently and seems an expansion of range for the northern subspecies.
Serious decline	Katipō spider	Believed to be declining.	Destruction and damage of coastal dunes and disturbance of vegetation and debris.
	Moth *Notoreas* 'Taranaki coast'	Fluctuating but promising.	Protective planting becoming established, landowners helping to protect vital habitat. Numbers unclear, monitoring will build up to a clearer picture over time.
	Western North Island brown kiwi	Improving where predators are controlled or birds added through management, declining elsewhere.	Very vulnerable to stoats (chicks) and dogs (any age). Long-lived adults remain a long time but local disappearance follows from recruitment failure. Possum poison operations slow decline by temporary reduction of stoat numbers, allowing temporary kiwi population growth.

SOURCE: Department of Conservation.

Table 3.10 (Continued): Trends in the status of some threatened fauna in Taranaki.

Threat status	Threatened species	How are Taranaki populations going ?	Why ?
Gradual decline	Flesh-footed shearwater	Unknown.	Unknown.
	Long-tailed cuckoo	Unknown.	This reflects a national trend.
	Northern little blue penguin	Probably declining.	This reflects a national trend of decline and fluctuating numbers.
	Red-billed gull	Unknown.	Declining at three main colonies elsewhere.
	North Island rifleman	Probably declining.	This reflects a national trend.
	Sooty shearwater	Unknown.	Unknown.
	White-fronted tern	Unknown.	Unknown.
	Yellow-crowned kākāriki	Declining.	Anecdotal reports, few records. Vulnerable to stoat predation.
	Pacific gecko	Declining.	Anecdotal reports.
	Wellington green gecko	Declining.	National trend, reduced sightings. Predation and habitat loss.
	Goldstripe gecko	Declining although newly discovered populations.	Vulnerable to predation by mammals. Opportunities exist where good predator control, e.g. Lake Rotokare Scenic Reserve.
	Speckled skink	Possibly declining.	This reflects a national trend due to their vulnerability to predation and habitat loss.
	Ornate skink	Declining.	Vulnerable to predation by mammals, populations lost elsewhere on mainland NZ.
Sparse	Black shag	Unknown.	Unknown.
	Spotless crake	Unknown.	Vulnerable to habitat loss.
	Brown skink	Gradually declining.	Vulnerable to rodent predation, loss of coastal shrubland.
	Carabid beetle, *Brullea antarctica*	Unknown.	Not monitored.
	North Island fernbird, Mātātā	Unknown.	Vulnerable to habitat loss.
Range restricted	Short-tailed bat	Possibly declining.	Historic records from Egmont, no recent sightings. May still occur in inland forests.
	Amphipod *Tara taranaki*	Unknown.	Not monitored.
	Ground beetle *Mecodema angustulum*	Unknown.	Unknown.
	Black petrel	Historically on Mount Taranaki, but no recent records.	Unknown.
	Giant landsnail *Powelliphanta* 'Egmont'	Possibly stable. Encouraging recent discovery of another population nearby.	Difficult to monitor, no evidence of decline or predation.
Data deficient	Striped skink	Unknown, probably declining.	No reliable survey methods known for this species so little known.

SOURCE: Department of Conservation.

Charles Mareikura (DOC), Turangapito Parata (Uncle Sandy from Ngāti Ruanui) and Dean Caskey (DOC) release blue ducks in Egmont National Park.

LIFE IN THE FAST LANE BECOMING LESS FRAGILE

Whio are the speed freaks of the duck world and it's not a life without risks – so many, in fact, that a big effort is being made to get them off the list of endangered species. And thankfully, the results are starting to show promise.

Also known as blue duck, whio are one of only three waterfowl species worldwide that live year-round on fast-flowing rivers like those that tumble down the slopes of Mount Taranaki.

But in modern times, introduced predators and loss of habitat have taken their toll – as if the blue duck didn't have enough problems anyway. It has always been vulnerable to spring floods washing away nests and eggs.

And as numbers decrease, breeding is a bigger challenge because the bigger and longer-living males make up more and more of the population.

That's been a problem in Egmont National Park, where since 1999 over 100 blue duck have been released into areas where predators have been intensely trapped. Before trapping only 41% of the released birds lived for more than a year. After trapping, survival rate rose to 63%[51]. Now, in addition to the trapping programme another approach is providing cause for optimism.

Under Operation Nest Egg, vulnerable eggs are taken from parent birds in the wild and then hatched in controlled conditions at Mount Bruce National Wildlife Centre in the Wairarapa. Ducklings are raised to the just-fledged stage, about four months old, and then released back to the source population. The male/female balance of these eggs is usually about even.

In the spring of 2007, Department of Conservation rangers observed pairs of breeding-age birds in Egmont National Park and assessed the vulnerability of their nests to flooding. Staff at Mount Bruce prepared their incubator and modified some outside cages for newly-hatched ducklings. The ducklings spend time in the rocky aviaries with flowing water to help prepare them for their release into the wild.

A suitable nest was found and in early November five eggs were lifted and taken to Mount Bruce. Four eggs were viable and hatched the following week and the skilled Mount Bruce team raised four healthy ducklings, three females and one male.

The successful hatching and rearing of juvenile blue ducks using Operation Nest Egg was a first for the population establishment project in the Egmont National Park. "To get three females from the four viable eggs was fantastic," said DOC's Dean Caskey.

By March 2008 the four ducklings were ready for release along with three captive bred males. Ngāti Ruanui kaumātua, Uncle Sandy blessed the birds and DOC staff and members of the East Taranaki Environment Trust released them in rivers and streams in core predator controlled areas of the Egmont National Park. It brought the population close to 50.

The first ducklings known to hatch on the mountain for decades were seen in 2005, and in 2007 several pairs were nesting and produced broods of ducklings. Flooding and the occasional stoat accounted for some, but at least four survived to leave their parents and strike out on their own.

This population re-establishment project was initiated by the Blue Duck Recovery Group. Mount Bruce National Wildlife Centre, the Central North Island Blue Duck Charitable Trust and the East Taranaki Environment Trust all make significant contributions towards its success. It's a partnership that's working well and hopes are high that the population on Mount Taranaki may become self-sustaining in the near future. Life can be viable in the fast lane.

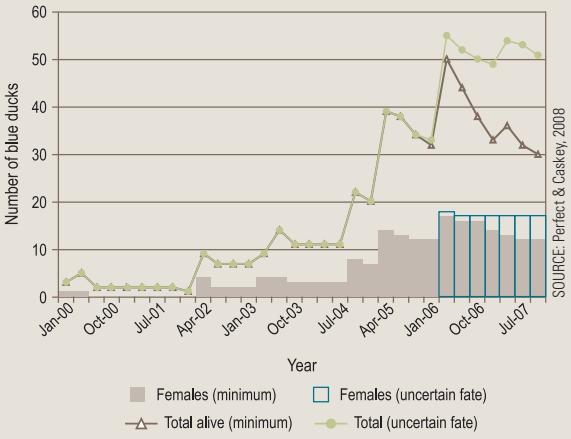


Figure 3.15: The growing blue duck population on Mount Taranaki.

51 Perfect, A.J, Caskey, D.A, 2007. *Blue Duck Hymenolaimus malacorhynchos Translocation and Establishment in Egmont National Park, 1999-2007.* Published by the Department of Conservation, Wanganui.

Adrian and Anna Mansell maintain stoat trap lines.

HILLS ARE ALIVE WITH KIWI CAN-DO

Treasure has been discovered in the hills of eastern Taranaki – but instead of a rush to exploit it, there's been a rush to protect and enhance it.

The treasure is not gold or millable forests. It's kiwi – our national icon, unofficial emblem and taonga.

Karen and Bob Schumacher bought a 192 ha run-off in remote Purangi in 2001, fully intending to covenant and protect the bush remnant on the property but unaware that it was home to 10 or more Western North Island brown kiwi. Their presence was confirmed by expert kiwi tracker Sid Marsh, and further investigations revealed there were probably around 100 kiwi in the surrounding area.

Thus was born the East Taranaki Environment Trust. With advice and financial support from a number of organisations, the Schumachers, and around 30 surrounding landowners, have combined to carry out pest control, an operation which now covers 3,000 ha and has included aerial drops.

But that's just the beginning. The next step is expanding the predator control operation to include the adjoining two large blocks of public conservation land, Pouiatoa and Taramoukou, and private land with cover of native bush, scrub, production pine forest, and pasture.

Initial kiwi surveys of Pouiatoa have resulted in hopeful signs, and the area also includes four locations identified by the Taranaki Regional Council as Key Native Ecosystems.

An aerial poison drop was carried out at Pouiatoa in 2005 and a private contractor has carried out follow-up work.

Karen said that the Trust's vision is a 16,000 ha sanctuary where 1,000 pairs of kiwi thrive, filling the night air with their raucous calls.

"This is do-able, it's not pie in the sky," said Karen. "There's already a good population of kiwi in the area and the project builds on an existing stronghold for the species. This is relatively easier than establishing a new population or recovering a small population".

"The project will result in the 'in situ' protection of a large sustainable population of kiwi - the only one in Taranaki - important not only to the people of Taranaki but nationally to all New Zealanders. It can be a cornerstone of the national plan to ensure the survival of the Western North Island brown kiwi."

The potential has already been seen by the Trust's backers and advisers, including the Department of Conservation, the Taranaki Regional Council, the BNZ Save the Kiwi Trust, the Government's Biodiversity Fund, Ngāti Maru, Ngāti Mutunga and the QEII National Trust.

The East Taranaki Environment Trust hopes for support from others who recognise there's gold in them thar hills … avian gold, biodiversity gold, kiwi gold.

Karen Schumacher with kiwi chick and the Waitara Māori Women's Welfare League, partners in the project.

Bob Schumacher, and Ian and Laurel Aitken.

Kererū, the native wood pigeon.

KERERŪ: SPECIAL PLACE IN CITY'S HEART

What's fat, big-mouthed and happily nestled in the civic bosom of New Plymouth?

The answer: Kererū. One of the nation's iconic birds, the native wood pigeon graces New Plymouth and surrounding areas in relatively high numbers. One pair even make a regular nesting place in the shadow of the New Plymouth District Council chamber.

What's the big attraction? A three-year study by Department of Conservation researchers has found the city offers ideal habitats with its stream gullies lined with native vegetation, native forest patches and extensive private gardens full of trees and shrubs. If you grow it, they will come.

Not surprisingly the flowers and leaves of the native kōwhai and pūriri fruit are prominent in their top 10 favourite foods. But interestingly, so are the flower buds, flowers and new leaves of cherry, apricot, plum and peach trees. So a place like New Plymouth, with its mixture of native and exotic flowering and fruiting trees, provide kererū with a year-round source of goodies.

Other big favourites are kawakawa, magnolia, pigeonwood, cabbage tree, miro and strawberry dogwood.

And don't underestimate the importance of the big mouth that does all this eating. While most people are familiar with the slow whoosh-whoosh sound of the kererū moving its opera-singer body through the air, fewer may realise it is the only surviving native bird species with a beak wide enough to swallow big fruit. This gives it a vital role in the dispersal of seeds from trees like pūriri, miro, taraire, karaka, tawa and kohekohe.

A team of DOC researchers led by Ralph Powlesland became avian sleuths between 2003 and 2006 as they tracked populations of kererū and tūī in New Plymouth and in Invercargill. This involved fitting some birds with radio transmitters, as well as enlisting the public's help in locating nesting and feeding spots.

Of 13 birds radio-tagged in New Plymouth, nine were perfectly happy to stay city bound, moving less than 2 km over two years. Four travelled up to 60 km in autumn and winter, heading over to Purangi and further north to the Moki Conservation Area.

Of four kererū tagged at Lake Māngamāhoe and Ōākura, three travelled to Egmont National Park for autumn-winter, and one went to Pūrangi in spring-autumn.

The locations of kererū and tūī nests were tracked down in New Plymouth, which were not evenly distributed through the city but instead most occurred in forest patches (parks, reserves). The hotspots included Pukekura Park, Barretts Lagoon, Ratapihihi Reserve, Te Henui walkway and the Huatoki Walkways (Figure 3.16). Nesting is determined by the time of egg-laying and this peaks in October.

The study confirmed they are doing all right in New Plymouth. Ralph Powlesland puts this down to their ability to survive in a variety of habitats and thrive on a range of food types, both native and exotic. They are happy to fly over unfavourable habitat to reach seasonal food sources, and will nest in urban gardens and parks in exotic trees while feeding on exotic foods.

But rats, possums and cats remain a major threat.

Ralph says nesting success rates during the study were measured at 27% in the first year (11 successful nests), 28% for the second year (18 nests) and 50% for the third year (28 nests). While this is reasonable, nesting success is much better in areas where rat and possum populations are controlled to very low levels.

"The kererū nesting success rate could probably be increased by undertaking intensive predator control – control of stoats, possums, feral cats and rats to very low densities – at nesting hotspots between September and March," he says.

Imagine expanding an already thriving population of city-dwelling kererū. That would be a civic coup. Or, as New Plymouth's downtown kererū might put it, a civic coo.

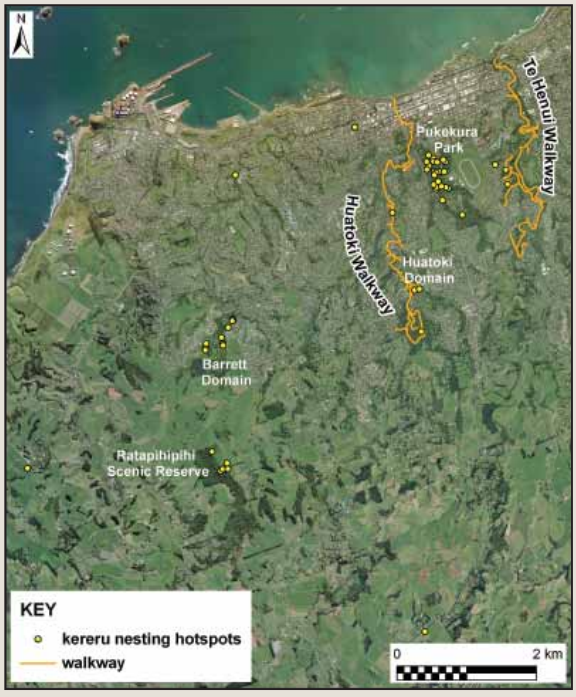


Figure 3.16: Nesting locations in New Plymouth.

Gratiola nana, a threatened plant found at Cold Creek bush, Egmont National Park.

(E) THREATENED PLANTS

There are several indigenous plants on the South Taranaki coast that are nationally or regionally rare or threatened[52]. Several of these plants live on the cliff faces, including *Euphorbia glauca*, *Sonchus kirkii* and *Craspedia* 'Otakeho'. Others occur in herbfields at the top of cliffs or associated with rocky beaches, e.g. *Ranunculus recens*, two species of *Myosotis*, and *Lepidium flexicaule*. Stent Road is the only known North Island location for this plant. Some are endemic to this coastline, e.g. *Crassula manaia* and *Limosella* 'Manutahi'. Coastal herbfield and cliff plants are particularly vulnerable to the impacts of pest plants.

Other special plants occur in the coastal dunes, e.g. *Sebaea ovata* (one of two natural populations remaining in New Zealand) and pingao. Cook's scurvy grass is found on the Sugar Loaf Islands.

Other rare and threatened plants in the region are associated with Mount Taranaki, e.g. *Gratiola nana, Myriophyllum robusta* and the endemic *Melicytus drucei*. Dactylanthus occurs on Mount Taranaki as well as in the forests of eastern and northern Taranaki. Possums love dactylanthus. Possum control on Mount Taranaki helps to protect dactylanthus, but individual clumps also need to be caged in stainless steel mesh to exclude possums. Seed set would not occur without this additional protection.

Many of the plant populations are stable. These are monitored regularly to ensure that they are still safe. Others, e.g. *Sebaea ovata* and *Scandia rosifolia* need supplementary plantings. Schools, nurseries and private individuals help in these programmes (see case study).

Moturoa school children grow plants from local stock.

MOTUROA SCHOOL -THEY SHARE WHAT'S RARE

Story by the Department of Conservation

When it comes to rare plants the kids at Moturoa School are real experts and now they're sharing their knowledge and plants with other coastal Taranaki Schools.

Their mentor is part-time teacher Bill Clarkson who oversees the school's 'Trees for Survival' programme and the plants the children grow are sourced from the last of the Taranaki stock.

Take *Scandia rosifolia* - commonly called koheriki. In the wild this *Scandia* species only grows on a rocky point near Ōkato overlooking the sea. It is thought that cattle and possums ate them up. The very last plant known in Taranaki is fenced off in a reserve named Maitahi.

Bill's brother and ex-DOC man Jim Clarkson gave the Moturoa children six seeds from this last plant, from which they grew six more. They have planted 50 of their plants back in the reserve in 2007, and another 100 in 2008. Many more have also been planted by children in association with New Plymouth District Council along the city's coastal walkway.

Now the *Scandia* and two more rare plants are growing at 17 schools in coastal gardens designed and monitored by their student minders.

The second plant is the 'Paritutu korokio' *(Corokia cotoneaster)* which grows naturally on Paritūtū Rock, the last remnant of an old volcano much older than Taranaki. Moturoa children have been growing them from cuttings of plants they have established in their school's native gardens. Many of these have been planted by the children in local public gardens and parks.

The third plant, pinatoro *(Pimelea prostrata var. urvilleana)*, is really special. It is the only host plant for the very rare day flying moth, *Notoreas* 'Taranaki Coast'. The kids will love this thumb sized moth if it turns up. It has amber and black wings like the Taranaki rugby jersey.

The schools exchange botanical tips, questions and photos of their gardens via email. It began as a DOC Arbor Day project and now there's a widespread team of young botanists ensuring local plants survive.

And that can only be good.

The rare moth *Notoreas* 'Taranaki Coast'.

52 La Cock, G. 2001. *Threatened Plant Strategy.* Wanganui Conservancy. Occasional Publication. Department of Conservation, Wanganui.

Indicative monitoring suggests possum numbers have reduced over the last 30 years.

(F) ANIMAL THREATS

A number of introduced animals threaten Taranaki's indigenous biodiversity such as goats, deer, possums and predators such as stoats, mustelids and feral cats.

Goats prevent forest regeneration by browsing seedlings and saplings of canopy trees. They also change the make-up of the forest by eating out their favourite species leaving those they don't like as much to take over. In forests without goat control, young plants of highly palatable species such as wineberry, tree fuchsia, māhoe and large-leafed coprosmas are scarce, the lower canopy are not the dense forests they would have been once been and less palatable plants like hookgrass, bush rice grass, crown fern and tree ferns thrive.

Feral deer will destroy the under-storey of vegetation which, when combined with possum damage to the upper canopy, can result in severe deterioration of forested areas. Even small numbers of feral deer can cause sufficient damage to affect the diversity, and survival of rare and endangered species.

Possums also have favourite foods, including northern rātā, tōtara, kāmahi, kohekohe, māhoe and fuchsia. Over several years, heavy browsing can kill tall trees or make them more vulnerable to drought, high winds and insect damage. Possums seek out fruits and flowers, and eat seedlings on the forest floor. By stripping forests of fruit, flowers, and leaves, possums also affect vital food sources for birds. Possums also eat eggs and chicks as well as invertebrates such as wetas and giant land snails.

Numbers of possums trapped are an indicator of the state of this threat to biodiversity. Possums are monitored through setting out trap lines and, based on the number of possums caught per trap, a residual trap catch index, or RTC can be calculated. A high RTC of 30 indicates that the forest is suffering significant possum damage, so much so that its species composition will probably be changing. In contrast, a low RTC (of say, five) means that possums are too scarce to cause serious damage, although they will still impact particularly sensitive threatened plants.

Anecdotally, farmers in Taranaki recall much higher possum numbers in the past. Council officers have over the past 30 years also undertaken an informal monitoring of possum numbers by counting road kill around the upper ring plain road at the same time every year. In the late 1970s more than 100 possum road kills were counted, whereas in 2007 none was

Vegetation in Egmont National Park has recovered as goats have been controlled.

GOAT NUMBERS KEPT DOWN IN THE EGMONT NATIONAL PARK

Weeds have long been a problem for Taranaki farmers, even when the land was barely cleared. Some bright spark figured that goats could be the answer.

250 pairs of goats took the train from Hawke's Bay to Inglewood in 1910 and local farmers snapped them up. Most farms bordering the Egmont National Park soon had goats and it wasn't long before some escaped into the bush-clad slopes.

The goats liked the forest and by 1928 Ranger Rupert Larsen was reporting thousands on Mount Egmont as a result of the goats increasing at a tremendous rate.

By 1945 regular reports of hectares of dead areas and a bare and depleted understorey had Chief Ranger Gordon Atkinson worried. He reported that it was a ghastly spectacle with thousands of large trees having been ring barked and destroyed and an almost total absence of seedlings.

Official goat control in the Egmont National Park began in 1925 and 97,000 goats have been killed since then. Today, DOC's team of hunters keep numbers right down but without them the population would double about every 20 months.

The forest has responded well. Thirty years of analysis shows vegetation that has greatly improved and the few goats that slip the hunters' guns are having minimal impact on the plant life of the Egmont National Park. DOC hunters are now reporting how difficult it is to navigate their way through the forest because of the thick dense undergrowth.

Now that's a problem that those early park rangers could only have dreamed of!

Setting a mustelid trap at Te Wawa wetland.

Giant gunnera, once an ornamental plant, is now a pest plant.

sighted. This less-than-scientific, but still indicative monitoring shows that possum numbers have dramatically reduced over the past 30 years.

Predators on indigenous biodiversity include cats, mustelids (ferrets, stoats and weasels) and hedgehogs. In and around natural areas such as forests, shrubland, wetlands and dunelands, cats are significant predators of indigenous birds, reptiles and invertebrates. Stoats are now by far the most common of the mustelids. They are widespread in forest and on farmland and serious predators of indigenous bird-life. Along with cats, mustelids predate on young kiwi resulting in 95% of juvenile kiwi being killed within the first six to nine months of leaving the nest, before they are able to reach a weight at which they can defend themselves. Hedgehogs predate the eggs and chicks of ground-nesting birds and are especially abundant in coastal areas.

Feral pigs can also have a significant impact on indigenous biodiversity values. Where present in large numbers, feral pigs will eat the tops and dig up the roots of indigenous vegetation resulting in the decline of some plant species. They are also a significant predator on threatened native land snails as well as destroying their habitat. The Egmont National Park is the only national park in New Zealand that has no established feral pig populations – illegal releases of pigs into the park are eradicated by the Department of Conservation.

(G) PLANT THREATS

Pest plants are a threat to indigenous biodiversity values where they compete with native plants for space. Certain climbing pest plants such as climbing spindleberry and old man's beard can form dense colonies, smothering and shading out indigenous plants, affecting the succession or regeneration of native plants. Pest plant species are able to invade forest remnant, riparian areas or wetlands through their ability to seed prolifically or through their ability to grow from tubers, such as giant bindweed.

Ornamental plant species that escape from gardens have huge potential to adversely impact on indigenous biodiversity. For example, giant gunnera and hybrids have massive umbrella-sized leaves with stems up to 2 m tall. It is a very free-seeding plant with seeds being spread by water and birds. Giant gunnera threatens indigenous biodiversity values in coastal, wetland and riparian areas through its ability to form dense colonies which shade-out lower growing native plants or suppress natural regeneration of indigenous species. Kahili ginger and yellow ginger are once popular garden plants that are now recognised to have significant impact on indigenous biodiversity values, by smothering and replacing under-storey species and seedlings.

(H) CONDITION OF INDIGENOUS VEGETATION

While the extent of indigenous vegetation is one indicator of biodiversity in Taranaki, the condition of that indigenous vegetation is an equally important indicator, particularly given the threats from animal and plant pests.

Egmont National Park has had a long and effective programme of animal control. In the past, the Park has been greatly modified by goats and possums, with extensive dead areas created in the upper catchment shrublands and loss of palatable under-storey plants from the forest[53]. However, monitoring in 2001 found that species preferred by possums and goats, like pate, hangehange and large-leafed coprosmas, had increased in abundance relative to initial measurements in 1977. It was also found that the abundance of these species was higher than other New Zealand forests where pest animals such as goats, deer and pigs are present[54].

Monitoring the impact of possums on trees involves examining a number of trees (either from the ground or aerially) and assessing such things as foliage density, presence of dieback (bare, dead twigs), evidence of possum damage (chewed leaves or trunk marking) and production of flowers and fruits. This information is then used to calculate a foliar browse index (FBI)[55].

The FBI is calculated from the ground at sites where possum control is undertaken to protect kohekohe forest. Recent results have found that, although there has been a slight increase in browse, all sites are in good condition and meet the targets set[56].

Individual threatened species known to be susceptible to possum browse are also monitored. A population of *Melicytus druceii*, a plant found only on Mount Taranaki, has been monitored since 1991. Two cages were built in 1992. One protected some plants from hare and possum damage, the other protected plants from hares but was open to possums. Browse intensity has decreased over time and appears to be

53 Clarkson, B.D. 1986. *Vegetation of Egmont National Park, New Zealand.* DSIR Science Information Publishing Centre, Wellington.
54 Husheer, S. 2006. *Changes to the Forests of Egmont National Park 1977-2001.* Research and Development Series. Department of Conservation, Wellington.
55 Payton, I.J.; Pekelharing, C.J.; Frampton, C.M. 1999. *Foliar Browse Index: A method for monitoring possum (Trichosurus vulpecula) damage to plant species and forest communities.* Landcare Research, Lincoln.
56 Prip, P.; Robertson, L.; Robinson, M. 2005. *New Plymouth Area Possum Management Plan 2005-2010.* Department of Conservation, New Plymouth.

especially reduced after possum control operations. Hares now appear to be the main browsing agent[57].

In large, rugged or inaccessible blocks, monitoring is conducted from a helicopter looking down on the canopy. This method is used in Egmont National Park and Waitōtara, Moki, Makino, Hutiwai and Pouiatoa conservation areas, which all receive periodic treatment with 1080 to control possums. Twenty to 40 trees of seven common species are measured at five sites, and taking into account each tree's own susceptibility to possums and rate of recovery from damage, a general pattern has emerged. Typically, over the first one and a half years after a possum control operation the forest recovers, showing reduced browse and dieback and increased foliage density. Recovery or at least maintenance of forest health continues for the next four years, and then six years after the operation some decline in becomes apparent, although it is not ever as bad as before the operation.

The Department of Conservation uses three methods to quantify goat impact and measure the outcomes of goat control operations: permanent forest plots[58], fenced plots (20 by 20 m) that goats are excluded from, and a measure of seedling growth called the seedling ratio index (SRI).

Three goat exclosure plots are maintained in the Taranaki region and are measured every 5-10 years. Monitoring of these plots in Egmont National Park and near Whitecliffs (measured in 2005 and 2006 respectively) showed no difference between the vegetation within the fence and that outside the fence exposed to goats. This showed that goat control had successfully reduced goat densities to a point where they are only having a minor impact on the vegetation. In contrast, at Taramoukau Conservation Area, palatable seedlings and saplings were more common inside the fenced area than outside, and a wider range of species was recorded inside the fence. These results suggest that more goat control is required at this site. Fenced areas have also been used to study the effects of goats on seedling growth in forest near Whangamonona. Survival and growth rates were higher in the fenced areas over the six years' study[59].

Measurements of the numbers and types of seedlings to calculate the Seedling Ratio Index provide a rapid method of assessing goat impact on forest health[60]. So far, networks of 15-20 400 m transects (monitoring lines) have been established in the Moki Conservation Area and other forests with different degrees of goat management outside the Taranaki region. Results from Moki (surveyed in 2005) found that goat browse was still preventing regeneration of palatable species. Forests that have had extensive goat control, such as Waitaanga and Motutara (near Taumarunui) have been found to be in much better condition. Re-measurement of the seedling ratio index at Moki in the next two years will reveal whether there has been any improvement.

Possum browse on māhoe, Mount Messenger.

(I) LOGGING OF INDIGENOUS FORESTS

Under the *Forests Amendment Act 1993* any indigenous timber from privately-owned indigenous forest may be milled as long as it is harvested and milled in accordance with a registered Sustainable Forestry Management Plan or a sustainable forestry permit issued by the Ministry of Agriculture and Forestry.

Taranaki is one of the regions with the greatest harvest of indigenous timber in the country. In mid-2008 there were 102 registered permits for indigenous logging in Taranaki (Figure 3.17). Several more were pending. This represents more than a third of all permits in the North Island, and 38 more than the Manawatu/Wanganui region, - the next highest. These permits are for almost 25,000 m^3 of the 122,000 m^3 of timber to be harvested nationally under the permit system. Rimu and tawa are the two main species, with black beech a distant third.

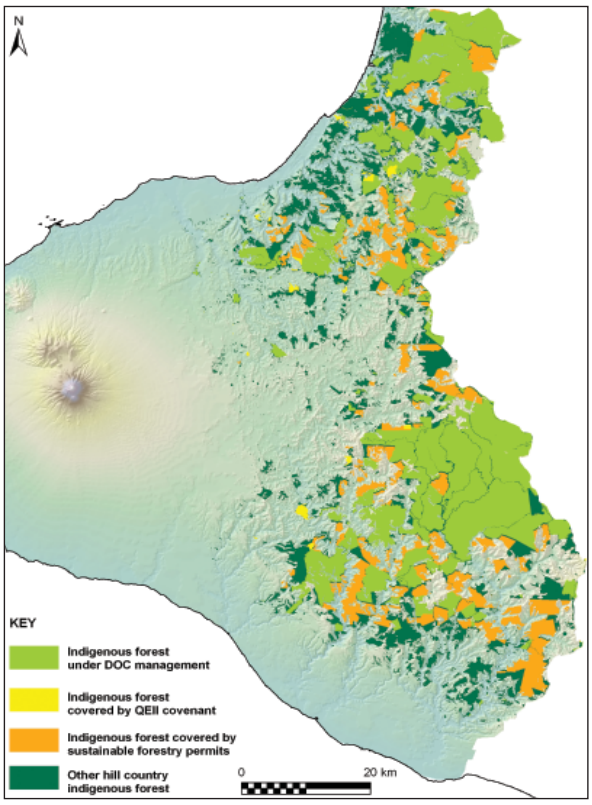


Figure 3.17: Extent of indigenous forest permits in relation to existing indigenous forest and indigenous forest legally protected through either being public conservation land or private QEII land.

57 J. Clarkson, unpublished data, 2008.
58 Hurst, J.; Allen, R. 2007. *A Permanent-plot Method for Monitoring Changes in Indigenous Forests.* Landcare Research.
59 Blaschke, P. 1992. *Measuring the Impact of Goats and Possums on Vegetation Composition, Growth and Regeneration, Matemateonga Ecological Region, from Exclosure Plot Data.* DSIR Contract Report.
60 Sweetapple, P.; Nugent, G. 2004. Seedling Ratios: A simple method for assessing ungulate impacts on forest understories. *Wildlife Society Bulletin* 32: 137-147.

Rimu harvested under a sustainable logging permit, South Taranaki.

Permits allow the harvest of up to 250 m^3 of hardwoods (usually made up of rimu and tawa) and softwoods, and up to 500 m^3 of beech from a property over a 10-year period. In addition to these permits there are six sustainable logging plans. These plans permit the annual logging of 1,600 m^3 of timber, mainly rimu, from 4,764 ha of forest. These plans normally have a lifespan of 50 or more years.

There are 187,619 ha of indigenous forest in the eastern Taranaki hill country[61]. Of this, 93,321 ha is public conservation land and 1,649 ha is legally protected under a QEII covenant. Of the remaining privately-owned indigenous vegetation (92,411 ha), 34,861 ha (38%) is subject to a sustainable forestry permit.

(J) RESTORATION OF BIODIVERSITY

Riparian management has been a key focus for the Taranaki Regional Council. While riparian planting was intended initially to provide benefits for aquatic biodiversity and water quality, little was known about its effects on terrestrial biodiversity. A study has been undertaken to investigate to what extent riparian management has improved native terrestrial biodiversity values. Biodiversity values, richness and abundance of plant and bird species, were measured and compared in different types of riparian margins. Sites included riparian margins that were still grazed, some that had just been fenced, margins with medium aged plantings (four to eight years), margins that had been planted eight-12 years ago and margins with remnant or naturally regenerated vegetation more than 20 years old.

The preliminary results seem to indicate that riparian planting leads to an increase in native plant species richness over time. Figure 3.18a illustrates that once areas have been retired for over eight years, the average number of species is comparable to naturally regenerated areas. The interesting thing seems to be the increase in the number of fern species in older riparian areas. Ferns are not planted but naturally regenerate in newly planted areas. This is clearly illustrated in Figure 3.18b.

The study has shown that native and introduced birds do not use grazed riparian areas, yet they start to turn up in areas once they are fenced. After riparian areas have been planted for four to eight years, bird use increases, and this is even more apparent once riparian plantings reach eight to 12 years (see Figure 3.18c). Riparian margins with naturally regenerated vegetation older than 20 years have significantly higher native bird abundances than grazed and un-vegetated fenced margins.

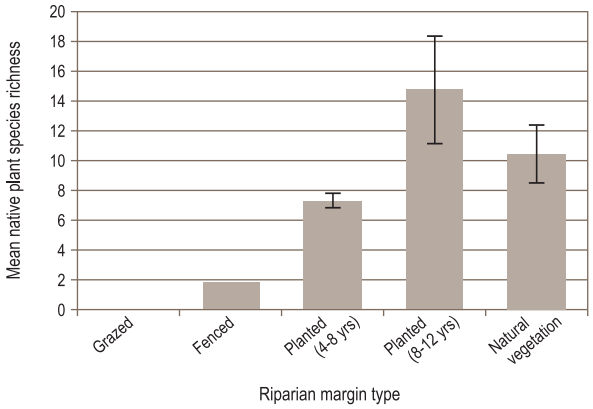


Figure 3.18a: Changes in plant diversity with age of riparian planting.

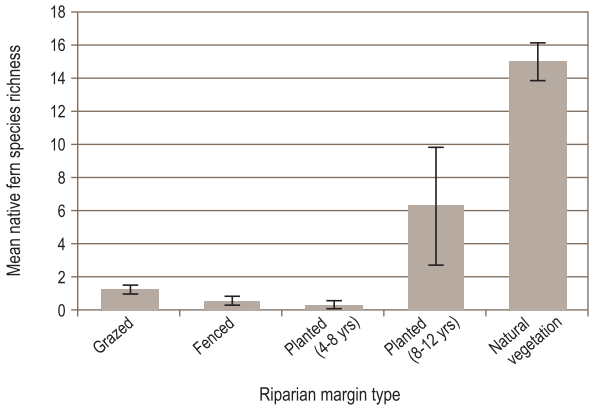


Figure 3.18b: Changes in diversity of ferns with age of riparian planting.

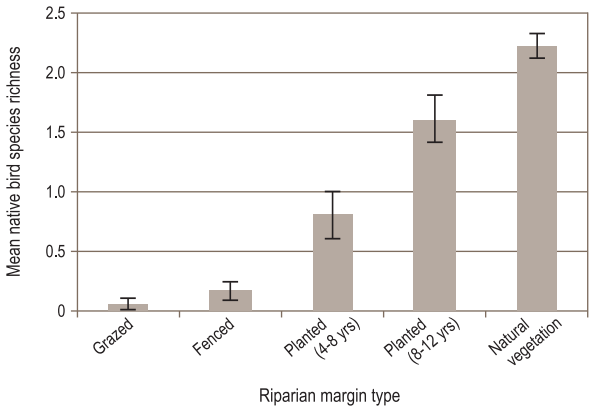


Figure 3.18c: Changes in bird diversity with age of riparian planting.

Overall, the study indicates that planting of riparian margins is creating new habitat for native plant and bird species where none existed previously and is leading to an improvement in the biodiversity of the region.

61 Using data from LCDB2.

Ruka Holden and David Rangitawa grow native species at Kii Tahi Nursery for the riparian plant scheme.

KII TAHI, THE HUMAN FACTOR IN BIODIVERSITY

They grow plants and they grow people at Kii Tahi Nursery and Land Care, which is based at Wai-o-Turi Marae south of Pātea.

Most of the plant output – about 44,000 per year, all of them native species – is destined for Taranaki stream banks where the plants protect and enhance water quality and promote biodiversity.

And many of the young workers that have come through the nursery have found it a springboard to a career, not only in horticulture but also with organisations like the Navy.

"A lot of people think the youngsters don't want to work but there are plenty keen to work here," says the Operations Manager, Heremia Taputoro. "And many have done well. We're growing our people."

An enterprise of Ngā Rauru Kiitahi, the nursery has a 'catchment' of 11 marae to call on and currently has satellite growing operations at two others besides Wai-o-Turi.

Heremia leads four full-time staff at the 1.6 ha main site, set amongst the marae's 4 ha. A stunning garden of native flaxes and grasses graces the road frontage, a clear signal to visitors about this enterprise's kaupapa.

Kii Tahi produces 20 varieties of native plants and flaxes, most under contract to the Taranaki Regional Council for its riparian management programme. Nursery workers also get involved in the on-farm planting and follow-up maintenance work.

The nursery was established in 2000, growing vegetables at first but they soon made the switch to native species, as the Council's riparian scheme offers a relatively secure customer base.

Kii Tahi shares the Council's ambition to greatly increase the rate of riparian planting in the region – in this case for the extra employment opportunities it will create for the iwi, as well as the biodiversity and environmental benefits of the project.

3.4.2 HOW ARE WE MANAGING BIODIVERSITY ON LAND ?

(A) PLANS

The *Proposed Regional Policy Statement for Taranaki* includes a new chapter dealing with the maintenance and enhancement of indigenous biodiversity. The policy statement recognises the importance of protecting under-represented habitats of terrestrial indigenous vegetation, the need to reduce the impacts of pest animals and plants, particularly in areas with regionally significant indigenous biodiversity values and the importance of encouraging connectivity between remnant habitats. The *Biodiversity Strategy: an operational strategy to guide the biodiversity actions of the Taranaki Regional Council* provides the operational policy and action plan for the Council's involvement in biodiversity management. This Strategy identifies that the Council will contribute to biodiversity through focusing proactive attention on regionally significant sites (Key Native Ecosystems), through enhancing the biodiversity of existing programmes (e.g. the pest programmes and the sustainable land management programmes), through working with others in the community, particularly on flagship biodiversity projects, and through establishing the systems for gathering and managing biodiversity information.

The *Conservancy Management Strategy for the Wanganui Conservancy* is the guiding policy document for work of the Department of Conservation. It became operative in 1997 and is currently being reviewed. It established a vision and objectives for the management of biodiversity on land administered by the Department. The *Egmont National Park Management Plan* and the *Whanganui National Park Management Plan* provide the operational policies.

Under the *Biosecurity Act 1993*, the Council has prepared the *Pest Management Strategy for Taranaki: Animals* and the *Pest Management Strategy for Taranaki: Plants*. These strategies set out the eradication, containment and surveillance pests, and the rules for landowners relating to these pests, and indicate the Council's intention to become more proactive with pest management on regionally significant sites.

Each district council in Taranaki has prepared a district plan which addresses, amongst other things, the management of significant indigenous vegetation. The New Plymouth District Council has a schedule of significant natural areas, where consents are required for the removal of indigenous vegetation. A heritage fund is available for landowners wishing to receive financial assistance with protecting these areas. A number of significant natural areas have been covenanted. The Stratford District Plan has a general vegetation clearance rule. The South Taranaki District maintains a schedule of significant natural areas and works closely with QEII to secure protection of these sites through their Significant Natural Areas Fund. The South Taranaki District Plan also has a general vegetation clearance rule. Two consents have been granted under this rule: one for the removal of indigenous vegetation to provide a clear path for the predator proof fence at Lake Rotokare, and a second more recently, for the clearance of just over 7 ha of forest on the most threatened land environment type (the red zone in Figure 3.13), for the purpose of creating more dairy land.

(B) INVENTORIES

The New Plymouth and South Taranaki district councils have prepared inventories of significant natural areas. The New Plymouth District Council has recently had its inventory re-assessed[62].

Through a multi-agency working party, the Taranaki Regional Council facilitated the compilation of an inventory of terrestrial sites with indigenous biodiversity values of regional significance in the Taranaki region[63]. Sites in the inventory, which are referred to as key native ecosystems, are regionally significant because:

- rare and distinctive indigenous flora and fauna species are present;
- they are representative of an indigenous vegetation type that is now much reduced (e.g. less than 10 or 20%) from its former extent in the ecological district;
- they enhance connectivity between fragmented indigenous habitats, enhance the values or provide buffering for other sites of value, or provide seasonal or core habitat for specific indigenous species; or
- they are sustainable i.e. they are of a size or shape and have the ability, through appropriate management, to sustain those other values referenced above.

Of the 140 identified Key Native Ecosystems, 99 have some portion of private ownership, while the remainder is public conservation land (Figure 3.19).

(C) COVENANTS

The QEII National Trust helps landowners protect significant natural and cultural features on their land. The Trust was established in 1977 at the request of New Zealand farmers to protect open space on private land for the benefit and enjoyment of the present and future generations of

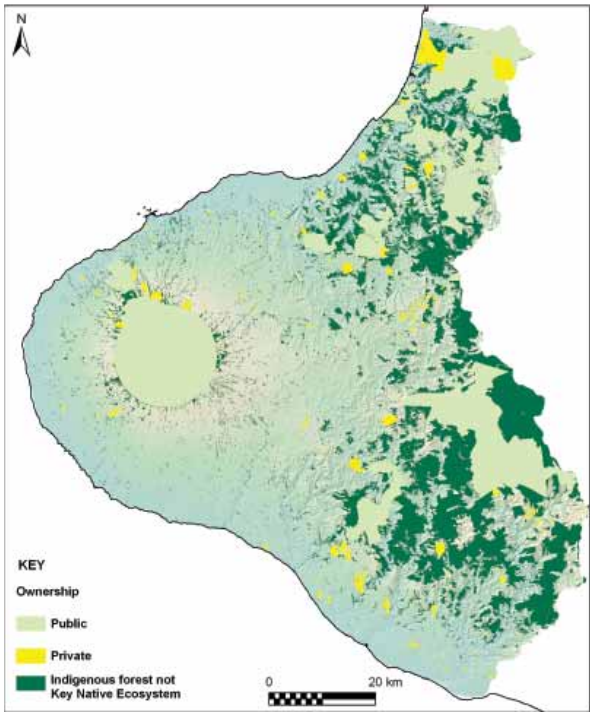


Figure 3.19: Key Native Ecosystems: Private and publicly managed.

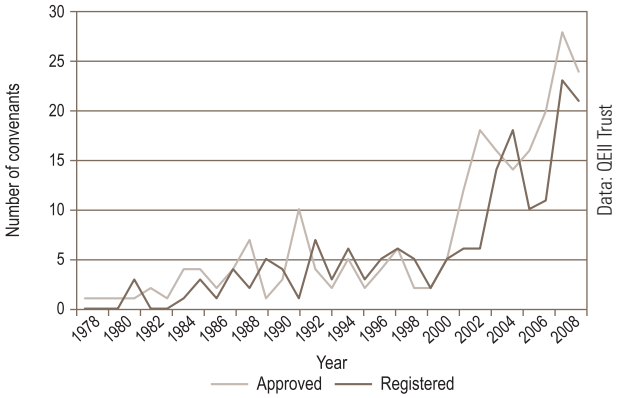


Figure 3.20: Number of QEII covenants approved and registered over the past 30 years.

New Zealanders. The QEII National Trust works with landowners who wish to enter into a voluntary covenant - a form of legal protection put on the land title - to protect areas of indigenous vegetation.

In Taranaki, there are now 175 registered QEII covenants with an additional 47 approved and awaiting registration, - totalling 3,374 ha in registered or approved covenants. The largest registered QEII covenant in Taranaki is 334 ha, with the average sized covenant being 15.6 ha. QEII covenants protect significant natural and cultural features on private land in perpetuity[64]. Figure 3.20 shows the huge growth in QEII covenants over the past eight years.

In addition, 238 ha of North Taranaki has recently been protected through Ngā Whenua Rāhui Kawenata (covenants). These are conservation covenants tailored to Māori landowners.

(D) PEST CONTROL

The Taranaki Regional Council runs a self-help possum control programme, which is a joint approach with land occupiers for managing possum populations. The major emphasis of the programme is the protection of agricultural production, as possums compete directly with livestock for grass, along with reducing the threat of bovine Tb. The programme also has major advantages for indigenous biodiversity and now covers most of the Taranaki ring plain. The Council first reduces possum levels in operational areas to at least a 5% residual trap catch. Figure 3.21 shows how successful Council operations have been at achieving this.

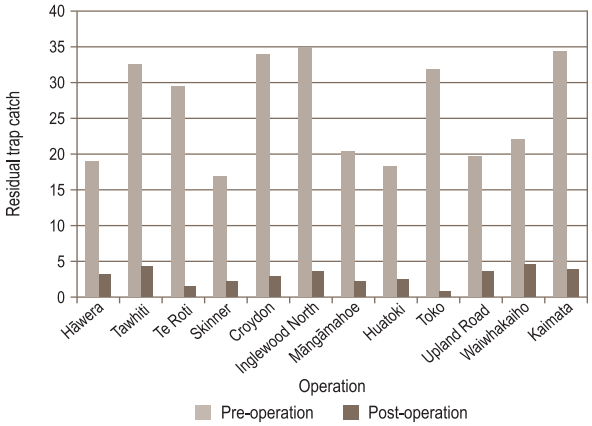


Figure 3.21: Possum numbers before and after Taranaki Regional Council control operations.

62 Wildlands. 2007. *Significant Natural Areas in New Plymouth District.* Prepared for the New Plymouth District Council.
63 Taranaki Regional Council. 2006. *Key Native Ecosystems. Inventory of Sites with Indigenous Biodiversity Values of Regional Significance.*
64 More information on the QEII Trust can be found on www.qe2.org.nz

Kerry Matthews (TRC) and Pat Morris discuss the re-growth of native vegetation.

POSSUMS NO PLAYTHINGS

Rahotū farmer Len Pentelow and near neighbour Pat Morris have both been part of the self-help possum programme since the scheme started in the early 1990s.

And both Len and Pat have also discovered the benefits go far beyond preserving stock health and export receipts, as important as they are.

As well as spreading bovine TB, possums are known for damaging bush and preying on birds' eggs and even chicks. Len has a couple of stands of native bush on his farm, protected under QEII covenant, and he's observed "massive changes" since the possum control work started.

"Kohekohe trees, rātā, tawa trees – they're all coming back. There's been a big, big difference," he said. "And tūī are here now, we hear them all the time. It's a significant change to hear these birds coming back."

Pat Morris has a similar story to tell. Back in the old days, he says, you didn't realise how many possums were around and the damage they were doing.

"Now you realise because of the re-growth of native vegetation along the streams. Bracken fern – I thought it had disappeared. Now it's coming through in fenced-off areas where the cows can't get at it.

"I see karo trees. Ponga are starting to pop up along the stream edges. You rarely saw them before. Possums would strip their fronds. There's akeake. Karaka trees are coming back. Coprosma."

Following the initial knock-down operation, the Council facilitates land occupiers to keep possum numbers to at least a 10% residual trap catch (RTC) rate. This is monitored annually. Table 3.11 indicates that the average RTC is generally below the 10% target, and the proportion of properties failing to meet this target is generally low. The higher proportion of lines exceeding the 10% RTC target in the 2006-07 year was due to more accurate placement of traps in more suitable possum habitat and monitoring both before and after landowners completed their possum control work. Properties that failed the 10% target were followed up, and required to undertake possum control.

The self-help possum programme now covers 227,000 ha or 96% of the Taranaki ring plain (Figure 3.22).

Table 3.11: Results of monitoring the ring plain self-help possum programme.

	04-05	05-06	06-07	07-08
Number of properties monitored	320	305	300	341
Mean Residual Trap Catch	4.6	4.1	8.2	7.5
Number of lines exceeding 10% Target	32	34	89	85
Percentage exceeding 10% Target	10%	11%	30%	24%

The Department of Conservation undertakes extensive pest animal and pest plant management work in Taranaki, maintaining 102,000 ha of public conservation land and 3,000 ha of private land under sustained possum control (Figure 3.22). Possum operations include periodic aerial control or annual ground-based control at specific sites, such as in the Waitaanga, Hutiwai, Waitōtara and Moki/Makino conservation areas, Egmont National Park, and a number of smaller reserves around New Plymouth.

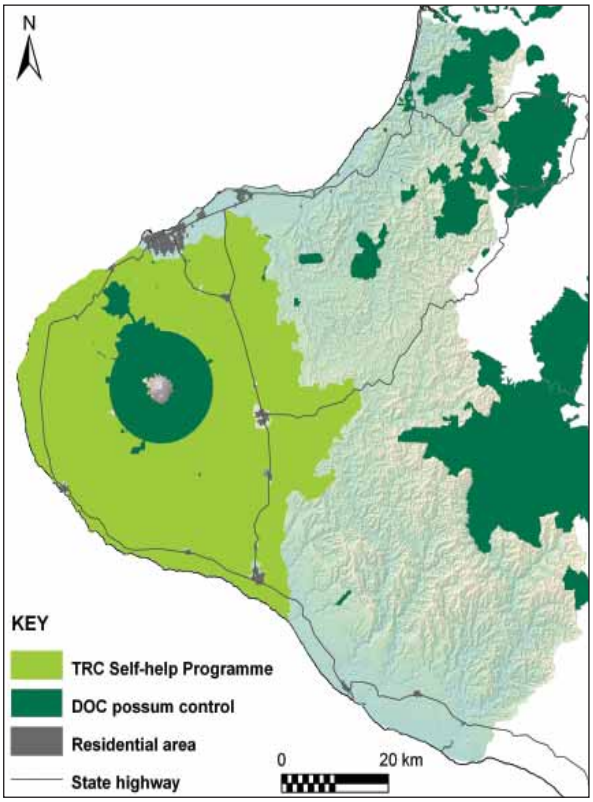


Figure 3.22: Areas under sustained possum control under the Taranaki Regional Council's self-help possum programme and the Department of Conservation programmes.

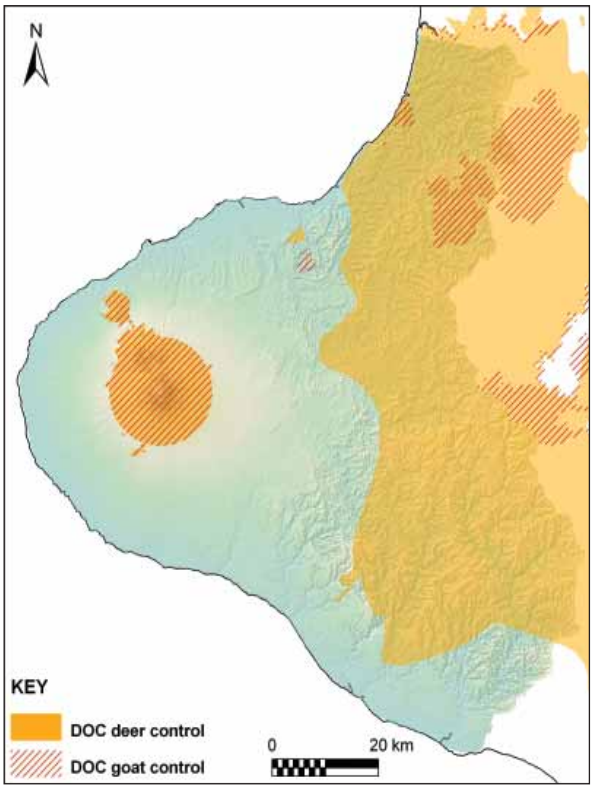


Figure 3.23 Area of Taranaki under sustained management for deer and goats.

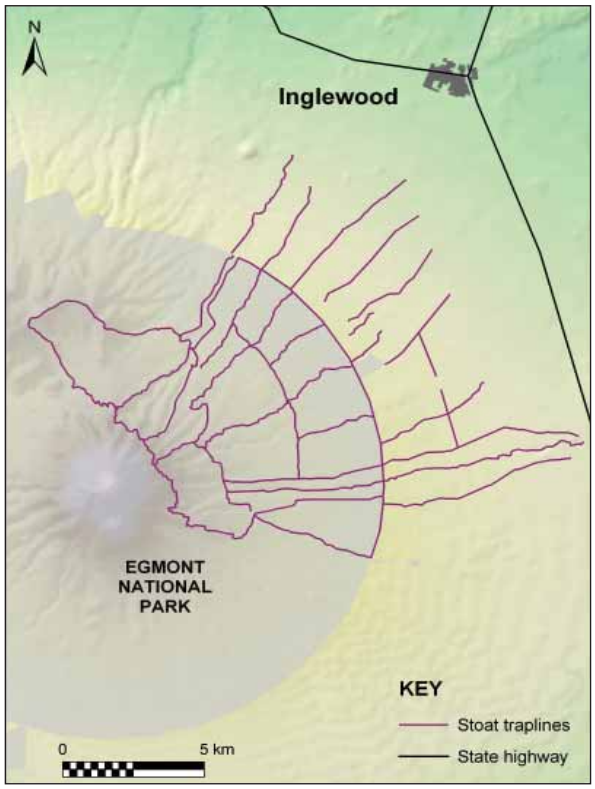


Figure 3.24: Stoat trap lines in the Egmont National Park and on adjacent private land.

The Department of Conservation has over 48,000 ha of public conservation land and 5,000 ha of private land under sustained management for goat control, and over 108,000 ha of public conservation land and almost 200,000 ha of private land under sustained management for deer control (Figure 3.23).

Predator trapping programmes are undertaken throughout Taranaki, primarily targeted at protecting threatened species. For example, the extensive predator trapping programme to enhance the survival of blue duck and kiwi on Mount Taranaki (in and adjacent to the Egmont National Park) comprises 1,160 trap boxes within Egmont National Park and 200 on private land adjacent to the park (Figure 3.24). Traps are checked 18 times a year (twice monthly from October to March, monthly from April to September). Numbers of stoats trapped peak over the summer of each year (Figure 3.25). The large increase in stoat numbers caught from December 2006 was due to the extension of the trapping programme from November 2006.

This programme is a partnership between the Department of Conservation, the Taranaki Kiwi Trust, the Central North Island Blue Duck Trust, the Koala Trust and the East Taranaki Environment Trust, with support from the Taranaki Regional Council.

Other examples of predator programmes in Taranaki include:

- the predator trapping programme carried out by the East Taranaki Environment Trust in the Pūrangi/Matau area which has killed 91 stoats and 685 rats since January 2007 (see case study);
- the trapping programme carried out by the Ngāti Tara Ōaonui Sandy Bay Society around the Sandy Bay area which has trapped 191 hedgehogs, 10 mustelids and 3 rats since October 2004 (see case study in section 5.2);
- the trapping programme carried out by the landowners of a regionally significant wetland at Toko that has destroyed more than 169 predators over 1,200 trap nights from the 4.8 ha area since 2004;
- extensive possum and predator control to establish a pest free sanctuary around Lake Rotokare (see case study); and
- predator trapping around other key native ecosystems by community groups such as Forest and Bird.

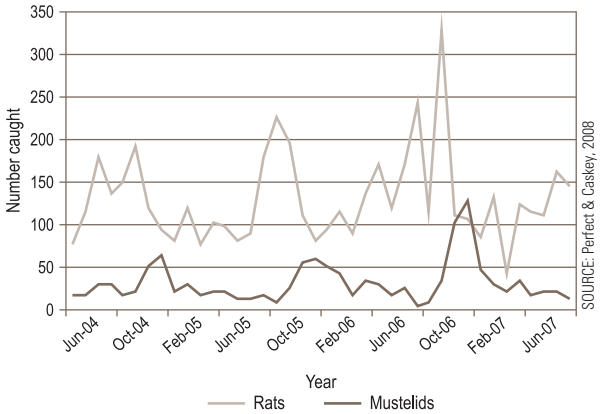


Figure 3.25: Mustelid and rat trap catch, June 2004-September 2007.

Tahana O'Carroll of Ngāti Tama discusses possum control with Daniel Cuming (TRC).

IWI SETS SCENE FOR KOKAKO HOMECOMING

Tahana O'Carroll has a vision of a special homecoming – and it's a vision with sound effects.

All going to plan, the vision will become reality in the early years of next decade: The haunting call of the kōkako will ring through the morning air in the bush at Whitecliffs.

Tahana, the kaitiaki of 1,320 ha of Whitecliffs bushland that was returned to Ngāti Tama as part of a Treaty settlement in 2003, has particular birds in mind – those descended from the region's last known kōkako, a lone male transferred from Moki Forest to a Wairarapa refuge in 1999.

And the vision encompasses much more than kōkako. Whitecliffs offers a habitat where a huge range of native flora and fauna can flourish, and where the rangatahi (young people) of Ngāti Tama can have opportunities to experience the bush.

But first, much work needs to be done. Although it is already an ecological jewel, regarded as one of the best remaining examples of coastal hardwood/podocarp forest in the North Island, introduced predators continue to take a heavy toll.

The hard yards have started with an intensive possum poisoning operation in the spring of 2008, carried out with the Taranaki Regional Council, which has successfully reduced possum numbers to very low levels. While mustelids were a secondary target, further intensive trapping is still needed. Then there are the feral cats, the goats, the wild pigs … and pig hunters whose dogs have had no kiwi aversion training.

"It's a huge mission," says Tahana. "But we're holding fast to the vision of a kōkako sanctuary. The Kōkako Recovery Group has identified Whitecliffs as a preferred site for re-introduction. But for that to happen, there must be intensive predator control."

He envisages further predator control being centred in a 700 ha core area around the upper Waipingau Stream, inland of the Whitecliffs Walkway, before spreading to cover the entire block.

Helping Tahana hold to the vision is experience of similar blocks in the Tūhoe rohe on the East Coast. "The morning birdsong just blew me away. It could be like that here, too."

He believes the Whitecliffs block will provide an opportunity for the young people of Ngāti Tama to have positive experiences of the bush and the treasures it holds. "I never had that when I was younger," he says. "Some might come here and then decide they'd rather do other things, and that's fine. As long as they get the opportunity to come here."

The Ngāti Tama block and adjoining Department of Conservation-administered land are recognised by the Taranaki Regional Council as a key native ecosystem. With Mt Messenger, it forms a continuous sequence from coastal to inland forest and supports a range of plants that do not occur elsewhere in the region.

It is home to threatened species including matangaoa or NZ cress and king fern, and has the only naturally growing pīngao in North Taranaki. The area is the northern growing limit for NZ mistletoe and the southern limit for other species such as pōhutukawa.

Scratching on trees noted in 2006 was attributed to North Island kaka, and while the kokakō are long gone, kiwi monitoring in 2002 recorded 36 birds.

Stewardship of the land is overseen by a Joint Advisory Committee made up of representatives of Ngāti Tama and DOC. The same group is also involved in management of the new Parininihi Marine Reserve adjoining the block.

And on the ground, Tahana walks the ridges and gullies, eyeing up potential trap-line terrain and dreaming of the day when the morning birdsong here will rival that of anywhere else.

Pest control is not all about animals. Weed control programmes in the region are undertaken to protect biodiversity values. For example, the Department of Conservation has controlled giant gunnera, a pest plant that grows to over 2 m tall, and shades out anything under it such as threatened plants growing on cliffs and in herbfields. Pasture grasses and weeds are the big threat to herbfields on top of the cliffs. The programme has been focused on over the 40 km cliff face stretch on the South Taranaki coastline between Manaia and Otākeho, land that is owned by DOC, iwi and about 65 farmers. Many of the threatened plants and special habitats occur on private land, so this control programme is reliant on ongoing good co-operation between the Department and farmers. The programme involves some helicopter spraying, abseilers and, ground-based crews and even hand weeding of herbfields. Threatened species are starting to re-establish in the weeded sites.

Lake Rotokare, the 'rippling lake'.

ISLAND LIFE FAR FROM THE SEA

How do you turn an inland lake and its surrounds into an island? And why would you want to anyway?

Answer #1: With thousands of volunteer-hours of sheer hard work. Answer #2: To restore to Taranaki some of its former treasures of biodiversity – for we are talking here about a 'mainland island', a landlocked area where introduced pests are excluded so native fauna and flora can thrive and grow.

Long a popular spot for nature-lovers and recreational boaties, Lake Rotokare and its 230 ha bush-clad catchment sit amidst a sea of farmland 12 km east of Eltham. And thanks to the grit and determination of locals, it is now encircled by an 8.4 km high-tech predator-proof fence, within which introduced pests are being eradicated with traps and baits.

It's all the work of the Rotokare Scenic Reserve Trust. This grassroots organisation was formed in 2004 by reserve neighbours concerned about the run-down state of the habitat, and it has quickly developed its scope, stature, membership and experience.

Already the reserve is home to precious native species including the North Island robin, fernbird, spotless crake, kererū, tūī, New Zealand scaup, mallard, grey duck, New Zealand shoveler, morepork, tomtit, bellbird and black shag.

But the Rotokare Scenic Reserve Trust has a yet grander vision: - a restored and protected ecosystem that is a safe haven for the release of endangered species such as the kiwi, saddleback and kōkako. In the words of the trust's mission statement, it aims to offer the Taranaki community 'the best opportunities for education, recreation and inspiration within the bounds of environmental protection'.

"The Xcluder predator-proof fence is the most sustainable method of controlling pests – volunteer burn-out or long-term use of toxins is a risk the trust doesn't want to take," said Chairman Joe Menzies.

"A completely pest-free area will allow vegetation to recover without browsing pressure, allow existing fauna to breed successfully in an environment free from exotic predators, and provide a safe habitat for translocation of endangered species."

It possibly may be a source of endangered species for translocation to other projects. And once bird numbers start increasing inside the reserve, a spill-over effect is likely in neighbouring reserves and patches of bush.

The Trust has succeeded in convincing many in Taranaki and beyond that its vision can become reality. Volunteers and sponsors have given up many weekends of free time to take part in an intensive trapping and monitoring programme.

Eye-wateringly enormous fundraising targets have also been met – for example, the predator-proof fence cost $1.9 million. The Trust has won support from the South Taranaki District Council and the Taranaki Regional Council, the TSB Community Trust and the Taranaki Electricity Trust. But Joe says most credit must go to individuals in the community who have sponsored and given their support. "This really is what got us in the door of the major sponsors."

South Taranaki District Council Property and Facilities Manager John Sargeant has one word for the Trust's achievements: Incredible. "It really is a model of a community project working from the bottom up."

Project Co-ordinator Kara Prankerd checks a tracking tunnel.

(E) WORKING WITH LANDOWNERS ON KEY NATIVE ECOSYSTEMS

The Taranaki Regional Council has much experience and expertise in preparing riparian plans and farm plans through its sustainable land management programme. Using these as a model, the Council is now working with landowners and other agencies to develop Biodiversity Plans for regionally significant sites. These plans will vary according to the complexity of management needs at a particular site. They will be customised to suit the site and landowners.

Planning the management at each site is important to ensure that all aspects of management are considered (e.g. it is no good killing the predators if meanwhile old man's beard is smothering the canopy). Developing a plan of the required management actions will provide the landowner with a clear idea of what management is required to sustainably manage the site for biodiversity purposes, show landowners what tasks they can do, and what tasks Council staff, or staff from other agencies they can do, and will be used to assist landowners to access funds from the various funding pools available (e.g. QEII, TRC Environmental Enhancement Grant, district council heritage funds, Taranaki Tree Trust and Biodiversity Condition Fund).

A few landowners have started implementing their biodiversity plans. For example, the plan developed for the Umutekai bush, a regionally significant area of lowland forest just out of New Plymouth, was used to successfully apply for biodiversity condition funds to develop a predator programme.

(F) SUSTAINABLE LAND MANAGEMENT PROGRAMME

The Council's sustainable land management programme involves preparing for landowners property plans and making recommendations for riparian fencing and planting on the ring plain and retirement of steep land in the hill country. By implementing the recommendations contained in these plans, landowners are making valuable contributions to biodiversity. By the end of June 2008, the Council had prepared a total of 2009 riparian management plans, cumulatively covering 10,818 km of stream bank. 6,539 km of stream bank is fenced and 4,705 km is vegetated (either with existing vegetation or new riparian planting).

(G) THREATENED SPECIES PROGRAMMES

There are a number of programmes undertaken in Taranaki led by the Department of Conservation targeting threatened species. These have been outlined in Table 3.10 above and described in a number of case studies. Examples of threatened fauna programmes include the following:

- The whio/blue duck population on Mount Taranaki is gradually increasing as a result of the predator control, releases of captive and wild birds, and operation nest egg.
- Kiwi chicks have been reintroduced to the Egmont National Park by the Department of Conservation and Taranaki Kiwi Trust with the support of the Bank of New Zealand Save the Kiwi Trust. Since 2004, 33 kiwi chicks have been released on the mountain. Annual kiwi calls are monitored and suggest the population is still low. However, it is hoped that call rates will increase in the coming years as the released chicks mature and start calling.
- Breeding of Northern NZ dotterel is monitored to see if there is any range expansion for the northern subspecies. A dotterel census is planned for 2011 by DOC and the Ornithological Society.
- Survey and monitoring are a priority for striped and speckled skinks. This involves the Department of Conservation conducting surveys, revisiting recorded populations, and following up public reports.
- Giant powelliphanta land snails are regularly monitored and surveyed on Mount Taranaki. Recently a second population was discovered on the Pouakai range.
- The habitat of the coastal moth, *Notoreas* 'Taranaki coast' is protected through liaison with landowners and a host plant weeding and replanting programme.
- Gecko surveys of new areas have resulted in the recent discovery of gold stripe geckos at Lake Rotokare. Previously recorded populations and public reports of geckos are also followed up.

A mass release of kiwi chicks into Egmont National Park, April 2007.

(H) MONITORING

The Taranaki Regional Council is developing a programme to monitor the state of privately-owned key native ecosystems, and is including monitoring recommendations in each biodiversity plan prepared.

The Department of Conservation runs several forest monitoring programmes in Taranaki, mainly focused on the impacts of possums and goats, to determine whether wild animal management is meeting its objectives of maintaining or restoring forest health.

Community groups also gather information valuable for monitoring biodiversity in the region. Groups such as the Ornithological Society and the Herpetological Society gather information about birds and lizards respectively. The Taranaki Regional Council is planning to work with such groups to ensure that their information is incorporated onto the Taranaki Regional Xplorer website so that it can be made more widely available.

(I) FUNDING FOR BIODIVERSITY PROTECTION

Biodiversity projects on private land or by private trusts have been funded, over the past five years, by a number of sources (Table 3.12).

Two district councils have funds that they allocate to biodiversity projects (South Taranaki District Council and New Plymouth District Council). The Taranaki Regional Council's environmental enhancement grant is targeted for regionally significant wetlands and other sites of regional significance.

South Taranaki District Council and New Plymouth District Council both have heritage funds from which they fund biodiversity projects. The Taranaki Tree Trust assists land owners with the protection of valuable forest remnants and wildlife habitats. It helps with fencing and planting of riparian (stream bank) margins and the protection of forest and wetland remnants through fencing or planting.

Over the past five years the Biodiversity Condition and Advice Fund has funded 30 projects within the Taranaki region, with a total investment from the fund being $805,650, covering 15,000 hectares of private property. Many other organisations and the landowners also put significant contributions forward themselves to gain this funding. The projects have directly benefited more than 500 landowners through fencing, pest animal and weed control projects, restoration plantings, and dog aversion training. In addition, many of these approved projects have had significant benefit for endangered species including kiwi and blue duck through landowner initiated projects.

Other sources for biodiversity projects have included corporate sponsorships. For example, Greymouth Petroleum sponsors aspects of the East Taranaki Environment Trust, Shell Todd Oil Services has donated to biodiversity work undertaken at Sandy Bay. In addition to the funds noted above, additional council funds have been used for significant projects (e.g. both South Taranaki District Council and the Taranaki Regional Council have provided funds for the Rotokare Scenic Reserve project). Finally, funds have been received from trusts from outside the region (e.g. the Central North Island Blue Duck Charitable Trust).

(J) COMMUNITY PROJECTS

A number of community groups are actively involved in biodiversity projects in Taranaki.

Part of the 8.4 km predator-proof fence which encloses Rotokare Scenic Reserve.

For example, the East Taranaki Environment Trust undertakes extensive predator control work to protect around 3 ,000 ha of kiwi habitat in the Matau/Pouiatoa area in eastern Taranaki. The Trust focuses on 'in situ' native species protection with a focus on kiwi. Its goal is to see 500 pairs of kiwi under predator protection in Taranaki within five years (see case study).

The Ngāti Tara Ōaonui Sandy Bay Society undertakes activities such as fencing, pest control and putting up signs to protect New Zealand dotterels and other threatened bird species in the Sandy Bay area in Ōaonui.

Table 3.12: Grants allocated to landowners/Trusts for biodiversity protection in Taranaki over the past five years.

Source	2002-03	2003-04	2004-05	2005-06	2006-07	TOTAL
Environmental Enhancement Grant (TRC) [65]	$121,093	$102,942	$41,863	$84,410	$112,663	$462,971
Significant Natural Areas fund (STDC) [66]	$14,851	-	$23,359	$12,808	$23,299	$74,317
Heritage Fund - SNAs (NPDC)	$7,111	-	$47,725	$13,688	$23,620	$92,144
Biodiversity Condition Fund (DOC)	$107,222	$112,460	$212,109	$100,852	$273,007	$805,650
Taranaki Tree Trust	$168,000	$79,239	$111,226	$78,923	$125,846	$563,234

65 Primarily used to protect regionally significant wetlands (see Chapter 4.4 Freshwater Biodiversity, but included here for comparison and completeness).
66 Used to protect areas of indigenous vegetation not just identified Significant Natural Areas.

The Rapanui Grey-Faced Petrel Trust was established to assist in the management, conservation and monitoring of the Rapanui grey-faced petrel colony, particularly the management of the predator exclusion fence.

The Rotokare Scenic Reserve Trust aims to eradicate all introduced mammal pests from the Rotokare Scenic Reserve within three years and prevent their re-introduction back into the pest free sanctuary (see case study).

The Taranaki Kiwi Trust works throughout Taranaki 'to promote and facilitate the restoration and protection of sustainable populations of kiwi in Taranaki'. The Trust is involved in the predator trapping project on Mount Taranaki, and the Bank of New Zealand's Save the Kiwi Trust Operation Nest Egg project that enables the Egmont National Park's kiwi population to be rejuvenated. The Trust is also actively involved in advocacy and education.

Taranaki branches of Forest and Bird are also actively involved in several biodiversity projects.

Individual landowners and other community groups are increasingly getting involved in managing and protecting biodiversity.

The Rapanui coastline.

(K) SUMMARY OF PROGRESS

Progress with implementing regional objectives and policies on biodiversity is summarised in Table 3.13.

Table 3.13: Summary of progress implementing regional objectives and policies on biodiversity.

Issue	What do we want to achieve	How is it measured	What progress are we making
Protecting under-represented habitats of terrestrial indigenous flora and fauna.	• Maintenance of the areal extent of indigenous ecosystems and habitats. • An increase in the number and areal extent of regionally significant values that are formally protected or covenanted.	• Extent of indigenous vegetation. • Extent of indigenous vegetation formally protected or covenanted.	• Slight decrease in the coverage of indigenous vegetation at monitored sites. • 225,566 ha of indigenous vegetation remains in Taranaki, 11,034 ha on land that nationally has less than 10% indigenous vegetation remaining. • 128,549 ha of indigenous vegetation is formally protected through either being public conservation land or private land protected with a QEII covenant. Other areas have also been covenanted through Ngā Whenua Rahui Kawanata. • 3,374 ha have been formally protected through a QEII covenant.
Reducing the impact of pest animals and plants.	• Maintenance and enhancement of the ecological condition of regionally significant habitats.	• Number of pests killed in pest operations. • Response from indicator species, such as threatened plants/animals (e.g. kiwi, blue duck).	• 96% of the Taranaki ring plain is included in the Regional Council's self-help possum programme. • 105,000 ha of Taranaki is included in a Department of Conservation possum programme. • There are a number of specific programmes targeting predators. • Blue duck population on Egmont National Park has increased to between 30 and 50 birds over the last eight years.
Encouraging connectivity between remnant habitats.	• An increase in the areal extent of planted riparian margins along ring plain rivers.	• Extent of riparian vegetation – both existing and planted.	• 6,539 km or 60% of stream bank covered by riparian plans is fenced, 4,705 km or 57% of stream bank is vegetated.

3.4.3 HOW DO WE COMPARE?

The extent of indigenous vegetation remaining in threatened land environments (where there is now less than 20% indigenous vegetation remaining) in Taranaki was presented in section 3.4.1(c) and Figure 3.13. This has been reported for all district and regional councils in the country[68]. This study ranked the district councils for the area of indigenous cover not protected in each of the threatened land environments (described in the section on indigenous vegetation above and illustrated in Figure 3.13 for Taranaki). The three district councils in Taranaki, - New Plymouth, Stratford and South Taranaki, ranked 42nd, 33rd and 40th, respectively, out of a total of 73 councils in terms of the amount of indigenous vegetation remaining in these categories. Councils with the most indigenous vegetation remaining in threatened land environments included Central Otago (ranked 1st), Queenstown Lakes (2nd), Waitaki (3rd) and Mackenzie (4th).

The area of indigenous vegetation cover not protected was also identified for the regions. This is set out in Table 3.14.

Comparing Taranaki with other regions in terms of how much indigenous vegetation remains in the most threatened land environment categories reveals that Taranaki ranks 7th behind Hawke's Bay, Wellington, Waikato, Otago, Canterbury and Manawatu-Wanganui. However, when considering the amount of indigenous vegetation remaining in both categories (acutely threatened and chronically threatened), Taranaki is 5th from the bottom, just ahead of Nelson City, West Coast, Auckland and Tasman.

The loss of indigenous vegetation (between 1996-97 and 2001-02) from threatened land environments was also calculated. This found that South Taranaki District had one of the largest losses of indigenous vegetation cover from the land environment category that now has less than 10% indigenous vegetation remaining (with an estimated 99 ha being lost), just behind Masterton District which saw a loss of 194 ha. Across the whole country there was a decrease of 17,200 ha in native vegetation cover over that period[69].

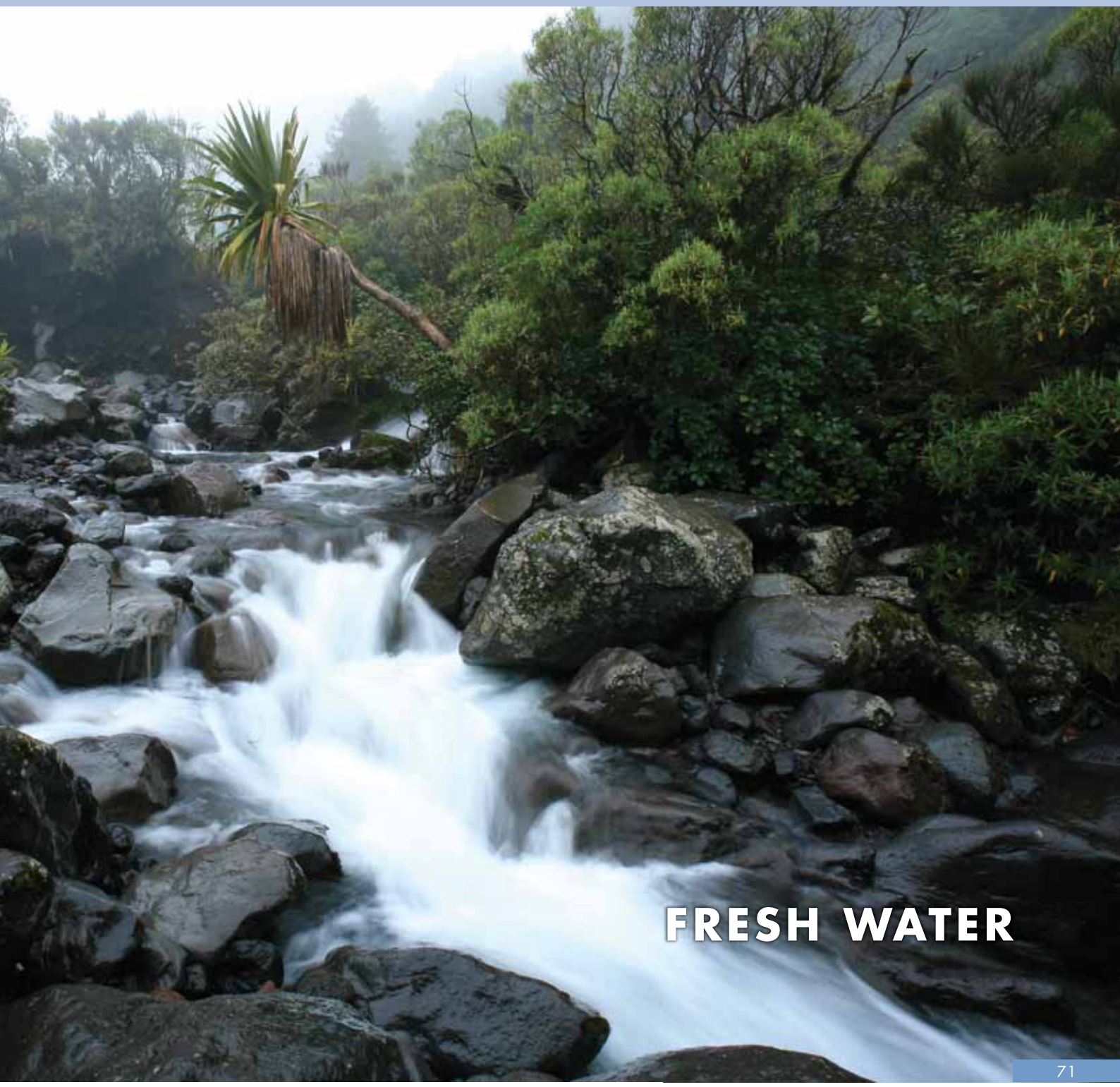
Table 3.14: Area of indigenous vegetation not protected in land environments with less than 10% or less than 20% nationally across 16 regions.

	Area (in ha) of indigenous vegetation cover not protected		
Region	**0-10% category**	**10-20% category**	**In both categories, i.e. 0-20%**
Auckland	3,464	5,299	8,763
Bay of Plenty	8,636	5,027	13,663
Canterbury	25,077	36,836	61,913
Gisborne	3,815	47,601	51,416
Hawke's Bay	12,128	41,481	53,609
Manawatu-Wanganui	30,883	25,878	56,761
Marlborough	3,183	9,080	12,263
Nelson City	398	213	611
Northland	6,893	16,308	23,202
Otago	23,748	52,494	76,242
Southland	10,149	12,355	22,504
Taranaki	11,034	307	11,341
Tasman	3,277	6,232	9,509
Waikato	22,484	12,161	34,645
Wellington	17,404	13,434	30,838
West Coast	0	711	711

Data from Walker et al, 2004.

68 Walker, S; Price, R and Rutledge, D. 2004. *New Zealand's Remaining Indigenous Cover Recent Changes and Biodiversity Protection Needs.* Prepared by Landcare Research for the Department of Conservation.
69 Ministry for the Environment. 2007. *Environment New Zealand 2007.*

CHAPTER 4



FRESH WATER

FRESHWATER QUALITY

The quality of Taranaki's fresh water is highly valued for a wide range of uses from recreational of fishing and swimming, to uses for agriculture, industry and town supplies. Maintaining and enhancing the mauri (life form) and wairua (spirit) of water is of fundamental importance to tangata whenua. Management of water quality has been a significant issue for the Taranaki Regional Council and its predecessors for the past 40 years. Monitoring has shown that:

- measures of ecological health, such as the communities of invertebrates living in streams, are good to excellent in the upper catchments where there is more stream bank vegetation cover but only fair further down the catchment where land use is more intense;
- over the past 12 years, ecological health has demonstrably improved at a number of sites, including a number in the middle and lower reaches of catchments, and has not demonstrably deteriorated at any sites;
- the region's fresh water usually meets the bacteriological guidelines for swimming, although at certain times of the summer (immediately after a flood event) or in certain catchments (such as small intensively farmed catchments) water quality may not meet national guidelines;
- the region's water quality comfortably meets guidelines for dissolved oxygen and clarity;
- measures of levels of organic pollution (BOD), bacteriological pollution (faecal coliforms and enterococci) and toxicity (ammonia) are now stable regionally, after past improvements;
- Taranaki rivers are naturally high in phosphorus and so do not meet national guidelines, furthermore levels of phosphorus are generally increasing; and
- nitrogen levels meet guidelines in the upper reaches of catchments, but not further down, where impacts of agriculture are more intense.

The *Regional Fresh Water Plan*, made operative in 2001, contains policies, methods and rules to maintain and enhance water quality in Taranaki. Council officers regularly monitor for compliance with the plan and resource consents, undertaking enforcement action where necessary. Management highlights over the past five years include:

- a decline in the number of point source discharges to surface water from 1,612 in 2003 to 1,413 in 2008;
- significant investments have been made by agriculture, industry and the community in wastewater treatment and disposal systems;
- 100% of dairy farms have effluent treatment and disposal systems that are monitored and inspected each year;
- a high rate of compliance with consent conditions with an average of 96% of farm dairy discharges complying with consent conditions and 93% of consent holders showing high or good levels of performance;
- a significant growth in the Council's riparian management programme – 2,009 riparian plans have now been prepared (treble the number of plans that had been prepared by 2003 (385), covering a total of 10,818 km of stream bank;
- 1.3 million riparian plants provided at low cost to riparian plan holders since 1997; and
- landowners' fencing of 504 km of stream bank and planting of 426 km through implementing riparian plans, which, added to existing fencing and planting means that 60% of stream bank on the ring plain, under a riparian plan, is fenced, and 43% is vegetated.

The Council will continue to promote fencing and planting of ring plain streams to meet the target of 90% of riparian plans implemented by 2015.

FRESHWATER QUANTITY

Surface fresh water is used for a wide range of uses from agriculture and industry to town water supplies. The region is well-endowed with fresh water having no less than 530 named rivers or streams. For most of the time, there are no significant water use pressures in Taranaki. Since 2003 the region has experienced some of the biggest floods and lowest flows on record, with floods for the Waitōtara region in 2004 and the May 2007 flash flood event between Ōākura around to Egmont Village. Conversely, the region experienced a drought over the summer of 2007-08, recording extremely low rainfall totals, and low stream flows. The main features of water quantity are that:

- there are 150 resource consents to take and use surface water, and 52 consents to direct and use surface water;
- total surface water use is over 474,371 m^3 (the equivalent of 194 Olympic-sized swimming pools) per day;
- the single largest use category is for municipal and rural water supply schemes, with a total allocation of 152,333 m^3 per day (1,763 litres per second) or 32% of all allocated water use;
- overall there has been a 7% increase in surface water used since 2003;
- more than 30% of the average low flow is allocated for use in 8% of catchments, but flows at which abstraction must cease are set to safeguard ecological values; and
- interest in irrigation has increased in recent years, especially in the coastal and southern areas of the region.

The *Regional Fresh Water Plan*, contains provisions to manage water use to protect aquatic life and other values. Measures are required to be put in place to mitigate or reduce the environmental effects of water use and these are closely monitored by the Council.

GROUNDWATER

Taranaki's groundwater is increasingly becoming an important source of water for a variety of purposes including domestic, industrial, agricultural and domestic water supply, particularly in South Taranaki. Groundwater is also the major component of stream flow during dry weather periods for the hundreds of streams in the region. Groundwater systems are complex, being influenced by the nature of geological systems. In summary:

- there are 81 resource consents for groundwater use in Taranaki;
- a total of 1,550 wells are recorded on the Council's database. Most of them are used for farm and domestic water supplies, although it is estimated that a large number of bores are not recorded on the Council's database;
- 44,022 m^3 (the equivalent of 17 Olympic-sized swimming pools) of groundwater a day is currently allocated, twice the amount reported in 2003, but still not a significant pressure on groundwater levels;
- the deeper aquifers mostly show less variation in groundwater levels than do the shallower aquifers;
- groundwater quality in Taranaki is generally high, there are no problems associated with pesticide residues, microbial contamination or saltwater intrusion and mineral levels reflect the geology of the aquifers;
- 94% of the 68 groundwater wells monitored had nitrate levels that met national drinking water standards, although nitrate levels have been found above the guidelines in a few wells tapping into shallow aquifers in South Taranaki; and
- shallow groundwater quality, in terms of nitrate levels, is generally improving.

The *Regional Fresh Water Plan*, controls groundwater use and discharges to land that have the potential to affect groundwater quality.

BIODIVERSITY

The diverse freshwater wetlands in Taranaki range from pristine ones surrounded by national park to small remnant wetlands that are the subject of restoration by some landowners, but drainage and land reclamation by others. The region has a diverse range of rivers and streams - mountain fed rivers with their headwaters in the Egmont National Park; ring plain streams arising in pasture land; and river systems draining hill country. Taranaki rivers and streams support a diverse range of native fish and invertebrates. In summary:

- regionally significant wetlands have, on the whole, been adequately protected through formal mechanisms and proactive protection works such as fencing and planting;
- 63 small wetlands have been drained or reclaimed since a study undertaken in 1995;
- Over the past five years, consents have been granted for 25.5 km of small streams to be piped underground and the realignment of almost 7 km of streams for the purpose of land improvement with consequential loss of native fish habitat;
- of 108 structures that have the potential to impede fish passage, 49 provide adequate fish passage, two have been removed and the others need remedial work;
- since 2001, fish passage has been improved over 12 structures; and
- four out of five sites monitored for the threatened brown mudfish show healthy breeding populations.

The *Regional Fresh Water Plan*, contains policy and objectives for managing freshwater biodiversity through provisions for land drainage, protection of regionally significant wetlands and provision of fish passage over structures. The Council works with landowners to protect regionally significant wetlands.

PUBLIC ACCESS

Public access to rivers and lakes is important for all people of Taranaki who use freshwater sites for a variety of recreational purposes, such as swimming, fishing, whitebaiting and enjoying picnics. Public access to rivers and lakes in Taranaki is often provided by way of public roads, or directly through parks and reserves. However, access to many rivers and stream sites requires the permission of the adjoining landowner. Respondents to several surveys have indicated that public access to freshwater sites is "about right". No major constraints on public access exist to rivers and streams in Taranaki.

District plans prepared by the New Plymouth, Stratford and South Taranaki district councils provide for the creation of esplanade reserves and esplanade strips alongside rivers and streams.

Waiwhakaiho River and Mount Taranaki.

OUR FRESH WATER

Fresh water is important to the people of Taranaki, and is vital for community water supplies, major industrial uses and agriculture. Maintaining and enhancing the mauri and wairua of water is of fundamental importance to tangata whenua. Water forms an important part of the cultural and spiritual values of Māori who have a kaitiaki or guardianship role in relation to water. It is highly valued for its association with a wide range of amenity and recreational uses such as swimming, angling, enjoying picnics, walking and tramping.

Wise management of that freshwater resource is a significant regional issue for the people of the region and for the Taranaki economy, and has been for at least the past 40 years. It is a key component of a 'prosperous Taranaki', a region that has a sustainable, resilient and innovative economy that prospers within the natural and social environment. Equally it is a key component of a 'sustainable Taranaki', a region that appreciates its natural environment and its physical and human resources in planning, delivery and protection[1]. Protecting the quality of water in our streams, rivers and lakes is considered by most people to be very important (81% of people surveyed in the *Future Taranaki* report agreed). Interestingly, protecting water quality was identified by only 17% of people surveyed as an area where significantly more effort was required, indicating that the large majority of respondents consider that current efforts and current progress are delivering on their aspirations. Access to high-quality recreational sites (i.e. lakes and rivers), was also noted as important to the community in this and other surveys[2].

Rainfall in Taranaki is generally high and frequent, meaning water supply for agriculture, community water supplies and industry is generally plentiful and streams are well-flushed, although certain parts of the region can still find themselves stretched for water during periods of low rainfall and low flows, as witnessed during the dry summer of 2007-08. Increasingly, those needing water at critical periods are seeking groundwater, to ensure continuity of availability during times of water restriction. Demand, particularly from agriculture, for groundwater is increasing, but is still not at levels seen elsewhere around the country.

The region contains hundreds of rivers and streams. Those around the ring plain are, on the whole, short, relatively small and fast-flowing, and they drain catchments formed from volcanic geology. These characteristics influence the water quality and stream ecological health, which are generally high, particularly in the upper catchments of those rivers with their headwaters in Egmont National Park. Naturally high levels of phosphorus in Taranaki rivers can be attributed to the volcanic catchments they drain. Rivers and streams draining the eastern and northern hill country tend to be more silt-laden, largely due to the erodible nature of the geology of their catchments.

The quality of Taranaki's fresh water is also strongly influenced by uses of it and the adjacent land. Intensive agriculture leads to contamination from surface run-off particularly from pastoral land, point source discharges, and structural alteration of streams and wetlands for the purpose of land improvement. Pastoral and urban development over the past 150 years has resulted in dramatic changes to the character of Taranaki's rivers and their catchments. Rivers and streams that once flowed through forest cover, today flow through farmland for most of their length. Streams where stream bank vegetation has been retained or restored are less susceptible to erosion, flooding, loss of shading, increased water temperature, and increased nutrients, and support richer natural aquatic and stream bank habitat.

Manganui River at Everett Park.

1 Community Outcomes Project Team, 2004. *Future Taranaki: A Report on Community Outcomes for Taranaki.*
2 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-08.*

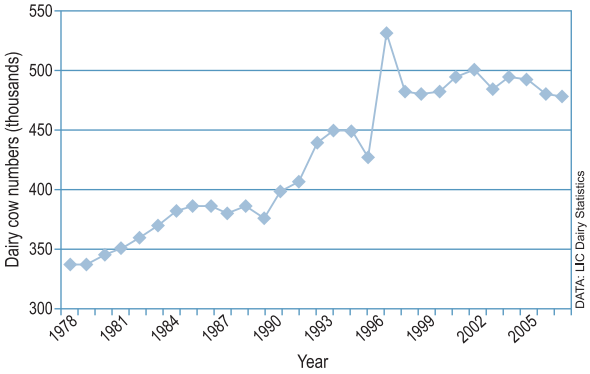


Figure 4.1: Dairy cow numbers in Taranaki.

There are around 480,000 dairy cows in Taranaki.

In Taranaki, the predominant agricultural pressure on freshwater resources comes from the dairying sector, which covers the majority of the ring plain. Dairy herds are increasing in size through stocking rate intensification and farm amalgamations, resulting in larger operations. Overall, the number of cows in Taranaki has steadily increased from 350,000 in the late 1970s and appears to be on a plateau of about 480,000 cows (Figure 4.1). Pressures on freshwater quality and quantity also come from industrial uses.

Managing freshwater quantity and quality, and managing freshwater habitats (streams, rivers and wetlands) in a manner that is sympathetic to the demands of 21st century living, and which allows the regional community to meet its aspirations and expectations, is the challenge for not just the Council, but for all of Taranaki.

Looking to the future, it is anticipated that a mix of regulatory and non-regulatory measures such as increasing riparian planting, the exclusion of stock from water courses and from stream banks, and continued vigilance in terms of managing point source discharges, should result in maintaining, or improving upon existing water quality and ecological health.

4.1 SURFACE WATER QUALITY

Water quality may be influenced by a number of natural factors such as climate, flow, geology, soils and vegetation cover. It is also influenced by human activities such as waste disposal, urban and industrial development, and agricultural land use.

Monitoring water quantity and quality has been, and continues to be, an important component of the Taranaki Regional Council's work. Results enable the Council to compare Taranaki's water quality against national water quality guidelines and to examine trends in water quality over time. Being able to report accurately on the environmental results of the management of Taranaki's freshwater resources will depend on continuing the Council's scientifically robust monitoring programmes, something the Council is committed to doing.

When water quality is investigated or monitored, it is for the purpose of being able to assess what the health of the river, stream or lake is like, and the suitability of the water for other uses. Stream ecological health can be measured directly by looking at the composition of the communities of invertebrates (such as insects, crustaceans and snails) that live on the stream bed and by looking at the algae (in terms of how much and what type) growing on the rocks. These communities respond directly to water quality and ecological conditions, so the indices derived from the data are particularly useful for monitoring trends in stream health over time. This chapter first discusses the outcomes of the Council's biomonitoring programme. It is the state of the ecology that is one of the ultimate measures of the success or otherwise of water management in the region.

Water quality is also assessed indirectly through a range of physical and chemical measurements such as levels of nutrients, water clarity, water temperature and bacteria. These indicators can help identify specific pressures or problems (in turn allowing remedial and control measures to be better focused). This chapter then discusses the outcomes of the Council's physicochemical monitoring programme and whether Taranaki streams comply with guidelines for physical and chemical variables in order to safeguard water quality for such purposes as protecting the aquatic ecosystem, for ensuring that water quality is adequate for stock drinking water, for irrigation or for contact recreation. Furthermore, trends in the variables monitored are examined to see if Taranaki's water quality is moving closer to the guidelines or further away.

In considering Taranaki's water quality, as measured by either physical, chemical or biological variables, monitoring aims to examine differences between sites, between catchments, down catchments, and over time. Interpreting the data aims to answer questions of why water quality differs, whether differences are due to natural or human impacts, the effectiveness or otherwise of management interventions, and what amount of change (either between sites or over time) is appropriate.

Measuring water temperature.

4.1.1 WHAT IS THE STATE OF ECOLOGICAL HEALTH OF TARANAKI'S RIVERS & STREAMS?

(A) INDICATORS AND GUIDELINES

Freshwater invertebrates

Freshwater invertebrate communities include a range of insects, crustaceans, worms and snails that live in river and stream beds and waterways. They are often called 'macroinvertebrates' as they are visible to the naked eye. The composition of these communities reflects water quality and habitat conditions[3]. Indices based on these communities are an important measure of overall ecological health because they measure what actually lives in the water, and how those organisms are responding to instream conditions such as levels of algae.

The key index used is the 'Macroinvertebrate Community Index' (MCI) which is based on scores for individual taxa living in stony streams according to their particular tolerance to organic pollution or nutrient enrichment. The higher the MCI the greater the proportion of organisms that prefer better water quality and better ecological conditions[4].

The interpretation of the MCI index has been adapted for Taranaki streams and rivers,[5,6] based on the original classification[4,7], and in consultation with the index's author. This six-step classification system is based on a much more comprehensive dataset than available for the original scale, and so more accurately reflects the situation for Taranaki ring plain streams. It means that ecological conditions for stony-bottomed streams can be graded from very poor to excellent (Table 4.1).

Table 4.1 MCI categories of Taranaki stream 'health'.

Grading	MCI	Code
Excellent	>140	
Very Good	120-140	
Good	100-119	
Fair	80-99	
Poor	60-79	
Very Poor	<60	

Algae as an indicator

'Periphyton' is the term used to describe the algae and 'slime' found on the beds of streams and rivers. It is the primary food source in streams, transforming light and nutrients into food for most other stream life. However, when it grows excessively it can become a nuisance, through reducing suitable habitat for sensitive invertebrates, degrading the attractiveness of swimming and fishing spots, making it dangerous for wading, and clogging irrigation and water supply intakes.

Nuisance algal growths in rivers can be caused by elevated concentrations of nutrients, primarily nitrogen and phosphorus. However, if either of these two nutrients is limited, algae growth is constrained even if the other nutrient is abundant. Algal growth is also strongly influenced by light, water temperature, stream flow regime and invertebrate grazers. Riparian vegetation that shades streams reduces levels of algal growth even when there are sufficient dissolved nutrients available. The flow regime of the stream also has a part to play in affecting the rate at which algae grows, during floods, for example, a lot of the algae can be scoured off the rocks.

Photo 1

Photo 2

Photo 3

Invertebrates like stoneflies (photo 1) prefer only the highest water quality, others such as cased caddisfly larvae (photo 2) are more tolerant of less ideal conditions and others like midge larvae (photo 3) are more 'pollution tolerant' and can live where water quality is not so high.

3 Collier, KJ; Winterbourn, MJ, 2000 (eds.). *New Zealand Stream Invertebrates: Ecology and implications for management.* NZ Limnological Society, Christchurch.
4 Stark, J.D. 1985. *A Macroinvertebrate Community Index of Water Quality for Stony Streams.* Water and Soil Miscellaneous Publication No. 87.
5 Taranaki Regional Council, 2006. *An Interpretation of the Reasons for Statistically Significant Temporal Trends in Macroinvertebrate (MCI) SEM data in the Taranaki Region 1995-2005.*
6 Taranaki Regional Council, 2007. *Fresh Water Biological Monitoring Programme. Annual SEM Report 2006-2007.* Technical Report 2007-22.
7 Stark, J.D 2000; Boothroyd, I.K.G, 2000. Use of invertebrates in monitoring. In Collier KJ; Winterbourn, MJ eds. *New Zealand Stream Invertebrates: Ecology and implications for management.* NZ Limnological Society, Christchurch.

(B) WHAT INVERTEBRATES TELL US ABOUT THE ECOLOGICAL HEALTH OF RIVERS AND STREAMS

Freshwater invertebrate communities have been used to assess the environmental state of rivers and streams in the region for nearly 30 years. Over 7,500 macroinvertebrate samples have been collected from more than 1,000 sites within the Taranaki region. Samples are collected and processed according to national protocols[8]. Since 1995 the Taranaki Regional Council has used them to monitor long-term regional water quality trends. This component of the Council's state of the environment monitoring (SEM) programme commenced with 32 sites surveyed under stable spring and summer flow conditions each year. The programme had expanded to 51 SEM sites by 2007 (Figure 4.2). The sites in the programme are mostly in the cool or extremely wet climate category of the national classification of streams[9]. They all are sourced from hills or the mountain (rather than springs) and are all in areas of volcanic geology. There are a few sites within indigenous vegetation with the remainder in areas where pasture is the main land use.

Biological monitoring within the larger, more erosion-prone catchments of eastern Taranaki has not been as extensive as elsewhere in the region (particularly on the ring plain where the majority of compliance biomonitoring and most state of the environment monitoring is undertaken). However, some monitoring has been carried out at 22 hill country sites in six catchments extending from coastal to upper reaches[10] (Figure 4.2).

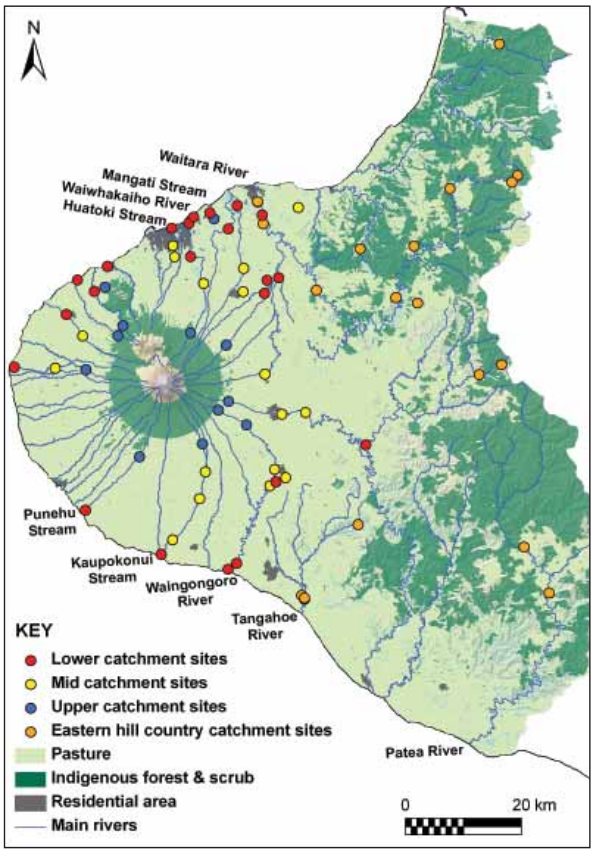


Figure 4.2: Locations of biomonitoring sites around the region.

Collecting freshwater invertebrates.

All sites are classified as low elevation sites in soft sedimentary geology rivers with eight sites in indigenous forest and 14 in pastoral land use types[9].

Summary of results

The results from the Council's state of the environment monitoring are summarised for each site in Table 4.2. The table sets out the range and median MCI scores, provides an indication of the stream health, as classified by MCI score, and indicates the direction of any trends (together with an indication of the statistical significance of the trend).

Median MCI scores of greater than 120 were found in the upper reaches of the Pātea, Manganui, Waiwhakaiho, Kaupokonui and Waingongoro rivers and Timaru, Maketawa, Waimoku and Katikara streams. MCI scores of greater than 120 are indicative of very good stream health, high water quality and good habitat conditions.

Sites with good stream health (MCI scores between 100 and 119) were mainly situated in mid to upper catchments, with these sites reflecting effects such as non-point source run-off, point source discharges and physical habitat changes downstream of the Egmont National Park boundary.

Fair stream health tended to typify sites in the mid to lower reaches of rivers and streams, where cumulative impacts of point and non-point source discharges, and stream bed and stream bank changes, were more pronounced.

Poor to very poor stream health (MCI scores below 80 units) has been found in smaller streams subject to point source organic overloading (Mangawhero Stream) and intensively industrialised catchments (Mangati Stream).

The long-term health of the Stony (Hangatahua) and Waiaua rivers cannot be accurately assessed using MCI scores as both have been markedly affected by severe natural erosion events in the headwaters on several occasions during the 12 year period, hence the wide range of MCI scores for these rivers.

In terms of the sites in hillcountry catchments, those in the indigenous forest class had greater species richness (median: 30 taxa) and higher MCI values (median: 116 units) than those sites in the pasture land cover class (median: 19 taxa and 87 MCI units). The overall range of MCI scores in eastern hillcountry catchments was narrower and the median lower than found for ring plain rivers and streams[10].

8 Stark, J.D; Boothroyd, I.K.G; Harding, J.S; Maxted J.R; Scarsbrook, M.R, 2001. *Protocols for Sampling Macroinvertebrates in Wadeable Streams. New Zealand Macroinvertebrate Working Group Report No 1.* Prepared for Ministry for the Environment. Sustainable Management Fund Project No 5103.
9 Snelder, T; Biggs, B; Weatherhead, M. 2004. *New Zealand River Environment and Classification User Guide.* Prepared for the Ministry for the Environment by NIWA.
10 Taranaki Regional Council, 2006. *A Review of Macroinvertebrate Biomonitoring Data for Large Hill Country Catchments in the Taranaki Region.*

Table 4.2 Summary of state and trends of stream health as measured by freshwater invertebrates, 1995-2007.

Sites				Stream health (median)	Trends
River/Stream	Location	Range	Median		Significance
Stony (Hangatahua) R	Mangatete Road	64-160	113	good+	😐
	SH45	84-160	109	good+	😐
Huatoki S	Hadley Drive	79-105	92	fair	🙂
	Huatoki Domain	91-115	102	good	🙂
	Near coast	69-99	86	fair	😐
Kapoaiaia S	Wiremu Road	83-119	101	good	😐
	Wataroa Road	78-98	91	fair	😐
	Cape Egmont	76-92	84	fair	😐
Katikara S	Carrington Road	132-148	138	very good	😐
	Coast	81-116	99	fair	ID
Kaupokonui R	Opunake Rd	125-138	129	very good	😐
	u/s of Kaponga WWTP	98-126	112	good	🙂
	u/s of Fonterra, Kapuni factory	71-118	98	fair	😊
	Upper Glenn Rd	66-101	91	fair	🙂
	near mouth	69-98	89	fair	😐
Kurapete S	u/s of Inglewood WWTP	80-100	90	fair	😊
	6km d/s of Ing'd WWTP	70-103	87	fair	🙂
Maketawa S	Denby Rd	116-141	129	very good	ID
	Tarata Rd	91-115	99	fair	ID
Mangaehu R	Raupuha Road	77-104	84	fair	😊
Manganui R	SH3	113-143	126	very good	😐
	Bristol Road	77-115	98	fair	😐
Mangaoraka S	Corbett Road	75-104	86	fair	😊
Mangati S	d/s of railway line	56-83	77	poor	😐
	Te Rima Pl, Bell Block	44-72	63	poor	🙂
Mangawhero S	u/s of Eltham WWTP	58-79	73	poor	😐
	d/s of Mangawharawhara S	68-86	77	poor	🙂
Mangorei S.	SH3	86-113	104	good	ID
Pātea R	Barclay Road	127-143	138	very good	😐
	Swansea Road	99-130	110	good	😐
	Skinner Road	86-104	97	fair	😐
Punehu S	Wiremu Road	104-133	119	good	😐
	SH45	70-99	85	fair	🙂

Table 4.2 Continued: Summary of state and trends of stream health as measured by freshwater invertebrates, 1995-2007.

Sites				Stream health (median)	Trends
River/Stream	Location	Range	Median		Significance
Timaru S	Carrington Road	125-144	136	very good	😐
	SH45	89-120	99	fair	☺
Waiau S	Inland North Road	80-98	87	fair	😐
Waiaua R	Wiremu Road	96-126	117	good+	😐
	SH45	69-112	94	fair+	☺
Waimoku S	Lucy's Gully	121-137	132	very good	😐
	Beach	75-95	87	fair	😐
Waingongoro R	Adjacent to Nat. Pk. boundary	122-139	133	very good	☺
	Opunake Road	119-139	127	very good	😐
	Eltham Road	91-115	100	good	☺
	Stuart Road	82-105	93	fair	😐
	SH45	73-105	95	fair	😐
	Ōhawe Beach	69-98	86	fair	😐
Waiongana S	SH3a	82-112	94	fair	😐
	Devon Road	72-102	83	fair	☺
Waitara R	Mamaku Road	64-97	84	fair	😐
Waiwhakaiho R	National Park	121-137	127	very good	ID
	SH3 (Egmont Village)	87-122	107	good	😐
	Constance St, NP	71-108	93	fair	😐
	Near mouth	70-111	86	fair	😐

Note: Stony and Waiaua Rivers regularly affected by significant headwater erosion events.

Key:

upper	Upper reaches of the catchment
middle	Middle reaches of the catchment
lower	Lower reach of the catchment
☺	Statistically very significant improvement P<0.05 using the most stringent statistical test (i.e. there is a less than 5% chance of finding a trend when really there isn't), and that trend is ecologically significant (i.e. greater than 10 MCI unit improvement)
☺	Statistically significant improvement P<0.05 and ecologically significant
☺	Statistically significant improvement P<0.05 but not ecologically significant (i.e. less than 10 MCI unit improvement)
😐	No statistically significant change
☹	Statistically significant deterioration P<0.05 (i.e. there is a less than 5% chance of finding a trend when really there is not one.)
ID	Insufficient data to analyse temporal trends, i.e. less than 9 years data

Mid reaches of the Waingongoro River below Eltham.

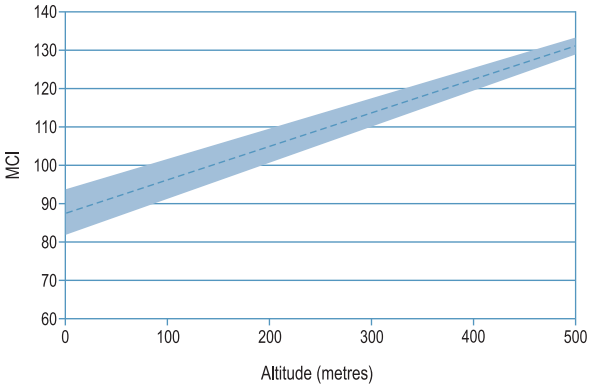


Figure 4.4: Relationship between MCI score and altitude on the Taranaki ring plain.

How invertebrate communities change down a catchment

The median MCI scores from reference, sites have been mapped to illustrate the distribution of MCI scores around the region (Figure 4.3).

The distribution of MCI scores reflect variations in water quality, habitat and flow conditions throughout the region, and illustrate a gradual decrease in scores from Egmont National Park downstream to the coast. For example, MCI scores in the Waingongoro River range from very good in the upper reaches, through good near Eltham, to fair over the length below Eltham to the sea (Table 4.2).

To a certain extent this decrease is a natural and inevitable result of the changing physical habitat downstream. It is also due to the cumulative effects of land uses on water quality and habitat such as nutrient run-off, lack of riparian vegetation, and increased sedimentation as a result of erosion of the stream margins.

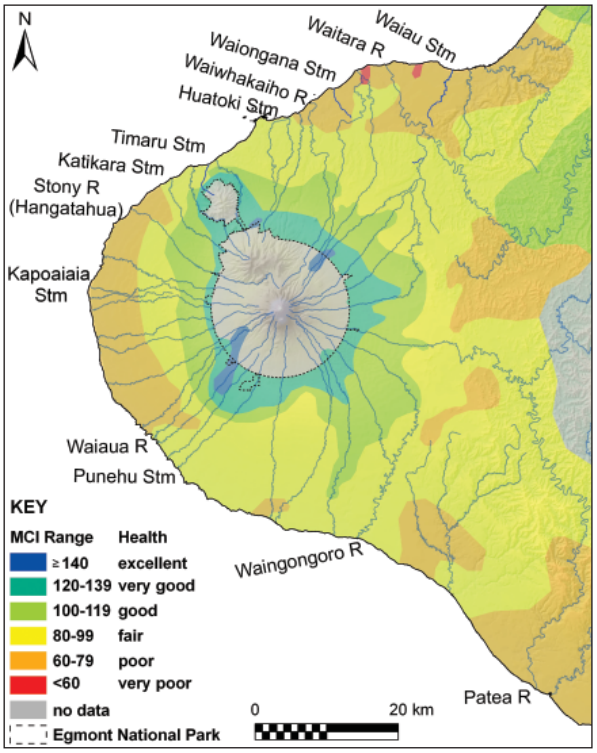


Figure 4.3 Stream health, as measured by MCI.

There is a strong link between altitude and MCI in Taranaki ring plain streams and rivers. MCI scores increase with altitude by approximately 9 units per 100 m in altitude (Figure 4.4). This means that typically, a Taranaki ring plain stream could be expected to have an MCI value of approximately 135 units near the National Park boundary and 85 units near the coast.

It is important to realise that MCI values lower down a catchment cannot match those higher in the catchment, even under ideal water quality conditions, because of habitat changes. Freshwater invertebrate communities are strongly influenced by the physical habitat. What is of interest is any site where the MCI deviates from what would be expected at that site based on the relationship between MCI and altitude.

In the 1995-2007 period the majority of SEM sites have shown MCI scores that would be expected based on values for sites in similar rivers and streams at equivalent altitudes.

However, there have been some exceptions. Figure 4.5 shows the median MCI scores for each of the 51 monitoring sites in relation to the expected MCI values. Some sites are more than 10 units lower than the expected score for that altitude. These include sites that have been subjected to large scale headwater erosion events (e.g. the Stony (Hangatahua) and the Waiaua Rivers), sites affected by point source discharges (e.g. the mid-reach of the Pātea River which is impacted by the Stratford wastewater discharge), and sites with poor riparian cover (such as the Kapoaiaia Stream). Some sites have better than expected MCI scores (e.g. the Huatoki and Katikara streams). This is thought to be due to higher than average levels of riparian vegetation in these catchments.

A relationship also exists between altitude and MCI scores for hill country streams (Figure 4.6). In the upper reaches of these streams and rivers MCI scores of about 125 MCI units (i.e. very good ecological health) can be expected, provided that the site has a stony substrate and reasonable riparian vegetation. Ecological health declines to fair (with MCI scores of 80) at the coast. This is due to finer substrates, wider channels and lack of riparian cover.

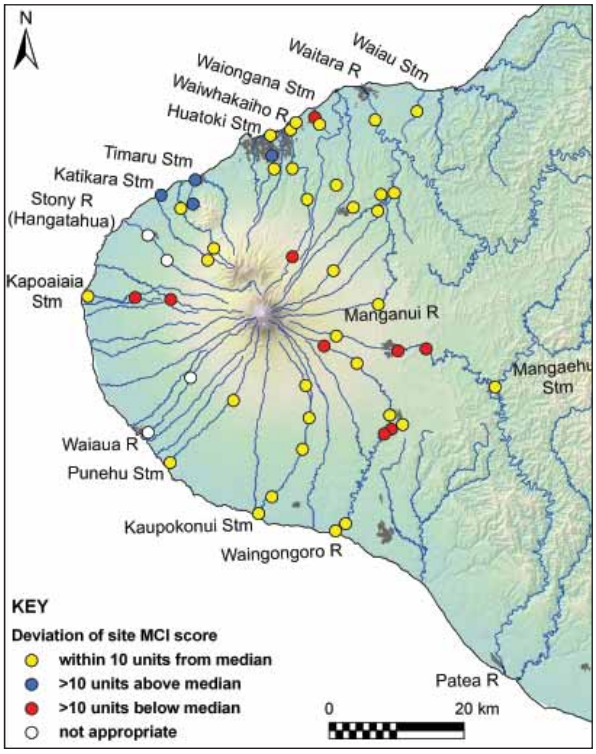


Figure 4.5: Deviations from typical median scores expected from relationship between MCI and altitude.

How invertebrate communities have changed over time

Data on invertebrate communities from 51 sites has now been gathered for 12 years and has been analysed to see if MCI scores have changed significantly over that time[11,12]. Trends that are statistically significant are set out in Table 4.2 above.

Table 4.2 illustrates is that of the 51 state of the environment monitoring sites, no site has significantly deteriorated and 17 sites (one third) have shown a statistically and/or ecologically significant improvement, with seven showing a highly significant improvement.

This general improvement in river health is occurring principally at sites in the middle and lower reaches of catchments, where there has been an approximately 20% increase in sites graded good or better

Riparian fencing and planting, Kaupokonui Stream.

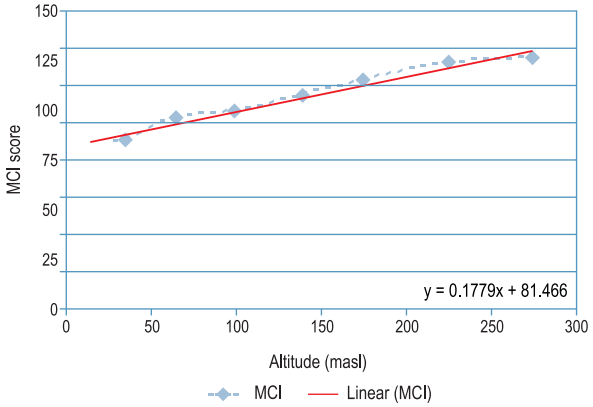


Figure 4.6 MCI Scores in relation to altitude at control sites in large hill country streams and rivers.

(see Table 4.2). These reaches are those that are most intensively used and are under the greatest pressures. There have been sites that have improved to such an extent that they have moved up one or even two scale grades.

For example, the ecological health of the mid reaches of the Kaupokonui Stream has increased from poor to good over the 12 years from 1996 to 2007 (Figure 4.7). This is attributed to improved management of the wastewater disposal from the Fonterra factory at Kāpuni, improved compliance with dairy shed waste discharges and additional riparian retirement and vegetation growth adjacent of the upstream river margins.

Reasons for the measurable improvement in stream health at other sites with statistically significant trends relate primarily to improvements made to point source discharges. For example, measurable improvements were made when the tributary draining the old Inglewood landfill was diverted to the wastewater treatment plant, and the Inglewood wastewater was no longer discharged into the stream. Waiongana Stream improvements followed better compliance with consent conditions for a piggery waste disposal and in other streams there was improved compliance with farm dairy waste disposal conditions. Other reasons for measurable improvements include natural events such as less severe flood events in an otherwise erosion-prone

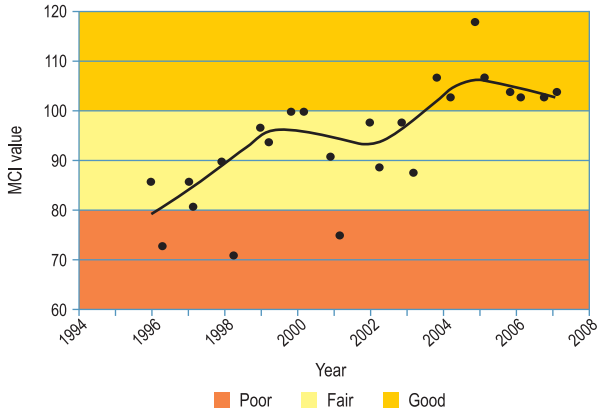


Figure 4.7: MCI values of the Kaupokonui Stream, downstream of the Fonterra, Kāpuni factory discharge from 1996 to 2007.

11 Stark, JD and Fowles, CR, 2006. *An Approach to the Evaluation of Temporal Trends in Taranaki State of the Environment Macroinvertebrate Data.* Cawthron Institute Report No 1135.
12 Taranaki Regional Council, 2007. *Fresh Water Biological Monitoring Programme Annual SEM Report 2006-2007.*

catchment. For some sites, reasons behind the measurable improvement are unclear, particularly the site in the Waingongoro River immediately downstream of the Egmont National Park.

Changes in stream health as reflected in the biological communities may occur for a variety of reasons. These reasons could be due to natural causes such as physical disturbances (floods, sedimentation, mountain erosion), biotic interactions, and/or changes to water quality. These in turn can be due to changes in land or water management, such as changes in flow regulation, land use (including stocking rates, fertiliser application) and/or discharge management (rates, concentrations or diversion to alternative treatment).

Changes in stream health may also reflect management initiatives such as increased compliance by point source discharges with consents, upgrading/improving wastewater treatment standards, and riparian initiatives (retirement, fencing and planting of stream margins).

Invertebrate communities may change at a site due to factors occurring in the catchment some distance upstream from the site where monitoring has been undertaken, rather than in the immediate vicinity of that site. This is particularly the case with riparian planting which, once the plants are sufficiently grown, can provide shading over some distance of the main stream/river or tributaries and thereby enhance ecological conditions for some distance downstream. However, measurable improvements to river health are unlikely to become significant until riparian planting is fully implemented, provides effective shading, and covers considerable proportions of mainstream and/or tributary catchments. It is anticipated that ongoing monitoring (e.g. over the next 20 years or more) should be more likely to discern trends due to riparian planting initiatives.

(C) WHAT ALGAE TELLS US ABOUT THE ECOLOGICAL HEALTH OF RIVERS AND STREAMS

The Taranaki Regional Council has been undertaking monitoring of periphyton, or stream algae and slimes, at 21 sites, in 10 catchments since 2002 (Figure 4.8). These sites are surveyed during the spring, mid-summer and late summer, under standard protocols that take natural flow variability into account. At each site the types of periphyton growth and the percentage of streambed covered are recorded and assessed.

Assessing periphyton growth.

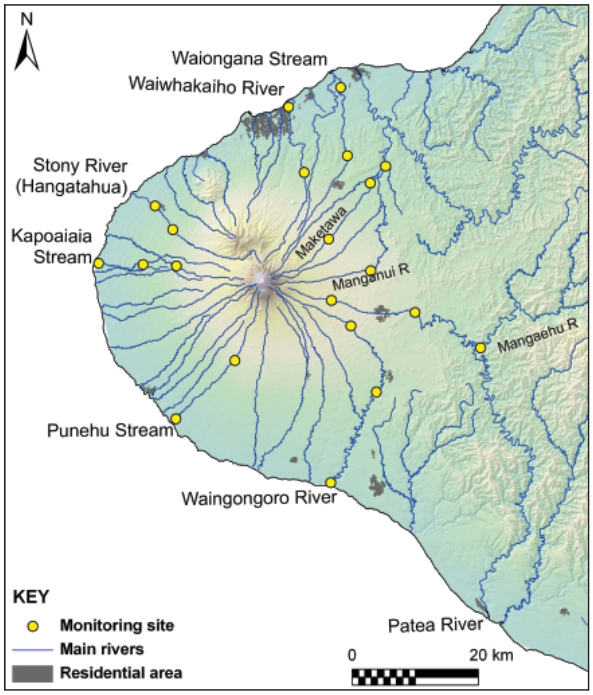


Figure 4.8: Monitoring sites for periphyton.

In a manner similar to the MCI for macroinvertebrates, a periphyton index can be calculated based on allocating scores for the various types of periphyton according to their preferences for different levels of stream nutrient enrichment. The lower the score, the more that particular algae prefers a nutrient-enriched environment. For example, long green filaments, grow best in nutrient enriched waters, and so are given a score of 1.

The periphyton index score for a stream can be expected to decrease downstream, because periphyton will increase as water temperatures and nutrient inputs increase, and shade and flow velocities decrease. Index scores will also usually decrease at any site from spring to summer, as water flows become more stable, and warmer.

National guidelines have been produced which recommend the maximum periphyton cover acceptable for aesthetics and recreation purposes[13]. These guidelines are breached when the visible streambed is 60% covered by thick mats of periphyton (more than 3 mm thick), or 30% covered by long filamentous algae (longer than 2 cm).

Table 4.3 sets out the results from the periphyton monitoring. It highlights that upper catchment sites with little agriculture upstream, generally show little periphyton proliferation, and only occasionally breach the recreational guidelines during summer (Table 4.3). Most upstream sites maintain a very good median periphyton index score throughout the year, indicating that although flow conditions might be suitable, the low amount of nutrients limits excessive periphyton growth.

The only upstream site to show a low periphyton index score is the Kapoaiaia Stream. This could be due to the wide shallow nature of the stream that flows through intensive farmland, even though it is in the upper catchment.

13 Biggs,B. 2000. *New Zealand Periphyton Guideline: Detecting, monitoring and managing enrichment of streams.* Prepared for the Ministry for the Environment.

Table 4.3: Frequency of times samples met the periphyton recreation guidelines and the median periphyton index scores between 2002-2007.

Place in catchment	River/Stream	Location	% of samples that met the guideline for 'thick mats' (n=10-11)	% of samples that met the guideline for 'Long filamentous algae'	Median periphyton index.
upper	Pātea River	Barclay Road	100	100	9.5
	Punehu Stream	Wiremu Road	100	90	9.2
	Maketawa Stream	Denby Rd	100	100	8.6
	Waingongoro River	Opunake Road	100	100	8.1
	Kapoaiaia Stream	Wiremu Road	100	36	3.5
middle	Stony (Hangatahua) River	Mangatete Road	100	100	9.5
	Manganui River	SH3	100	100	9.4
	Pātea River	Skinner Road	100	36	5.2
	Waiwhakaiho River	SH3 (Egmont Village)	100	40	6.0
	Waingongoro River	Stuart Road	90	90	8.0
	Kapoaiaia Stream	Whataroa Road	82	73	6.5
	Waiongana Stream	SH3a	100	70	5.9
Lower	Hangatahua (Stony) River	SH45	100	100	9.1
	Maketawa Stream	Tarata Road	100	70	5.6
	Manganui River	Bristol Road	100	73	5.9
	Waiwhakaiho River	Constance St, NP	100	70	6.7
	Waingongoro River	Ōhawe Beach	82	100	7.0
	Punehu Stream	SH45	100	55	6.3
	Kapoaiaia Stream	Cape Egmont	90	36	4.8
	Waiongana Stream	Devon Road	100	90	7.2
	Mangaehu River	Raupuha Road	90	60	5.0

The monitoring shows that mid-catchment sites, which are in intensively farmed areas, generally breach the recreational guidelines for long filamentous algae, usually during summer.

Lower catchment sites typically have warmer water temperatures, lower water velocities, and less shading. Consequently, all lower catchment sites, with the exception of the Stony (Hangatahua) River, breached the recreational guidelines at least once during the period monitored, generally with filamentous growths rather than with thick mats. The Stony (Hangatahua) River has low nutrient inputs (discharges to surface water are prohibited), few tributaries that drain farmland and significant erosion in the headwaters which scours periphyton off the rocks.

Most of the lower catchment sites monitored have higher nutrient levels, so periphyton growth is limited primarily by flow regime and water temperature. As there are fewer floods in mid-to late summer, periphyton is not scoured off streambeds as frequently, and this combined with the warmer water temperatures can lead to a build up of periphyton to nuisance levels. The growth of nuisance periphyton in lower catchments is expected to reduce as riparian margins are fenced and planted, although improvement will take some years to become apparent and will be more significant once the plants have established and grown, shading the streambed.

4.1.2 WHAT IS THE CURRENT PHYSICAL AND CHEMICAL STATE OF TARANAKI'S WATER QUALITY?

(A) INDICATORS AND GUIDELINES

Water quality can be assessed by various physical and chemical measurements. These indicators are used nationally and internationally to highlight and quantify aspects of the key pressures on the health of the water and suitability for various water uses, and trends in their state. A number of indicators vary naturally (e.g. over the course of a day or season) but standardised sampling protocols eliminate this variability to allow robust assessment of underlying trends in water quality that may be very subtle but statistically significant. Beside statistical significance, the ecological importance of any trend is also evaluated.

State of the environment monitoring does not necessarily identify the very best or very worst conditions that may occur at any one site, or the full range of conditions that may occur. For example, samples are generally collected between early morning and mid-afternoon, which from spring to autumn coincides with the period just after farm dairies have been washed down and therefore effluent ponds have discharged across the region – raising biochemical oxygen demand (BOD), nutrients,

and bacteria, and reducing clarity, from the background levels present in the region's streams during the rest of the day.

BOD is an indicator of the level of residual organic pollution from sources such as farm effluent treatment ponds. High BOD may cause slime growth in streams. The plant nutrients phosphorus and nitrogen are useful indicators of ecological health as increased nutrients may lead to increased algae growth given the right conditions. High dissolved oxygen and clarity are important for the health of aquatic organisms (and, with respect to clarity, for aesthetic and recreational reasons). Temperature is another critical aspect for healthy stream life and to track the influence of riparian management and climate change. Finally, three measures of bacterial contamination are used: faecal coliforms, *E.coli* and enterococci are used as an indicator of faecal contamination. They all provide useful information on bacteriological sources and quality. For example, *E.coli* levels are used to indicate the relative risk of disease causing micro-organisms being present such as bacteria, viruses or protozoa.

For each of these variables guidelines have been developed that relate to the use and value of that waterway. For example, clarity guidelines for contact recreation (i.e. how far you should be able to see in the water for safe swimming) differ from the guidelines recommended for aquatic ecosystem protection (i.e. how far fish need to see through the water or

Table 4.4: Guidelines for commonly measured water quality variables.

Water quality variable	Standard or guideline	Purpose of standard or guideline (variable may be important for other reasons also)	Reference
Dissolved reactive phosphorus	<0.009 g/m^3 for upland rivers <0.010 g/ m^3 for lowland rivers	Aquatic ecosystem protection	ANZECC 2000[14]
Total phosphorus	<0.03 g/ m^3	Aquatic ecosystem protection	ANZECC 2000
	<0.8 g/ m^3	Irrigation	ANZECC 2000
Ammonia nitrogen	<0.01 g/ m^3 for upland rivers <0.02 g/ m^3 for lowland rivers	Aquatic ecosystem protection	ANZECC 2000
Nitrate	<0.2 g/ m^3 for upland rivers <0.4 g/ m^3 for lowland rivers	Aquatic ecosystem protection	ANZECC 2000
	<11.3 g/ m^3	Water supply	
	<9.0 g/ m^3	Stock drinking water	
Total nitrogen	<0.3 g/ m^3 for upland rivers <0.6 g/ m^3 for lowland rivers	Aquatic ecosystem protection	ANZECC 2000
	<25 g/ m^3	Irrigation	ANZECC 2000
Bacteria	>550/100 mls *(E.coli)*	Contact recreation **Action(red)**	MfE and MOH 2003[15]
	261-550/100 mls *(E.coli)*	Contact recreation **Alert (amber)**	MfE and MOH, 2003
	<260/100 mls *(E.coli)*	Contact recreation **Acceptable (green)**	MfE and MOH, 2003
	>15,000 cells per ml (cyanobacteria)	Contact recreation	MfE and MOH, 2003
	median <1000/100 mls faecal coliforms	Stock drinking water	ANZECC 1992
Dissolved oxygen	>80% saturation	Aquatic ecosystem protection	RMA, 1991, Schedule 3
Biochemical oxygen demand	<2 g/ m^3 (filtered)	Aquatic ecosystem protection	MfE 1992[16]
	<3 g/ m^3 (total)	Aesthetics	MfE, 2003
Clarity: black disc	>0.6 m for upland rivers >0.8 for lowland rivers	Aquatic ecosystem protection	ANZECC 2000
	>1.6 m	Contact recreation	MfE, 1994[17]
Clarity: turbidity	<4.1 NTU for upland rivers <5.6 NTU for lowland rivers	Aquatic ecosystem protection	ANZECC 2000
Temperature	25ºC 20ºC	Aquatic ecosystem protection	RMA, 1991, Schedule 3 Quinn and Hickey 1990[18]

14 Australian and New Zealand Environment and Conservation Council, 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Prepared by the Australian and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand.
15 Ministry for the Environment and Ministry of Health, 2003. *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas.*
16 Ministry for the Environment, 1992. *Water Quality Guidelines No. 1.*
17 Ministry for the Environment, 1994. *Water Quality Guidelines No. 2 Guidelines for the Management of Water Colour and Clarity.*
18 Quinn, J. M.; Hickey, C. W. 1990. Characterisation and classification of benthic invertebrate communities in 88 New Zealand rivers in relation to environmental factors. *New Zealand Journal of Marine and Freshwater Research* 24: 387-409.

Collecting a water sample.

Stony River.

how clear the water needs to be for light penetration for plant growth). In many cases consideration of aquatic ecosystem protection sets the most rigorous guidelines. The guidelines are designed to safeguard aquatic ecosystem values, however, these values are actually best measured through direct sampling of biological indicators such as the state of the invertebrates and algae, as described in the preceding section.

The guidelines referenced by the Council are set out in Table 4.4. They are consistent with those used nationally[19] and internationally. Some guidelines stipulate the median is an appropriate statistic to use, whereas other guidelines require compliance for every single sample.

The guidelines are not standards set in stone, and do have a number of limitations. For example, guidelines for phosphorus must be considered with caution when considering Taranaki streams, which are often subject to the natural leaching of this element from volcanic rock, particularly in the Egmont National Park, so that even pristine streams in the region do not meet this guideline.

The guidelines are generally 'precautionary'. For example, a high concentration of indicator bacteria means that it is more likely that disease-causing organisms are present. It does not mean that anyone/everyone swimming in the water at the time will actually get sick as individual exposure and susceptibility also play their parts. Likewise, the nutrient guidelines address the possibility of subtle shifts in ecosystem composition, rather than inhibitory or toxic effects (which occur at far higher values).

Furthermore, scientific consensus on some guidelines is lacking. For example, there are two guidelines available for dissolved oxygen: the RMA sets a lower limit of 80% saturation, and the Australia and New Zealand Environment and Conservation Council (ANZECC) guidelines specify 99-103% saturation or 98-105% saturation for upland and lowland rivers respectively. The RMA schedule has been used in Table 4.4, because even in a completely un-impacted waterway the ANZECC guidelines would often be breached through natural variability in dissolved oxygen levels.

Likewise, the guideline for bacteria levels (faecal coliforms) in stock drinking water proposed by ANZECC in 2000 (a median of 100 per 100 mls) differs markedly from the guideline proposed in 1992 (a limit of 1000 per 100 mls), and there appears little scientific basis for either guideline[20]. The link between any particular concentration of bacteria and stock health is not well-established. The guideline from the 1992 ANZECC guidelines has been adopted in Table 4.4, as the derivation of the standard is more appropriate to surface water.

(B) HOW DOES TARANAKI'S WATER QUALITY COMPARE WITH THE GUIDELINES ?

Water quality has been monitored monthly by the Taranaki Regional Council since 1995 at nine river sites with an additional site added in 1997 (the Waingongoro River at SH45) and a further site in 2003 (Maketawa Stream) bringing the total number of sites routinely monitored to 11. Three sites (one also included in the Council's sites) have been monitored by National Institute of Water and Atmosphere Research (NIWA) since 1989, as part of a national water quality monitoring programme[21]. The locations of these sites in relation to their catchments are shown in Figure 4.9.

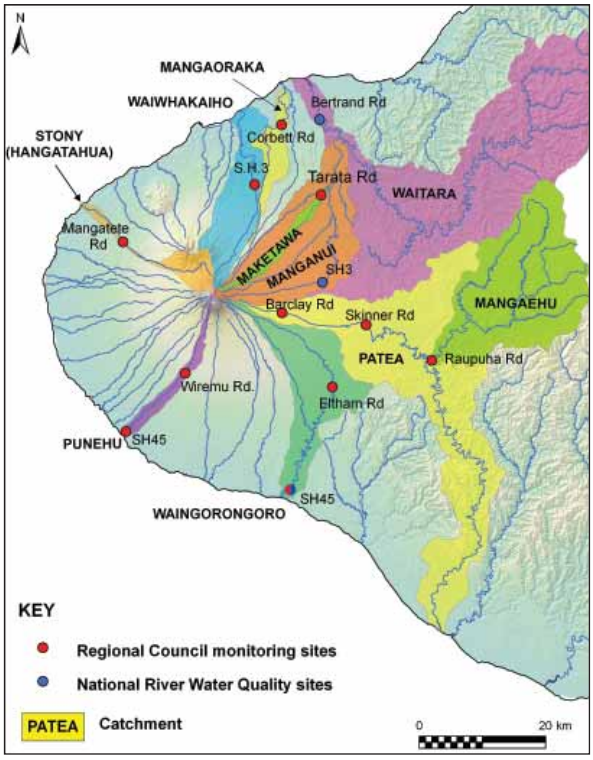


Figure 4.9: Locations of state of the environment monitoring sites for physicochemical variables.

19 Ministry for the Environment, 2007. *Environment New Zealand 2007.*
20 Sinton, L and Weaver, L. 2008. *Environment Southland Proposed Regional Water Plan – Comments on the bacteriological standards.* Client report prepared by Institute of Environmental Science and Research Ltd.
21 The National River Water Quality Network (NRWQN).

Viewing a black disc to assess water clarity.

Waingongoro River.

Table 4.5 : Evaluation of physicochemical data against water quality guidelines.

		Aquatic ecosystem protection								Irrigation		Stock drinking		Contact recreation aesthetics	
Catchment Level	Location	Biochemical Oxygen Demand	Dissolved Reactive Phosphorus	Total Phosphorus	Nitrate	Ammonia-N	Total Nitrogen	Dissolved Oxygen	Black disc	Total Phosphorus	Total Nitrogen	Faecal coliforms	Nitrate	Black disc	Biochemical Oxygen Demand
Upper	Pātea R. Barcley Rd	☺	☹	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
Upper/ Middle	Punehu R. Wiremu Rd	☺	☹	☹	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
Middle	Stony R. Mangatete rd	☺	☹	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
Middle	Pātea R. Skinner Rd.	☺	☹	☹	☹	☹	☹	☺	☺	☺	☺	☺	☺	☺	☺
Middle	Waiwhakaiho SH3	☺	☹	☹	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
Middle	Waingongoro Eltham Rd	☺	☹	☹	☹	☺	☹	☺	☺	☺	☺	☺	☺	☺	☺
Lower	Maketawa St. Tarata Rd	☺	☹	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺
Lower	Mangaoraka Corbett Rd	☺	☺	☺	☹	☺	☹	☺	☺	☺	☺	☺	☺	☺	☺
Lower	Waingongoro SH45	☺	☹	☹	☹	☹	☹	☺	☺	☺	☺	☺	☺	☹	☺
Lower	Punehu R. SH45	☺	☹	☹	☹	☹	☹	☺	☺	☺	☺	☺	☺	☹	☺
Lower hill country	Mangaehu R. Raupuha Rd	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☺	☹	☺

Key:

☺ Maximum (or minimum, depending on variable) meets the guidelines – **Very good**

☺ Median value meets the guidelines - **Good**

☹ Median value does not meet guidelines – **Poor**

Water quality testing in the Council's IANZ-registered chemistry laboratory.

Checking for algal growth on a stream bed.

Twelve years of state of the environment monitoring data undertaken by the Council have been summarised in Table 4.5 and compare the medians (the mid-point value of all values) with the guidelines (where the use of medians is appropriate) for aquatic ecosystem protection, irrigation, stock drinking water and contact recreation.

Sites within the table have been grouped according to their location within their catchment, i.e. upper, middle and lower reaches of rivers. The Stony (Hangatahua) River site has been placed directly below the upper catchment sites as its water quality should be less influenced by human activity due to strict controls placed on all discharges within this catchment. In this way, patterns can be more easily seen in their catchment-location context.

In addition to evaluating Taranaki's water quality data against the guidelines, it is possible to examine patterns, such as changes in a variable down a catchment or between catchments with differing levels of intensive land use and to investigate deviations from values expected. In the absence of a stream or river that is in a state un-impacted (by human activities) to function as a benchmark, the guidelines (albeit with limitations) are an appropriate estimate of the standards we should be aiming to attain.

Aquatic Ecosystem protection

In relation to aquatic ecosystem protection, Table 4.5 shows that there are some guidelines that all sites meet comfortably (such as dissolved oxygen, biochemical oxygen demand, and clarity), some guidelines where the majority of sites exceed the guidelines (such as dissolved and total phosphorus), other guidelines that most sites meet (such as ammonia) and others where it is about 50:50 (nitrate and total nitrogen).

Biochemical oxygen demand

Biochemical oxygen demand is a measure of the amount of organic matter (dissolved and particulate) in the water. This material is a source of carbon for slimes and filamentous growths, commonly referred to as 'sewage fungus', that as a nuisance growth adversely degrades habitat quality for instream ecosystems. BOD is sourced primarily from dairy farm effluent treatment ponds, as well as municipal sewage ponds and various other discharges.

All samples at all sites meet the guideline.

Plant nutrients

Overall, very few sites met the guidelines for dissolved reactive phosphorus or total phosphorus. In Taranaki streams, phosphorus is derived from the leaching of volcanic rock but can also be indicative of fertiliser and sediment run-off or leaching. The only ring plain site that met the guideline for phosphorus was the Mangaoraka Stream which does not have its headwaters in the national park, and is thus less susceptible to erosion of volcanic materials. Likewise, the Mangaehu River, being sourced from the eastern hill country, is not influenced by the leaching of phosphorus from volcanic soils. For ring plain streams, it is difficult to distinguish between the levels of phosphorus derived from natural erosion and that contributed by intensification of agricultural activities. Even the natural background levels exceed the guidelines.

For upper catchment sites and the Stony (Hangatahua) River, even the site with the highest recorded levels of nitrogen met the ANZECC guidelines. In contrast, lower catchment sites exhibited elevated levels of nitrate/total nitrogen. This is probably due to increased nutrient run-off, possible stock access, and discharges from effluent treatment ponds.

Ammonia guidelines are only exceeded by the median values of samples at three sites. This is very encouraging considering intensive livestock agricultural land use involving high stocking rates and levels of fertiliser use, particularly the increases in urea.

Algal growth requires both nitrogen and phosphorus, and its growth will be limited by the nutrient that is in shortest supply. In Taranaki's upper catchments, the nutrient most likely to be limiting for algal growth is nitrogen, given the naturally high levels of phosphorus. Therefore more nitrogen is likely to lead to more algal growth, although other factors, such as light, temperature and frequency of floods will play a crucial role. Lower in the catchments, nitrogen becomes relatively plentiful while phosphorus becomes the limiting nutrient. Research continues to examine how the changes in nutrient levels actually affect the aquatic ecosystems in Taranaki streams, irrespective of the guidelines, and to determine what aspects are most appropriate to target management (e.g. managing shade through increased riparian planting may be a more efficient means of managing algal growth than trying to manage naturally derived phosphorus).

Collecting a sample to measure dissolved oxygen.

Well oxygenated water supports a diversity of aquatic life.

Dissolved oxygen and clarity

Well-oxygenated water supports a greater diversity of aquatic life. Levels of dissolved oxygen can be an indicator for organic pollution, and may reflect the level of algae growth. Dissolved oxygen levels and clarity (as measured by the length one can see a black disc) are consistently high, and adequate to support aquatic ecosystems at all catchment levels.

Temperature

If water temperatures exceed their usual ranges for too long, plants and animals in waterways can become stressed. Higher temperatures can also encourage excessive algal growth.

Temperature medians are not included in Table 4.5 because the monthly spot sampling is not appropriate to assess compliance with this guideline, although still valuable for trend analysis. However, five sites have continuous temperature measuring devices and from this the number of days when temperature has reached ecologically significant levels such as 25ºC/20ºC has been determined (Table 4.6). This table shows that the number of days that sites have exceeded 25ºC is relatively small, even during the long, hot summer of 2007-08. The two sites that more frequently reach 20ºC, are located in the lower, open reaches of the Mangaoraka Stream and Waingongoro River.

While Table 4.6 shows how frequently sites reached these temperatures, it does not show for how long, or at what time of the day. Generally sites that did reach 25ºC, stayed at that temperature for a few hours. Sites that reached 20ºC could stay at that temperature for several days. These extreme temperatures can be attributed to factors such as little riparian shading, but also to the volcanic rock boulders in Taranaki ring plain streams that retain heat and release it slowly. Thus the higher water temperatures generally occur later in the day.

Guidelines for irrigation and stock consumption

All monitored sites meet the relevant nutrient-related guidelines for irrigation and stock drinking purposes (see Table 4.4)

In terms of stock drinking water, all sites comfortably met the 1992 bacteria guideline for stock drinking water, although not the 2000 guidelines. Given that higher faecal coliform levels in streams generally

Table 4.6 Number of days when temperature has ever reached 20ºC or 25ºC (n/a = no complete data available for these years).

			2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Mid catchment	Pātea River at Skinner Rd	>25ºC	n/a	n/a	n/a	0	0	0	0	0
		>20ºC	n/a	n/a	n/a	15	21	19	14	40
	Waiwhakaiho River at SH3	>25ºC	0	0	0	0	0	0	0	1
		>20ºC	10	3	15	6	18	13	7	44
	Waingongoro River at Eltham Rd	>25ºC	0	0	0	n/a	n/a	n/a	n/a	0
		>20ºC	22	17	36	n/a	n/a	n/a	n/a	40
Lower catchment	Waingongoro River at SH45	>25ºC	n/a	n/a	n/a	0	1	1	0	2
		>20ºC	n/a	n/a	n/a	43	52	66	57	91
	Mangaoraka Stream at Corbett Rd	>25ºC	n/a	n/a	n/a	0	8	6	0	0
		>20ºC	n/a	n/a	n/a	22	76	72	55	96

Kaupokonui River mouth.

Meeting of the Waters, Waiwhakaiho River.

occur under conditions of heavy rainfall, when stream water is less likely to be utilised as stock drinking water, individual results above this guideline may not necessarily indicate a need for concern.

Guidelines for contact recreation

The Council's state of the environment monitoring programme gathers some information that is of relevance to contact recreation – levels of bacteria, clarity and BOD. Cleaner water is more aesthetically pleasing and safer to swim in. Table 4.5 shows that the majority of sites meet the bathing water guidelines for clarity (as measured by black disc), except for the lower Waingongoro River and Punehu Stream, and the Mangaehu River which have greater levels of fine suspended sediments from catchment erosion and run-off.

All sites comfortably meet the guidelines for BOD.

In order to monitor compliance with the contact recreation standards, and to monitor trends over time, the Council undertakes separate specific water quality monitoring at a number of popular lake, river and stream sites around Taranaki during the summer months (November to April) according to national protocols[22]. Sites included in this programme feature the most popular sites in the recent survey of recreational use of fresh water[23] (Figure 4.10).

Samples collected are classified into three categories according to the level of bacterial contamination (see Table 4.4). If they fall into the 'Acceptable' category, monitoring continues on a weekly basis, if they fall into the 'Alert' category, then more frequent monitoring is undertaken and if they trigger the 'Action' category, then further investigation is carried out and the public is advised with warning signs. For each site, the proportion of samples that results fell within these categories is illustrated in Figure 4.10. This shows that most sites are safe for swimming most of the time, although there are some exceptions. More detailed information on gradings of sites can be found in the Council's technical reports.

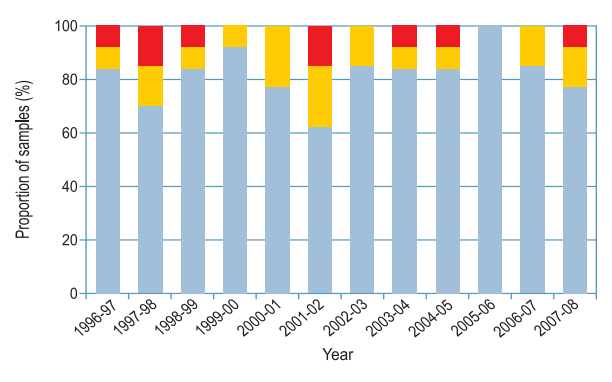
The sites in the Waiwhakaiho and lower Urenui rivers have been consistently within the guidelines, with very few samples exceeding the Alert or Action criteria per season. The sites in the Kaupokonui, Ōākura, Manganui and (lower) Waingongoro streams or rivers, and Lake Rotomanu generally showed acceptable water quality. However these sites exceeded the guidelines more frequently, up to 40% in some seasons. These are due to a variety of reasons, from high wild fowl numbers in Lake Rotomanu, stock having access to streams, and/or dairy treatment pond discharges (see case study).

Similarly, the Waingongoro River at Eltham, Timaru Stream and Pātea River often exceeded acceptable levels, with samples in the Pātea River in particular recording over 60% of samples above acceptable levels. Bacteria may enter rivers and streams from a variety of sources, including direct waste discharges, seepages from septic tanks, stock access, run-off from agricultural land, dairy farm treatment pond wastes, and as a result of the presence of wildlife (including birds).

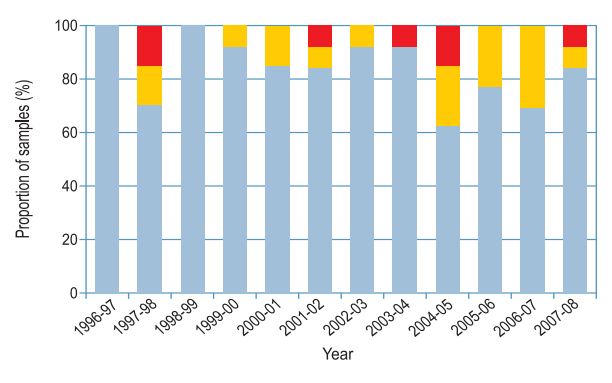
Water quality for contact recreation in the small Waimoku Stream at Ōākura Beach is consistently poor, with results frequently exceeding the Action level. Intensive investigations of the catchment have attributed this to birdlife as there are extensive ducks and pūkeko populations present on or adjacent to tributaries upstream of the township. However, discharges/seepages into groundwater from septic tanks can not be ruled out as possible contributors of faecal contamination.

Whitewater kayaking.

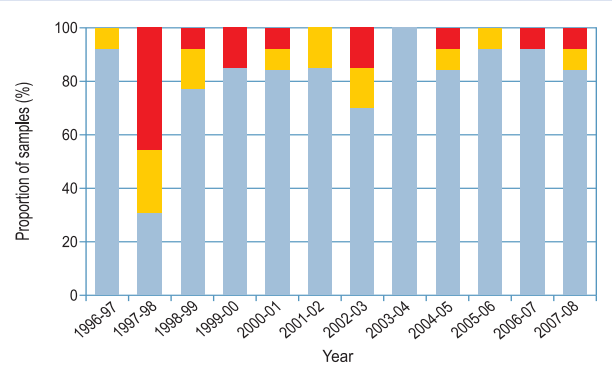
22 Taranaki Regional Council, 1997-2008. *Freshwater Bathing Contact Recreational Water Quality at Selected Taranaki Sites. State of the Environment Reports.* Technical Reports 97-04, 98-20, 99-18, 00-06. 01-07, 02-01, 03-05, 04-19, 05-09, 06-32, 07-11, 08-02.
23 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki. 2007-08.*



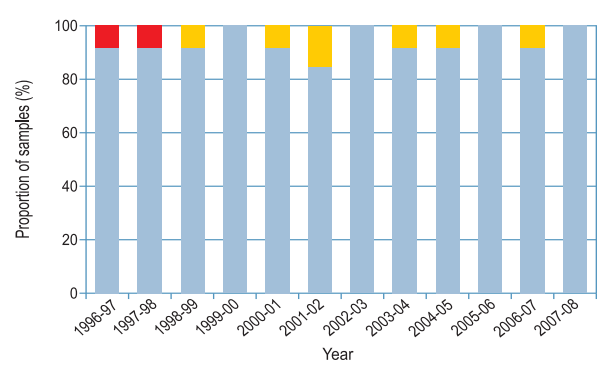
a. Manganui River



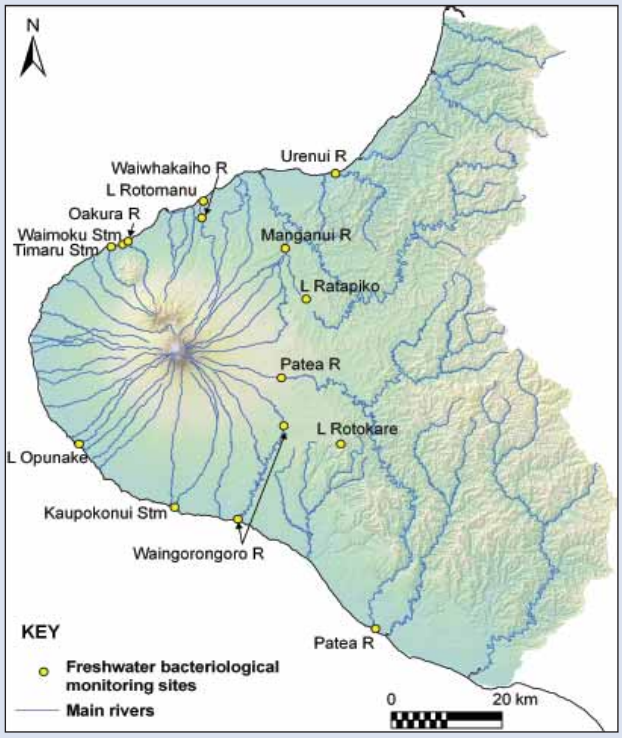
b. Ōākura River below SH45

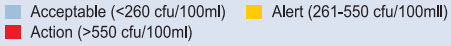


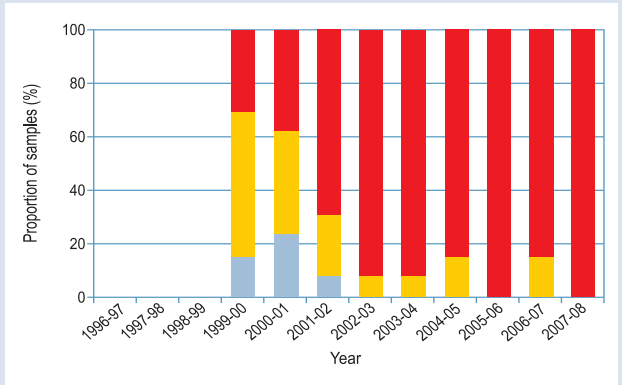
c. Kaupokonui River at beach



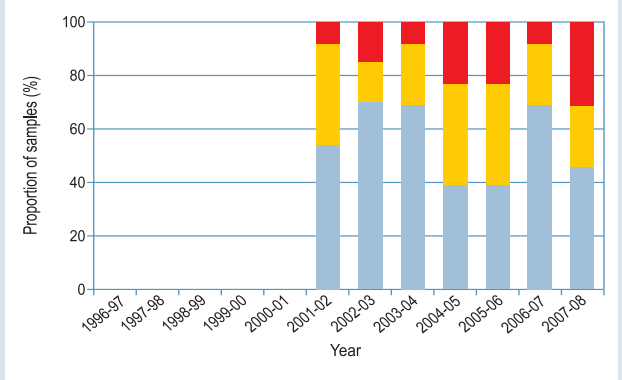
d. Waiwhakaiho River at Merrilands domain





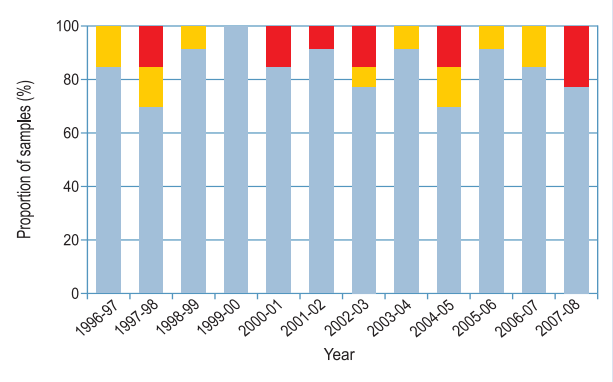


e. Waimoku Stream at Ōākura beach

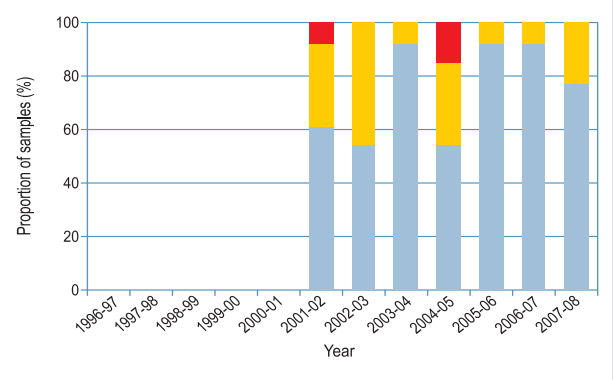


f. Pātea River at Stratford

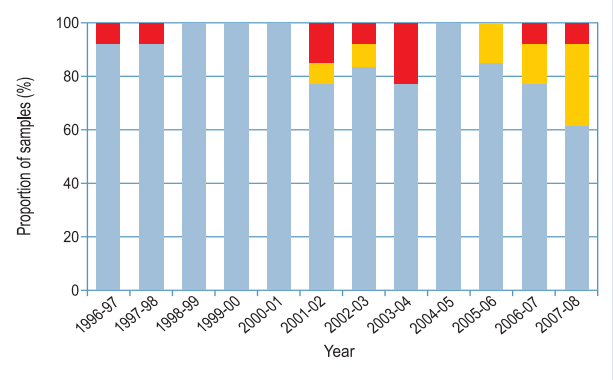
Figure 4.10: Map of rivers monitored for bathing water quality and monitoring results.



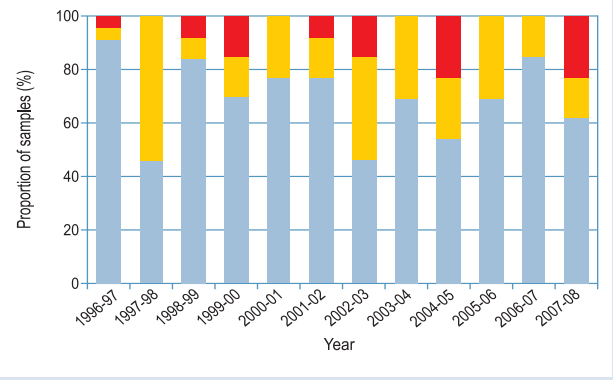
g. Waingongoro River at Eltham



h. Waingongoro River at Ōhawe



i. Lake Rotomanu



j. Timaru Stream at Lower Weld Rd

Urenui River.

Rural and urban run-off during significant rainfall events substantially increases bacterial levels in rivers and streams for up to several days after these events. Samples for monitoring contact recreational water quality are not taken within three days of heavy rain, because there is generally less likelihood of people swimming in rivers and streams immediately following significant rainfall. These results are therefore more conservative than if sampling was carried out on a random basis.

The frequency that results comply with the contact recreation guidelines varies not only between sites, but also between years. The proportion of all the samples taken each year that comply with contact recreational guidelines is illustrated in Figure 4.11. The proportion falling into the combined Alert or Action categories was generally between 10 and 30%, and this proportion did not show a trend over time, but rather varied from year to year.

During the very dry summer of 2007-08 for example, a high proportion of samples in the Action category (37) occurred in the Waimoku Stream. At least 60% of sites surveyed seasonally have entered the Alert level at some instance every summer since 2003, but in most cases such events are isolated rather than ongoing.

While the guidelines for contact recreation include requirements framed in terms of individual samples rather than seasonal medians, nevertheless, medians can be a useful indication of the level of bacterial contamination found most often at each site and can be analysed for trends over time. The good news though is that there were very few significant trends over time in the seasonal medians data, with the only exception being the Ōākura River, which is showing a statistically significant increase in bacterial numbers. However, median results and most individual sample levels remain well within the contact recreation guidelines.

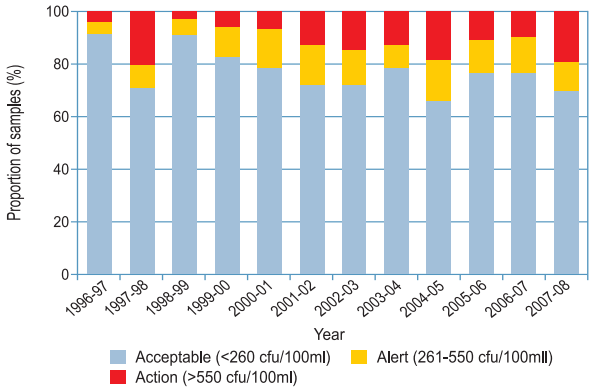


Figure 4.11: Proportion of samples meeting guidelines each year.

Lake Rotomanu.

PUT DUCKS ON DIET FOR LAKES' SAKE

Duck-feeders please desist – you are contributing to a water quality problem.

That was one of the messages to go out during the drought summer of 2007-08, when a number of issues were highlighted in the Taranaki Regional Council's annual recreational freshwater monitoring programme.

E. coli bacteria counts in water samples from nine of the 14 monitored sites at times reached or exceeded the Action level established under national guidelines, nine also exceeded the Alert level.

At Lake Rotomanu in New Plymouth, high *E. coli* counts were related to the droppings from large numbers of wildfowl gathered there to escape arid conditions elsewhere and to take advantage of free feeds from picnickers.

Notified of the Taranaki Regional Council's test results, health authorities stepped in with signage advising the public to stay out of the water – and a plea from the New Plymouth District Council for picnickers not to aggravate the problem by feeding the ducks.

"If we can keep the number of ducks low, there will be less chance of the lake being closed off to the public for health reasons in future," New Plymouth District Council Manager Parks Mark Bruhn told local media.

Ducks were also an issue at Lake Opunake. But elsewhere, bigger beasts were the culprits, with problems in at least one stream traced back to a landowner upstream allowing thirsty stock into the waterway and allowing his cows to use the stream as a race to access an adjacent property. This resulted in follow-up advice, and an abatement notice, to the individual by Taranaki Regional Council inspectorate staff.

Generally, monitored sites fluctuate in and out of compliance with the guidelines for a variety of reasons, some of which require immediate investigation when alert levels are reached.

Most of the monitored sites are near the mouths of rivers where conditions are generally attractive for recreational users. But these sites are also where the cumulative effects of upstream farmland run-off and discharges, stock access and urban stormwater disposal can have an impact on water quality, varying according to weather conditions, river flows and farming activities.

Results of the summer bathing water quality monitoring programme are immediately reported on the Taranaki Regional Council's website, www.trc.govt.nz, and there is close liaison with district councils and the Taranaki District Health Board.

www.trc.govt.nz

(C) HOW IS TARANAKI'S WATER QUALITY CHANGING?

Trends in physical and chemical water quality

With 12 years of physical and chemical data now analysed for 10 state of the environment monitoring sites, detection of trends in water quality through statistical analysis is possible.

This section examines trends in the physical and chemical water quality variables listed earlier. These are variables influenced by changing land use practices, and those in which there is most interest nationally.

The methods of statistical analysis used by the Council follow those increasingly being adopted for such analysis in New Zealand[24]. The statistical technique involves adjusting for variations in flow and seasonality, calculating trends, and then determining the statistical significance of the trend i.e. how sure can we be that a trend is 'real' and not just natural fluctuation? This is calculated via the 'p value', i.e. if $p < 0.01$ or $p < 0.05$, then there is a less than 1% or 5% chance, respectively, of finding a trend when there is not one. Trends in water quality data from the Council's monitoring are presented in Table 4.7 and discussed below. Data or details on the magnitude of trends is available from the Council for any site.

Water quality data is also available for a longer period for three sites that have been monitored by NIWA as part of the national river water

24 Scarsbrook and McBride, 2007. *Best Practice Guidelines for the Statistical Analysis of Freshwater Quality Data. Version 1.* Prepared by NIWA for Ministry for the Environment.

quality monitoring programme (see Figure 4.9). Trends have been analysed for the whole 18-year dataset for these sites and compared with trends in the data for these three sites over just the past 12 years (Table 4.8). These comparisons enable us to detect *changes* in the trends over the longer term. For example, if a variable has been found to improve over the whole 18-year time period, but no significant trend over the past 12 years is demonstrated, then it could be concluded that the rate of change may have plateaued or been arrested.

Alongside the question of whether there is a change occurring in our waterways, is the question of whether any such change has environmental implications, such as affecting the suitability of water for various purposes, uses and values. Therefore the discussion set out below also includes comments on how important for our environment any trend might be.

Examining Tables 4.7 (trends over 10-12 years) and Table 4.8 (trends over 12 years compared with trends over 18 years), what is noticeable is that traditional indicators of pollution, organic matter (BOD), suspended solids, clarity, conductivity (dissolved matter), and bacterial contamination, generally show no apparent trends at most sites over the past 12 or 18 years. Fundamentally, these aspects of water quality could be considered stable. This is during a time when the number of consents involving water abstractions and discharges has increased considerably, urban centres are spreading, and livestock farming has intensified.

However, more nutrients are being released into the region's streams overall, particularly in the middle and lower catchments. At sites with 18 years of data, all of these trends in nutrients have either plateaued or have become less statistically significant, that is, the rate of deterioration may have slowed down more recently at these sites.

Table 4.7: Trends in surface water quality at state of the environment monitoring sites in Taranaki- 1995-2007.

		Water Quality Variable												
Catchment Level	**Location**	Dissolved Reactive Phosphorus	Total Phosphorus	Nitrate	Ammonia-N	Total Nitrogen	Faecal coliforms	Enterococci	Conductivity	Black Disc	Suspended Solids	Temperature	Biochemical Oxygen Demand	pH
Upper	**Pātea River Barclay Rd**	☹	😐	😐	😐	☺	😐	😐	😐	😐	😐	😐	😐	😐
Upper/ Middle	**Punehu Stream Wiremu Rd**	😐	😐	😐	😐	☺	😐	😐	😐	😐	😐	😐	☺	😐
Middle	**Stony River Mangatete Road**	☹	☹	😐	😐	☺	☹	😐	😐	☹	☹	😐	😐	😐
Middle	**Pātea River Skinner Rd**	☹	😐	☹	😐	☹	😐	😐	😐	😐	😐	😐	😐	😐
Middle	**Waiwhakaiho SH3**	☹	☹	☹	😐	😐	😐	😐	☺	😐	😐	☺	😐	😐
Middle	**Waingongoro Eltham Rd***	☹	😐	☹	😐	☹	😐	😐	😐	😐	😐	☺	😐	😐
Lower	**Mangaoraka Stream Corbett Rd**	☹	😐	😐	😐	😐	😐	☹	😐	☹	😐	😐	😐	😐
Lower	**Waingongoro SH45**	😐	😐	😐	😐	☹	😐	☹	😐	😐	😐	☺	😐	😐
Lower	**Punehu Stream SH45**	☹	😐	😐	😐	😐	☺	😐	😐	😐	😐	😐	😐	😐
Lower	**Mangaehu River Raupuha Rd**	☹	😐	😐	☺	☺	😐	😐	☺	😐	😐	😐	😐	😐
Total no. sites:	Improvement ☺	0	0	0	1	4	1	0	2	0	0	3	1	0
	No change 😐	2	8	7	9	3	8	8	10	8	9	7	9	10
	Deterioration ☹	8	2	3	0	3	1	2	0	2	1	0	0	0

Key:

* Data for this site only for the past 9 years: 1998 – 2007

☺ statistically very significant improvement P<0.01 (1%)

☺ statistically significant improvement P<0.05 (1%)

😐 no statistically significant change

☹ statistically significant deterioration P<0.05 (5%)

☹ statistically very significant deterioration P<0.01 (less than 1% probability that the trend is due to natural variability and does not represent an actual change)

Table 4.8: Trends over the past 18 years and over the past 12 years.

(a) Waingongoro River at State Highway 45

	18 years	12 years
Ammonia	☹	
		☹
DRP	☹	
		😐
Total Phosphorous	☹	
		😐
Nitrate	☹	
		☹
Total Nitrogen	☹	
		☹
Clarity	😐	
		😐

(b) Manganui River at State Highway 3

	18 years	12 years
Ammonia	☺	
		😐
DRP	☺	
		☺
Total Phosphorous	☺	
		☺
Nitrate	😐	
		😐
Total Nitrogen	😐	
		😐
Clarity	☺	
		😐

(c) Waitara River at Bertrand Road Bridge

	18 years	12 years
Ammonia	☺	
		😐
DRP	☹	
		😐
Total Phosphorous	😐	
		😐
Nitrate	😐	
		😐
Total Nitrogen	😐	
		☹
Clarity	😐	
		😐

☺ statistically significant improvement P<0.01 (1% probability of error)
☺ statistically significant improvement P<0.05 (5% probability of error)
😐 no statistically significant change
☹ statistically significant deterioration P<0.05 (5% probability of error)
☹ statistically very significant deterioration P<0.01 (1% probability of error)

Data: NIWA

Waitara River, upstream from Bertrand Road Bridge.

Phosphorus is derived from natural erosion of volcanic material. Pyramid stream, Mount Taranaki.

While increased nutrient levels are not being reflected in trends in the aquatic health of streams of the region (see previous section, where stream health is discussed), increasing nutrients into the middle and lower reaches of the region's catchments where stream ecological health is already poorer than in the upper catchments, and less than what might be expected in ideal conditions, is of concern. Furthermore, trends in nutrient losses from land to fresh water is a real issue for Taranaki, environmentally and economically.

Changes in the amount of organic wastes

Biochemical oxygen demand levels, an indicator of the amount of organic wastes entering our streams, show no apparent trends over the past 12 years, despite increasing intensification of dairy farming during this period. Some extrapolation from earlier data suggests instream BOD levels may have actually fallen[25]. This may reflect the adoption of treatment pond designs providing a higher degree of treatment for dairy farm effluent, better management of these systems, an increasing proportion of such ponds discharging to land instead of to water, and improvements in the quality of other discharges.

Changes in phosphorus levels

The overall story for phosphorus, particularly dissolved reactive phosphorus, is however not such good news. In addition to many sites not meeting phosphorus guidelines, most sites in the Council's monitoring programme (80%) show a statistically significant deterioration in dissolved reactive phosphorus has occurred over the past 12 years, and a couple of sites also show deterioration in total phosphorus (Table 4.7).

Deterioration found at sites in upper catchments most probably reflects natural causes such as an increase of phosphorus leaching from volcanic material exposed by subsidence and erosion events within the headwaters in the Egmont National Park. However, deteriorating trends in the middle and lower catchments will have been influenced by farming activities within the catchments, as well as these natural events.

At the mid-catchment site in the Waingongoro River (upstream of the Eltham wastewater treatment system and the Riverlands meatworks discharges), dissolved reactive phosphorus deteriorated over the past nine years (Table 4.7). Interestingly, while dissolved reactive phosphorus has shown deterioration when viewed over the past 18 years at a site further down the catchment (State Highway 45) (Table 4.8), over the past 12 years levels have shown no apparent trend at this site. This suggests that the deteriorating trend may have been arrested in recent years. This may be attributed, at least in part, to reduced waste loadings from the Riverlands meatworks discharge (see case study). A similar pattern has been found in the Waitara River at Bertrand Road (Table 4.8). Interestingly, significant improvements in dissolved reactive phosphorus levels in the Manganui River at SH3 are evident over the past 18 years and also over the past 12 years (Table 4.8).

Changes in nitrogen levels

The overall story for nitrogen in Taranaki's waterways is more positive, although some concerns do emerge. The majority (70%) of Council's

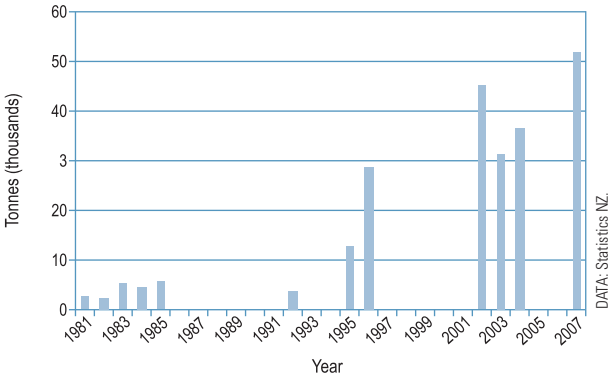


Figure 4.12: Use of nitrogenous fertilisers in Taranaki.

monitored sites show no statistically significant change in nitrate or total nitrogen levels over the past 12 years, and ammonia levels have not statistically changed at any of the monitored ring plain sites (Table 4.7). These results are encouraging and surprising, as the use of nitrogenous fertiliser, especially urea, is increasing (Figure 4.12), and intensification of stocking rates means more urine in paddocks and more effluent in ponds. All these indicate more nitrogen, primarily as ammonia which is transformed into nitrate, potentially entering our environment. Stabilisation of ammonia concentrations in particular indicates enhanced treatment of effluent and disposal to land rather than water are showing environmental benefits. However, some sites in mid-catchments do show deterioration in either or both nitrate and total nitrogen, probably due to the pressures discussed above.

Over the longer term, nitrate levels in the Waingongoro River at SH45 have deteriorated over the past 18 and 12 years (Table 4.8), but this trend is not evident over the past nine years (Table 4.7). While ammonia levels have also been deteriorating over the past 18 years at the same site, this trend may likewise have been arrested over the past nine years (Table 4 .7). This could also be due to improvements in the Riverlands discharge (see case study).

The lower Mangaehu River site (a hill country site in the Pātea catchment) has shown statistically significant improvements in both ammonia and total nitrogen trends, for reasons as yet unknown.

Changes in bacteria levels

Most sites monitored do not show statistically significant trends in levels of bacterial contamination (either faecal coliforms or enterococci). Two lower catchment sites, of the Mangaoraka Stream and Waingongoro River, show anomalous trends of significant deterioration in levels of enterococci, but no changes in faecal coliforms. This is an unusual situation that could be due to environmental growth of enterococci, but warrants further investigation.

Changes in other variables

Dissolved oxygen levels in surface water throughout Taranaki are consistently high, and this situation is not changing.

25 Taranaki Regional Council. 2006. *Trends in the Quality of the Surface Water of Taranaki.*

Cyanobacteria warning sign, Lake Rotokare.

Clarity, measured by the black disc method, is not significantly changing at 85% of the monitored sites. The exceptions are the Stony (Hangatahua) River (due to natural erosion episodes), and in the lower Mangaoraka Stream, where clarity is deteriorating.

Trends in temperature can be analysed from the Council's state of the environment programme because they are taken at the same time of day at each site. Interestingly, temperatures in our streams and rivers are either not changing significantly, or are measurably improving (i.e. getting cooler). The cooling effect is most pronounced further downstream on the ring plain, rather than at upper catchment sites, suggesting an influence other than natural temperature fluctuations. However, it is too early to attribute this to the riparian programme given how little new planting has occurred and how long it will take for plants to provide shade to streams.

(D) WHAT IS THE PHYSICAL AND CHEMICAL STATE OF TARANAKI LAKES?

The main purpose of four of Taranaki's largest lakes is for hydro-generation, i.e. Lakes Rotorangi, Māngamāhoe, Ratapiko and Opunake. Because of their use for energy generation, water tends to flow through these lakes relatively quickly and so they are less susceptible to potential water quality issues than might otherwise be the case. Although artificial, these lakes, and lakes Rotomanu and Rotokare are highly valued for their recreational uses, including fishing and boating, water and jet-skiing, picnicking and as wildlife reserves[26].

Cyanobacteria levels in lakes

Cyanobacteria are not indicators of faecal contamination, but rather are naturally occurring algae that may produce toxins which may pose risks to humans and animals by contact or consumption during recreational activities. Levels of cyanobacteria have been monitored since 2006-07 at three lake sites (Rotokare, Rotomanu and Ratapiko) and in the lower Waiwhakaiho River. Lake Opunake was added the following year.

This monitoring has found no cyanobacteria problems associated with lakes Opunake and Ratapiko, or in the lower reaches of the Waiwhakaiho River. However, cyanobacteria counts exceeded health standards towards the end of the exceptionally dry 2008 summer at Lake Rotomanu, and throughout the entire summer at Lake Rotokare[27]. Counts peaked at 37,000 cells per ml at Lake Rotomanu in late February 2008

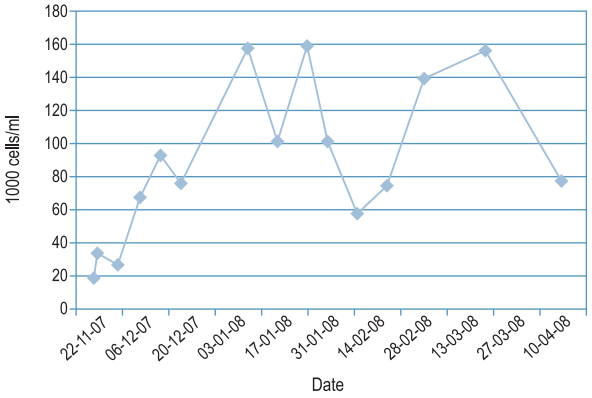


Figure 4.13: Cyanobacteria counts (cells/ml) at Lake Rotokare (health warning: > 15,000 cells/ml).

while counts at Lake Rotokare exceeded 150,000 cells per ml twice in January and again in March 2008 (Figure 4.13).

Further monitoring into late autumn to mid-winter 2008 revealed the algal count had subsequently dropped considerably at Lake Rotokare, but risen at Lake Rotomanu despite wet, cold weather.

With Lake Rotokare being closed to boating over the 2007-08 summer, boating use increased on Lake Rotorangi[26]. No cyanobacteria were detected at Lake Rotorangi.

Monitoring of Lake Rotorangi

Lake Rotorangi is the largest lake in Taranaki – a reservoir formed by the 82 m high Pātea earth-fill hydro-electric dam. The dam, 41 km upstream of the Pātea River mouth, was constructed in 1984.

The water entering the upper lake is often turbid, carrying high sediment loads under flood conditions. However, as this water slowly moves down the lake, the sediment settles and the water becomes clearer. Lake stratification, where the lake water separates into distinct layers because of temperature differences, is an annual feature in spring/summer particularly at the deeper sites near the middle and the lower end of the lake. The lake's layers become mixed again in mid-to late winter, although full mixing might not always happen leaving the bottom layers with lower oxygen levels in deeper areas of the lake. Lake mixing has the potential to cause environmental effects, by bringing nutrients to the surface where they become available for algal growth leading to odours, algal blooms, or even fish kills. It was originally predicted that these effects were possible in the reservoir, particularly during the early years with the decomposition of terrestrial vegetation. The sampling programme has been designed to monitor these potential effects. Since monitoring began in 1984, none of these effects has been recorded.

The lake has been classed as being moderately nutrient enriched and appears throughout the 22 years of monitoring to have been slowly moving towards a more nutrient enriched state[28]. More enriched lakes have the potential to lead to algal blooms. Lake Rotorangi water contains nitrate nitrogen in plentiful quantities for enriched algal growth, but relatively low levels of phosphorus. Four of the main variables monitored regularly (chlorophyll-a, clarity, total phosphorus and total nitrogen) have not changed significantly over time, which indicates

26 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*
27 Taranaki Regional Council, 2008. *Freshwater Contact Recreational Water Quality at selected Taranaki Sites.* Technical Report 2008-02.
28 Burns, N.M., 2007. *Patea Hydro Electric Power Scheme Reconsenting Project Aquatic Ecology Review. Water Quality Trends in Lake Rotorangi, 1990-2006.* Prepared by Lakes Consulting for Trust Power Ltd.

that the lake chemistry is not significantly changing, although levels of dissolved reactive phosphorus and nitrate seem to be increasing. While currently, the relatively low levels of phosphorus limit algal growth within the lake, the situation could change if this upward trend continues[22].

All of this means that the lake is probably increasing in trophic level, but at a very low rate. This indicates that riparian management initiatives within the catchment upstream, improvements to point-source waste discharges and more sustainable land use in the hill country catchments to reduce sediment input, should be supported.

4.1.3 HOW IS FRESHWATER QUALITY MANAGED ?

(A) REGIONAL FRESH WATER PLAN

The *Regional Fresh Water Plan for Taranaki* became operative in October 2001. One of the main objectives of the plan is to maintain and enhance water quality in Taranaki's rivers and streams. The plan recognises that point and diffuse source discharges and their effects on water quality must be addressed if it is to meet this objective. The plan uses a combination of regulatory and non-regulatory approaches as part of an overall strategy for managing the environmental effects of discharges to land and water. Key features of the plan are:

- rules containing environmental standards or conditions for all major point source discharges to land or water;
- policies and methods for the promotion of sustainable land management practices that prevent or minimise adverse effects on water quality from diffuse sources, including good stock and fertiliser management practices;
- policies and methods for the promotion of riparian planting on all ring plain catchments;
- policies and methods to recognise and provide for the relationship of tangata whenua and the culture and traditions with their water, sites, wāhi tapu and other taonga;
- best practice guidelines for water and land-based treatment and disposal of agricultural effluent;
- water quality guidelines for different water values and uses that are taken into account when assessing applications to discharge contaminants to land or water; and
- special rules for the Stony (Hangatahua) River catchment so that the waters of this catchment are protected as far as possible in their natural state.

The Council has prepared a report looking into the effectiveness and efficiency of the *Fresh Water Plan* and has sought comments on it from stakeholders[29].

(B) RESOURCE CONSENT MANAGEMENT

Point source discharges to surface water require a resource consent from the Council to ensure that discharges do not have unacceptable adverse effects on water quality.

There are a number of point source discharges throughout the region that have the potential to result in the contamination of surface water. These include both discharges directly to water and discharges to land, where there is potential for run-off to water. Table 4.9 shows the number and type of consented discharges to land and surface water in Taranaki. 2,655 consents are held for discharge to land and surface water. A little over half (53%) are for discharges to water, 44% are for discharges to land and 2% are to land and/or water.

Table 4.9: Consented discharges to land and surface water in Taranaki.

	Discharges to surface water	Discharges to land	Discharges to land or water	Total
Agricultural - dairy	989	817	62	1868
Agricultural - piggery	5	11	1	17
Agricultural - poultry	3	43	0	46
Agricultural - goats	2	4	0	6
Hydrocarbon exploration	140	137	0	277
Petrochemical processing	43	11	1	55
Quarries	32	12	1	45
Landfill	20	7	0	27
Cleanfill	2	23	0	25
Sewage treatment	18	24	0	42
Water supply or treatment	19	4	0	23
Dairy processing/manufacturing	13	6	0	19
Power generation	18	3	1	22
Other industry	109	71	3	183
Total	1413	1173	69	2655

Data from Council's consent database to June 2008.

29 Taranaki Regional Council, 2008. *Effectiveness and Efficiency of the Regional Fresh Water Plan for Taranaki.*

Inspecting dairy farm effluent treatment ponds.

There has been a slight decline in the total number of discharge consents to land and water, from 2,997 in 1996, to 2,655 in 2008. There has been a 23% reduction in the number of issued discharge consents to surface water (from 1,845 in 1996 to 1,413 in 2008).

All discharges of treated farm dairy effluent require a resource consent from the Council. The vast majority of all discharge to land or water consents (1,868 or 70%) are for dairy farms. This has dropped from 2,299 reported in 2003[30]. Where minimum standards for waste disposal to water cannot be met, the Council requires wastes to be disposed of on to land, or the use of other treatment and disposal methods. Land disposal is also subject to conditions to avoid adverse environmental effects. The discharge of untreated dairy farm, piggery and poultry farm effluent to water is prohibited. Largely due to increasing amalgamation of dairy farms over the past few years and encouragement to farmers to consider land treatment and disposal, there are fewer discharges into water than there were in 1995 (see Figure 4.14).

There has been a significant increase in discharge consents for hydrocarbon exploration (from 80 in 1996 to 277 in 2008). The proportion of these discharges that are to water, however, has declined from 92.5% in 1996 to 50% in 2008. This reflects a significant shift to land treatment and disposal options, particularly for drilling solids and stormwater over the past 10 years.

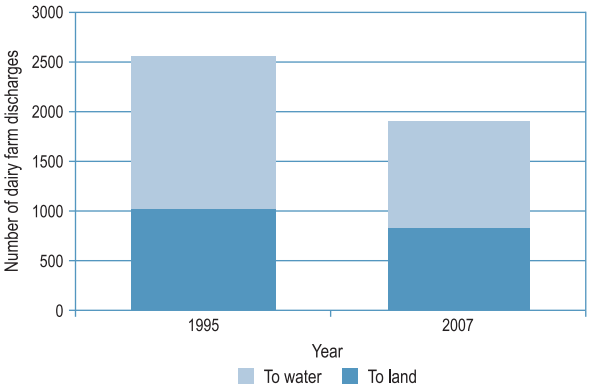


Figure 4.14: Comparing the number of agricultural discharges to water or to land between 1995 and 2007.

Other major industries, notably meat and by-product processing, have also moved to land-based effluent disposal over the past 10 years. Municipal sewage discharges at Inglewood and Hāwera no longer discharge to rivers and streams. Several industries in the Mangati catchment in Bell Block have ceased discharging to the stream and have redirected their discharges to the New Plymouth municipal wastewater system. These changes have reduced pressures on surface water quality in Taranaki.

Resource consents are renewed and reviewed by the Council over time. As an outcome from reviews of monitoring results, conditions are often adjusted to improve environmental performance.

The community, through the district councils, has invested over $83.4 million in capital costs over the past five years, to protect and improve surface water quality, mainly related to stormwater handling, wastewater and sewage collection, treatment and discharge. This figure is considerably higher than the $15.5 million reported for the period 1997-02[31]. For example, New Plymouth District Council invested more than $15 million on wastewater collection, treatment and disposal and in addition upgraded the Fitzroy Beach camp stormwater discharge system, costing an additional $80,000 (approx). Other examples include more than $2 million invested on stormwater and wastewater treatments by Stratford District Council, and around $17 million by South Taranaki District Council.

Over the period 2002-07 there were approximately 31 farm dairy effluent treatment systems installed in Taranaki and, over the same period, 184 were upgraded. Among the 31 newly-installed systems, six of them were oxidation ponds, seven were tertiary oxidation ponds and 18 were effluent irrigation systems. Total installation and upgrade costs reached $3.6 million over the past five years and annual cost of running and maintaining all systems was estimated to be around $1.5 million.

(C) UNAUTHORISED INCIDENTS

The risk of unauthorised discharges such as accidental spills, breaches of consent conditions and other non-authorised discharges entering watercourses is a continuing water quality issue in the region.

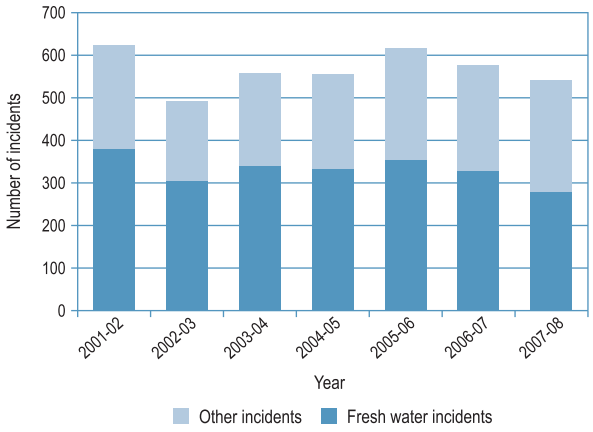


Figure 4.15: Number of freshwater incidents over time as a proportion of total number of incidents.

30 Taranaki Regional Council. 2003. *Taranaki – Our Place, Our Future. State of the Environment Report.*
31 Wu, J; Sanderson, K. 2008. *Community Investment in Environmental Improvements in Taranaki.* Report prepared for the Taranaki Regional Council.

Table 4.10: Major sources of freshwater incidents by sector from 2001-02 to 2007-08.

	2003-04	2004-05	2005-06	2006-07	2007-08
Total freshwater incidents	339	333	355	329	277
% of all incidents	60.8	60.3	57.4	56.9	51.3
Major sources of incidents by sector					
Dairy farm	159	172	163	125	138
Dairy processing/manufacturing	3	4	5	5	4
Meatworks, rendering plants	4	8	12	12	7
Private housing	17	16	16	25	17
Transport	7	9	11	6	5
Cleanfill	4	1	6	3	1
Building construction/drainage/flood control	13	6	11	6	1
Recreation/tourism/cultural	14	19	11	15	15
Quarries	8	4	9	6	1
Other agriculture[32]	17	8	19	12	15
Unknown			33	30	23
Other[33]			59	84	50

Reports of unauthorised incidents arise mostly from public complaints and from Council compliance and monitoring checks. Most environmental incidents are reported by the public (67% of all incidents in 2007-08). This is indicative of a general societal trend of rising expectations of environmental performance and quality. Increasingly, incidents are reported by consent holders as part of implementing stormwater management plans, or just as part of being environmentally-conscious citizens.

Figure 4.15 illustrates the trends in freshwater related incidents. This shows that water pollution incidents make up over half of all registered unauthorised incidents (51% in 2007-08), the majority of these relating to surface fresh water.

The major sources of freshwater incidents are illustrated by sector for the past five years in Table 4.10. Farm dairy discharges consistently account for the greatest proportion of all fresh water unauthorised incidents (on average 47%).

(D) RESOURCE CONSENT MONITORING

Council monitors compliance with the conditions placed on consents on a regular basis. Tailored compliance monitoring programmes are implemented for major activities and can involve a range of monitoring activities including chemical and biological monitoring, inspections, data audit and annual reporting. At 30 June 2008, there were a total of 283 current tailored compliance monitoring programmes covering 345 resource consent holders, exercising 1,020 consents (Table 4.11).

The Council annually monitors agricultural point source discharges to ensure compliance with consent conditions. The major programmes in this category are for inspections of dairy farm effluent treatment and disposal systems. 1,868 dairy farms were inspected in 2007-08. The number of agricultural point source discharges inspected, along with an indication of the level of re-inspection or follow up required, is illustrated in Figure 4.16.

Some inspections are carried out for minor industrial operations such as garages that do not require resource consents from the Council but are required to comply with conditions set out in the Council's regional plans.

(E) COMPLIANCE AND ENFORCEMENT

The overall level of compliance with consent conditions and plan requirements is high. Consent holders with tailored compliance monitoring programmes have shown consistently high levels of

Table 4.11: Sites and activities monitored in 2007-08.

Type of activity	
Sewerage	12
Marine outfalls	3
Motorcamp and community wastewater systems	4
Landfills	14
Cleanfills	20
Dairy companies	3
Petrochemical	39
Meat processing and feedmills	5
Miscellaneous industry	9
Abrasive blasting	13
Quarries	29
Water supply schemes	20
Energy	6
Abstraction for farm irrigation	48
Consent holders in the catchment monitoring programmes	58
Total number of sites/activities covered by tailored programmes	**283**

32 Includes: agricultural services, drystock, goat, poultry and piggery farming operations.
33 Includes: chemical processing/manufacturing; concrete products; electrical manufacutring; fertiliser storage or distribution; garage/workshop; hydrocarbon exploration; light engineering; local authority; pesticide manufacture/use; petrochemical processing; power generation; retail; road/bridge construction; sewage treatment; timber treatment and water supply or treatment.

Riverlands Chief Executive Trevor Johnston (left) and farmer Russell Joblin.

WIN-WIN DEAL HELPS KEEP WAINGONGORO CLEAN

The inspiration could have come from the name: Riverlands is doing its bit for the environment by diverting discharges from river to land.

The busy meatworks, which sits on the banks of the Waingongoro River at Eltham, has more than trebled its throughput since the mid-1990s and has also taken on the processing of bobby calves.

That level of increase could have been expected to put greater stress on the Waingongoro – but monitoring by the Taranaki Regional Council is in fact suggesting a gradual improvement in the quality of the river water[34].

Why? Because during crucial summer seasons, when river flows are at their lowest, an increasing amount of treated effluent from the plant is discharged to land via irrigators on a neighbouring dairy farm.

It's the classic win-win: Riverlands keeps its impact on the environment to a minimum; pastures on the Joblin family farm next door get a boost at precisely the right time they need it.

"We're very pleased with the arrangement," said the Riverlands Chief Executive Officer, Trevor Johnston. "It's good to keep our own operation as environmentally clean as possible, it's good to work in with a neighbour and it's good that it's going towards boosting production."

Farmer Russell Joblin agreed: "It's been really good for the farm, especially during the dry summer we've just had. It is a real win-win, and it's going to be more important as time goes on."

The soil acts as a living filter for the treated effluent, processing it physically, chemically and biologically. Ultraviolet radiation in sunlight and the drying effect of the elements also have an effect.

And, of course, the spraying brings nutrients and moisture to pastures – crucial for maintaining production in dry summers.

Riverlands' discharges to land began in 2001 and rapidly increased so that by 2005, they accounted for 62% of the plant's annual treated effluent. During this time, bacterial colonies known as "sewage fungus" have disappeared from the river, and studies of invertebrate populations downstream of the meat plant indicate that water quality may be improving.

The effects of the discharges to land are also monitored and no significant detrimental impacts have been detected.

Meanwhile, a resource consent has been approved allowing treated municipal wastewater from Eltham to be piped to Hāwera and then out to sea via the Fonterra Whareroa outfall.

That will bring an end to the discharge of Eltham municipal wastewater into the Mangawhero Stream, a tributary of the Waingongoro River. The new pipeline is expected to be completed in mid-2009.

environmental performance, with 93% showing either a high or good level of performance in 2007-08. Ninety-six percent of the agricultural operations inspections and 97% of the minor industrial operations inspected in 2007-08 complied with their consent conditions or Council requirements. The re-inspection rate for farms failing to meet Council policy or consent conditions was 4% in 2007–08 - up from 2.7% in 2006–07. However, most farm dairy effluent systems consistently meet Council requirements with compliance rates between 95 and 97% over the past five years (Table 4.12).

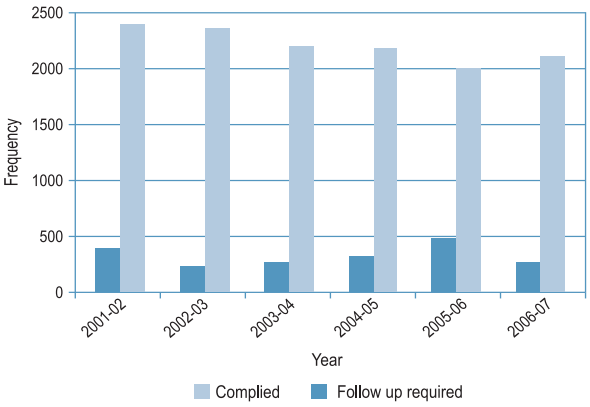


Figure 4.16: Frequency of Council inspections of agricultural point source discharges.

Abatement notices are issued to require action to be taken where there is non-compliance. Table 4.12 sets out the annual number of abatement notices, infringement notices and prosecutions issued under the *Regional Fresh Water Plan*, including the number specifically relating to farm dairy discharges.

The strategic use of enforcement in resource management to modify attitudes and encourage positive environmental outcomes has been long recognised by the Council.

(F) CONTINGENCY PLANS AND STORMWATER MANAGEMENT PLANS

The Council has the power to require consent holders to prepare contingency plans containing measures or procedures to avoid pollution in the event of a leak, spillage or failure of plant or equipment. A total of 338 contingency plans have been prepared, 312 relate to discharges

34 Taranaki Regional Council, 2007. *Riverlands Eltham Limited. Monitoring Programme Biennial Report 2005-2007.* Technical Report 2007-116.

Table 4.12. Annual number of abatement notices, infringement notices and prosecutions.

		2003/04	2004/05	2005/06	2006/07	2007-08
Consent compliance rate	Relating to farm dairy discharges	95%	95.8%	94.1%	97.3%	95.9%
Abatement notices	Total	146	143	143	118	104
	Relating to fresh water (relating to farm dairy discharges)	125 (105)	125 (117)	131 (108)	103 (73)	88 (74)
Infringement notices	Total (relating to farm dairy discharges)	9 (2)	9 (4)	26 (4)	40 (11)	30 (7)
Prosecutions	Relating to fresh water (relating to farm dairy discharges)	2 (1)	0	3 (2)	5 (4)	4 (3)

to land and/or water, for a wide range of industrial activities including oil and gas exploration and production sites, landfills, quarries, meatworks, transport depots and engineering works. Contingency plans are regularly reviewed and updated.

In addition to its industry-based contingency plans, the Council has prepared a contingency response plan for responding to spills or other unauthorised incidents in inland and estuarine areas[35]. This plan complements the Council's *Marine Oil Spill Response Plan* and ensures the region is fully prepared for unauthorised discharge events.

Recently, the Council prepared a template for stormwater management plans to assist industries develop their own plans[36].

(G) MANAGEMENT OF RIPARIAN MARGINS

Riparian planting, incorporating streamside fencing and improved stock management near waterways, is an important method for maintaining and improving water quality. The Council promotes riparian management through the preparation of riparian management plans, at no cost to the landowners, the provision of low cost riparian plants and assisting with planting contractors. The philosophy is that landowner initiative, voluntary co-operation and ongoing commitment are vital for the long-term success of riparian management.

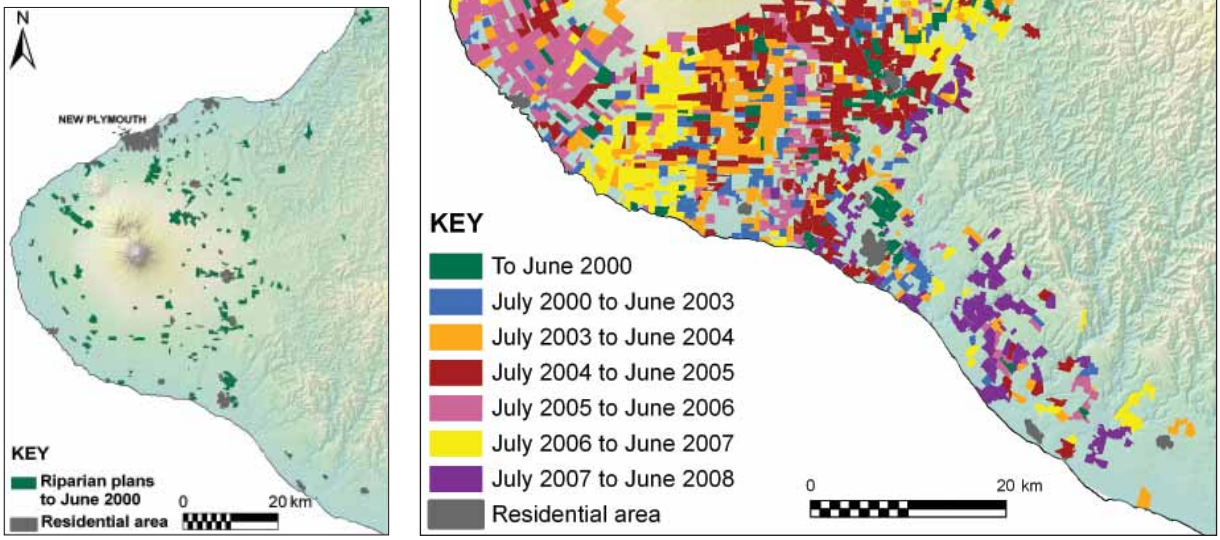


Figure 4.17: Coverage of riparian plans to June 2000 compared to the coverage of riparian plans to the end of June 2008.

35 Taranaki Regional Council. 2003. *Inland and Estuarine Contingency Response Plan.*
36 www.trc.govt.nz/environment/pdf/smp_template.DOC.

Collecting riparian plants from the Council's plant depot, Lepperton.

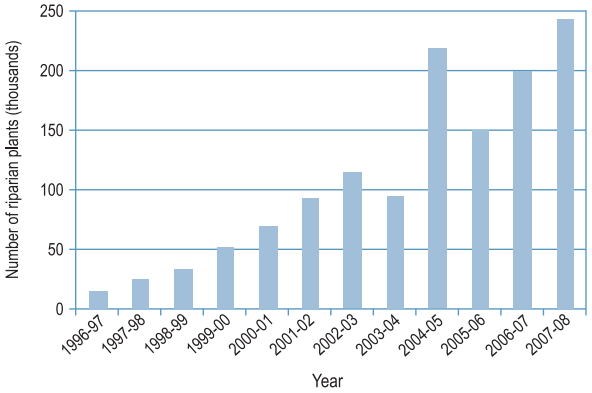


Figure 4.18: Number of plants supplied through the riparian plant scheme.

To date the Council's riparian management initiatives have resulted in the preparation of 2,009 riparian management plans making recommendations for riparian planting and fencing for 10,818 kilometres of stream banks. The coverage of riparian plans across the ring plain is illustrated in Figure 4.17.

The Council supports riparian management by making riparian plants available to riparian plan holders at low cost. This involves contracting nurseries to supply suitable native riparian planting material. By bulk-purchasing these plants, costs are reduced and savings are passed on to landowners. In the first year of the riparian plant scheme 15,600 plants were provided. In 2007-08, some 256,438 plants were provided to riparian plan holders, almost three times the number of plants provided in 2001-02. In total, almost one and a half million plants have been provided to plan holders since 1996-97 (Figure 4.18).

Progress in implementing riparian plans is closely monitored. Most plan holders are visited or contacted each year to assess progress and discuss any difficulties or problems. The extent of fencing and planting completed from 2002 to 2007 was 412 km, compared to 139 kilometres from 1997 to 2002, at an estimated cost of approximately $1.2 million as part of the $3.6 million investment on riparian protection[37]. As at 30 June 2008, landowners had fenced 504 km of stream bank and planted 426 km of stream bank. Taking into account the pre-existing fencing and planting into consideration, this means that 60% of stream banks are fenced and 43% of stream banks are planted[38].

The progress with planting and fencing stream banks in four catchments is set out in Table 4.13. These are the catchments that are subject to a monitoring programme. This shows that in the Katikara stream for example, 116 km of stream bank has been covered by a riparian plan, 62 km (53%) is protected from stock through existing fencing or natural boundaries, a further 35 km fencing has been recommended in the riparian plans but only 2 km (6%) of this has been completed. In the Kapoaiaia Stream, 5% of recommended fencing has been completed compared with 15% in the Kaupokonui River.

Land management officers support landowners to implement riparian plans.

Table 4.13: Progress with developing and implementing riparian plans in the four monitored catchments.

		Katikara	Kapoaiaia	Kaupokonui	Tangahoe
Area of catchment (excluding ENP) (ha)		1849	1177	11899	29769
Area of catchment covered by riparian plans (ha)		1385	1053	10802	11870
Total length of streams covered by plans (km)		58	49	417	213
Total length of stream bank (km)		116	99	835	426
Fencing (km)	existing	58	40	474	169
	natural boundary	4	5	10	5
	proposed	36	41	230	149
	completed	2	3	34	5
Planting (km)	proposed	14	56	408	203
	completed	1	2	37	7

37 Wu, J. Sanderson, K. 2008. *Community Investment in Environmental Improvements in Taranaki.* Prepared by Business and Economic Research Limited for Taranaki Regional Council.
38 Taranaki Regional Council. 2008. *Land Management Annual Report 2007-08.*

Kaponga farmer Tom Gibson with well-established riparian planting on the banks of the Kaupokonui Stream.

DOLLARS AND SENSE IN STREAMSIDE PLANTING

Kaponga farmer Tom Gibson knows all about the value of stock. And about the value of streamside fences and plants.

A keen enthusiast for riparian (streamside) fencing and planting, he reckons it's well worth the investment.

"I'd have to say, the cost of planting is a lot less than the cost of the stock I was losing," he said. And that was even before the current large dairy payouts, which have pushed cow prices up to $2,500-$3,000 a head – enough to pay a contractor to put in around 800 m of tax-deductible riparian fencing.

Mr Gibson has been implementing a riparian management plan on his 100 ha-property for five years. And he's had the benefit of hard lessons from earlier forays into streamside work, seeing stock demolish new plantings after flood-damaged fences weren't repaired quickly enough.

Now it's smooth sailing, however, with a contractor taking care of the hard graft and Mr Gibson happy to see the end of stock being lost by drowning or by being bogged.

"At calving time the cows would head for the streams, and often come down with milk fever. If you weren't there when they got up again, they'd get into the stream and drown," he said.

Liver fluke is another lurking peril for animals drinking from streams, while agricultural research has also shown that cows drinking from reticulated troughs tend to walk less, eat more and do better than cows drinking from streams.

For these reasons and more, Mr Gibson said riparian fencing and planting have made farm and stock management much easier – providing shelter, making stock movement safer, and break feeding simpler because the temporary line can be strung across the paddock to a fence alongside a stream.

He also appreciates the protection and enhancement of water quality – the reason that riparian fencing and planting is among the targets under the *Dairying and Clean Streams Accord Regional Action Plan* agreed to by Federated Farmers, Fonterra and the Taranaki Regional Council.

Properly established riparian buffers filter sediment and pollution, and reduce the speed of run-off, which moderates stream flows and reduces flooding.

Riparian buffers also provide food and shelter for wildlife and corridors for plants and birds. Streamside vegetation also reduces water temperatures and supplies food for aquatic insects that in turn provide food for fish.

"Land in Taranaki is among the most valuable in the world," said Mr Gibson. "And it's the same with the waterways. We need to keep them as clean and pristine as possible."

(H) STATE OF THE ENVIRONMENT MONITORING

Regular monitoring of general water quality occurs throughout the region. State of the environment physicochemical, bathing water and biomonitoring programmes have been fully described in this chapter.

A programme has been developed to monitor the long-term effects of the riparian policy in four catchments - Kapoaiaia, Katikara and Tawhiti streams, and Kaupokonui River in terms of enhancement of water quality and stream health.

Didymosphenia geminata (didymo), also known as "rock snot" is a type of single-celled algae and was first reported in New Zealand in the South Island in 2004. Didymo has the ability to bloom in nutrient-limited streams, breaching the recreational guideline for long filamentous periphyton cover, and impacting on other values by blocking intake screens for water takes, clogging jet boat intakes, and entangling fishing equipment as well as impacting on the ecology and aesthetics of streams. Surveys have been undertaken in nine Taranaki rivers that are of recreational value, at three-to-four-monthly intervals. To date, didymo has not been recorded in Taranaki or anywhere else in the North Island.

(I) RESOURCE INVESTIGATIONS

The Council undertook investigations on the effectiveness of Taranaki dairy wastes treatment pond systems for the treatment of these wastes. Ten pond systems were studied to determine if the criteria in the *Fresh Water Plan* provided adequate protection against unacceptable adverse environmental effects from individual consented discharges[39].

The results suggest that individual pond systems, if designed and sized in accordance with the criteria in the plan, and if consistently achieving a dilution ration of 100:1 or greater, are unlikely to result in more than minor effects on the environment. Biological effects ranged from

39 Taranaki Regional Council, Oct 2006. *Dairy Shed Oxidation Pond Discharges in Taranaki. A study and discussion of oxidation pond performance, management and environmental effects.*

Riparian planting, Taungatara Stream.

undetectable to significant in nature – the latter only where ponds were overloaded and dilution inadequate. The study highlighted that other factors, such as shading from riparian vegetation, appear to influence the potential effects of discharges. Where the downstream riparian vegetation is good, effects on ecological health and other indicators of instream ecology were reduced.

This study has been followed up by a more intensive study of assimilation of dairy pond discharges which will provide guidance on appropriate separation distances between discharge points to help avoid cumulative effects[40].

The Council supports research in the Waiokura Catchment as part of the *Best Practice Dairying Catchments for Sustainable Growth* project, initiated in 2001 by the dairy industry and a consortium of research partners. The Council provides financial support and ongoing fieldwork. Impacts of dairy intensification on farm productivity, soil physical and chemical resources and stream water quality are measured. This information is being used to measure long-term trends in soil and stream water condition, and to predict the effects of improving management practices.

Trend analysis of water quality and quantity monitoring coupled with surveys of farming practices and soil quality, have shown that significant improvements have been achieved over 2001-07. Reductions of 25-40% of phosphorus and suspended soils have occurred, primarily as a result of riparian protection of 42% of the total stream length, and also because of a reduction in farm dairy effluent pond discharges (from eight to six), and a 25% reduction in the average application rate of phosphorus-derived fertiliser.

(J) INFORMATION, EDUCATION AND ADVICE

The Council provides information and advice on a wide range of matters concerning water quality, and has prepared a large number of guidelines, pamphlets and educational material. Examples of material produced in recent years include:

- guidelines for earthworks in the Taranaki region;
- a stormwater management plan template for industrial sites;
- guidelines for the construction of culverts and bridges and for road culvert maintenance;
- guidelines for clean-fill disposal;
- riparian management guide;

Vogeltown School students identifying invertebrates from the Huatoki Stream.

- a range of information sheets on riparian management, establishing and maintaining riparian vegetation and fencing options and costs; and
- guides to regional plan requirements for dairying and sheep and beef farming, the oil and gas industry and for small businesses.

As part of its environmental education programme, the Council works with teachers and schoolchildren to raise awareness of freshwater issues and encourage wise and sustainable use of freshwater resources. The Council provides a unit of work and a teaching resource kit to teachers that links water studies to the New Zealand curriculum. The Council also offers support and equipment for field trips to rivers where children participate in monitoring activities such as measuring flow, temperature, turbidity, pH, dissolved oxygen and aquatic invertebrate sampling.

Council officers visited popular river and lakeside areas over the summers of 2006-07 and 2007-08 and provided information on didymo and on how to disinfect equipment that has been in contact with fresh water. Educating people about cleaning gear between freshwater sites will help avoid the spread of freshwater pests such as didymo.

(K) CLEAN STREAMS ACCORD AND ACTION PLAN

The *Dairying and Clean Streams Accord* was signed on 26 May, 2003, by representatives of Fonterra Co-operative Group, the Ministry of Agriculture, the Ministry for the Environment and regional councils. The Accord promotes sustainable dairy farming and focuses on reducing the impacts of dairying on the quality of streams, rivers, lakes, groundwater and wetlands. A *Regional Action Plan for Taranaki* was prepared by local representatives of the Fonterra Co-operative Group, Federated Farmers, and the Taranaki Regional Council. The plan adapts the actions outlined in the *Accord* to Taranaki conditions and is reported on annually.

By June 2008, 1,347 riparian property plans had been prepared, representing 72% of the total dairy farms in the region. Annual monitoring of works completed is conducted on-site by land management staff of the Council. In addition, all properties were inspected to monitor farm dairy discharge permit compliance. A summary of Taranaki's progress against the targets at the end of June 2008 is set out in Table 4.14. The Council will be looking to further the retirement and planting of riparian margins to meet the 2015 target.

40 Taranaki Regional Council. 2008. *The Assimilation and Dilution of Dairy Shed Oxidation Pond Discharges in Taranaki. A study and discussion of instream environmental effects below a pond discharge.*

Rebecca Croft and Ayla Fryer monitoring stream health and water quality.

SCIENTIFIC SATISFACTION IN THE STREAM

If you're taking trouble to plant stream banks in an effort to protect and enhance water quality, you want to be sure it works.

That was part of the reason for Opunake High School Year 10 students Rebecca Croft and Ayla Fryer carrying out an investigation into the effectiveness of riparian planting – and claiming a number of awards at the Regional Science and Technology Fair in 2007.

The pair had also noted "some confusion" among farmers over the benefits of riparian planting. "We thought if we could prove that it does work, farmers would be happier … We were also interested in the result because we have done riparian planting ourselves."

And prove it they did, carrying out three tests at sites upstream, alongside and below established riparian plantings on the Waiteka Stream and the Rautini Stream.

They measured the temperature and turbidity of the water at each site and took samples of the tiny insects and worms found in the stream. The state and variety of this macroinvertebrate life give valuable indications of overall stream health and water quality.

Their findings: Significant differences in temperature and invertebrate life between sites above and alongside riparian planting, with higher temperatures and less variety of life forms upstream. This suggests the plantings do shade the water and encourage the formation of healthy ecosystems.

Downstream of the plantings, water temperatures rose again but invertebrate variety remained healthy.

No significant differences were found in turbidity, though the girls noted that the water "looked a lot cleaner and clearer" as it passed through areas of riparian planting.

Rebecca and Ayla also observed that there were other factors which could have been investigated – the effects of recent storms, soil types, the species of riparian plants. But overall, they satisfied themselves that riparian protection is worth the effort.

Among their Science Fair prizes was the Taranaki Regional Council Award for Environmental Science, whose judges noted that the process the girls followed was as important as the result. In essence, Rebecca and Ayla demonstrated that they knew what they were doing and why they were doing it.

The judges also heartily endorsed their final conclusion: The more trees, the better.

Table 4.14: Summary of progress with the regional action plan.

Taranaki Target	Progress with target
90% of all dairy farms have a riparian plan by 2010.	72% of Taranaki dairy farms have a property plan.
50% of property plans are to be implemented by 2010, 90% by 2015.	61% of stream bank is protected by fencing. Of that protection, 56% consists of fencing that was already in place (existing) at the time of preparing the property plans, 5% consists of new work completed on dairy farms. 56% of stream bank is protected by planting and vegetation. Of that protection, 52% consists of vegetation that was already in place (existing) at the time of preparing the property plan, 4% consists of new work completed on dairy farms.
50% of regular crossing points are to have bridges or culverts by 2007, 90% by 2015.	97% of all regular stream crossings at the regional level are adequately bridged or culverted.
100% of dairy farms in Taranaki have an effluent discharge consent that complies with the *Regional Fresh Water Plan.*	100% of dairy farms had a consent that complied with the *Regional Fresh Water Plan* by 2004.
60% of regionally significant wetlands are to be fenced by 2005, 90% by 2010.	76% of regionally significant wetlands are fenced.
100% of dairy farms with systems in place to manage nutrient inputs and outputs by 2007.	99.1% of dairy farms in Taranaki have a nutrient budget in place.

(L) SUMMARY OF PROGRESS

Table 4.15: Summary of progress implementing regional objectives and policies on surface water quality.

Issue	What do we want to achieve ?	What are we doing about it ?	Where are we at ?
Adverse effects on water quality from point and diffuse source discharges.	Maintenance and enhancement surface water quality.	• Implementing the *Regional Fresh Water Plan for Taranaki*. • Undertaking an effectiveness and efficiency review of the *Fresh Water Plan*. • Issuing and monitoring resource consents for discharges to land and water. • Promoting good land management practices and riparian management and planting. • Providing information and advice on water quality management and implement a schools' education programme.	• *Regional Fresh Water Plan* made operative in 2001 and effectiveness review undertaken in 2008. • 1,413 current resource consents controlling discharges to water, 1,173 discharges to land, 69 discharges to land/water. • 214 freshwater tailored compliance monitoring programmes covering 345 consent holders, exercising 1020 consents established. • 1,868 dairy farms annually monitored with 96% compliance. • 312 contingency plans relating to discharges to land/water required. • Over the past five years 544 abatement notices, 114 infringement notices and 12 prosecutions have been undertaken. • 2,009 riparian management plans prepared covering 10,818 km of stream bank. Over 1.5 million riparian plants sold to plan holders at low cost. • A range of information and advice and educational services provided. • Monitoring shows good to excellent water quality on most variables but elevated nutrient and bacterial levels, particularly in lower catchments. Ecological health decreases down catchments. • Trend monitoring shows ecological health is not changing generally, but has measurably increased at some sites. Some physicochemical variables are deteriorating.

4.1.4 HOW DOES OUR WATER QUALITY COMPARE WITH OTHER REGIONS?

Measures of physical, chemical and bacteriological variables are the most common methods of comparing water quality between different localities as they are subject to the same or very similar techniques of sampling, measuring and analysis.

The Ministry for the Environment has in recent years released reports describing aspects of water quality and management in New Zealand lakes and rivers. These reports have enabled comparison of the state of freshwater quality and trends found in Taranaki waterways, with the state and trends in water quality in other regions and nationally.

(A) HOW DOES THE PHYSICAL AND CHEMICAL QUALITIES OF TARANAKI WATERWAYS COMPARE WITH WATERWAYS NATIONALLY?

The National River Water Quality Network has been used to compare water quality around the country[41]. Two Taranaki rivers included are among the smallest in the programme, they are relatively cool, and they

41 Scarsbrook, M, 2006. *State and Trends in the National River Water Quality Network (1989-2005).* Prepared by NIWA for the Ministry for the Environment.

are in the middle of the range for conductivity (dissolved material) and pH. The Waitara River had one of the lowest median clarities, which is not surprising given the influence of hill country sediment on clarity at this site.

The lower Waingongoro River had one of the highest median levels of nitrate, ammonia, and dissolved and total phosphorus nationally. Given the freezing works and wastewater treatment plant at Eltham, this is to be expected. The upper Waingongoro River and the Waitara River sites were closer to national averages. Compared to the national median for faecal coliforms, the Waitara River's counts were high, but counts for the Waingongoro River were near the median.

Data for Taranaki's state of the environment monitoring sites has also been compared with data from close to 1,000 sites from around New Zealand that are similar in terms of climate, land cover, geology and stream type[42]. Median values were used to compare Taranaki sites with the ranges of all national data (see table key)[43]. With only a few isolated exceptions, water quality in Taranaki appears as good as or better than water quality at comparable sites around New Zealand.

Trends in water quality have also been considered nationally[41]. This has shown that nationally, for the period 1989-2003, there have been measurable improvements in water clarity, ammonia and BOD levels (suggesting improvements to point source pollutants), but some measurable deterioration in nitrates, total nitrogen, dissolved reactive phosphorus, and total phosphorus (suggesting ongoing or increased pollution from diffuse source pollutants) at some sites. The national studies note that dissolved reactive phosphorus levels appear to have stabilised in recent years but nitrates appear to be deteriorating the most in rivers where concentrations are highest. Figure 4.19 shows the proportion of sites both nationally (for the years 1989-2003) and regionally (for the years 1995-2007) that are measurably improving or deteriorating. Generally, water quality trends in Taranaki rivers appear to be following the national pattern.

Table 4.16: Comparison of water quality at Taranaki state of the environment monitoring sites with a national database.

	Pātea River Barcley Rd	Punehu Stream Wiremu Rd	Stony (Hangatahua) River Mangatete Rd	Patea River Skinner Rd	Waiwhakaiho River SH 3	Waingongoro River Eltham Rd	Mangaoraka Stream Corbett Rd	Waingongoro River SH 45	Punehu River SH 45	Mangaehu River Raupuha Rd
Catchment level	**Upper**	**Upper/ Middle**	**Middle**	**Middle**	**Middle**	**Middle**	**Lower**	**Lower**	**Lower**	**Lower**
NH4	☺	😐	☺	😐	😐	😐	😐	😐	😐	☺
NO3	☺	☺	☺	😐	😐	😐	😐	☹	😐	☺
E coli	☺	😐	☺	☺	☺	☺	😐	☺	😐	☺
Clarity	☺	☹	☺	☺	😐	😐	😐	😐	😐	☹
DRP	😐	😐	😐	😐	😐	☺	☺	😐	😐	☺

NH4: ammonium NO3: nitrate DRP: dissolved reactive phosphorus

Key:

☺ median value is better than three quarters of values for comparable sites nationwide
😐 median value lies between the range of values occupied by a quarter to three quarters of values from comparable nationwide sites
☹ median value is worse than a quarter of all values for comparable sites nationwide.

42 S. Larned, M. Scarsbrook, T. Snelder, N.Norton. 2005. *Nationwide and Regional State and Trends in River Water Quality 1996-2002.* Prepared by NIWA for the Ministry for the Environment.
43 Taranaki Regional Council. 2006. *Trends in the Quality of the Surface Water of Taranaki.*
44 Scarsbrook, M, 2006. *State and Trends in the National River Water Quality Network (1989-2005).* Prepared by NIWA for the Ministry for the Environment.

Mountain stream.

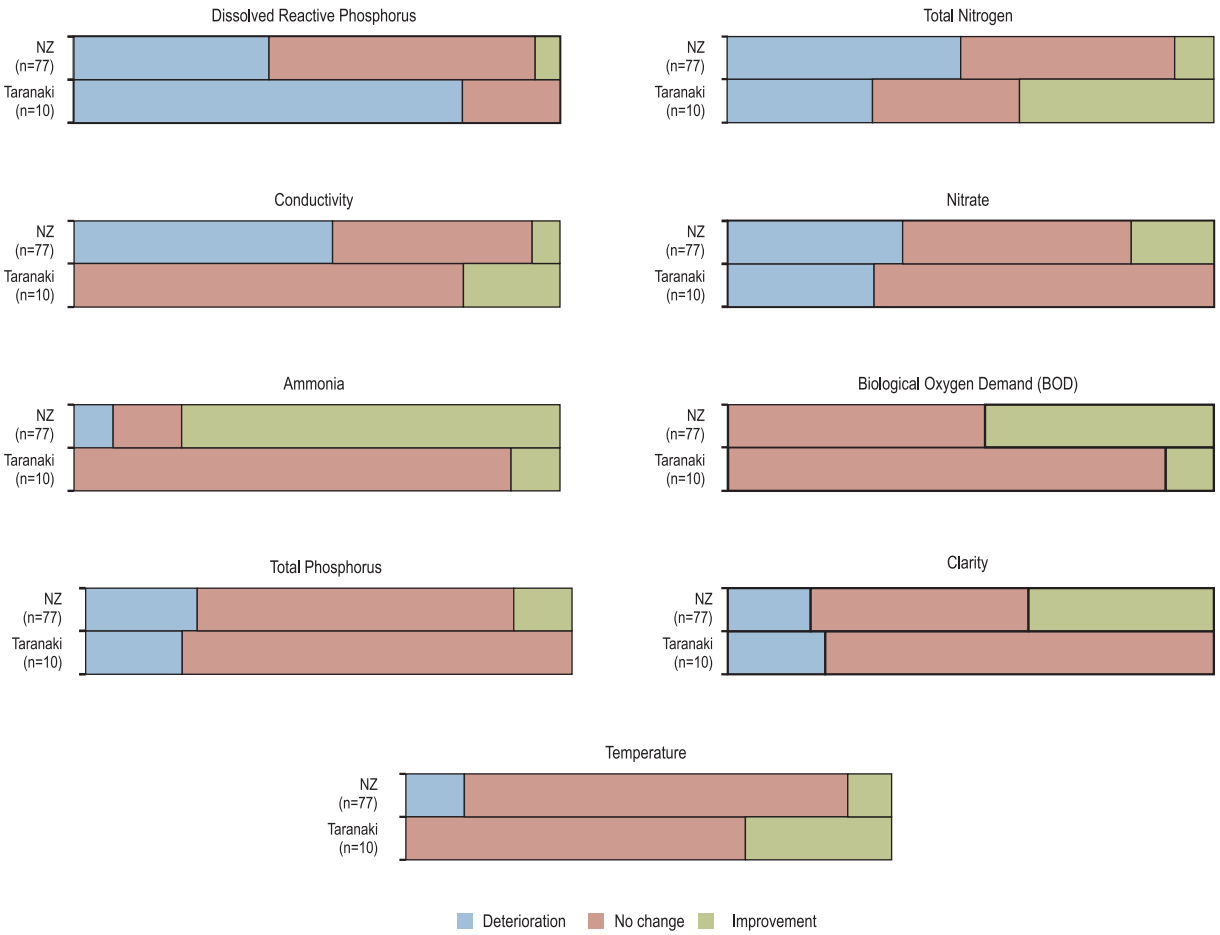


Figure 4.19: Comparing trends in surface water quality in Taranaki waterways (1995-2007) with trends in surface water quality from waterways across New Zealand (1989-2003).

Lake Rotomanu, New Plymouth.

(B) HOW DO TARANAKI LAKES COMPARE WITH OTHER REGIONS?

Comparison of lake data between regions in New Zealand is difficult because lake monitoring is undertaken for different reasons. Monitoring may be carried out because a lake is of a high value or quality, of the largest size, at high risk of nutrient enrichment, or eutrophication, or of high use and public interest[44]. There is no representativeness across current regional monitoring programmes, so results can only be compared with caution.

Table 4.17 shows the number of New Zealand lakes according to their nutrient status compared to Lake Rotorangi. This shows that Lake Rotorangi has a similar nutrient status to 16% of lakes monitored across New Zealand.

Trends in nutrient status in lakes have also been examined. Across New Zealand 13 (19%) are declining, 34 (48%) are showing no change and 23 (33%) are showing improved water quality. Like Lake Rotorangi, the nutrient status of most monitored New Zealand lakes is not changing, although more monitored lakes are improving than declining.

(C) HOW DOES TARANAKI BATHING WATER QUALITY COMPARE NATIONALLY?

The suitability of Taranaki's freshwater sites for swimming can be compared with the national data provided by the Ministry for the Environment[45]. Figure 4.20 shows that Taranaki freshwater bathing sites were suitable for contact recreation a greater proportion of the time than the national average, i.e. more samples were under the Alert threshold. For three out of the four years that national data is available, Taranaki swimming spots were more likely to be suitable for bathing than the national average.

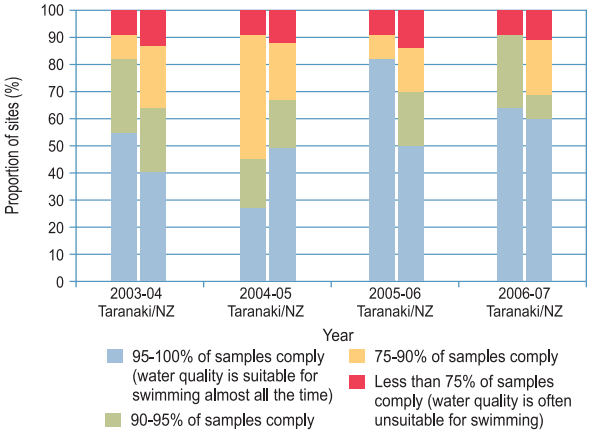


Figure 4.20: Proportion of sites in various categories of compliance with water quality guidelines for swimming in Taranaki and New Zealand from 2003-04 to 2006-07.

4.2 SURFACE WATER QUANTITY AND FLOWS

4.2.1 WHAT IS THE CURRENT STATE OF TARANAKI RIVERS?

Since the 2003 *State of the Environment Report* the region has experienced some of the biggest floods and lowest flows on record, with floods for the Waitōtara region in 2004 and the May 2007 'flash flood' event in the area from Ōākura around to Egmont Village. During the summer of 2007-08 the region recorded extremely low rainfall totals, with some of the streams recording their lowest flow on record. Two of the streams recorded a low flow return period of a '1 in 80 year' event, meaning that that probability of such a low flow occurring in any one year was 1.2%.

(A) INDICATORS AND GUIDELINES

There are several key measures of river or stream flow that are used as indicators of surface water quantity: the mean, or average flow, the median flow which is the flow that occurs 50% of the time, and the mean annual low flow, or MALF, which is an average of the lowest flow that the river reached each year (usually during summer).

National guidelines for ecological flows, i.e. flows that should be retained in rivers and streams to safeguard ecological values, are in the process of being developed[46]. The Taranaki Regional Council has adopted a guideline for ecological flows in the *Regional Fresh Water Plan*. This guideline requires levels of water to remain in rivers and streams that will retain two thirds of the amount of instream habitat that

Table 4.17: Trophic status of Lake Rotorangi compared with lakes in New Zealand.

State	☹ More impacted <<<<< 😐 >>>>>>>>> more pristine ☺					
	Hyper-trophic	Super-trophic	Eutrophic	Meso-trophic	Oligo-trophic	Micro-trophic
Lake Rotorangi				yes		
All NZ	18 (13%)	13 (10%)	44 (33%)	21 (16%)	25 (19%)	13 (10%)

National data from Opus, 2006.

44 Opus, 2006. *Snapshot of Lake Water Quality in New Zealand.* Prepared by Opus International Consultants for the Ministry for the Environment.
45 Ministry for the Environment. 2007. *Environment New Zealand 2007.*
46 Ministry for the Environment. 2008. *Proposed National Environmental Standard on Ecological Flows and Water Levels Discussion Document.*

Gauging the flow of the Mangaoraka Stream.

would be found at the mean annual low flow (or MALF), i.e. the average lowest summer level. This formula was developed to predict when instream conditions become limiting for a range of aquatic species[47]. Compliance with this guideline is used as an indicator of surface water quantity in Taranaki.

Indicators of the level of pressure on the rivers and streams include the quantity of water allocated for different uses and the number of consents issued for water abstraction. There are 224 parent catchments in Taranaki, 45 of these have consented water abstractions.

(B) FLOW CHARACTERISTICS

River flows in Taranaki are typically high in the winter with low flows occurring in the summer. Rivers draining the mountain typically rise rapidly from high rainfall events, and they recede at a steady rate once the rain has stopped. Generally mean or average river flows are much higher than the median flows.

The Egmont National Park is critical for maintaining flows in ring plain streams and rivers during prolonged dry periods. During low flow periods, Egmont National Park is the source of approximately 80% of water in ring plain streams. In some rivers, such as the Stony (Hangatahua) River, the flow at the coast is almost all (95%) derived from the park. In contrast, for other rivers such as the Kāpuni, the park's contribution is somewhat lower (57%), but this is still reasonably high.

The other significant feature of ring plain streams and rivers is the stability of their low flows. In general, stream flows recede, or drop, predictably once low flow conditions prevail, but flows in some streams continue to go down faster than others. In most summers, ring plain streams recede to approximately 50% of their median flow levels, but once they reach these levels, they tend to take a relatively long time to drop much lower. Even during a 10-year drought, levels typically recede to only 35-40% of median flows.

Rivers draining the mountain also generally have high base flows, due to the water storage on the mountain from ice and springs located high in the catchment. In comparison, the streams draining the hill country

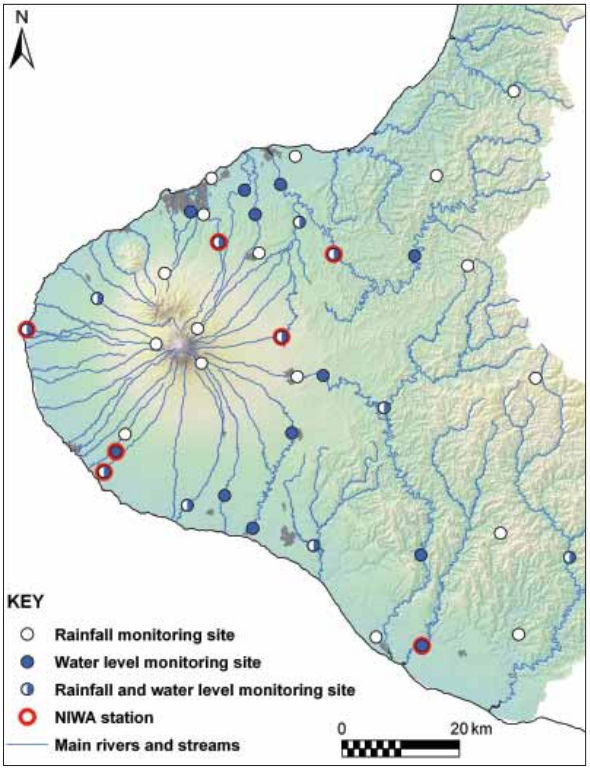


Figure 4.21: Location of monitoring stations in Taranaki.

have reasonably low base flows, as there is less storage of water in the ground reservoirs.

Hillcountry rivers do not have the same flash-flood type events as the ring plain streams do. They tend to rise and fall quite uniformly and take a lot longer to reach their peak flows. This is due to the rivers taking longer to respond to rainfall levels. Hillcountry catchments do not usually receive rainfall events as intense as ring plain streams, and surface flows are slowed down by vegetation.

During summer or when there is an absence of rainfall, the rivers from the hill country tend to recede quite quickly to their low flows, and continue to decrease at a higher rate than the ring plain streams do, and they also take longer to recover to normal flows once rainfall occurs.

The Council operates a network of 35 monitoring stations which continuously collect data on rainfall, stream flow and water levels. This is complemented by a further five stations operated by NIWA. Two stations are shared by the Council and NIWA. All monitoring stations are shown in Figure 4.21. This system provides valuable information on floods as well as water availability during droughts.

The Council also undertakes stream flow measurements for many waterways in the region for state of the environment and pasture irrigation monitoring, particularly during low flow periods.

Regular monitoring enables the Council to gather valuable information about the region's surface water resources. This information is used to assess the low flow behaviour of rivers and streams, assess the likely impacts of current and future abstractions and to develop appropriate water management policies.

47 Jowett, I. 1993. *Report on Minimum Flow Requirements for Instream Habitat in Taranaki Rivers.* NZ Freshwater Miscellaneous Report No. 75. NIWA, Christchurch.

Table 4.18 shows that data on water levels in streams have been gathered for a long time for certain sites. For example, almost 40 years of data have been gathered for the Punehu Stream. The mean annual low flow relates to the size of the catchment – the larger catchments obviously having a larger flow. The maximum flow ever recorded was 2.4 million litres per second in the Waitara River.

The mean annual low flows for the past 20 years were analysed to see if there were any statistically significant trends over that time. Fourteen of the 27 sites showed significant temporal changes and 13 showed no statistically significant trend. There were five significant increases and one decrease (which was Waingongoro River at Eltham Rd) in MALF. In terms of median levels, seven sites showed statistically significant increases and one showed a measurable decrease (the Waitara River at Bertrand Rd). Three streams showed statistically significant increases in both MALF and median - the Punehu Stream, Waitara River at Tarata and Kaupokonui Stream ($p<0.05$). These trends are illustrated in Figure 4.22.

Table 4.18: Flow data for selected Taranaki river sites.

River/Site	Record Began		Catchment Area		MALF	Min	Max	Mean	Median
			Upstream of Recorder	Total Catchment	(1 day)	Instantaneous			(50% of time)
	From:		(km2)	(km2)	(litres/sec)	(litres/sec)	(litres/sec)	(litres/sec)	(litres/sec)
Kapoaiaia at Lighthouse*	Feb-86		20	23	264	111	40,496	1,109	672
Kapuni at SH45/Normanby Rd	Jun-80		41	44	352	133	379,834	1,810	1,279
Kaupokonui at Glenn Rd	Apr-78		62.6	150	749	322	298,922	3,093	2,001
Mangaehu at Bridge	Jan-78		421	422	2449	1,159	778,077	12,809	6,934
Manganui at Everett Park	Jun-91		200	220	3050	2,347	1,054,374	18,194	8,574
Manganui at SH3 (Midhurst)*	May-72		11.3	220	446	255	82,938	1,507	841
Mangaoraka at Corbett Rd	Apr-75		46.4	63	246	115	668,713	2,033	1,215
Mangatawa at McKays/Pihama*	Dec-85		11.4	11.4	21	5	9,524	203	134
Pātea at Skinner Rd	Feb-78		87.5	1074	783	406	303,782	5,055	3,132
Punehu at Pihama*	Dec-69		29.5	42	269	174	89,854	1,152	663
Stony at Mangatete Bridge	Sep-79		43.6	52	2167	1,489	514,927	6,683	3,417
Tawhiti at Duffys	May-85		54.5	56	171	60	18,923	670	525
Waingongoro at Eltham Rd	Dec-74		46.7	244	437	183	150,727	2,755	1,713
Waingongoro at SH45	Nov-80		202	244	1336	661	287,619	6,935	4,845
Waiongana at SH3a	Apr-80		32.6	98.4	412	253	221,268	2,808	1,437
Waitara at Bertrand Rd	Feb-80		1120	1160	7229	4,400	2,449,757	58,433	29,720
Waitara at Tarata*	Dec-68		725	1160	3358	1,358	1,310,811	34,415	18,128
Waiwhakaiho at Egmont Village (SH3)*	Feb-80		58	77	2104	1,141	559,499	7,771	3,910
Whenuakura at Nicholson Rd*	Mar-83		441	472	1898	53	359,334	10,126	5,285
Closed Sites	From:	To:							
Huatoki at Mill Rd	Jul-81	Nov-90	20.7	25	130	53	33,963	737	547
Maketawa at SH3	Oct-80	Jan-97	18.7	28	864	699	163,528	2,431	1,300
Mangatoki at Hastings Rd	May-83	May-96	20	32	248	181	62,297	1,121	801
Ngātoro at SH3	Jun-75	Jan-97	11.6	38	276	170	162,096	1,249	579
Pātea at Mangamingi	Apr-75	May-84	740	1074	3823	1,841	548,095	24,183	15,573
Timaru at SH45	Mar-80	Jan-94	27	31	420	293	138,723	1,834	1,112

Notes:
* NIWA sites
MALF: Mean (average) annual low flow
Min: Minimum flow recorded over the period of record
Max: Maximum flow recorded over the period of record
Instantaneous: The flow measured at an instant in time by the recorder (every 15 minutes)
Median: The flow recorded 50% of the time.

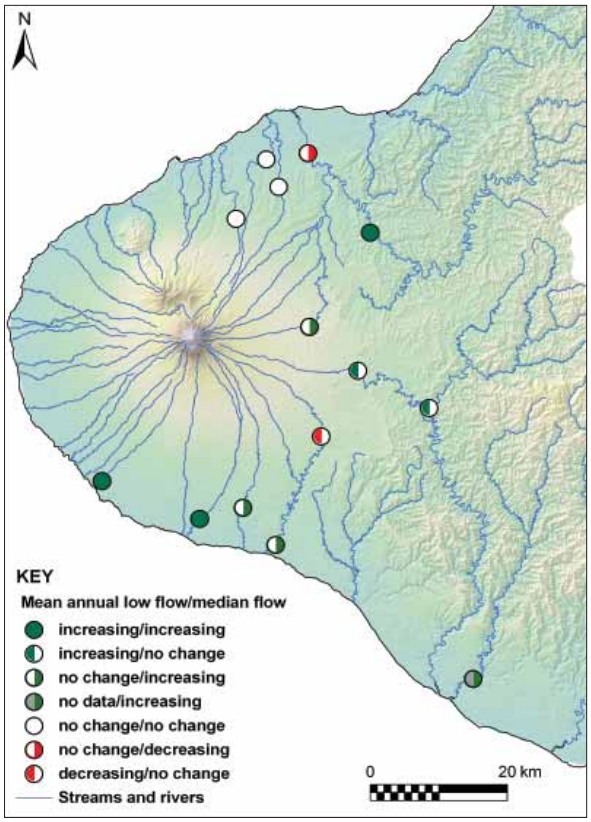


Figure 4.22. Statistically significant trends in water quantity in rivers and streams (p<0.05).

Trends in water levels are most likely symptomatic of climate variability. Flows in rivers are a product of rainfall, run-off from land as well as water abstractions. At the Kaupokonui an irrigator did surrender his consent in the early 2000s, which may explain why the MALF and median have increased. Decreases for Waitara at Bertrand Rd could possibly be due to water abstractions for Methanex and the Motukawa hydroscheme, and the decreases for the Waingongoro River at Eltham Rd could possibly be linked to South Taranaki District Council's water takes at the bushline and Finnerty Road. However, it is most likely that these trends are linked to cyclic weather patterns.

Boom spray pasture irrigation near Manaia.

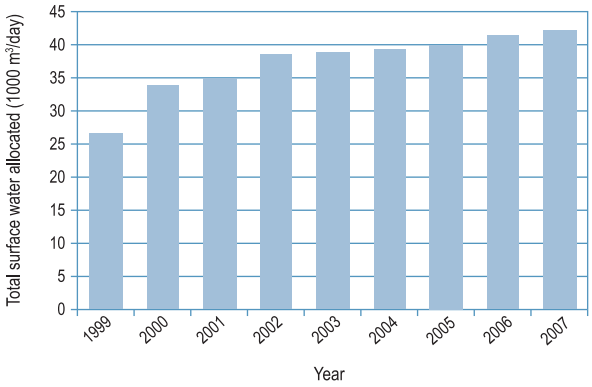


Figure 4.23: Taranaki total consented surface water takes allocation from 1999 to 2007.

(C) SURFACE WATER ALLOCATION

It is estimated that in Taranaki 54,300 m^3 (cubic metres) per day is abstracted as a permitted activity, primarily for domestic and farm water supplies[48]. This is equivalent to 22 Olympic-sized swimming pools per day. Small takes are permitted under the *Regional Fresh Water Plan*. Larger takes require consent from the Regional Council. The consent process determines the maximum volume of water that may be taken, the maximum rate at which it may be taken and usually, the flow level in the stream or river at which water abstraction must cease in order to safeguard environmental values.

As of the end of June 2007, 420,071 m^3 per day had been allocated to resource consent holders to take and use surface water. This does not include consents granted to divert water for hydro-electric power generation or consents used for the purpose of water-cooling because in these cases the abstracted water is largely returned to the river. Together with the permitted use, the total surface water allocation for the region is 474,371 m^3 per day (the equivalent of 194 Olympic-sized swimming pools a day). This is up from 442,526 m^3 per day reported in 2003, an increase of 7%[49].

Every year more consents are being granted to take and use surface water for a variety of uses. Figure 4.23 shows the total water allocation volume from the past 8 years.

Stratford combined cycle power station.

48 Taranaki Regional Council, 1998. *Taranaki Dairy Industry and Evaluation of Stock, Dairy Shed and Domestic Water Consumption.*
49 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region, 2003*

Table 4.19: Taranaki surface water allocation by use category.

Use Category	2003 Volume allocated (m^3/day)	2003 Percentage of total allocation	2008 Volume allocated (m^3/day)	2008 Percentage of total allocation
Water Supply or Treatment	143,432	32%	152,333	32%
Agriculture - pasture irrigation	92,758	21%	99,022	21%
Petrochemical Processing	65,538	15%	62,239	13%
Dairy Processing/Manufacturing	49,500	11%	30,000	6%
Power Generation - thermal	10,541	2%	23,940	5%
Drystock Farm	1,232	<1%	23,326	5%
Meat and By-Product Processing	10,687	2%	10,790	2%
Hydrocarbon Exploration	4,074	1%	9,229	2%
Horticulture	4,027	1%	2,888	1%
Quarries	3,626	1%	2,652	1%
Recreation/Tourism/Culture	1,128	<1%	1,968	<1%
Distribution or Storage	960	<1%	960	<1%
Swimming Pool	270	<1%	270	<1%
Other	150	<1%	150	<1%
Chemical Processing/Manufacturing	90	<1%	90	<1%
Timber Treatment or Sawmill	78	<1%	78	<1%
Piggery Farm	75	<1%	75	<1%
Poultry Farm	60	<1%	60	<1%
Estimated permitted takes	54,300	12%	54,300	11%
Total consented allocation	388,226	100%	420,071	100%
Total consented allocation and permitted use	442,526		474,371	

What is water used for?

Water is used for a number of consumptive uses. Much of the permitted take is for agriculture such as for farm dairies. The volume consented for the top 10 categories is illustrated in Figure 4.24. This shows that the single largest category is for municipal and rural water supply schemes. This category includes town water supplies, which in turn supply small industrial and domestic users. The municipal and rural water supply schemes have a total allocation of 152,333 m^3 per day (1,763 litres per second) or 32% of all allocated water use (Table 4.19). This is the same percentage of total surface water allocation as reported in the 2003 *State of the Environment Report.*

Water supplies are critical for many industrial and domestic uses.

The category of water use with the greatest increase since 2003 has been for thermal power generation, which is used for gas processing and steam supply. Water allocation for this use has increased from 13,399 m^3 to 23,940 m^3 per day, a 79% increase. The amount of water allocated for dairy processing/manufacturing has decreased since 2003 from 49,500 m^3 per day to 30,000 m^3 per day, a decrease of 19,500 m^3 per day or 40%.

Irrigation is not new in Taranaki and it is generally needed only during the summer months. Some areas, particularly the sandy soils bordering

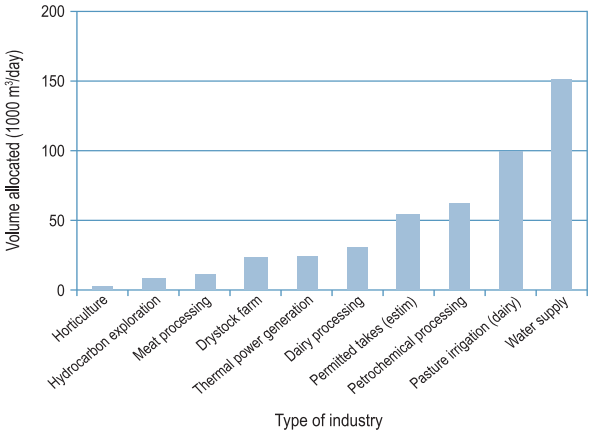


Figure 4.24: Volume of water allocated through consents.

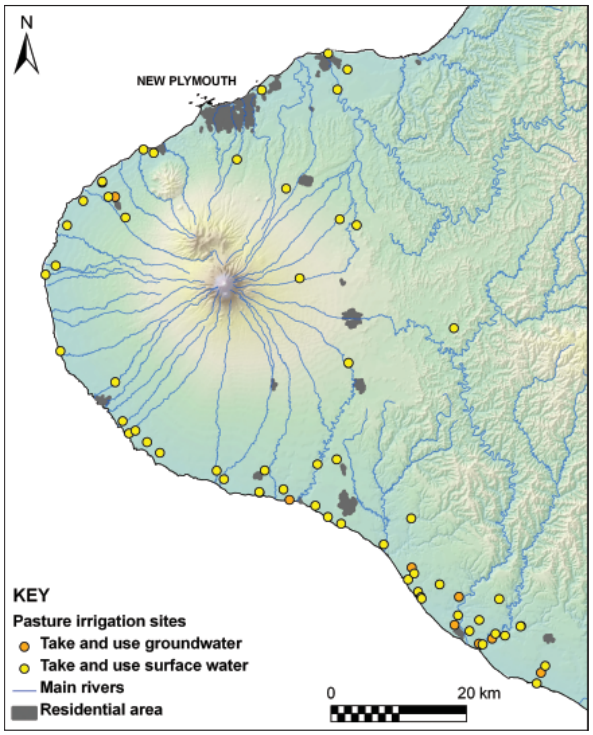


Figure 4.25: Location of consents held for pasture irrigation.

coastal areas and in the south of the region, can experience significant dry periods. Interest in irrigation has increased in recent years, particularly after relatively dry summers in 2000, 2001, 2003 and 2008. The location of these irrigation sites is shown in Figure 4.25. The volume of water allocated for pasture irrigation has increased by more than 6,000 m3/day, a 7 % increase.

In a sense, hydroelectric power generation can be considered a non-consumptive use, as water is returned to the river, although there can be significant environmental effects on the river reach between the point where the water is abstracted and where the water is returned to the river. The flow regime can also be impacted below the abstraction site.

Taranaki has four significant hydroelectric power generation schemes: Pātea, which uses water from Lake Rotorangi; Opunake, which diverts water from the Waiaua Stream; Mangorei, which diverts water from the Waiwhakaiho River; and Motukawa, which diverts water from the Manganui and returns it to the Waitara River.

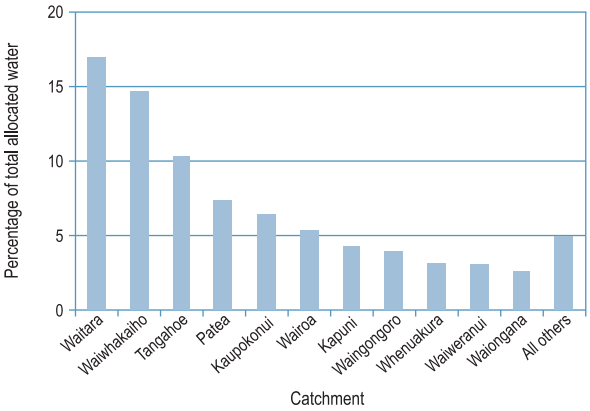


Figure 4.26: Taranaki surface water allocation by catchment.

The combined throughput of these hydroelectric power schemes is in the order of 10,000,000 m^3 per day or 116,000 litres per second. However, this is a maximum and can only occur when sufficient water is available. Nevertheless, this is a much greater volume than all the other consumptive water surface water uses combined, which account for just 4% of the total water use when hydrogeneration is included. Residual flows are required below each of the hydropower abstractions and monitoring is carried out by the Council to ensure compliance with these requirements.

Water allocation by catchment

Taranaki receives frequent and plentiful rainfall. This, together with the generally stable nature of river flows during drier periods (described earlier in this chapter), mean that for most of the time, there are no significant water use pressures on Taranaki's many rivers and streams. A useful measure of water use pressure is to compare the amount of water allocated for use with either the median flow or average or mean annual low flow (MALF).

The majority of the water used in Taranaki is taken from several of the larger catchments. Figure 4.26 shows the 11 top catchments with the highest levels of water allocation. The five catchments with the largest volume use, Waitara, Waiwhakaiho, Tāngahoe, Pātea and Kaupokonui, account for 55% of the entire consented surface water allocation. Five percent of the total amount of water allocated is from other smaller catchments. This proportion has increased from that reported in 2003

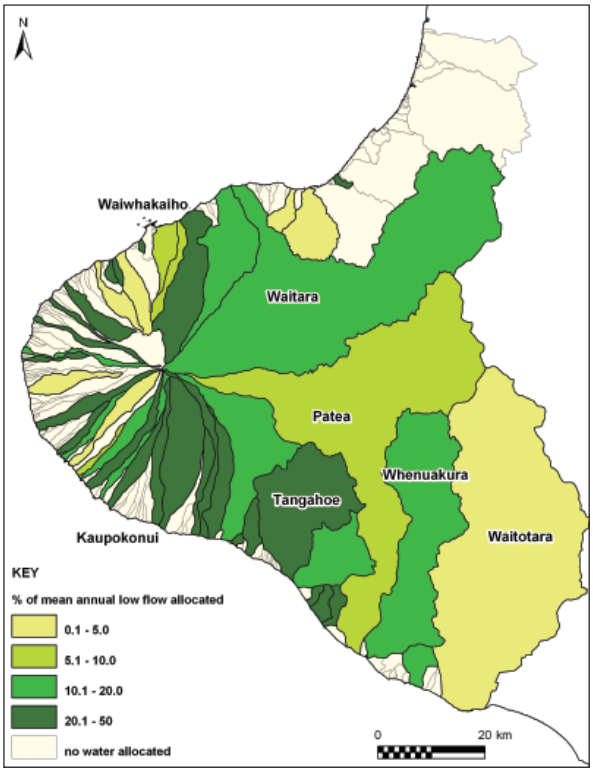


Figure 4.27: Proportion of MALF allocated from Taranaki rivers and streams.

due to increased demand for water from small streams that were formerly not abstracted from.

Over most of the region (i.e. the largest 25 catchments) water allocation is only a small proportion – one or 2% of median flows. Some smaller catchments have higher allocations but these represent a relatively small proportion of the total surface water resources of the region. Taken overall, water allocation in Taranaki is only 4.6% of the total median flow. The proportion is higher when compared with MALF, but overall, total water allocation is still reasonably low at 12.9% of MALF.

Some catchments however have a higher proportion of their summer low flow allocated in accordance with the *Regional Fresh Water Plan*. Figure 4.27 illustrates the proportion of the MALF allocated from all the catchments in Taranaki. This shows that 24 catchments, or 10% have more than 20% of their MALF allocated (also see Table 4.20). Recent national guidelines for water allocation have proposed water allocation limits of 30% of MALF in rivers and streams where limits have not been set by regional plans[50]. In Taranaki, 19 catchments, or 8%, have more than 30% of MALF allocated.

An arguably more relevant indicator of the impact of water allocation is the flow at which abstraction must cease in order to protect ecological values.

Table 4.20 show the levels of water allocation compared to the median flow and MALF, the flow that abstraction must cease at, and whether this complies with the 2/3 habitat guideline set in the *Regional Freshwater Plan*. The table includes catchments with the highest level of water allocation. This shows that the Wairoa Stream, the Manganui River (a tributary of the Waitara River) and the Tawhiti Stream (a tributary of the Tāngahoe River) have the highest proportions of their median and mean annual low flows allocated, and do not meet the guideline.

The Tawhiti Stream and Manganui River both have longstanding water abstractions, for the Fonterra Whareroa's milk processing site and for the generation of electricity by Trust Power respectively. These abstractions provide other benefits to the community and have been assessed against other criteria in the *Regional Freshwater Plan*. Through decisions involving the community, restrictions on use or other mitigation measures have been put in place to enable environmental effects to be minimised.

Table 4.20: Consented surface water allocation compared with mean annual low flows at selected sites (l/s).

River site	Natural median flow[1]	Natural MALF[2]	Consented water allocation above recorder sites (No. of consents)	% of median flow allocated	% of MALF allocated	Flow at which abstraction must cease (l/s)	Complies with 2/3 habitat guideline[3]
Wairoa at Coast	150	128	265[4] (2)	176.7	207.0	50	No
Manganui at Everett Park	11513	3956	5801[5] (10)	50.4	146.6	400	No
Tawhiti at Duffy's Farm	784	380	426[6] (4)	54.3	112.1	50	No
Inaha at Coast	1220	240	130[7] (4)	10.7	54.2	200	Yes
Kāpuni at SH45	1507	525	228 (5)	15.1	43.4	-	Yes
Pātea at Skinner Rd	3200	851	331 (8)	10.3	38.9	-	Yes
Waiokura at Coast	487	175	65 (3)	13.3	37.1	122	Yes
Punehu at SH45	663	269	79 (2)	11.9	29.4	230	Yes
Ngātoro at SH3	691	339	76 (3)	11.0	22.4	-	Yes
Waingongoro at SH45	5037	1528	252 (9)	5.0	16.5	-	Yes
Kapoaiaia at Lighthouse	706	298	46 (2)	6.5	15.4	285	Yes
Waingongoro at Eltham Rd	1792	516	77 (3)	4.3	14.9	-	Yes
Mangatoki at Hastings Rd	801	237	29 (2)	3.6	12.2	-	Yes
Waitara at Bertrand Rd	29995	7504	611 (13)	2.0	8.1	4600	Yes
Whenuakura at Nicholson Rd	5285	1898	151 (4)	2.9	8.0	1945	Yes
Waiongana at SH3a	1443	418	6 (2)	0.4	1.4	-	Yes
Kaupokonui at Glenn Rd	2001	749	0 (1)[8]	0.0	0.0	-	Yes
Waiwhakaiho at Egmont Village	3910	2104	0 (0)	0.0	0.0	-	Yes

Notes:
1 Corrected to include consented water allocation.
2 Corrected to include consented water allocation.
3 A rate of abstraction that retains at least two-thirds of the aquatic habitat in the river at the mean annual low flow (MALF) of the river.
4 Fully allocated at the coast, however a residual flow of 50 l/s has to be provided downstream of take.
5 Includes water diverted to the Motukawa Power Scheme as this water is not returned to the Manganui River.
6 Fully allocated, however a residual flow of 50 l/s has to be provided downstream of Fonterra's take.
7 Fully allocated, however residual flow requirements have been provided to reduce or cease abstracting when flows in the stream fall.
8 Only one consent and that is an in and out system at Fonterra's Lactose Plant, so no water actually taken.

50 Ministry for the Environment. 2008. *Proposed National Environmental Standard on Ecological Flows and Water Levels Discussion Document.*

The small Wairoa and Inaha streams are also under some heavy pressures for water abstraction for pasture irrigation. Residual flows, i.e. flows at which water abstraction must cease, have been set for each of these catchments in order to safeguard environmental values.

Water demand has decreased in a number of catchments. This includes the Kaupokonui above its confluence with the Mangawhero, the Waiwhakaiho above Mangorei Power Scheme, Ngātoro, Waiongana, the lower Waingongoro at Eltham and the Waitara. However, water allocations have increased in the Whenuakura, Kapoaiaia, Waingongoro, Inaha, Punehu, Wairoa and Waiokura catchments, largely through increased abstractions for pasture irrigation. The Council has identified a number of catchments which are now fully allocated[51], but overall water allocation is not a major issue in the region.

4.2.2 HOW IS WATER QUANTITY MANAGED?

(A) REGIONAL FRESH WATER PLAN

The *Regional Fresh Water Plan for Taranaki*, made operative in 2001, establishes a policy framework for managing water use and allocation. The key elements of the policy framework are:

- the taking and use of up to 50 m^3 of water per day is permitted without a resource consent provided certain conditions to safeguard the environment can be met. This is to allow for reasonable farm and domestic water uses;
- the taking and use of water from all of the Stony (Hangatahua) River catchment and parts of the Maketawa and Manganui rivers is prohibited except for minor takes for stock watering and domestic uses. These provisions aim to protect high value rivers in the region;
- the taking and use of water above existing levels from the Kāpuni, Kaupokonui, Mangorei, Pātea, Waiongana, Waingongoro and Waiwhakaiho rivers, is to be strictly limited as far as possible, and assessed on a case-by-case basis according to policies in the plan. This recognises the high natural and recreational values of these rivers;
- a guideline for assessing proposals for the taking and use of surface water that seeks to retain at least two-thirds of the habitat of the river at its mean (average) annual low flow;
- criteria for the assessment of resource consent applications for the taking and use of water that allow variations of the guideline according the natural, ecological and amenity values of the waterbody, the relationship of tangata whenua with the waterbody, hydrological characteristics and the reasonably foreseeable future needs for water; and
- policies to guide decision making to take into account the likely benefits of the water use, mitigation measures including minimum flows or flow regimes, maintenance of fish passage and riparian planting and the degree of community or regional benefit, as distinct from individual or private benefit.

(B) RESOURCE CONSENT MANAGEMENT

The Taranaki Regional Council is responsible for granting resource consents for the taking and use of water. These consents are generally required before surface water may be abstracted for irrigation, drinking water supply, industrial and manufacturing works and other activities. Consents are assessed on a case-by-case basis according to the policies, guidelines and criteria in the *Regional Fresh Water Plan.* There are 150 current surface water take consents and 52 consents to divert and use surface water. Smaller volumes of water can be allocated through permitted activity rules provided certain conditions are met.

Conditions on consents may specify the volumes of water that can be abstracted, the rate at which it can be abstracted, minimum flow requirements beyond which abstraction must cease and other circumstances under which water can be abstracted. Consent monitoring (regular inspections and abstraction data collection) ensures ongoing compliance with these measures.

In the 2006-07 monitoring period, the Council had 59 tailored monitoring programmes for water takes. These were associated with municipal and rural water supply schemes, pasture irrigation, stock and domestic takes, horticultural, golf clubs and power generation schemes.

The total number of resource consents held for pasture irrigation has been steadily increasing since 1995 as shown in Figure 4.28. Monitoring of these consents showed a good level of compliance with allocated abstractions, maintenance of minimum residual flows and provision of abstraction records. During the 2006-07 monitoring year for example, six out of 40 consent holders exceeded their consented water allocations, but these were isolated events and did not result in any significant adverse effects[52].

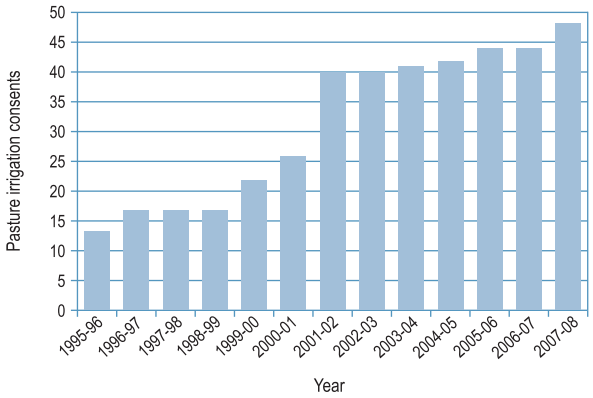


Figure 4.28: Cumulative number of pasture irrigation consents held.

(C) STANDARD OPERATING PROCEDURES

In 2000, the Council adopted standard operating procedures for floods[53] and water shortages[54]. The Council's hydrological monitoring is a critical part of both flood, and water shortage management procedures. The standard operating procedure for floods sets out the procedures the Council is to follow to avoid or reduce the risk to life and property. The standard operating procedure for water shortages allows the Council to take steps to reduce environmental and other effects during water shortages or droughts. In extreme situations, the Council may issue a water shortage direction under section 329 of the RMA to restrict water use. The Council has been close to issuing a water shortage direction on two occasions, during the 2002-03 and 2007-08 summers.

51 Taranaki Regional Council.2005. *A Guide to Surface Water Availability and Allocation in Taranaki.*
52 Taranaki Regional Council. 2008. *Pasture Irrigation Compliance Monitoring Annual Report 2006-07.* Technical Report 2007-55.
53 Taranaki Regional Council, 2000. *Flood Event Standard Operating Procedure.*
54 Taranaki Regional Council, 2000. *Water Shortage Event Standard Operating Procedure.*

Ella Burrows saving water.

MP'S SPOUSE FINDS LEAKS IN THE HOUSE

Every single drop of water is important during times of drought – and if you don't believe it, just ask Hāwera woman Ella Borrows.

It was all buckets to the taps for Ella, wife of local MP Chester Borrows, as she joined many residents heeding the South Taranaki District Council's call for water conservation during the summer drought of 2007-08.

She had buckets in the shower, in the laundry tub and under every tap in the house, catching grey water for re-use in the garden or on the car. And she took a good, hard look at her household's water habits.

"I was absolutely stunned by how much water I wasted," Ella said. "A leaky tap here, an extra minute or two in the shower, rinsing the dishes before putting them in the dishwasher – not to mention all that water going out from a full machine load of washing.

"I found I saved an average of 35 litres a week – and considering I'm at home alone most of the time, that was a shock for me. I did a project with a school class and we worked out average savings if my street had 80 houses, with an average of three people per house who saved on average 70 litres a week – 5,600 litres a week.

"Suddenly it did matter and 'every little bit' did help."

Although the water conservation effort could be tiresome, Ella said she was also spurred on by thoughts of people across the Tasman facing years of drought.

Although the drought here was nothing like those proportions, it did force restrictions on water use throughout the region, most notably in southern areas.

Partial water restrictions were introduced in November but in January, the South Taranaki District Council banned the use of all hoses, sprinklers and irrigation systems – urban, rural, commercial and industrial. The bans continued until early April.

The Taranaki Regional Council also had to take action, issuing infringement notices when the Mangawheroiti Stream ran dry below the intake weir.

Elsewhere, the Stratford District Council also imposed water restrictions and hired two local plumbing companies to fix residents' leaking taps.

Because of low flows in the Pātea River, the Stratford District Council was also forced to draw water from Konini Stream, a contingency permitted under its resource consent issued by the Taranaki Regional Council.

New Plymouth District also felt the drought's bite, though restrictions were limited to the Ōkato area, while a water conservation notice was issued for Inglewood. There were no restrictions in the New Plymouth urban area.

Supplies to the Ōkato Water Treatment Plant were restricted due to low flows in the Mangatete Stream. Under its resource consent, the New Plymouth District Council limited the volume of the water take to the minimum amount necessary to maintain the health of people and animals.

Region-wide, and as Ella's response of indicates, the restrictions brought out the best in many people.

Announcing the lifting of restrictions in April, South Taranaki District Council group manager of engineering services Neil McCann noted the fantastic response of some residents.

"I know a lot of people have changed the way they've used water this summer because of the drought and water restrictions," he said.

"I hope some of these behaviours will become common practice. Water is a precious resource, with demand rising every year it is vital we manage our resources in a positive way without impacting negatively on our environment."

(D) INFORMATION, EDUCATION AND ADVICE

The Council operates a network of 35 monitoring stations that continuously record rainfall, wind, water level, water temperature and soil moisture and temperature. Much of this data is available for the public on the Council's website, www.trc.govt.nz. The data is updated at 30-minute intervals, so the public can find out the current state of the rivers and the weather situation in and around the region easily.

The Council provides water users and applicants for resource consents with information and advice on water allocation and the effects of water use. The Council may also give advice on water conservation, water harvesting and the efficient use of water to avoid or minimise adverse environmental effects.

In 2005, the Council published guidelines to inform water users or those planning to take and/or use water about how much and where in the region water is available[51].

Table 4.21 Summary of progress: implementing regional objectives and policies on water allocation and use.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
• Adverse effects of the taking, use, damming and diversion of water.	• Sustainable management of quantities, levels and flows of surface water. • Avoidance or mitigation of adverse effects of the taking, use, damming and diversion of surface water.	• Implementing the *Regional Fresh Water Plan.* • Adopting a habitat-based guideline to guide decisions on sustainable management and avoidance of the adverse effects of water use. • Issuing and monitoring resource consents for water abstraction and use. • Maintaining hydrological monitoring systems. • Providing information and advice on sustainable and efficient water use. • Establishing procedure for water shortage events.	• *Regional Fresh Water Plan* operative in October 2001. • Flow guideline of two-thirds habitat at MALF applied having regard to policies in the *Regional Fresh Water Plan.* • 202 resource consents for water use issued and monitored. • 35 hydrological sites maintained. • Standard operating procedures for flood flows and water shortage events adopted. • Information and advice provided. • A guide to surface water availability and allocation in Taranaki published in 2005.

(E) RESOURCE INVESTIGATIONS

Although the Council has developed a guide to surface water availability and allocation, this information needs to be updated constantly as new consents are granted or better monitoring data is obtained. Therefore, the Council anticipates undertaking further resource investigation work in this area, to better refine the water balance/budgeting used in order to better understand the surface water resource and to be able to provide up-to-date water availability information. This will involve a mixture of obtaining better information on river flows.

The Council has undertaken an evaluation of surface water availability for pasture irrigation purposes[55]. This complemented work to investigate current and potential irrigation development and to provide information relevant to the management of water resources in the region[56]. That report highlighted potential demand for water resources, particularly in southern and coastal areas of Taranaki, and provided information on irrigation methods and efficiencies. It also recognised areas where pressures for water for irrigation were likely to come from.

(F) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on surface water allocation and use is reported in Table 4.21.

4.2.3 HOW DOES OUR WATER QUANTITY COMPARE TO OTHER REGIONS?

If all the water consents were added together, the total allocation of water in New Zealand (in 2006) was 676 m^3 per second[57]. Canterbury and Otago regions account for almost three-quarters of the total allocation, with the amount of water allocated in Taranaki contributing just 0.08% of this. In New Zealand over 60% of all water allocated is from surface water, whereas in Taranaki 95% of total water allocated is from surface water.

The use of water resources in Taranaki differs significantly from the pattern of water use for New Zealand as a whole (Figure 4.29), with a much greater proportion of Taranaki's allocated water going to water supply and industrial uses than in New Zealand generally, but a smaller proportion going to irrigation.

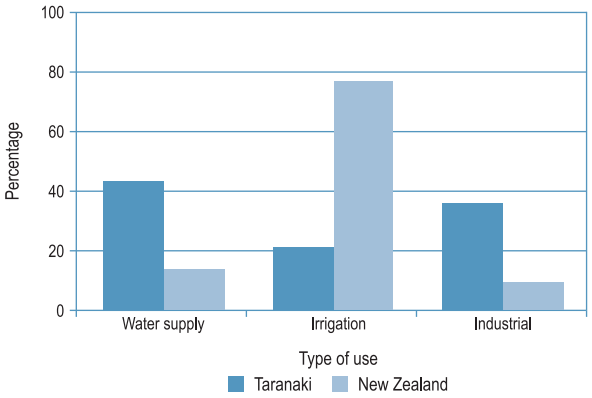


Figure 4.29: Comparison of water allocation –New Zealand and Taranaki.

The major pressures on surface water throughout New Zealand are for pasture irrigation, which accounts for 77% of all surface water allocated[58]. In Taranaki, pasture irrigation accounts for 21% of all water use. Irrigation is particularly significant in the Nelson/Marlborough and in east coast regions of Hawke's Bay, Canterbury and Otago, where prolonged dry periods occur regularly.

Figure 4.30 shows the allocation of the catchments as a percentage of the MALF throughout New Zealand[58].

55 Taranaki Regional Council, July 2003. *A Preliminary Evaluation of Surface Water Availability and Demand for Pasture Irrigation Purposes in Taranaki.*
56 Rout, R, April 2003. *Optimisation of Farm Irrigation.* Report prepared for Taranaki Regional Council by Lincoln Environmental.
57 Ministry for the Environment. 2007. *Environment 2007.*
58 Aqualinc Research Limited, 2006. *Snapshot of Water Allocation in New Zealand.* Prepared for the Ministry for the Environment.

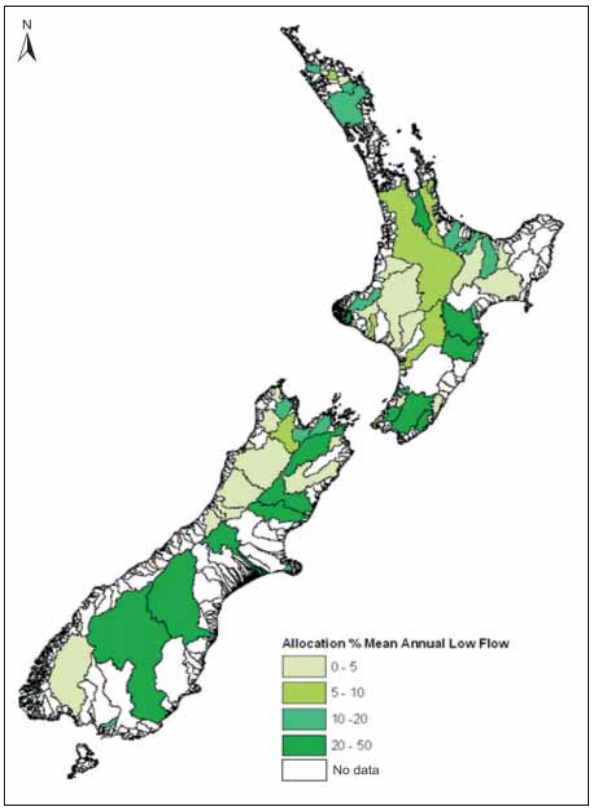


Figure 4.30: Allocation of surface water as a percentage of mean annual low flow.

4.3 GROUNDWATER

4.3.1 WHAT IS THE STATE OF GROUNDWATER IN TARANAKI ?

Groundwater is an important water resource in Taranaki as it is used for a variety of purposes including domestic, industrial, agricultural, and water supply for private and municipal use, particularly in South Taranaki. Groundwater is also the major component of streamflow during dry weather for most streams.

Groundwater aquifers vary according to their geology and depth, and tend to be named after the geological formations where they are encountered. They are classified as shallow or deep. There are five principal groundwater systems in the Taranaki region: the Matemateāonga Formation aquifers, the Whenuakura Formation aquifers, the Marine Terrace aquifers, the Tāngahoe Formation aquifers and the Taranaki Volcanics aquifers. The true size and capacity of the region's aquifers are highly complex, although the geology and characteristics of the formations they are encountered in has been extensively studied. The yields of the aquifers in the region are relatively low compared with other regions of the country due to the nature of geological formations.

Aquifers are recharged or 're-filled' by rain percolating through the soil and into the groundwater. The amount of rain available to recharge aquifers is the total rainfall less the amount that evaporates, is consumed by plants, stored in the soil or runs off into surface water.

Drilling a water bore, Eltham.

(A) GROUNDWATER QUANTITY

Abstraction of groundwater has the potential to lower levels in nearby wells, reduce flow in spring-fed streams, and induce seawater intrusion into the aquifer in coastal areas, even when groundwater resources are abundant. These effects are even more likely with several abstractions from the same aquifer.

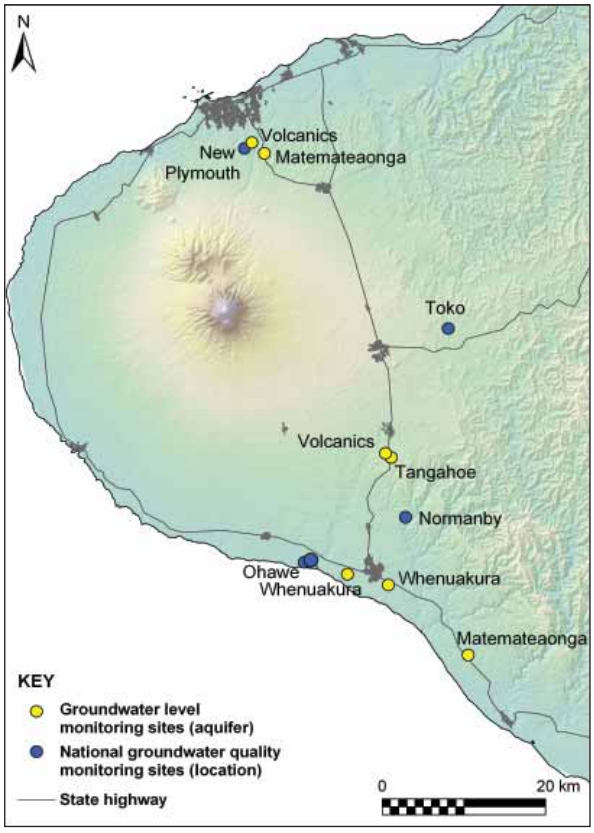


Figure 4.31: Location of groundwater level and groundwater quality monitoring sites.

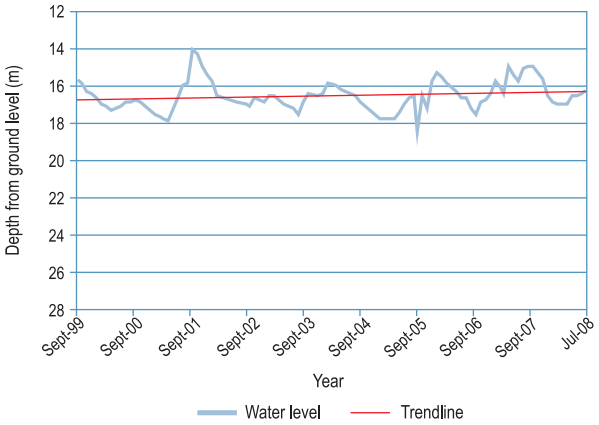


Figure 4.32: Example of water levels in a shallow aquifer, Taranaki Volcanics aquifer at Eltham.

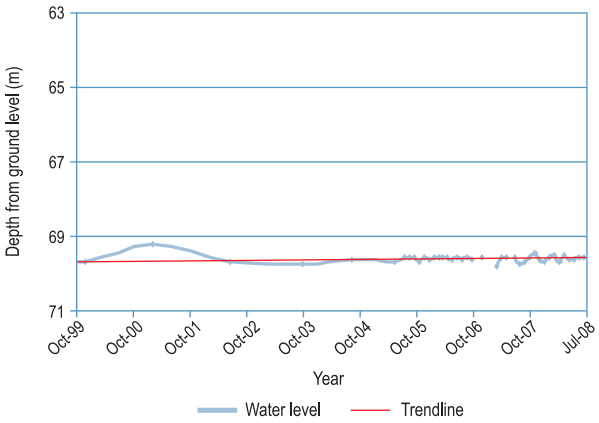


Figure 4.33: Example of water levels in a deep aquifer, Matemateaonga aquifer, in New Plymouth.

The Taranaki Regional Council monitors groundwater levels at seven sites across the region to assess recharge levels into the region's aquifers (Figure 4.31). Groundwater levels in wells indicate the status of the groundwater resource and are also used to assess the interaction between surface water and groundwater. They need to be measured regularly to provide an indication of the response of groundwater to climatic conditions and to the impact of groundwater abstraction.

Groundwater levels in the shallower Volcanic and Marine Terrace aquifers, generally show seasonal variation, with higher levels in late winter and lower levels in late summer. Seasonal variations up to four metres have been recorded. This is illustrated in Figure 4.32, an example of water levels in a shallow aquifer.

In contrast, deeper aquifers such as the Matemateāonga and Whenuakura aquifers usually do not show noticeable seasonal fluctuations. This is illustrated in Figure 4.33.

(B) GROUNDWATER ALLOCATION

Groundwater is a good and secure water supply for domestic and farm supplies. As a water supply, it has many advantages over surface water for water supply. It is more reliable in dry seasons or droughts, it is more economical to develop as less treatment is often required and it can be tapped where it is needed avoiding transport issues, depending on the depth of available water. Increasingly, more people in Taranaki are supplying their own drinking water from domestic wells.

There are currently 1,550 water bores listed on the Council's database (2008) illustrated in Figure 4.34. Council's records show that 85 new bores (5.5%) have been drilled since the 2003 *State of the Environment Report*. An average of 15 new reported water bores are drilled in Taranaki annually, most for farm and domestic water supply.

The *Regional Fresh Water Plan for Taranaki* allows for groundwater abstractions up to 50 m^3 a day and up to 1.5 litres per second, provided certain conditions are met. The great majority of groundwater takes in Taranaki are for stock and domestic supplies and fall within this permitted category. It is estimated that about 15% of the water abstracted on the ring plain comes from groundwater, which would amount to approximately 8,000 m^3 a day.

There are currently 81 resource consents to abstract groundwater in the Taranaki region. The total consented allocation of groundwater is 44,022 m^3 day, up from 22,299 m^3 per day reported in 2003[59]. The South Taranaki District Council holds eight consents for groundwater abstraction amounting to 7,100 cubic metres per day for community water supplies for Pātea, Waverley, Waiinu Beach, Hāwera, and Waverley Beach townships. Resource consents for the abstraction of groundwater by use category are summarised in Figure 4.35 and compared with the levels of abstraction in 2003 in Table 4.22. This shows that the greatest proportion of groundwater is for water supply (27%) which has increased by 938 m^3 per day since 2003.

The amount of groundwater allocated, while providing a useful indicator of the pressure on this resource, is not necessarily equivalent to the

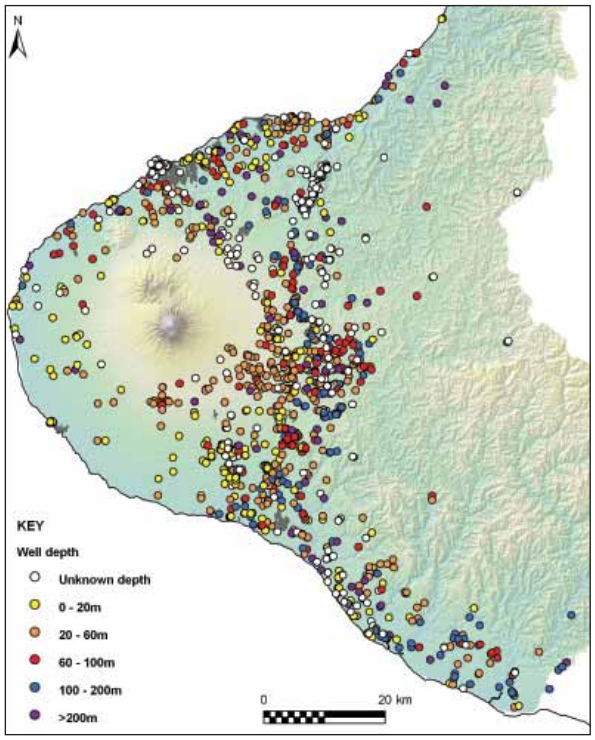


Figure 4.34: Location of groundwater bores.

59 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region – 2003.*

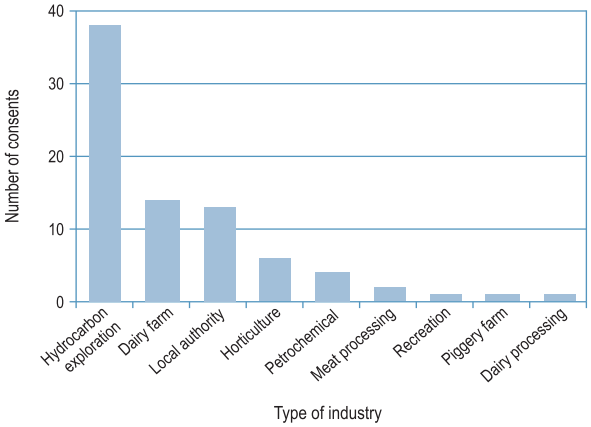


Figure 4.35: Groundwater allocation by use category.

amount actually used. Table 4.22 does not include temporary takes, such as those for hydrocarbon exploration activities that may abstract (and then discharge) groundwater for a short period. Between 2003 and 2004 more than 30 consents were granted to abstract groundwater during hydrocarbon exploration. Due to the temporary nature of these projects, rates and volumes to be extracted are not included in Table 4.22.

Groundwater resources in Taranaki are slowly coming under increasing pressure from a rapidly growing demand for irrigation, and water supply to towns. There are 58 more resource consents for groundwater takes than in 2003 which represent an increase of 300% in the past five years.

Consented groundwater takes for pasture irrigation are mainly to supplement water abstracted from other resources, as the relative low production from Taranaki's aquifers is insufficient to run an entire irrigation system.

It has been estimated that less than 2% of the total annual recharge, i.e. the amount of water going back into the aquifers is abstracted from aquifers in Taranaki. By way of comparison, national limits for groundwater abstraction have been proposed at levels of 15% of the average annual recharge for shallow coastal groundwater abstractions

Ground water monitoring.

and 35% of the average annual recharge for other types of aquifers[60]. Thus current levels of groundwater abstraction in Taranaki do not pose a significant pressure on this resource.

(C) GROUNDWATER QUALITY

Contamination of groundwater occurs when pollutants percolate through the soil and into the underlying aquifers. Potential sources of contamination are from intense land use, septic tanks, pesticides and fertilisers, areas of chemical storage, unsealed effluent treatment ponds and landfills, and intrusion of salt water. Activities that have the potential to cause adverse effects on groundwater quality include the discharge of contaminants onto land and water from point sources, poorly constructed water bores which allow contaminants to enter groundwater and diffuse source discharges such as farm run-off or effluent irrigation.

Table 4.22: Groundwater allocation by use category in 2003 compared to 2008.

Use classification	Total consented allocation (m^3/day) 2003	% Total	Total consented abstraction (m^3/day) 2008	% Total
Estimated permitted groundwater use	7,000	31	8,000	18
Petrochemical processing	5,384	24	5,734	13
Pasture irrigation	4,068	18	5,010	11
Water supply or treatment	2,571	12	11,752	27
Meat and by-product processing	1,300	6	4,300	10
Dairy processing/manufacturing	700	3	700	2
Hydrocarbon exploration	550	2	7,750	18
Horticulture	480	2	401	<1
Recreation/tourism	196	1	196	<1
Farm water supply	50	<1	180	<1
TOTAL	**22,299**	**100**	**44,022**	**100**

60 Ministry for the Environment. 2008. *Proposed National Environmental Standard for Ecological Flows and Water Levels.* Discussion Document.

Historically, the principal groundwater issues in Taranaki have been the presence of high concentrations of dissolved iron in the Taranaki Volcanics aquifers, a natural phenomenon, and the concentration of nitrates in shallow aquifers from intensive pastoral agriculture.

Current groundwater quality

The geological properties of an aquifer play a large part in determining whether contaminants discharged onto or into land will reach groundwater. The risk of groundwater contamination is usually greater for the shallowest unconfined aquifers than for deeper confined aquifers as the former lack an overlying impervious rock layer to stop the entry of contaminants.

Naturally occurring contaminants are present in soil, rocks and sediments. As groundwater flows through the soils, metals such as iron and manganese are dissolved and may later be found in high concentrations in the groundwater. While arsenic minerals are common in many volcanic rocks, no arsenic has been detected in Tarankai groundwater.

Groundwater quality from the region's three major freshwater aquifers has been monitored on a quarterly frequency since 1994 at five sites[61] (Figure 4.31). Health-related maximum allowable values and aesthetic guideline values related to taste, odour or colour have been developed[62]. Monitoring has found that water quality standards and health-related guidelines are not exceeded at any of the sites (Table 4.23).

Nitrates

Nitrates in groundwater are monitored for health and environmental reasons. Excessive levels of nitrate in drinking water have been linked with blood disease in infants (commonly known as 'blue baby syndrome'). From an environmental perspective, nitrates are essential nutrients for pasture growth. However, excess nitrates can be leached from the soil and enter the groundwater which can then cause problems when that groundwater enters surface water through springs. Elevated nitrate levels can also indicate the presence of other pollutants such as faecal contamination.

High levels of nitrates and bacteria are particularly common in shallow, unconfined aquifers. These aquifers are the most vulnerable to pollution from land-use activities, such as farming, although recent research suggests that soils of a volcanic origin are better able to bind nitrates and thus ultimately reduce the levels that enter the groundwater[63]. However, this will have to be further researched given Taranaki's soils unique characteristics. The complex nature of groundwater systems

Table 4.23: Average values for groundwater quality for state of the environment monitoring sites 1999-2007.

Location:		**Normanby**	**Ōhawe**	**New Plymouth**	**Toko**	**Ōhawe**
Aquifer:		**Whenuakura**	**Whenuakura**	**Volcanics**	**Matemateāonga**	**Volcanics**
Estimated age (years):		144	152	2	167	2
Variable	**Maximum allowable value**					
Ammoniacal nitrogen	1.5 mg/m^3	0.27	1.20	0.01	0.56	0.01
Bicarbonate	180 mg/m^3	169.39	138.91	37.25	180.97	55.85
Bromide		0.08	0.10	0.08	0.06	0.27
Calcium		30.25	17.52	7.42	28.49	17.19
Chloride	250 mg/m^3	23.87	26.95	9.19	9.62	81.50
Conductivity @ 20°C		47.96	44.24	16.55	42.07	49.98
Fluoride	1.5mg/m^3	0.07	0.30	0.03	0.13	0.10
Iron	0.2 mg/m^3	0.02	3.15	0.16	0.14	0.03
Magnesium		11.98	7.19	3.13	9.42	11.31
Hardness	200 mg/m^3	42.23	24.71	10.55	37.91	28.49
Manganese	0.04 mg/m^3	0.01	0.73	0.01	0.01	0.01
Nitrate nitrogen	11.3 mg/m^3	0.23	0.04	1.75	0.03	2.33
pH	7.0 – 8.5	8.00	7.49	6.32	7.85	6.68
Potassium		2.60	7.48	2.70	1.81	5.52
Silica		26.47	53.89	21.85	19.27	52.06
Sodium	200 mg/m^3	22.92	30.49	9.19	21.07	52.61
Sulphate	250 mg/ m^3	5.23	2.00	6.42	0.12	41.64
Temperature		14.34	14.58	16.14	13.78	14.46

Note: Groundwater is aged by analysing the quantities of tritium, chlorofluorocarbons and sulphur fluoride, and comparing them with the quantities that would have been in the rainfall when it first entered the groundwater system.

61 Taranaki Regional Council. 2008. *State of the Environment Groundwater Chemical Quality 1994-2007.* Technical Report 2008-58
62 Ministry of Health. 2005. *Drinking Water Standards for New Zealand 2005.*
63 Stenger, R; Barkle, G; Burgess, C; Wall, A; Clague, J. 2008. Low nitrate contamination of shallow groundwater in spite of intensive dairying: the effect of reducting conditions in the vadose zone-aquifer continuum. *Journal of Hydrology* (NZ) 47:1-24.

also means that the groundwater quality measured from a well may not necessarily reflect the land use immediately surrounding that well, as the groundwater quality may have been influenced by activities from much further afield.

The Council currently undertakes monitoring of nitrates in groundwater through two state of the environment monitoring programmes and through specific compliance monitoring programmes associated with industrial activities. Monitoring results conclude that Taranaki's groundwater is suitable for most uses, including human, stock or dairy use. Figure 4.36 illustrates the sites sampled and sites that have had any samples with nitrate levels that have exceeded the New Zealand drinking water standard of 11.3 mg/l. These tend to occur mainly in South Taranaki and to be intermittent in nature for the most part.

From the most recent report on nitrates in shallow groundwaters in Taranaki[64] it was observed that nitrate concentrations in shallow groundwater have continued to decrease in the region with 90.5% of the 550 samples analysed lying below the 11.3 mg/l guideline for drinking water. Trend analysis performed on all the data from 2002-2007 indicate that two thirds of the sampled sites showed an improvement in water quality.

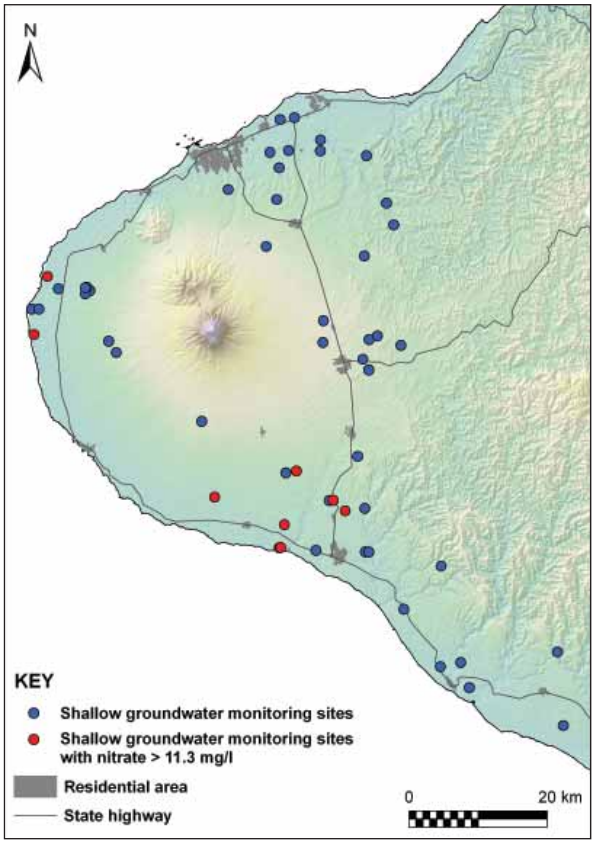


Figure 4.36 Results of nitrate sampling.

Iron, manganese and hardness

Iron and manganese occur naturally. In Taranaki it is not uncommon to encounter higher than normal levels of dissolved iron and manganese in groundwater in shallow aquifers around the ring plain. This is chiefly due to the geological volcanic origin of the aquifers, which dissolve away small particles of their compounds over time. On the other hand, groundwater chemical composition of the deeper aquifers is generally much better than that of the shallower aquifers although it has a higher degree of hardness.

Hardness is a common problem associated with groundwater from the Matemateāonga and Whenuakura aquifers which contain limestone and gypsum and is generally associated with the abundance of magnesium dissolved in the water. Although hard water does not pose a health risk it can be a trouble as it may cause clogging of pipes, incrustation of screens and other plumbing fixtures.

Iron bacteria or biofouling may also affect wells drilled through earth layers associated with old swamp and marsh deposits as in the Eltham area. Iron bacteria can clog wells with a gel-like slime that is natural and usually harmless but can be a nuisance as it can cause sulphide odours and corrosion of steel and iron.

Pesticides

Improper use of certain pesticides can result in inadvertent contamination of groundwater. In general, there is little reason for concern about pesticide residues in Taranaki's groundwaters because there is relatively little pesticide use associated with dairy farming, the dominant land use. In some minor land uses, such as horticulture, pesticide use is likely to be higher and hence there is a greater potential for pesticide contamination of groundwater.

In December 2006 the Council sampled groundwater in six selected shallow wells distributed throughout the region for pesticide residues[65]. Five out of the six wells sampled were located on properties used for commercial horticulture, while one well was located on a dairy farm. No pesticides of environmental concern were detected at any of the sites sampled.

Seawater intrusion

There is the potential for intrusion of saltwater into groundwater in coastal areas where rates of groundwater pumping are high enough to cause sea water to invade freshwater aquifers. However, groundwater abstraction rates in the coastal belt of Taranaki are normally low and so seawater intrusion has not been a problem yet. In the future, if demands for groundwater increase in the coastal areas, the balance between the amount of water abstracted and the rate of aquifer recharge will need to be closely monitored.

How has groundwater quality changed over time?

Data gathered from the state of the environment groundwater monitoring programme from 1995 to 2006 were analysed for any statistically significant trends[66]. A wide range of variables are monitored. Table 4.24 illustrates that for each of the five wells sampled which variables showed trends. This shows that 94% of the trends performed on the data showed either no change or measurable improvements. Only 6% of all the trends performed on the 17 parameters for the six Taranaki wells are deteriorating. This suggests that there is no indication that human activities on the land are negatively affecting the general groundwater quality of the region.

64 Taranaki Regional Council. 2008. *Nitrates in Shallow Groundwater in Taranaki, State of the Environment Monitoring 2002-2007.* Technical Report– 2008-78.
65 Taranaki Regional Council. 2008. *Pesticides in Shallow Groundwater in Taranaki.* Technical Report– 2007-113.
66 Taranaki Regional Council. 2008. *Groundwater Chemical Quality, State of the Environment Monitoring 1994-2007.* Technical Report 2008-58.

Table 4.24. Statistically significant trends in groundwater variables between 1995-2006.

Location:	Eltham	Normanby	Ōhawe	New Plymouth	Toko	Ōhawe
Aquifer:	Matemateāonga	Whenuakura	Whenuakura	Volcanics	Matemateāonga	Volcanics
Bromide	☺	😐	😐	😐	😐	☺
Calcium	☺	☺	☺	😐	😐	😐
Chloride	☺	☺	☺	😐	😐	☺
Conductivity	😐	😐	😐	☹	😐	☺
Fluoride	😐	😐	😐		😐	😐
Iron	😐	😐	☹	😐	😐	
Bicarbonate	😐	☹	😐	😐	😐	☹
Potassium	☺	☺	😐	😐	😐	😐
Magnesium	☺	😐	☺	😐	☺	😐
Manganese	☺	😐	☺	😐	😐	
Sodium	😐	😐	😐	😐	😐	☺
Ammoniacal nitrogen	😐	☹	😐		😐	
Nitrate	😐	😐	☺	😐	☺	☹
pH	😐	☺	😐	😐	😐	☺
Phosphate	😐	😐	😐		😐	😐
Silicon oxide	😐	😐	😐	😐	😐	😐
Sulphate	😐	😐	😐	😐	😐	☹

☺ statistically significant improvement P<0.05 (meaning that there is only a 5% chance of finding a trend when there was not one)
😐 no statistically significant change
☹ statistically significant deterioration P<0.05

(D) DISCHARGES TO GROUNDWATER

The Taranaki Basin has always been the main focus for hydrocarbon exploration and production in New Zealand. A great number of hydrocarbon exploration activities are undertaken within the region. Oil and gas wells are drilled up to 5,000 m into the ground. At these depths groundwater encountered is extremely saline and some of this water is brought to the surface when hydrocarbons are extracted. This saline water needs to be safely disposed of. Normally, this is accomplished by re-injecting the saline groundwater back into deep saline groundwater aquifers, a process called deep well injection. This process uses specially designed injection wells to discharge treated or untreated liquid waste into geologic formations or confined saline aquifers that seal contaminants off from freshwater aquifers. The receiving aquifers are themselves saline and separated from the shallower aquifers used for water supplies by thick impermeable rock layers.

In Taranaki, the contaminants disposed of via deep well injection are limited to produced waters, water–based drilling fluid waste, and contaminated well-site stormwater. The Council has approved, on special occasions, the discharge of small volumes of other specified contaminants by deep well injection.

4.3.2 HOW IS GROUNDWATER MANAGED?

(A) REGIONAL FRESH WATER PLAN

Prevention of groundwater contamination is simpler and is much cheaper than the clean-up of an aquifer. Once contaminated, an aquifer can be difficult and expensive to clean up and chemical substances may persist for many years.

The *Regional Fresh Water Plan for Taranaki* outlines management practices aimed at maintaining and enhancing groundwater quality, by reducing both diffuse and point sources of contamination. It contains policies relating to the siting, construction, and abandonment of wells and bores, the discharge of contaminants to land, and policies relating to the abstraction of groundwater. Rules govern the application of agrichemicals. The Council will continue to promote the careful use of such chemicals in accordance with these rules and the manufacturers' instructions.

The *Regional Fresh Water Plan* permits the taking and use of groundwater of up to 50 m^3 per day without a resource consent, provided certain conditions safeguarding the environment are met. This

Council staff meeting with drillers.

Bore drilling.

volume is to allow for reasonable farm and domestic water needs. The plan also sets conditions and standards for bore construction, bore location and separation. The Council maintains a database of the bores and wells in the Taranaki region. It is a requirement when drilling a well or bore that a driller's log and bore details are forwarded to the Council so that the bore can be registered in the databases and the well can be accounted for and protected. However, getting bore completion logs from those drilling wells or bores has proven difficult to enforce under this permitted rule and will need amending in a future review of the plan.

(B) RESOURCE CONSENT MANAGEMENT

Applications for a resource consent for taking groundwater are evaluated according to *Regional Fresh Water Plan* policies and rules. At June 2008, there were 81 resource consents for the taking of groundwater in Taranaki.

Conditions attached to a resource consent normally stipulate the volumes and rates permitted. These ensure the resource is allocated in a sound and suitable manner. Provisions for water metering are also being made in the past five years for all water takes in the region.

For activities such as intensive spray irrigation of effluent waters at high loading rates, resource consents have attached more strict conditions which are closely monitored for effects on groundwater. The results of these site-specific monitoring programmes are reported in the Council's annual compliance monitoring programmes.

Forty two resource consents are currently held for the discharge of wastewater to groundwater by deep well injection. Resource consent conditions for deepwell injection require, amongst other technical requirements, that records of the quantities and composition of fluids injected are kept and that they are made available to the Council.

(C) GROUNDWATER MONITORING

The Taranaki Regional Council has been regularly monitoring groundwater levels and groundwater quality since 1995. Groundwater quality and quantity are monitored in the province through four different programmes. These programmes vary in terms of the number of sites sampled, the sampling frequency, the sampling methods, and the parameters measured.

Groundwater quality is monitored in the Taranaki region through the state of the environment programme. This includes regular monitoring of pressures on the groundwater resource, groundwater chemical quality and nitrates, herbicides and pesticides in shallow groundwater.

The Council also participates in the National Groundwater Monitoring Programme which is run by the Institute of Geological and Nuclear Sciences. This programme records changes in groundwater chemistry in five key indicator wells in the region. Quarterly sampling of these sites forms the basis of the Council's groundwater state of the environment monitoring.

In addition, the Council closely monitors groundwater quality at the sites where industrial effluents are applied to land such as those from the NZMP Kāpuni lactose factory, Taranaki by-products, Riverlands meat processing-Eltham, Silver Fern Farms, and the Ballance Agri-Nutrients ammonia urea plant. The Council has established compliance programmes to monitor these activities and the potential effects that they may have on groundwater quality.

In Taranaki, reliance on groundwater is likely to increase in the near future because surface water is becoming fully allocated in many catchments. The drought of 2007-08 enabled the Council to start looking at how the groundwater systems behave and respond to extreme climatic events, but more research is needed to address climatic extremes and changes.

(D) INFORMATION, EDUCATION AND ADVICE

Taranaki Regional Council provides information and advice for groundwater investigations and siting of bores in the region. The Council has updated the groundwater database and has acquired more tools for the interpretation and mapping of data generated during groundwater exploration activities. Guidelines for drilling and for location of bores have been made available to drillers and landowners alike and to consulting companies undertaking groundwater investigations in

Kāpuni Ammonia-Urea Plant and irrigation area.

MONITORING GETS TO THE BOTTOM OF THE STORY

Groundwater monitoring is the bottom line, literally and figuratively, that helps to prevent the Kāpuni Ammonia-Urea Plant having adverse effects on the environment around it.

It's a far cry from the plant's early days, when environmental problems became evident even as it was being commissioned in 1982. Effluent was to be disposed of by spray irrigation on to surrounding paddocks. But the effluent proved to be too concentrated, the irrigation area too small and, in an unforeseen consequence of the disposal process, the soil became too impervious.

After one series of events, effluent escaped and burnt surrounding grassland while also making its way into the Kāpuni Stream and killing fish in the 16 km stretch between the plant and the sea.

As a result, the irrigation area was increased from the initial area where grass was harvested and removed, to also encompass nearby grazing land. Concurrently the soil was broken up and treated. Measures were taken to reduce the amount of ammonia and urea in the effluent produced by the plant both by recycling and air stripping. To help alleviate the problem of soil becoming impervious, disposal of the effluent from one intermittent process was altered.

Over a number of years and after a range of adjustments across the entire operation, the plant's environmental performance was improved and it now enjoys a consistently good record.

And to get to the bottom of the story, groundwater monitoring has been stepped up and there are now 42 bores on and around the site. This ensures that the Taranaki Regional Council and Ballance Agri-Nutrients, which now runs the plant, have reliable information on the legacy of those early problems, primarily the two plumes of ammonia in groundwater under the site.

The more recent introduction of new technology – electro-magnetic conductivity monitoring – has offered an even more accurate picture, and also confirmed that earlier conclusions and suggested remedial work were correct.

To minimise the environmental impact, pump and treatment operations run for both ammonia plumes, with the contaminated groundwater pumped back through the plant and its waste treatment systems. Neither plume extends beyond the extent of Ballance-owned land. There is a chance that one is likely to eventually find its way to tributaries of the Kāpuni Stream, but it will be considerably diluted by then.

So although the groundwater's nitrate levels remain elevated, they are not having an impact on the surrounding environment.

Most of the compliance and environmental monitoring is done by Ballance, with checks by the Taranaki Regional Council. Over the course of a year the Council's monitoring programme typically includes four site inspections and the collection of nine water samples. Ngā Ruahine Iwi are given regular updates.

It's been a long-running saga but one with a happier outcome than may have been expected at the height of the problems in the 1980s.

the region. The Council provides advice on the importance of proper maintenance of water wells and the importance of appropriate construction of bores. These matters are important both from the perspective of investments made in such infrastructure as well as environmental consequences of poorly maintained wells.

In a joint programme, the Council and the Taranaki Health Board, offer a free service to pregnant women to test domestic groundwater water supplies for nitrate contamination. Whenever the Council collects groundwater samples that exceed the drinking water standards, the owner of the well is informed and advised to engage a drinking water assessor or a Health Officer from the district council for advice.

(E) SUMMARY OF PROGRESS

Table 4.25 summarises the progress with implementing regional objectives and policies on groundwater quantity and quality.

4.3.3 HOW DO WE COMPARE ?

Compared with other parts of New Zealand, groundwater use in Taranaki is a relatively small proportion of overall water use. Table 4.26 shows the number of consented water takes from groundwater sources in Taranaki compared with other regions. This shows that compared to other regions, the number of groundwater consents in Taranaki is very small. Nationally, the number of groundwater consents increased by 80% between 1999 and 2006[67]. However, in Taranaki, the percentage of consented groundwater takes increased between 2003 and 2008 by 300%.

Groundwater quality data from around the country has been analysed for the Ministry for the Environment[68]. This report provided an assessment of the current state and trends in groundwater quality at a national scale. Data was sourced from state of the environment monitoring undertaken by 15 regional authorities, and from the National Groundwater Monitoring Programme run by GNS Science. It was concluded that there are issues with contamination of groundwater with

67 Aqualinc Research Limited, 2006. *Snapshot of Water Allocation in New Zealand.* Prepared for the Ministry for the Environment.
68 Ministry for the Environment, 2007. *Groundwater Quality in New Zealand State and Trends 1995–2006.* Prepared by GNS Science for the Ministry for the Environment.

Table 4.25: Summary of progress with groundwater objectives.

Issue	What do we want to achieve ?	What are we doing about it ?	Where are we at ?
Adverse effects on groundwater levels and quality.	• Sustainable use, development and protection of groundwater. • Maintain and enhance groundwater quality.	• Implementing the *Regional Fresh Water Plan.* • Controlling groundwater abstraction and drilling. • Controlling discharges to land. • Monitoring groundwater levels and quality. • Providing nformation and advice on groundwater resources and drilling.	• *Regional Fresh Water Plan* made operative in 2001. • 81 resource consents issued for groundwater use and monitored (27 in 2003). • Three-monthly monitoring of groundwater quality at six sites. • 69 sites monitored every five years for nitrate concentrations . • No significant pesticides or microbial contamination of groundwater or saltwater intrusion issues. • 1,550 borelogs listed (639 in 2003).

nitrates and or microbial contamination, especially for shallow wells in unconfined aquifers. The health guidelines for bacterial contamination were exceeded at 20% of sites, and nitrate concentrations exceeded drinking water standards at 5% of sites. About a third of the groundwater monitoring sites samples showed some level of human impact with high nitrate concentrations. There was little or no evidence of human influence for 30% of sites.

In the same report, trends in groundwater quality were examined. Trends were categorised according to specific characteristics (Table 4.27). This showed that in Taranaki, and elsewhere around the country, the majority of sites fell into the category where only slow changes in variables were occurring and this was likely due to natural interactions between groundwater and rocks. Nationally, one third of sites showed rapid changes in groundwater quality and all likely to be the effect of human influence.

Table 4.26: Number of consented ground water takes in different regions in New Zealand as at June 2008. Data from regional councils.

Region	Number of groundwater abstraction consents
Northland	275
Bay of Plenty	814
Tasman	920
Manawatu–Wanganui	334
Marlborough	844
Canterbury	2,845
Otago	820
Southland	705
Auckland	1,422
Greater Wellington	479
Taranaki	81

Table 4.27: Percentage of monitoring sites assigned to a trend category.

Council	Diluting. Less salt water intrusion occurring.	Degrading. Increases in minerals and nutrients probably from agricultural impact.	Improving. Decreases in minerals and nutrients from decreasing human impact.	Water-rock interaction. No or only slow changes in most variables over time.
Auckland	4.2	0	4.2	91.7
Bay of Plenty*	12.3	7	15.8	63.2
Southland	0	28.9	40	22.2
Waikato	8.2	17.5	19.6	53.6
Wellington	2.8	7	23.9	64.8
Hawke's Bay	4.0	8.0	4.0	84.0
Manawatu-Wanganui	3.2	9.7	15.6	33.3
Northland*	17.8	15.6	15.6	33.3
Taranaki	0	14.3	0	71.4
West Coast	0	12.5	0	87.5
Otago	7.8	14.4	5.6	65.6
Tasman*	6.3	25	6.3	62.5
Gisborne	14.3	13	3.9	51.9

* Regions in which trends may be biased by groundwater under marine influence.
Data from Ministry for the Environment, 2007.

4.4 FRESHWATER BIODIVERSITY

4.4.1 WHAT IS THE CURRENT STATE OF FRESHWATER BIODIVERSITY?

Freshwater biodiversity describes the variety of all biological life dependent on fresh water. It includes the diversity of freshwater ecosystems - streams, rivers, small wet gullies, lakes, mountain top tarns, lowland wetlands and freshwater life - micro-organisms, algae, invertebrates, fish and birds.

Freshwater ecosystems are influenced by the source of the water and the underlying geology - mountain-fed rivers, spring-fed streams, hill country streams and river catchments, such as the Pātea or the Waitara fed from both hill country and ring plain rivers. Each of these river types has a distinct biodiversity assemblage associated with them. Most catchments are relatively small (Figure 4.37).

(A) INDICATORS OF FRESHWATER BIODIVERSITY

Indicators used for measuring and reporting on freshwater biodiversity include the extent and condition of wetlands, the number of wetlands identified as regionally significant, and pressures on small streams through modifications (such as culverting or straightening). Many native fish need to migrate between fresh water and the coast so the number of structures that impede or allow fish passage can be used as an indicator for native fish biodiversity. The distribution of threatened fish species is an important component of freshwater biodiversity, as are trends in their population status, although this is more difficult to quantify. Freshwater stream invertebrates, already used earlier in this chapter to measure water quality, can also be examined in relation to biodiversity.

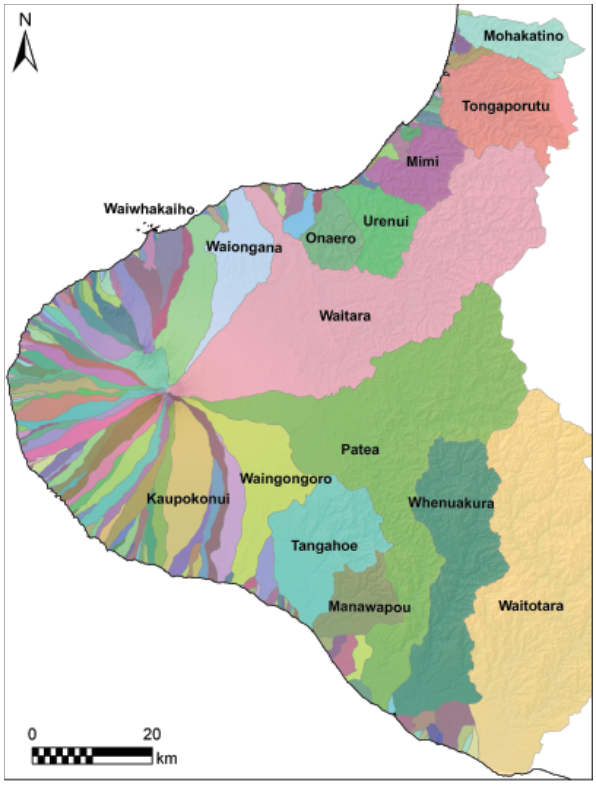


Figure 4.37 Map of parent catchments in Taranaki.

(B) WETLANDS

Wetlands, such as lagoons, estuaries, bogs, swamps, shallow lakes and farm dams, have a vital role in maintaining the health of the region's natural environment. Wetlands are essentially wet lands – places of poor drainage, where water accumulates, sites where seepage or flooding is frequent, and sites at the interface between land and streams, rivers, lakes and estuaries[69].

All forms of life need water, but wetland plants and animals are adapted to cope with an oversupply of wetness, and its consequences, such as nutrient shortages and the need to ensure a supply of oxygen to underwater parts. Wetlands support a variety of biodiversity, including wildlife such as gold-striped geckos, fernbirds, spotless crake, brown mudfish and bittern. There is also a wide diversity of wetland types, as wetlands vary according to a whole range of variables – from the depth of water, the degree of salinity, the substrate, water regime, nutrient status and what vegetation is dominant.

Tapuae wetland.

Extent of wetlands in Taranaki

Today, wetlands in Taranaki are relatively scarce and under-represented. According to a recent national survey, it is estimated that 7.6% of Taranaki's original wetland area remains[70]. This is more than earlier estimates, which suggested only 1.5% of the original wetland area remained with only about 0.2% outside of the Egmont National Park[71].

In 1996, the Taranaki Regional Council carried out a survey of aerial photos and identified some 717 naturally formed wetlands of varying sizes, types and conditions within the region[72]. Most of these wetlands, particularly those outside public conservation areas, were small with 79% of the wetlands estimated to be less than 6 ha. Furthermore, most remaining wetlands had been modified, suffering some form of loss of value and condition from land use and development.

69 Johnson, P; Gerbeaux, P. 2004. *Wetland Types in New Zealand.* Department of Conservation, Wellington, New Zealand.
70 Ausseil, A; Gerbeaux, P; Chadderton, L; Stephens, T; Brown, D and Leathwick, J. 2008. *Wetland Ecosystems of National Importance for Biodiversity: Criteria, methods and candidate list of nationally important inland wetlands.* Prepared by Landcare Research for the Department of Conservation.
71 Taranaki Regional Council. 1992. *Land Drainage in Taranaki.*
72 Taranaki Regional Council. 1996. *Wetlands in the Taranaki Region.*

Table 4.28: Wetland numbers.

	Ecological District					TOTAL
	Egmont	Nth Taranaki	Matemateāonga	Manawatu Plains	Foxton	
Number of wetlands reported in the 1996 survey	289	125	187	56	50	717
Number found to have disappeared by 2008	23	16	1	8	15	63
Total number of wetlands found in 2008	272	107	174	45	41	639
Area of wetlands found in 2008 (ha)	1,762.5	659.3	977.3	275.7	372.9	4,048

In 2008, aerial photos taken in 2007 were used to evaluate changes in the extent of wetland coverage in the region from 1996. The grid references listed in the 1996 inventory were examined on the 2007 aerial photos and the area of each wetland was calculated. Table 4.28 sets out the number of wetlands found through the 1996 survey, the number that were found to have disappeared and the number found in 2008, according to ecological district. The number of wetlands found in 2008 differed from that found in 1996 because: some had clearly disappeared (and this was verified by checking aerial photos taken in 2001), some areas originally classified as estuaries were not counted (as they were not really estuaries), some errors in grid references were found, some areas had been double-counted in 1996 and some additional wetlands were located.

Table 4.28 shows that of the original 717 natural wetlands identified in the 1996 inventory 63 (8.8%) were confirmed to have disappeared. The majority of wetlands that had disappeared were from the Egmont and Foxton ecological districts, areas where there is greatest pressure for land development from agriculture. The majority of these wetlands were estimated as being less than 5 ha.

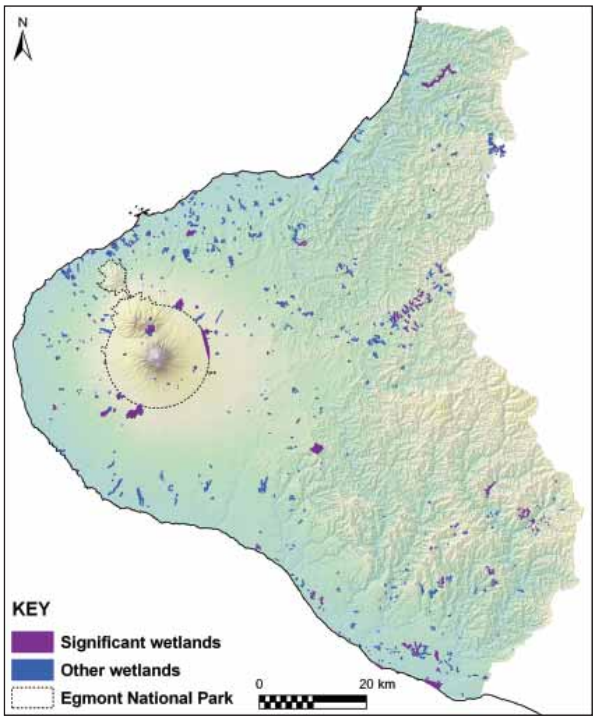


Figure 4.38. Wetland extent and regionally significant wetlands.

The total number of wetlands, as identified through aerial photographs, now sits at 639, covering an area of 4,048 ha. This estimation of the total area of wetlands in Taranaki differs from that estimated through a national analysis of satellite imagery, which concluded that 3,045 ha of wetland remains[70]. It is likely that the analysis of the aerial photographs is more accurate. The extent of wetlands, as well as those identified as regionally significant, is illustrated in Figure 4.38.

A systematic study is proposed to compare the area of wetland between aerial photos flown in 2001 with those flown in 2007. This will produce a more comprehensive baseline from which to evaluate future wetland monitoring and a better assessment of the extent (in terms of area) of wetland loss.

Small gully wetland (red dot) in South Taranaki, 2001.

Wetland replaced by contoured paddock, 2007.

Table 4.29: Status of protection of regionally significant wetlands identified in the *Fresh Water Plan*.

	Number identified in Fresh Water Plan	Legal status in 2001	Legal status in 2007	Fencing status
Regionally significant protected wetlands	28	• 28 legally protected (DOC or QEII).	• 28 legally protected (DOC or QEII).	• 18 adequately protected from stock access with fences or natural barriers. • 10 only partially fenced or unfenced.
Regionally significant other wetlands	20	• All protected from drainage through rules in plan but none with additional legal protection.	• All protected from drainage through rules in plan. • 1 destroyed (owners prosecuted). • 8 fully or partially protected by QEII covenants. • 2 fully or partially protected by council memorandum of encumberance.	• 10 fully fenced. • 6 partially fenced. • 3 unfenced.
Wetlands over 5 ha	18	• All protected from drainage through rules in plan but none with additional legal protection.	• All protected from drainage through rules in plan. • 3 fully or partially protected by QEII covenant.	• 7 adequately protected from stock access by fences or natural barriers. • 5 partially fenced. • 6 unfenced.
Wetlands with rare or uncommon species	11	• All protected through rules in plan but none with additional legal protection.	• All protected through rules in plan. • 4 fully or partially legally protected by memorandum of encumberance or covenant.	• 5 fully fenced. • 1 partially fenced. • 5 unfenced.

Status and condition of regionally significant wetlands

The Council has identified 77 significant wetlands - 48 regionally significant wetlands, 18 that are significant because they are over 5 ha, and 11 wetlands with rare or uncommon indigenous species. Together these wetlands cover an area of 2,811.8 ha. The change in legal status and fencing status of these wetlands is an indicator of the level of the legal and practical protection provided to these sites.

Thus on the whole, regionally significant wetlands have been adequately protected through formal mechanisms and proactive protection works such as fencing. Additional planting has been added to some wetlands to better protect wetland values from adjacent land uses.

Six Taranaki wetlands have been surveyed as part of a national wetland monitoring programme. A number of indicators are used in order to quantify the level of impact on the hydrology, on nutrient levels or soil compaction, on extent of the wetland and levels of damage from animal or plant pests. The results for those six sites are set out in Table 4.30.

Table 4.30: Wetland condition monitoring of six regionally significant wetlands.

Indicator	Indicator components	Score (average of indicator components, out of total of 5)					
		Barretts Lagoon	Corbett Lake	Lake Rotokare	Mohakatino Wetland	Potaema (ENP)	Umutekai
Change in hydrological integrity	Impact of manmade structures, water table depth, dryland plant invasion.	3.83	4	4.5	3.5	5	3
Change in physicochemical parameters	Fire damage, degree of sedimentation, nutrient levels, peat compaction.	4.16	4.66	4.83	4.16	5	4.33
Change in ecosystem intactness	Loss in area of original wetland, connectivity.	4	3.5	4.75	3.5	5	1.5
Change in browsing, predation and harvesting	Damage by animals, predator impacts, harvesting levels.	4.5	4.66	5	4.5	4.83	4.16
Change in dominance of native plants	Introduced plants in canopy and understory.	3.5	4	4	3	5	3.5
TOTAL (out of 25)		**19.99**	**20.82**	**23.08**	**18.66**	**24.83**	**16.49**

Data provided by Landcare Research.

Daryl Gibson and Maitahi wetland.

REGENERATION AND NEW GENERATION

Regeneration is becoming a generation game at the Maitahi wetland near Ōkato.

The wetland spans the dairy farms of Merv Hooker and Bernard and Pauline Gibson who, over a number of years, have achieved a transformation by fencing indigenous vegetation, establishing new plantings and carrying out willow control.

And now the Gibson farm is passing on to the next generation – but the environmental commitment endures.

"It's been a good project to be involved in and our son, who's taking over the farm, is keen to carry it on," said Pauline.

Merv Hooker agreed, saying it's been gratifying to see the re-growth of the plant life along with increasing numbers of birds.

"This area on our farm was regarded as waste land, and to have it fenced off to protect the plant and bird life has given myself and others great pleasure," he said.

Both properties are also protected with a Memorandum of Encumbrance on their titles, to ensure the environmental enhancement is protected long into the future.

Although comparatively small at just 7.5 ha and no more than 10 m across at any one point, the Maitahi wetland is a regionally significant wetland.

It makes a dramatic appearance in countryside dominated by pasture lands, and contains a large variety of wetland vegetation and habitat. Plant varieties include māhoe, cabbage trees, raupo, sedges and flax and among the birdlife are the rarely seen Australasian bittern and the spotless crake.

The vegetation acts as a natural riparian filter for the Maitahi Stream at an important location close to the coast, where water quality is generally lower than at higher altitudes.

The restoration project began in 2002 and has been assisted by a Taranaki Regional Council grant of $24,400 to help meet the costs of fencing and willow control.

In 2004, young people from the Conservation Corps carried out fencing, planting and spraying work at the wetlands. "Our programme relies on projects like this to teach young people work skills," said John Bowie of the New Plymouth YMCA, which co-ordinates the Conservation Corps.

For the Gibsons and Hookers, that just adds to the positive nature of the project.

The Taranaki wetlands included one surrounded by the Egmont National Park (Potaema) and one surrounded by native vegetation (Lake Rotokare). Neither of these sites showed much evidence of impacts from human activities, introduced plants or animals and so consequently obtained high overall scores. Two other sites, Barretts Lagoon and Umutekai wetland are located in rural settings, and consequently show some evidence of changes in hydrology through the invasion of some dry land plants, and impacts of weeds. These results establish a baseline from which future monitoring can be undertaken.

(C) STREAMS

The natural character of Taranaki ring plain streams and rivers as they flow from the mountain to the sea is that they meander often in deeply incised channels. This is a result of centuries of erosion, which has resulted in a stable river channel. A meandering stream includes a diverse range of habitat types – deep pools, shallow riffle areas, areas of faster running water. Different species of fish have different preferences for these habitat types.

Small streams can provide habitat for rare invertebrate and fish species, and can also play an important ecological role, such as providing spawning sites for lamprey, and refuge from large floods in the main stem rivers. For example, a fish survey undertaken in an unnamed tributary of the Waiwhakaiho River, immediately after a large flood, found over 50 redfin bullies taking refuge in a 70 m reach[73]. Also recorded were three adult eels that sought shelter while migrating downstream to spawn at sea. A later survey undertaken during normal flows recorded a much lower fish abundance.

Increasing intensification of land use on the Taranaki ring plain continues to see pressures being placed on the natural character of small streams and rivers. Landowners, particularly in South Taranaki, are increasingly undertaking land development by realigning or straightening sections of streams, or undertaking land reclamation through piping small streams. Recontouring these areas into land for grazing increases effective production hectares.

The amount of piping of small streams or stream modification that has been consented over the past five years is set out in Table 4.31.

73 Unpublished data.

Table 4.31. Number of consents issued for stream modification, and extent of stream affected, over the past five years.

Year: (1 Nov to 30 Oct)	Culverting/piping of streams		Stream realignment	
	No. of consents	Length of stream (m)	No. of consents	Length of stream (m)
2003-04	7	1,270	1	10
2004-05	8	2,618	3	480
2005-06	11	4,250	5	1,080
2006-07	16	10,970	4	1,440
2007-08	17	6,420	15	3,807
TOTAL	**59**	**25,528**	**28**	**6,817**

This shows that there have been a total of 59 consents issued for the culverting of a total of 25 km of stream, and 28 consents issued for the realignment of almost 7 km of stream. Certain catchments have been particularly affected such as the recontouring of 350 m of swampy headwaters at the top of the Rawa Stream and the piping of over 5,000 m of tributaries in the Taikatu catchment. This is likely to represent a small fraction of work being undertaken in the region as some land development work is a permitted activity. The Taranaki Regional Council has commenced a research investigation to examine the extent and likely environmental effects of this type of activity.

(D) FRESHWATER FISH

Taranaki rivers and streams support a diverse range of native fish species as well as some introduced species such as brown trout. The most well known native fish are two species of eels, five species of bullies, and six species of the whitebait (galaxiid) family. Other species include torrentfish, lamprey, common smelt, mullet and mudfish.

A special feature of Taranaki's native freshwater fish is that 15 of the 18 known species are diadromous – in other words, they have a marine or estuarine stage in their lifecycle and migrate to and from the sea. While the greatest variety of native fish is generally found in the lowest reaches of rivers and streams, the entire stream length provides habitat for different species' important habitats. For example, fish species such as inanga are more likely to be found in lowland streams that provide gentle flowing and well-vegetated habitats (see Figure 4.39a which shows where they are predicted to be found and where they have actually been found). Kōaro, on the other hand, prefer the cascading rocky habitats found further up the catchment and the forested cover provided by the Egmont National Park (illustrated in Figure 4.39b)[75].

Giant kōkopu *(Galaxias argenteus).*

Structures in waterways have the potential to impact on fish migration but can be modified or designed in such a way as to allow fish to navigate over, or through them (via fish passes). The Taranaki Regional Council created an inventory of all known structures that may affect fish passage and recorded information such as current use, resource consent status, ownership, effects on fish passage and historical values. One hundred and eight major dams, weirs and other barriers fish passage were identified[74].

This inventory has been reviewed and changes since 2001 are set out in Table 4.32. Thirty nine structures (36%) have resource consents and either an adequate fish pass or do not impede fish passage, so no further action is required. Of the 26 consented structures requiring further action, two have been removed and eight have had fish passes installed or had fish passage improved, but still need monitoring. Of the 30 unconsented structures requiring further action, six have gained consent and four of these have had fish passage improved, but still need monitoring. There remain five structures without resource consents that are 'orphaned' and have no current use and no party willing to take ownership and may therefore be removed.

In total, 12 structures have had works undertaken to improve fish passage.

Table 4.32: Dams, weirs and other barriers to fish passage in Taranaki.

	2001	2008
Consented structures requiring no action	37	39
Consented structures that require further action/monitoring	26	30
Unconsented structures – no further action required	10	10
Unconsented structures that require further action/monitoring	30	24
Unconsented structures that have no owner	5	5

74 Taranaki Regional Council, 2001. *Dams, Weirs and Other Barriers to Fish Passage in Taranaki.*
75 Leathwick, J. Julian, K. Elith, J. Rowe, D. 2008. *Predicting the Distributions of Freshwater Fish Species for all New Zealand's Rivers and Streams.* Prepared by NIWA for the Department of Conservation.
76 Department of Conservation, unpublished data.

A storm event in the Stony (Hangatahua) and Katikara catchments at the end of April 2008 has lead to streambed changes and potentially the displacement of native fish from the catchments. These catchments are known to contain good populations of shortjaw kōkopu and there is good baseline information about fish numbers and fish movements. Further monitoring of these catchments will provide valuable information on the rate at which native fish species are able to recolonise sites impacted by storm events.

The Department of Conservation currently monitors five sites within the Taranaki region for the endemic brown mudfish *(Neochanna apoda).* These fish are known for their ability to survive their wetlands drying up when water levels drop during the summer months, then becoming active and breeding when the water returns. Three sites have been monitored since 1994 and another two since 2002. Juveniles are frequently caught at four of the sites that are monitored indicating that recruitment is occurring and therefore the populations are healthy[76].

(E) FRESHWATER INVERTEBRATES

The Council uses the diversity of freshwater invertebrates to monitor water quality. This is reported on in detail in Chapter 4. The total number of species found in that monitoring also indicates where the greatest richness of freshwater invertebrates occur. The Council's sampling methodology, being designed for water quality monitoring, does not classify all invertebrates down to the species level, so for the purposes of this discussion, the number of taxa are being used as a surrogate for species biodiversity.

Inanga *(Galaxias maculatus).*

Kōaro *(Galaxias brevipinnis).*

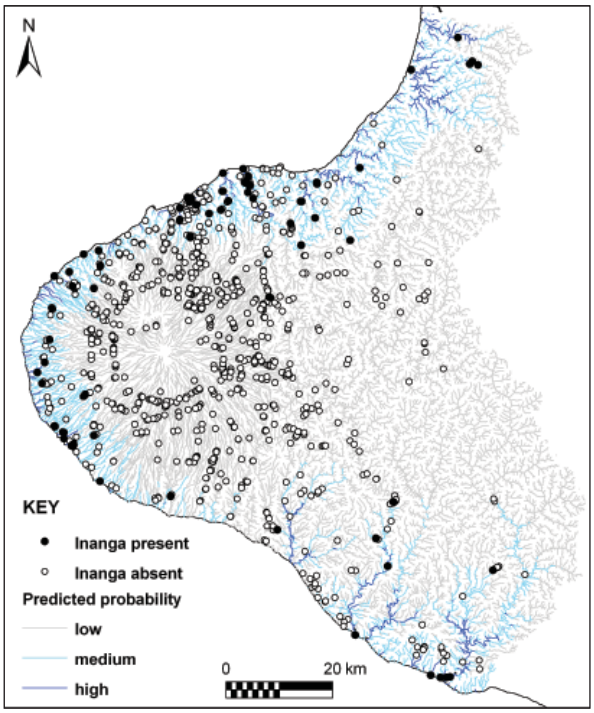
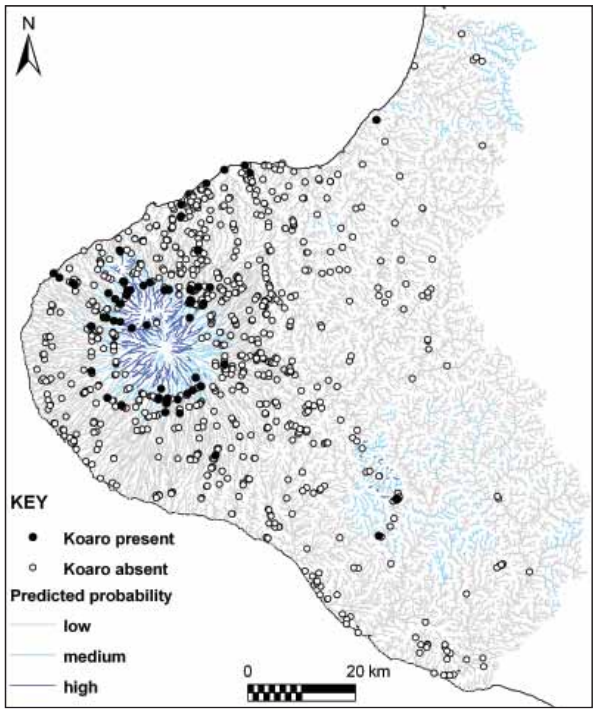


Figure 4.39(a): Predicted and actual distributions of inanga.



SOURCE: Leathwich et al. 2008.

Figure 4.39(b): Predicted and actual distributions of koaro.

Table 4.33 shows the number of invertebrate species that have been recorded from different types of stream. For example, 137 taxa have been recorded from ring plain streams arising out of the national park, with a maximum of 40 taxa recorded from a site. The maximum number of taxa recorded from a lowland coastal stream is 28. This suggests that ring plain streams draining the National Park tend to have higher species diversity than those from lowland coastal streams, and also hill country streams, but have a similar diversity to those ring plain streams rising outside of the National Park.

The number of taxa found in each of the major invertebrate groups is set out in Table 4.34. This illustrates that the most diverse invertebrate class is the true flies (diptera) with 30 different taxa, followed by the caddisflies (with 27 different taxa). Whilst these results will be influenced in part by the number of samples collected from each habitat type, it appears that streams arising from the National Park contain the greatest diversity in terms of the number of different types of caddisflies, crustaceans, stone flies and mayflies. For example, there have been 37 caddisfly taxa taxa found in Taranaki, 26 of those taxa have been found at sites in streams arising from the National Park, whereas only 16 caddisfly taxa have been found from sites in lowland coastal streams. This reflects the different habitat types found in such streams.

Fish pass on the Waiwhakaiho weir.

SOMEONE MAY NEED TO TELL THE FISH

When you provide something for fish to use, how do they know that it's there?

The question's not as silly as it seems and may be the nub of a puzzling absence of torrentfish and banded kōkopu from the Waiwhakaiho River above the Mangorei power scheme.

This is despite considerable efforts by the scheme operator and the Taranaki Regional Council to ease the passage of fish life over the power scheme's weir, including improving the residual flow for 6 km immediately below the weir, and the construction of an elaborate fish pass 10 years ago.

The absence of torrentfish and banded kōkopu above the weir was noted in a major survey conducted by Council staff in the summer of 2006/07.

The project involved night spotting and electric fishing surveys, in which fish are momentarily stunned by an electrical charge applied in the waterway.

The nearby Mangorei Stream, which has no weirs, was also surveyed to provide a comparison.

As well as torrentfish and banded kōkopu, the fish surveyors kept a special eye out for redfin bully and kōaro. All four species require passage to and from the sea to complete their life cycle, and all thrive in habitats such as those upstream of the weir.

Only redfin bully and kōaro were found upstream of the weir. Longfin eels and a solitary shortjaw kōkopu were the other migratory species recorded.

The absence of torrentfish was a particular concern, as they live commonly in the Mangorei Stream at an altitude higher than the Waiwhakaiho weir.

The next step was to trap fish moving through the pass, by netting the outlet at the top. The result: redfin bullies, one longfin eel and one juvenile fish tentatively identified as a kōaro.

More monitoring will be carried out in a bid to solve this fishy mystery. One explanation may be that due to the lack of adult fish and their attractant odours upstream of the weir, the species are not aware the habitat exists – despite it now being accessible via the new fish pass and the residual flow between the Meeting of the Waters and the weir intake.

Whatever the problem turns out to be, efforts will continue to facilitate fish migration in the Waiwhakaiho and thus protect and enhance biodiversity.

Table 4.33: Number of freshwater invertebrate taxa recorded from Taranaki rivers (from reference sites only).

	Large east hill country	Lowland coastal stream	Ring plain rising in national park	Ring plain rising outside national park	Small (lowland) hill country
Number of taxa recorded	111	100	138	123	118
Maximum no. of taxa per site	35	28	40	37	35
Median of no. of taxa per site	15	16	22	22	18

Table 4.34: Number of taxa found in each of the major invertebrate classes by habitat type.

	Large east hill country	Lowland coastal stream	Ring plain rising in national park	Ring plain rising outside national park	Small (lowland) hill country	Regional Total
Flatworms	3	3	4	4	4	**4**
Worms	4	3	3	2	2	**4**
Molluscs	7	9	9	9	11	**11**
Crustaceans	15	10	16	11	11	**17**
Mayflies	13	7	15	13	10	**15**
Stoneflies	6	3	10	7	7	**10**
Damsel/dragon flies	2	6	5	5	7	**7**
Beetles	7	6	7	7	7	**7**
Bugs	3	4	4	4	4	**4**
Neuroptera	0	0	1	1	0	**1**
Caddisflies	22	16	26	24	21	**27**
True flies	22	25	29	27	26	**30**

Interestingly, the largest freshwater invertebrate found, the freshwater crayfish or kōura, is more frequently found in lowland ring plain rivers that do not tend to rise in the national park, i.e. they tend to be in smaller streams. Table 4.35 shows the number of times that kōura have been found during the Council's biomonitoring programmes.

Kōura populations are decreasing in some areas as they are affected by stream modification. Predation by introduced species has also played a role, as has harvest for human consumption in some places. Kōura are listed as a threatened species and their populations are in gradual decline.

Table 4.35: Frequency of reference sites that koura have been recorded in Taranaki.

	Large east hill country	Lowland coastal stream	Ring plain rising in national park	Ring plain rising outside national park	Small (lowland) hill country
Total number of samples	247	231	1,832	572	436
Number of samples with kōura	5	23	49	143	88
% of samples with kōura	2	10	3	25	20

4.4.2 HOW IS FRESHWATER BIODIVERSITY MANAGED?

(A) PLANS

The *Regional Fresh Water Plan for Taranaki* contains objectives, policies and methods, including rules to address issues that relate to biodiversity such as the uses of river and lake beds, water quality and wetlands. For example, policies are included that require resource users to avoid, remedy or mitigate the adverse effects on aquatic life and habitat, other policies address issues such as regionally significant wetlands.

Specific policies require instream structures to provide for the unrestricted passage of fish or the installation of suitable fish pass facilities. When conditions of the rules cannot be met, resource consents are required and mitigation measures considered. The removal or decommissioning of unused structures is promoted unless for ecological, historical or other reasons the structure should remain.

Regionally significant wetlands, those over five ha and those with rare or uncommon indigenous species are protected from drainage through rules in the *Regional Fresh Water Plan for Taranaki.*

The Department of Conservation has prepared threatened species recovery plans for mudfish and large galaxiids. These plans set out advocacy and management actions.

(B) RESOURCE CONSENTS

All resource consents for uses of river and lake beds, or for activities in regionally significant wetlands, are assessed against policies in the *Regional Fresh Water Plan for Taranaki.* This includes an assessment of natural, ecological and amenity values, and the relationship of tangata whenua to the water body. Also considered are the costs and benefits of the use to the community and possible mitigation measures – including appropriate timing of the works and provision of fish passage.

The Council is also proposing to develop guidelines for both applicants and consenting officers in terms of information that needs to be gathered for stream modification applications (stream straightening, culverting etc.). This could include information on the amount of stream modification that has already occurred in the catchment using tools such as GIS and aerial photography.

(C) ENVIRONMENTAL ENHANCEMENT GRANTS

Environmental enhancement grants are used by the Taranaki Regional Council to promote the protection and enhancement of regionally significant wetlands (and more recently other sites with regional significance). The amount of money allocated from this fund over the past five years is set out in Table 3.2 in Chapter 3.4 (Biodiversity on land).

(D) INFORMATION, EDUCATION AND ADVICE

The Council provides information, education and advice to landowners and schools through its sustainable land management and education in schools programmes. The Council has prepared guidelines on resource consent requirements regarding the construction of culverts, bridges and road culvert maintenance.

Through the Council's sustainable land management programme, landowners are provided with advice and support on riparian planting and wetland protection.

The Council advocates for the protection of regionally significant wetlands from threats with a particular focus on fencing, supplementary planting and covenanting of the wetlands for their long-term protection. Grants are made to land occupiers to cover the costs of enhancement and protection. There are two legal protection mechanisms available – a covenant (with either the QEII National Trust or the Department of Conservation) or a memorandum of encumbrance with the Council.

(E) RESOURCE INVESTIGATIONS

While stream modification (stream realignment and culvert installation) carried out in small tributaries is not a new issue, the effect of these works on instream ecology has not been documented to any significant extent in the rural community in Taranaki. The Council is currently undertaking a resource investigation in order to:

- determine the ecological values in small tributaries in Taranaki;
- assess the effects of culverting various lengths of stream on these ecological and hydrological (particularly during low flow) values;
- determine the extent to which loss of small streams is occurring in Taranaki;
- assess the effects of clearing vegetation from small streams on ecological values;
- establish a method for assessing the cumulative effects of piping and realignment in a catchment and an approach to deal with this in the consenting process (i.e., a database or GIS map detailing total loss of stream reach); and
- investigate and recommend appropriate mitigation measures to mitigate the loss of instream habitat.

Field day on riparian planting and wetland protection.

(F) RESTORATION OF WETLANDS AND RIPARIAN VEGETATION

Wetland and riparian planting on the Caskey property.

NOT THE LAST TANGO IN TOKO

They're elusive, they're threatened and they have elaborate courtship dances – whoever invented the tango must have taken something from their displays, says one commentator.

And now New Zealand dabchicks have made their way to new wetlands established on a Toko dairy farm. Not only do these ponds and their surrounds make an excellent dance floor, but unwelcome visitors including stoats, ferrets, weasels and feral cats are kept at bay with an extensive trapping operation.

Another visitor has been the New Zealand scaup, a diving duck described by 19th century observer Charles Edward Douglas as "a happy, chubby little bird troubled with few cares".

The appearance of these birds has been among the positive spin offs for farmers Mark and Leigh Caskey since the wetland project began in 2004.

Three wetland gully areas have been fenced to exclude stock and enhanced with thousands of new plants and the creation of five areas of open water habitat that has attracted the dabchicks, scaups, spotless crake, pied stilt and gamebirds such as mallard ducks and even a solitary black swan. The drier sides of the gullies also provide much-needed habitat for the threatened striped skink Oligosoma striatum.

The safety of these indigenous species is enhanced by the trapping operation, which to date yielded 53 stoats, 11 ferrets, six weasels and a number of feral cats. The property is also part of a new self-help possum control programme in the Toko area.

A riparian management plan is being implemented to ensure waterways are protected, and steeper land on the farm has also been retired from farming and fenced and planted. The owners say the areas in question were difficult, unattractive and in some cases potential death traps for stock.

So with plenty of help from family and friends, and advice and assistance from the Taranaki Regional Council, the Taranaki Tree Trust, the NZ Gamebird Habitat Trust (through Fish and Game Taranaki), the Department of Conservation and the QEII National Trust, these pockets of the property have been transformed.

The owners say a long-running interest in the outdoors has evolved into a concern for the environment and a commitment to make improvements. The dabchicks, scaups and other birdlife are the dividend and the efforts were also recognised with a Taranaki Regional Council Environmental Award in 2007.

The farm hosted an open day in February 2008 to mark World Wetlands Day.

(G) MONITORING

Council staff undertake a significant wetland monitoring programme which includes site visits for all significant wetlands, liaison with landowners, the monitoring and recording of information relating to the protection, maintenance and enhancement of the wetlands, including following up on protection works initiated. 90% of regionally significant wetlands were visited in the 2006-07 year.

The Department of Conservation undertakes monitoring of the presence of mudfish populations at five sites in Taranaki and also short jaw and giant kōkopu populations.

(H) COMMUNITY BASED INFORMATION GATHERING

The Environmental Monitoring and Action Project is an environmental education programme funded by the Ministry of Education. The project involves encouraging students and teachers to undertake environmental investigations and then to take some form of action for the environment.

There is a national schools monitoring programme for kōura called 'Kōura Kraze' focused around the March monitoring month facilitated by the Environmental Monitoring and Action Programme[77].

Kōura *(Pararenphrops planifrons).*

77 http://www.emap.rsnz.org/events/marchmon

(I) SUMMARY OF PROGRESS

Progress on implementing regional objectives and policies on freshwater biodiversity is summarised in Table 4.36

Table 4.36 Summary of Progress with implementing regional objectives and policies on freshwater biodiversity.

Issue	What do we want to achieve	How is it measured	What progress are we making
Reducing threats to freshwater habitats.	• Maintenance of the areal extent of wetlands. • An increase in the number and areal extent of regionally significant wetlands that are formally protected or covenanted.	• Extent of wetland areas. • Number of regionally significant wetlands formally protected.	• 63 small wetlands have been drained since a survey of aerial photos in 1996. • 17 regionally significant wetlands have an increased level of legal protection than in 2001.
Adverse effects of land use activities on wetlands.	• Reduced loss of natural character of wetlands and their margins. • Avoidance of modification of natural character of regionally significant wetlands. • Enhancement and creation of wetlands.	• Condition of regionally significant wetlands. • Number of newly created or enhanced wetlands.	• An increased number of regionally significant wetlands have been fenced with additional planting. • Baseline monitoring of a selection of regionally significant wetlands has been undertaken. • Some landowners are creating or enhancing wetlands.
Adverse effects on the environment from uses of river and lake beds.	• Avoidance or mitigation of adverse effects on the environment from uses of river and lake beds. • Provision of fish passage past new and existing structures.	• Number of structures that are consented or providing adequate fish pass provisions.	• 49 structures need no further action regarding the provision of fish passage or monitoring. • Over the past six years, 12 structures have had works undertaken to improve fish passage.

Table 4.37: Current and historic extent of freshwater wetlands per region.

	Region	Current extent (ha)	% National extent	Historic extent (ha)	% left
North Island	Northland	14,114	5.7%	258,451	5.5
	Auckland	2,639	1.1	57,851	4.6
	Waikato	28,226	11.3	356,516	7.9
	Bay of Plenty	3,304	1.3	43,089	7.7
	Manawatu	6,983	2.8	264,511	2.6
	Taranaki	3,045	1.2	40,278	7.6
	Hawke's Bay	3,394	1.4	180,371	1.9
	Wellington	2, 774	1.1	122,804	2.3
	Total North Island	64,479	25.8	1,323,871	4.9
South Island	Tasman	5, 224	2.1	27,339	19.1
	Marlborough	1,545	0.6	12,785	12.1
	West Coast	84,396	33.8	358,182	23.6
	Canterbury	19,851	7.9	187,115	10.6
	Otago	27,050	10.8	110,804	24.4
	Southland	47,231	18.9	450,985	10.8
	Total South & Stewart Islands	185,297	74.2	1,147,209	16.3
TOTAL		249,776	100	2,471,080	10.1

Data from Ausseil et al, 2008.

4.4.3 HOW DO WE COMPARE?

The total historic extent of wetlands in New Zealand has recently been estimated to have been 2.4 million ha with the current extent of wetlands estimated to be 249,776 ha, or 10% of the former extent[78]. Wetland loss has been greatest in the North Island, which now retains only 4.9% of its historic extent, with loss being greatest in the Auckland, Coromandel, East Cape, Manawatu, Hawke's Bay, Northland and Wellington biogeographic regions. Wetland cover has survived best on the West Coast of the South Island, on Stewart Island and in the Otago region (Taieri, Clutha and Otago Peninsula). A comparison of wetland loss within regional council boundaries has been made (Table 4.37).

Trout fishing.

4.5 PUBLIC ACCESS TO FRESH WATER

4.5.1 WHAT IS THE STATE OF PUBLIC ACCESS TO WATERWAYS?

(A) RECREATIONAL USE OF FRESH WATER

There is a wide range of recreational uses of fresh water. These include traditionally popular forms of water-based recreation such as swimming, fishing, boating and aesthetic appreciation from walking, sitting or having picnics alongside waterways. Recreational use of these resources occurs alongside, and sometimes competes, with other users for water such as agriculture and industry, community water supplies, hydroelectric power generation, the port and other infrastructure development.

A water recreation survey was conducted over the 2007-08 summer period by the Taranaki Regional Council. The survey was undertaken to obtain up-to-date information on the recreational use of rivers, lakes and the coast in Taranaki, and the constraints if any for gaining access[79]. The last region-wide water recreation survey was conducted by the Council's predecessor – the Taranaki Catchment Commission as part of the Taranaki Ring Plain Water Resources Survey in 1984.

A postal questionnaire was conducted with Taranaki residents, to gain a broad indication of people's access to, and use of, water resources. Observation counts were made at selected locations of the total number of people present at each location and what activities were being undertaken.

Respondents were asked what activities they undertook while visiting identified river or lake sites. These are outlined in Table 4.38. Walking, swimming and relaxing are the most popular activities at beaches and rivers. Scenic appreciation and having picnics are also popular. At rivers, fishing and whitebaiting are popular activities. A higher percentage of people engage in passive recreation at lakes, but more people in the region go to lakes to boat and water ski rather than fish, jog or kayak.

Table 4.38: Main reasons for visiting river or lake sites Dec 2007-Dec 2008.

River activity	% of respondents	Lake activity	% of respondents
walk	47.4	walk	42.8
swim	46.4	relax	38.9
relax	40.3	scenic	28.3
scenic	24.6	swim	25.6
picnic	24.2	picnic	20.0
fish	15.6	watch	13.3
whitebait	14.7	drive	12.8
watch	9.5	boat	11.7
boat	8.5	waterski	9.4
camp	8.5	fish	8.3
drive	8.1	jog	8.3
jog	5.2	kayak	8.3
hunt	4.3	jetski	8.3
waterski	3.8	camp	7.8
raft	2.8	hunt	1.7
kayak	2.8		

78 Ausseil, A; Gerbeaux, P; Chadderton, L; Stephens, T; Brown, D and Leathwick, J. 2008. *Wetland Ecosystems of National Importance for Biodiversity: Criteria, methods and candidate list of nationally important inland wetlands.* Prepared by Landcare Research for the Department of Conservation.
79 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*

Table 4.39: Main activities observed at 10 freshwater/estuarine locations.

Location	On beach/ river bank	sea swim	river swim	fishing	sail craft	power craft	dogs	other	average total users
Audrey Gale Park	35		17				2	9	52
Burgess Park	48		3						49
Lake Ratapiko	28		12	3		7		6	46
Lake Māngamāhoe	33			1				7	36
Everett Park	16		13	1				5	25
Te Henui Stream	17		3		4		3	4	23
Meeting of the Waters	14		9						23
Lake Rotomanu	17		2			3		3	20
Waingongoro River	9	3	6	6				8	19
Lake Rotorangi	21		8			6		4	17
Urenui River	14	6	5			2		4	16
Waiwhakaiho Mouth	8		3	7				2	16
Stony River	5		5						10
Lake Opunake	4		4			1		1	7
Pātea River, Stratford	7			2			1	2	6
Wai-iti beach	4								5
Lake Rotokare	6								4

The study also observed recreational use at freshwater (and coastal) sites around Taranaki. Table 4.39 illustrates the different activities observed at each of these sites, although it needs to be noted that activities observed at the various lakes were likely to be influenced by the closure of Lake Rotokare for the majority of the summer, as well as Lake Ratapiko and Lake Rotomanu for periods of time due to high bacteria counts. Boaters commented there was a noticeable increase in the number of boats and jetskis on other lakes over the summer period.

Based on figures supplied by Fish and Game Taranaki, an estimated 1% of the Taranaki population hold whole-season trout fishing licences. A 2001-02 survey of angling activity carried out by Fish and Game Taranaki estimated over 6,300 total angler days for the season, which was likely to be below average. In the 1994-95 survey the number of angling days was estimated at over 8,400 visits.

Whitebaiting.

The New Plymouth Canoe and Kayak Club estimated they had approximately 60 active whitewater kayakers, and 80 active sea kayakers regularly frequenting the waterways and coast.

Whitebaiting (from 15th August – 30th November) is a popular activity in Taranaki enjoyed by a large cross-section of the community from young children to the retired. Retired people make up a large proportion of this group and can be very passionate whitebaiters. During the 2007 season it was estimated that at peak times there were more than 50 people on the Waiwhakaiho River alone, and peak counts on one day from the Mohakatino River estuary down to the Waitōtara River would have totalled in excess of 1,000 whitebaiters. Even small streams such as the Katikara, Timaru, and Te Henui had significant use with peak counts of somewhere between 5 and 20 people[80].

The recreational use survey[81], found 90% of respondents thought public access to such rivers and lakes was about right reflecting similar sentiments in a New Plymouth survey of New Plymouth residents[82].

(B) PUBLIC WALKWAYS

Public access to and along rivers and lakes is often provided for by way of public roads, esplanade strips, esplanade reserves and access strips.

The Department of Conservation in the Taranaki area is responsible for 300 km of actively managed track assets, of which a large number provide access to waterways. The tracks cater predominantly for the short stop travelers, day visitors and back country adventures. The track assets comprise 8 km of short walks, 2 km of barrier free short walks, 43 km of walking tracks, 25 km of easy tramping tracks and 222 km of tramping tracks.

80 Fish and Game and DOC officer, pers com.
81 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-08.*
82 New Plymouth District Council, 2008. *New Plymouth District Council CommunitrakTM Survey February 2008.*

Waingongoro River sign.

NO IDENTITY CRISES AT THESE STREAMS

Is that bridge spanning the Ngatoroiti Stream, or the Ngatoronui? The Mangamawhete or the Mangatengehu? With more than 300 named waterways running off Mount Taranaki and scores more flowing from the eastern hill country, there's plenty of scope for confusion.

But the four examples above, all on one rural road near Inglewood, are among 191 river and stream crossings named with Taranaki Regional Council signage.

The Council's stream signage programme began on the ring plain in 2002 and after its initial success it was expanded to sites further afield.

The programme serves a number of purposes beyond identifying waterways – as important as that can be to the perplexed traveller or temporarily confused local.

Besides the name of the waterway and the Taranaki Regional Council logo, each sign carries an unambiguous environmental message – "protect our streams". Signs at significant trout fisheries also carry a silhouette of an angler.

The latter locations are decided in consultation with Fish and Game Taranaki, whose field officer Allen Stancliff sees significant benefits in raising public awareness of not only trout fisheries but the environment in general.

"In a place like Wiremu Road, which crosses a lot of streams coming off the mountain, I don't think a lot of the landowners had a clear picture of which stream was which until the signs went in," he said. "The signs have done a lot to raise awareness of the different catchments."

He says that while local anglers are likely to already be aware of the good fishing spots, the signs denoting trout fisheries are a good guide for visitors. "And locals who aren't into fishing are made aware that they have a trout fishery in their area – so they know a little bit more about the environment they live in."

For the Council, the signs publicly highlight the fact that much of its core business lies in monitoring, protecting and enhancing freshwater quality – and the fact that the whole of Taranaki needs to play its part too.

Certain criteria must be met before signs are erected. These include:

- the river or stream is officially named (Taranaki has a large number of 'unnamed tributaries');
- the road has regional or district strategic importance;
- the river or stream has an important use or high environmental value; and
- the river or stream is not on a State Highway, where bridged waterways are generally sign-posted already.

Survey and maintenance of the stream signs were carried out in the summers of 2005-06 and 2007-08 and continue from time to time as necessary. The Council maintains an internal database for this purpose.

The three district councils in the region are also responsible for a number of walkways in the region many of which provide public access to Taranaki waterways. The New Plymouth, Stratford and South Taranaki district councils are responsible for a total of 23, 2 and 15 walkways respectively. Of these walkways, 20 are adjacent to rivers, streams and lakes in the region[83] (Figure 4.40).

Carrington Walkway, Stratford.

People are encouraged to access fresh water via the Stony (Hangatahua) River, the Huatoki and the Te Henui walkways, and the Carrington walkway along the Pātea River in Stratford.

It is also evident that substantial lengths of the major rivers in the inland hill country have road reserves adjacent to them[84].

Of the 10 major lakes (more than 8 ha in size) in the Taranaki region, four are either within reserves or have esplanade reserves along their shores. The region's largest lake, Lake Rotorangi, formed by the damming of the Pātea River for hydroelectric power generation, has a 200 ha esplanade reserve around its edge.

There are very few situations where public access to and along streams, rivers and lakes is restricted because of existing structures or operations that present a potential risk to public safety. In these cases alternative access can be provided.

83 Taranaki Regional Council, 2007. *Regional Walkways and Cycleways Strategy for Taranaki.*
84 Taranaki Regional Council, 1996. *State of the Environment, Taranaki Region 1996.*

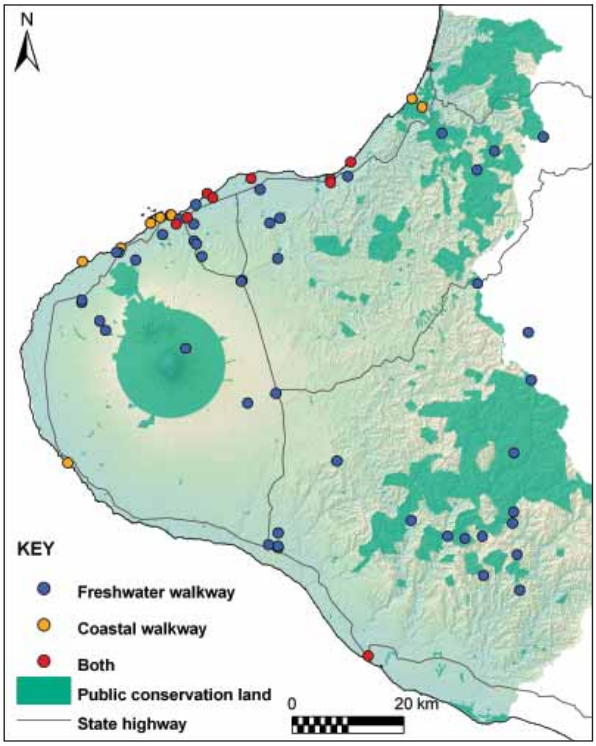


Figure 4.40: District council and Department of Conservation walkways that allow public access to or along rivers, streams, lakes or wetlands, or the coast.

The recreational use survey 2008[85], found only 10% of respondents had not been able to gain access to rivers, lakes or (parts of the coast) in Taranaki that they wanted to in the last year. The main reasons people could not gain access was because the access or entrance was closed, too difficult or too dangerous. Only 1% of respondents had been denied access by the landowner or occupier.

Approximately half of the beds of rivers, streams and lakes in Taranaki are in private ownership. This means that access to many rivers and lakes in the region occur largely through the goodwill and cooperation of landowners and often via the creation of esplanade strips and reserves. However, information on the number and location of esplanade reserves and strips that provide public access is limited.

(C) FORMAL PUBLIC ACCESS

Esplanade strips may be required by a rule in a district plan when land is subdivided or developed. Under the Resource Management Act, all subdivisions of allotments under 4 ha are required to have esplanade reserves of 20 m width created along the edges of any rivers and lakes or the coast. This requirement may be waived or modified, by either a rule in a district plan or a resource consent. There is no default requirement for an esplanade reserve when allotments over 4 ha are subdivided. However, requirements may result from a rule in a plan.

Esplanade reserves or strips can be used to provide public access to and along rivers and lakes, and therefore the number and extent of esplanade reserves and strips provide a useful indicator of the level of public access to and along rivers and lakes in the region[86].

The 1996 *State of the Environment Report* reported that 122 esplanade reserves and strips were created in the 13-year period between 1978 and 1991[87]. This was an average of 9.4 esplanade reserves for the region each year. Most were small and concentrated in urban and semi-urban areas.

The *2003 State of the Environment Report* reported that in the six-year period between 1996 and 2002, 113 esplanade reserves and strips were created in Taranaki covering 111.9 ha[88]. This equates to an average of 19 new esplanade reserves or strips each year and an average of 18.6 ha of improved access each year in Taranaki over the six-year period.

In the five-year period between 2003 and 2007, an additional 105 esplanade reserves and strips were created in Taranaki. This equated to an average of 21 new esplanade reserves and strips each year in Taranaki over that period.

The number of esplanade reserves and strips established per district in this period is summarised in Table 4.40.

Most esplanade reserves and strips established in Taranaki are adjacent to the region's priority rivers indentified by the district councils, including: the Waiwhakaiho River, Mangorei and Huatoki streams in the New Plymouth District; the Waingongoro River, Pātea River and Kahouri Stream in the Stratford District; and the Tawhiti and Punehu streams in the South Taranaki District.

(D) INFORMAL ACCESS

Informal public access (i.e. where access is over privately-owned land) is also an important part of providing access to fresh water in Taranaki, although access is reliant upon the goodwill of adjacent landowners. Generally most private landowners are happy to allow people to cross their land as long as property rights are respected and permission is sought first. Fish and Game Taranaki has produced a pamphlet showing access points to popular fishing spots in the region. This information highlights the importance of getting landowner permission to cross private land.

Table 4.40: Number and area of esplanade reserves and strips created between 2002 and 2007.

District	Number of new esplanade strips and reserves created	Area of new esplanade strips and reserves (ha) created
New Plymouth District	94	87.2
Stratford District	1	1.2
South Taranaki District	10	N/A
Totals	**105**	**N/A**

Data: Supplied by the district councils. Information on the area of the esplanade strips and reserves is not readily available from the South Taranaki District Council.

85 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*
86 Barrett Fuller and Partners, February 1992. *Esplanade Reserves: The implications of the Resource Management Act for the Taranaki region.* Prepared for Taranaki Regional Council, New Plymouth District Council, Stratford District Council, South Taranaki District Council.
87 Taranaki Regional Council, 1996. *State of the Environment, Taranaki Region 1996.*
88 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region.*

Planting day, Herekawe Walkway, New Plymouth.

EFFECTIVE PARTNERSHIP WALKS THE TALK

The Herekawe Walkway project in New Plymouth demonstrates the value of effective partnerships in improving both amenity values and environmental wellbeing.

In a combined effort involving the community, corporates and councils, an all-weather walkway has been formed along the Herekawe Stream from suburban Spotswood to Back Beach. The stream has been cleared of willows and weeds and bridged at two points, the quality of its waters is being protected and enhanced with 10,000 new streamside plants, and 1,500 m of new riparian fencing keeps stock out.

The project grew out of an initiative in 2003 by major industries operating in the Herekawe catchment – Dow AgroChemicals, Methanex and Shell Todd Oil Services – and the partnership has grown to include contractor AJ Cowley, which has donated land, and the Taranaki Regional Council, the New Plymouth District Council, the Taranaki Tree Trust and other groups.

Breadth is a feature of the partnership – for example, Motorua Primary School and New Plymouth Prison are among those to have provided plants for the project, which has also involved Conservation Corps and Community Service workers.

Most importantly though, enthusiastic public support has been evident on planting days and the project has the warm blessing of Ngāti Te Whiti hapū.

"It's a perfect example of people coming together with a single goal," said the Taranaki Tree Trust Chairman, Donald McIntyre.

Environmentally, the streamside planting will do much to enhance water quality, by filtering run-off, moderating peak flows, keeping water temperatures lower and promoting biodiversity.

Besides the amenity benefit of a clean and healthy stream, the walkway also offers locals an attractive and health-promoting "pathway to the sea" and a direct link to a potential future extension to New Plymouth's popular coastal walkway.

The project's amenity value is already recognised by real estate marketers, with "proximity to the Herekawe Walkway" noted in advertisements for houses being sold in the nearby area.

4.5.2 HOW IS PUBLIC ACCESS TO FRESH WATER MANAGED?

(A) REGIONAL POLICIES AND PLANS

The maintenance and enhancement of public access to and along rivers and lakes are matters of national importance under the Resource Management Act 1991.

The Regional Council has limited powers to provide public access to and along streams, rivers and lake beds where the adjoining land and riverbed are privately-owned. However, the *Proposed* and *Operative Regional Policy Statement for Taranaki* and the *Regional Fresh Water Plan for Taranaki* contain policies encouraging district councils to provide for public access in district plans, including the creation of esplanade reserves and strips. The plans contain objectives, policies and methods to maintain and enhance public access to streams, rivers and lakes. The *Regional Fresh Water Plan* also contains a list of rivers and streams (Appendix IA) for which access arrangements are desirable and appropriate because of their natural, ecological and amenity values.

(B) DISTRICT COUNCILS

All district plans in Taranaki provide for the creation of esplanade reserves and strips to ensure that public access to and along the region's most important streams, rivers and lakes can be maintained and enhanced. Each district plan also retains discretion for councils to be able to waiver a requirement.

The *New Plymouth District Plan* identifies "preferred esplanade reserves and strips" and "priority waterbodies", these are areas of land that would link existing public access and to which the enhancement of public access is desirable. These areas require an esplanade reserve or strip to be set aside at the time of subdivision and development.

The *Stratford District Plan* provides for the creation of esplanade reserves (upon subdivision) and esplanade strips (as a condition of any land use consent) on land adjoining priority ring plain river catchments. These are in areas of more intensive land use.

The *South Taranaki District Plan* has a schedule of priority rivers for protection via esplanade reserves and strips at the time of subdivision and development.

In addition, district councils also maintain roads, tracks, paths, reserves and walkways that provide public access to and along fresh water, e.g. Carrington walkway in Stratford, Huatoki and Te Henui walkways in New Plymouth.

(C) REGIONAL WALKWAYS AND CYCLEWAYS STRATEGY

A *Regional Walkways and Cycleways Strategy for Taranaki* has been developed to promote walking and cycling activities in the region, including access to fresh water[89]. The strategy lists current and potential routes that together would make up a network offering pedestrian and cycle access to the region's natural attractions, as well as population centres. The strategy aims to recognise and promote the leisure, recreational, commuter and tourism opportunities provided by walking and cycling.

(D) INFORMATION, EDUCATION AND ADVICE

Regional and district councils provide information and technical advice relating to the provision of public access when requested.

(E) WALKING ACCESS COMMISSION

Central Government is also investigating options for establishing a New Zealand Walking Access Commission to lead and co-ordinate the provision of public access to the outdoors especially around the coast, and lakes, and along rivers. The Commission's responsibilities would include the provision of information about the location of existing public access, the provision of a code of responsible conduct for the guidance of the public and landholders in respect of recreational access to the outdoors, and the facilitation and funding of negotiations for new public access across private land. The implications of these activities for the Taranaki region will be assessed in due course once the Commission commences operation.

(F) SUMMARY OF PROGRESSS

Progress in implementing regional objectives and policies on public access to rivers and lakes is summarised in Table 4.41.

4.5.3 HOW DO WE COMPARE?

New Zealanders have traditionally enjoyed good access to and along rivers and lakes throughout the country. The concept of the 'Queen's Chain' (introduced to New Zealand in 1841) was designed to protect in perpetuity, a 100-foot wide strip of public land alongside waterways. However, the Queen's Chain does not exist beside all water bodies because an increasing amount of land since the 1840s has become privately-owned. While it is often assumed that there is a right of public access to such areas for recreation and for cultural and spiritual purposes, this is not always the case, and is an issue encountered throughout New Zealand.

Table 4.41: Summary of Progress with regional objectives and policies relating to public access.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Maintaining and enhancing public access to and along rivers and lakes	• Increased formal public access to and along rivers and lakes. • Avoidance, remedy or mitigation of adverse effects that may arise from public access to and along rivers and lakes.	• The current and *Proposed Regional Policy Statement*, Regional plans and District plans contain provisions providing for public access. • The *Regional Walkways* and *Cycleways Strategy for Taranaki* was prepared in 2007 -to enhance public access to and along rivers and lake margins and to increase awareness of walkways in the region. • Advocating, when appropriate, for the establishment of public access to and along rivers, stream and lakes. • Providing information and technical assistance to those wishing to carry out activities to enhance public access to and along rivers and lakes.	• 105 new esplanade reserves and strips established between 2002-2007. • On average 21 new esplanade reserves and strips established each year over the five-year period, 2002-2007. • No major constraints on public access have been highlighted in the past five years.

89 Taranaki Regional Council. 2007. *Regional Walkways and Cycleways Strategy for Taranaki.*

CHAPTER 5

COASTAL AND MARINE ENVIRONMENT

Photo: Rob Tucker

COASTAL WATER QUALITY

The high standard of water quality is principally a product of the region's exposed coastal environment, although there have been significant investments in improving discharges to the coast. The Taranaki Regional Council monitors marine ecology, beach bathing water quality and compliance with resource consent conditions. In summary:

- Taranaki's coastal water quality for swimming is excellent, with most popular bathing beaches complying with national bathing standards;
- rocky shore ecological health is reasonably stable at most sites monitored, sand inundation reduces rocky shore species diversity, but this returns to normal once the sand moves on;
- 43 consents are held for discharges to the coast, but there are now only six major community or industrial treated wastewater discharges direct to coastal waters, compared to some 25 major discharges 30 years ago;
- compliance monitoring shows that significant improvements continue to be made in terms of waste treatment and disposal systems; and
- the main influence on coastal water quality is now rivers and streams discharging to the sea, carrying with them the cumulative effects of land uses within their catchments. This is most noticeable from catchments draining the more erodible hill country rivers.

The Council's *Regional Coastal Plan*, (made operative in 1997) contains policies and methods to protect the high water quality of the Taranaki coast.

NATURAL CHARACTER

The rugged nature of the Taranaki coastal environment means much of the coastal area has retained its distinct natural character. Features that contribute to this natural character include natural coastal processes, marine life and ecosystems, coastal landscapes and seascapes, surf breaks, areas of natural vegetation, open space and farmland. Taranaki has an active, high-energy coastline with natural erosion occurring at numerous points. In relation to natural character:

- since the *Regional Coastal Plan* became operative, 238 coastal consents have been granted, reviewed or varied for activities in the coastal marine area; 96 new consents have been granted since 2003;
- most coastal permits are for coastal protection works and stormwater structures, followed by foreshore disturbance and discharges;
- an estimated 11.6 km of seawall have been built to protect the region from coastal erosion; about 2 km of this have been over the last five years;
- activities authorised by resource consent generally have negligible effects on the natural character of the coast; and
- foredune restoration works and sand dumping trials have been conducted to restore natural character to parts of the coast.

The Council's *Regional Coastal Plan* contains policies and methods to protect the natural character of the coastal marine area, and district plans contain policies and methods to protect the natural character of the landward section of the coastal environment.

BIODIVERSITY

The steep cliffs, rocky shores, sandy beaches, subtidal reefs, river mouths and estuaries along the Taranaki coast provide a wide range of ecological habitats for native plant and animal species. Coastal biodiversity is influenced by currents, the high-energy coast and the nature of the ocean floor substrates. Since the last state of the environment report, 3,248 ha have been fully protected in two marine reserves. Monitoring of coastal and marine biodiversity is undertaken by Taranaki Regional Council (estuaries and rocky shore communities), the Department of Conservation (marine protected areas and threatened marine mammals), the Ministry of Fisheries (fish stocks) and the Ornithological Society (birds). In summary:

- ecological conditions in both the Tongaporutu and Waitōtara estuaries are generally stable although they can be affected by severe floods;
- more than 70 different bird species use the monitored estuaries;
- the legally protected subtidal habitats around the Sugar Loaf Islands (Ngā Motu) provide shelter for a greater diversity and higher numbers of fish and other organisms than neighbouring areas of reef;
- extensive reef ledges in North Taranaki support a highly diverse collection of rare and exotic sponges now protected from human activities under a marine reserve;
- there is a range of disparate views on trends in local fish stocks, and quality of recreational fishing;
- a number of threatened marine animals are observed in Taranaki waters, including great white sharks, orcas, humpback whales, southern right whales, and Māui's dolphins; and
- reclusive beaked whales have been washed up on Taranaki beaches, enabling scientists to study them.

Coastal and marine biodiversity is managed by a number of agencies operating under various pieces of legislation. It is safeguarded through the *Regional Coastal Plan*, the fisheries quota management system, and through the setting aside of marine reserves or marine protected areas.

PUBLIC ACCESS

The Taranaki coastal environment offers an extensive and important recreational resource for fishing, diving, swimming, surfing, windsurfing, walking, and boating. Generally, the public has very good access to most parts of the coast in Taranaki. A recent inventory of sites of local or regional significance found that:

- 58% had excellent to good public access;
- some sites are physically difficult to access due to high tides or eroding cliffs;
- public roads provide the greatest degree of public access to the coast;
- subdivision offers opportunity for public access to be increased through the provision of esplanade reserves of strips; and
- the biggest constraint to public access is lack of signs or formed roads, and the difficulty of distinguishing between public and private access.

Public access to the coast is primarily protected through district plans. A *Regional Walkways and Cycleways Strategy* has been developed to promote walking and cycling opportunities, including access to the coast, which are best illustrated by the success of the award-winning New Plymouth coastal walkway.

Taranaki's western coastline with Cape Egmont in the distance.

OUR COASTAL AND MARINE ENVIRONMENT

The Taranaki region has a long coastline with rocky shores and cliffs, sandy beaches, subtidal reefs, river mouths and estuaries. Taranaki people value the landscape, natural character and recreational amenity values of the coast. Protecting coastal water quality, the natural character of the coast and biodiversity are all considered to be very important[1].

Fitzroy Beach, Ngāmotu Beach, Opunake Beach and the New Plymouth coastal walkway are the most frequently visited coastal locations in the region. Also popular for recreation are East End, Urenui and Ōnaero Beaches. Walking, swimming and relaxing are the most popular activities undertaken at the coast[2]. The South Taranaki-Whanganui coastline is considered by locals there to be a special area for many reasons, valued for its ruggedness, remoteness, beauty, peace, unspoilt nature and the ability to catch a wide range of fish[3].

Taranaki's coast is particularly significant for local iwi and hapū as kaitiaki or guardians of the coast. Tangata whenua are particularly concerned that kaimoana (seafood) is protected and that their cultural and spiritual values associated with the coast are maintained. These feelings are captured in the case study on the *Mana Whenua Mana Moana* project.

The generally excellent coastal water quality found in Taranaki is the combined result of few point source discharges to the coastal marine area, improvements in waste treatment and disposal options and an exposed coastline with currents and high-energy waves. The number of coastal point source discharges in Taranaki has decreased over the past 30 years from some 25 major dairy factory and industrial and municipal discharges in 1975 to just six major point source discharges today (Figure 5.1).

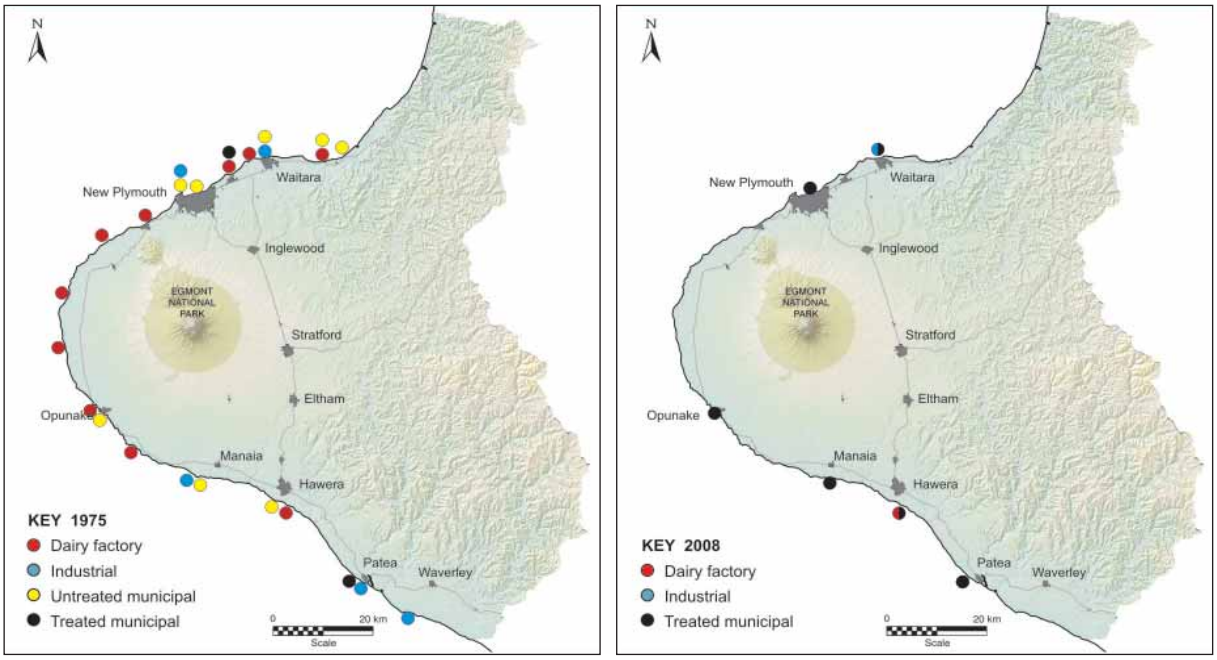


Figure 5.1: Major point source discharges to the coast in 1975 compared to today, (excluding stormwater and dredging activities).

1 Community Outcomes project Team, 2004. *Future Taranaki: A report on community outcomes.*
2 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*
3 Rush, M. 2006. *Netting Coastal Knowledge: A report into what is known about the South Taranaki-Whanganui marine area.* Published by the Department of Conservation.

Furthermore, improved quality of the few remaining direct discharges is resulting in less pressure on coastal water quality overall.

The main influence now on coastal water quality is rivers and streams that discharge to the sea, carrying with them the cumulative effects of activities within their catchments, including natural erosion materials, urban stormwater run-off, suspended sediments and agricultural and industrial wastes. Inland hillcountry rivers drain sandstone, siltstone and mudstone catchments, and discharge a naturally high load of suspended solids into coastal waters. The effects on coastal water quality are most noticeable after significant rainfall. The short, steep ring plain rivers, particularly those draining eroding headwater catchments, transport considerable amounts of sediment in the form of sand, rocks and boulders to the coast.

Taranaki's natural character is made up of coastal processes, coastal landscapes and seascapes including surfbreaks. Most stretches of the coastline are untouched by significant developments, although there is increasing pressure on coastal areas from urban development and subdivision which also have an expectation for protection from coastal erosion, invariably through protection structures such as sea walls. Industrial development (particularly oil and gas exploration) has also increased in the region over recent years.

Biodiversity of the coastal and marine environment is an integral part of the coast's natural character and is highly dependent on natural processes (e.g. sand movement is critical for sand dune ecosystems and the organisms found in them). Water quality and the nature of substrate play important roles in the maintenance of marine biodiversity. For example, seaweeds which are important nursery areas for fish, grow best where there is clear water.

Management of the coast is under the jurisdiction of numerous agencies and legislation. There are 20 agencies with policy and operational functions relating to the management of the ocean. The key agencies are the Ministry of Fisheries, the Department of Conservation, the Ministry for the Environment, the Ministry of Transport, Maritime New Zealand, regional councils, the National Marine Co-ordination Centre and the Ministry of Economic Development. The district councils manage land use on the landward side of the sea, regional councils prepare coastal plans containing objectives, policies and rules governing activities from the mean high water spring out to 12 nautical miles, the Department of Conservation acts under legislation relating to marine reserves and marine mammals and the Ministry for Fisheries manages fish stocks and fishing (Figure 5.2).

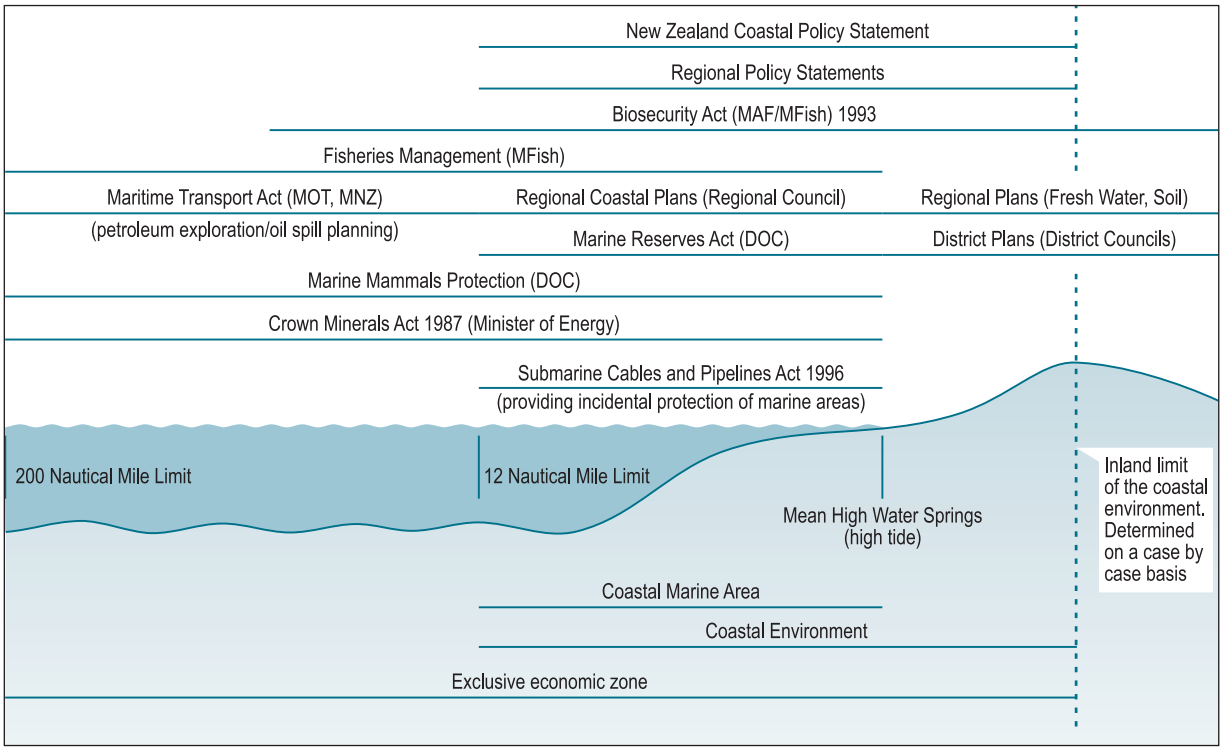


Figure 5.2: Some of the jurisdictional boundaries in the management of the coastal marine area.

The North Taranaki coastline has a rich cultural history and is a source of kaimoana.

PEOPLE OF THE SEA[4]

Beware the taniwha named Rangitotohu who protects the Taranaki coastline! He snatches passers-by and draws them into his cave if they violate rāhui (temporary restrictions) or are disrespectful when fishing or gathering kaimoana.

That is just one of the fascinating stories woven into a recent report prepared by representatives of tangata whenua of the New Plymouth District[5]. *Mana Whenua Mana Moana* describes issues, opportunities and history of the relationship of iwi with the coast as part of the New Plymouth District Council's Coastal Strategy.

Developed by the Mana Whenua Reference Group, a group of representatives from iwi and hapū around the New Plymouth coastline, the report outlines issues and opportunities within the coastal environment that impact on the protection, enhancement and management of mana whenua aspirations and cultural values. It describes the history of mana whenua through stories about specific coastal areas.

A cornerstone of the report is a practical description of the concept of kaitiakitanga. Kaitiakitanga was traditionally the obligation and responsibility of tangata whenua to be protectors and caretakers of natural resources, including putting in place such protection methods as rāhui. Today, kaitiakitanga is the responsibility to advocate and practice sustainable development. Members of the group believe that the mistakes of the past pertaining to environmental management will not be repeated if the implementation of kaitiakitanga practices becomes the basis for future sustainable management alongside existing management practices.

And there have certainly been some issues in managing the natural values of the coast in the past.

In 1881 Port Taranaki was constructed close to the Ngā Motu islands. Rock from Paritūtū was blasted away and used for the construction of the port. The shape of Moturoa was altered in the 1920s when the port authority carried out major quarrying. Extensive land reclamation around the port for the construction of the power station and Ngā Motu beach led to the destruction of mussel and pāua reefs and the original beach was drastically altered.

In the 1980s, the Waitangi Tribunal released the Motunui-Waitara Report. The claim was based on the failure of the Crown to properly control discharge of sewage and industrial waste into the sea between New Plymouth and Waitara which adversely affected fishing grounds and caused irreversible damage to a larger area of seabed on which the iwi relied on for food. As a result of this claim, the land-based treatment plant we have today was installed, protecting the coast from pollution.

The coast has always provided an abundance of kaimoana and this has important cultural value. Feeding guests, and ensuring that they don't go hungry, is one thing, but impressing visitors with an abundance of traditional foods is a symbol of tribal mana and standing.

In North Taranaki, an important feature is the high papa rock cliffs. Several iwi perfected a risky fishing technique for catching makō, snapper and trevally off the ledges hewn out by nature at the bottom of these cliffs. Other sites along the coast have significance to iwi as pātiki (flounder) and tāmure (snapper) breeding grounds, while the reefs have provided iwi with a consistant supply of food resources since time immemorial: pāua, kina, mussels, cats eye, crabs, pipi and many other species.

Coastal sites are not only significant for food gathering, but also for the rich cultural history of the area – battle sites, burial sites and areas that formed part of a complex defence network for battles both before and after Europeans arrived in Taranaki.

Understanding the importance of coastal sites is the first step towards achieving the vision of the report: A cherished environment which through kaitiakitanga, embraces, preserves, protects and enhances the spiritual, cultural and physical values to retain the natural rhythm of river, sea and coastland for future generations.

The first step is for the concept of kaitiakitanga to be understood, valued and supported by local government and the wider community.

If we all work in partnership to look after the coast, we might be able to achieve all of that, as well as keep the taniwha happy.

4 Tom Hunt and Jack Knuckey were kaitiaki involved in this project whose passing is acknowledged.
5 Mana Whenua Reference Group, 2006. *Mana Whenua Mana Moana*. Position paper prepared by the Mana Whenua Reference Group. Kaitiaki o Ngāti Tama, Ngāti Mutunga, Te Ātiawa, Ngā Mahanga-a-Tairi for the New Plymouth Coastal Strategy.

Windswept coastal environment.

5.1 COASTAL WATER QUALITY

5.1.1 WHAT IS THE STATE OF TARANAKI'S COASTAL WATER?

Taranaki coastal water quality is influenced by the exposed coast, high-energy wave environment, numerous discharges from rivers as they enter the sea, and a few direct discharges from point sources.

(A) INDICATORS

Indicators used to assess the ecological health and water quality of Taranaki's coastal water include the diversity of rocky shore invertebrates, levels of bacterial contamination (important for assessing beach bathing water quality), distribution of kelp (which requires both the appropriate substrate type and water quality) and levels of bacteria in shellfish tissue.

The diversity of rocky shore invertebrates is an indicator of rocky shore ecological health, however the composition of these communities is determined by more than just water quality: the high-energy nature of the Taranaki coast, abrasive and turbulent shoreline conditions, high water turbidity, suspended silt, sand inundation, nature of the substrate, and proximity to large rivers, all influence the make up of rocky shore communities.

Nutrients or sediment levels are not monitored in coastal or estuarine waters.

Intertidal survey of Kawaroa reef, New Plymouth.

(B) ROCKY SHORE MARINE ECOLOGICAL QUALITY

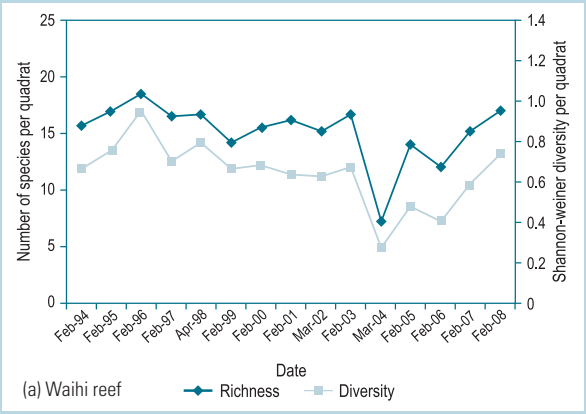
Rocky shore sites around the Taranaki coastline are monitored twice a year for state of the environment monitoring (Figure 5.3). A number of other reef sites are included in compliance monitoring programmes.

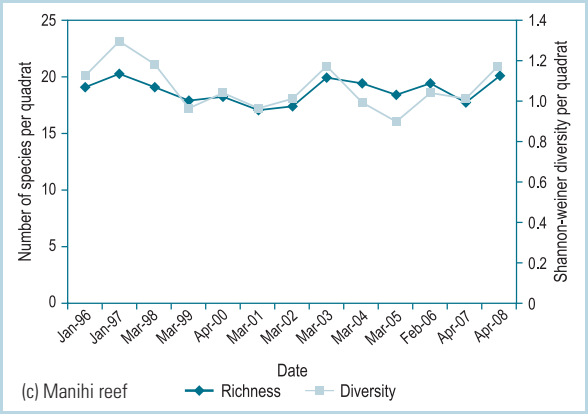
The ecological health indices used are species richness (the number of species recorded) and the Shannon-Weiner index (a measure of diversity that incorporates both the number of species and their relative densities). Results from monitoring of these sites over a number of years show only minor variations in ecological health over time (Figure 5.4). Large and sudden dips in species diversity, such as occurred at Waihi in March 2004, at the Mangati site in 2007 and at Orapa B in 2002 were all attributed to natural sand inundation. Interestingly, species diversity at each of these sites was quickly restored when the sand moved on.

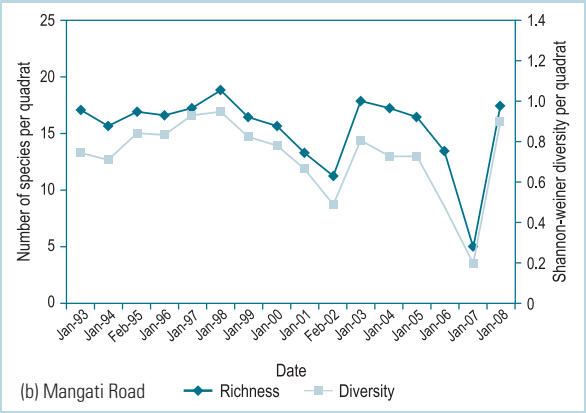
The Waihi Reef site in South Taranaki has generally had a lower level of diversity compared with the other control sites along the North Taranaki coastline. The South Taranaki coastline may have a relatively lower level of diversity than further north because of higher levels of wave exposure and possibly higher levels of cliff erosion depositing fine sediments on the reefs. In general, both the Greenwood and Manihi Road sites have the highest numbers of species and levels of diversity.

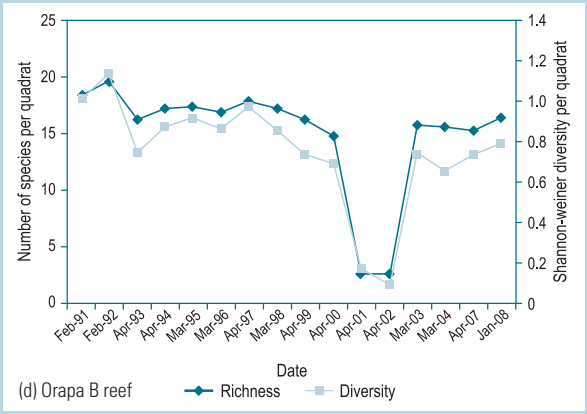
Long-term trend analysis was undertaken on data collected at each site (between 13 and 30 surveys). The results mostly indicated no significant long-term trends for either species richness or diversity. However, summer diversity at Turangi Road, and summer and spring diversity at Orapa B showed significant negative trends, even when the samples affected by sand inundation were removed from the analysis[6]. Reasons for these trends are unknown, and may have been largely due to some higher species numbers recorded in the late 1990s, which may in turn have been the result of settled weather patterns.

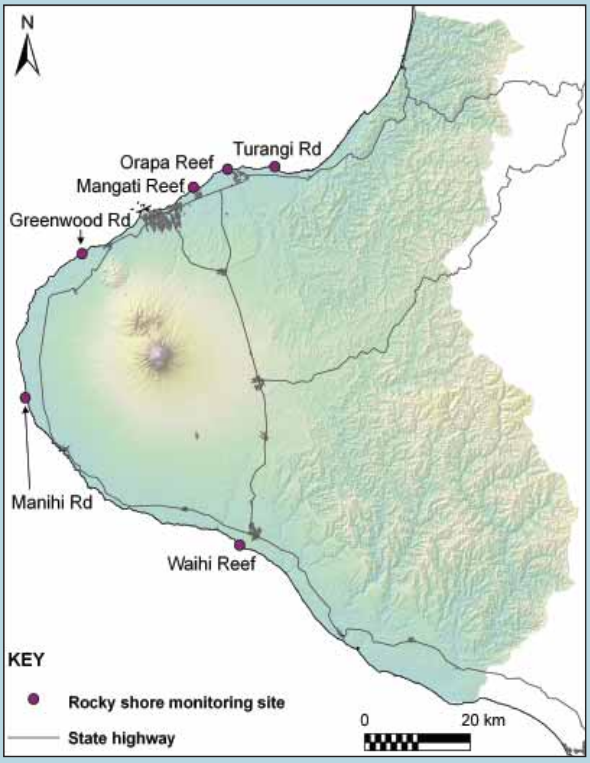
6 Taranaki Regional Council, 2008. *State of the Environment Monitoring Hard-shore and Soft-shore Marine Ecological Programmes 2007-2008.* Technical Report 08-07.

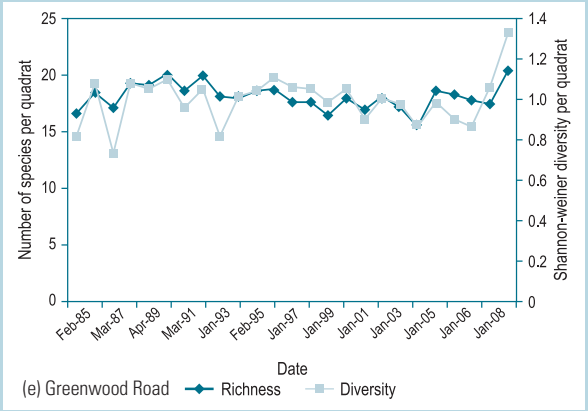












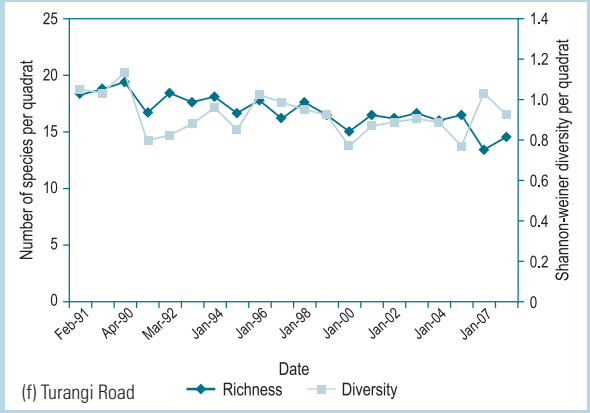


Figure 5.3: Rocky shore state of the environment monitoring sites and results.

Fitzroy Beach, New Plymouth.

(C) BEACH BATHING WATER QUALITY

Water quality for swimming has been monitored at popular swimming beaches since 1995. Water quality of bathing beaches is assessed against the national marine bathing guidelines[7]. The guidelines use the bacterial concentration of enterococci as a measure of the risk of water users contracting gastrointestinal and respiratory illnesses. Enterococci are faecal bacteria which indicate the possible presence of disease-causing organisms. Following the monitoring, the water quality at each beach is categorised into one of three categories: 'Acceptable' (safe), 'Alert' (potentially unsafe) or 'Action' (likely to be unsafe). Results are posted for the public on the Taranaki Regional Council website (www.trc.govt.nz) as soon as they become available. Immediate action is taken when water quality guidelines are exceeded to ascertain the cause and to notify the appropriate health authority.

Seven popular beaches are monitored every year (Figure 5.5). An additional 10 beaches are monitored every third year on a rotational basis[8]. The beaches included in the Council's monitoring programme featured among the most popular for recreational activities in the recent survey of recreational use of the coast[9].

The frequency of samples falling within the guideline categories is illustrated for each of the seven sites for the past six summers in Figure 5.4. To determine if coastal water meets the national guidelines, at least 20 samples must be collected during the bathing season, in any weather. The Council's state of the environment programme, on the other hand, collects only 13 samples per year, and does not sample within three days of high river flows. Therefore the Council collects a further seven all-weather samples at the four most popular bathing sites. The graphs of these four beaches have a total of 20 samples, while the other three beaches have only had 13 samples taken each year.

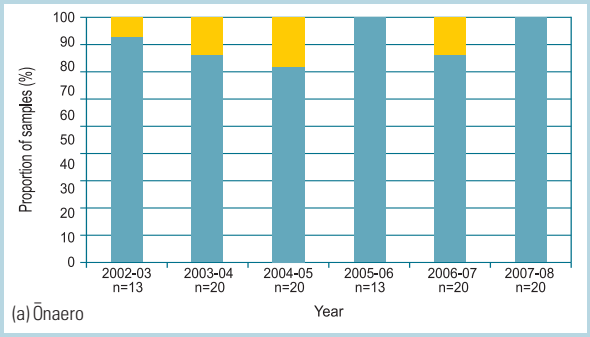
The high quality of Taranaki's coastal water quality can be gauged by the vast majority of samples for most of the sites tending to fall within the safe swimming guidelines. Over the past six years, 100% of the samples collected from Opunake Beach met the safe bathing water guidelines.

The only beach to have ever had samples in the action category was Ōhawe. Sites that have on occasions exceeded the safe swimming guidelines tend to be close to rivers (which carry faecal matter from the land down to the coast). For example, the site at Ōākura Beach at the surf club exceeds the safe swimming guidelines more often than the site a few hundred metres south at the campground. This is because the Waimoku Stream (a stream which frequently exceeds the freshwater safe swimming guidelines largely due to birdlife) discharges to the south of the surf club and the prevailing south-west flow brings bacteria to this monitoring site.

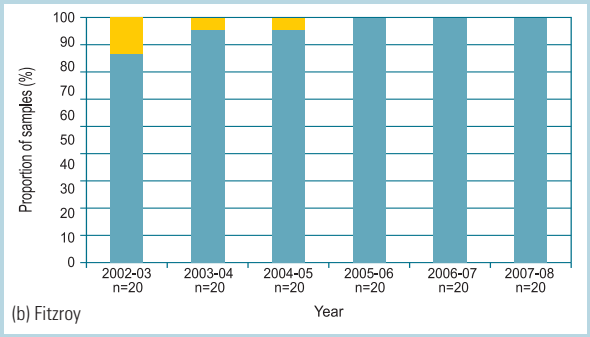
Coastal beaches generally have lower background levels of bacteria than river or lake swimming spots. This is largely due to contaminants being more rapidly diluted and dispersed by currents and the large volumes of water at the coast[10].

Several factors may cause variations in coastal water quality from year to year. The proportion of all samples taken each summer that meet beach bathing guidelines is illustrated in Figure 5.6. During wet summers, more faecal matter is carried from the land into rivers and streams and out to the coast. The Council's monitoring programme has been designed to avoid these effects by not sampling within three days of high river flows and so the results are more conservative than if sampling was random.

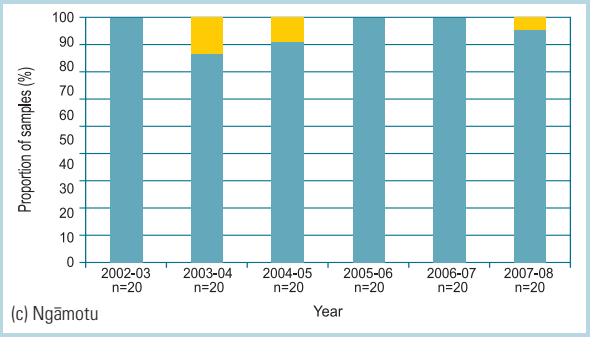
7 Ministry for the Environment and Ministry of Health, 2003. *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas.*
8 Taranaki Regional Council, 1998, 2000, 2007, 2008. *Bathing Beach Water Quality State of the Environment Monitoring Report.* Technical Reports 90-09, 00-03, 07-13. 07-17, 07-18, 07-19, 07-20, 08-01
9 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-08.*
10 Ministry for the Environment. 2007. *Environment New Zealand 2007.*



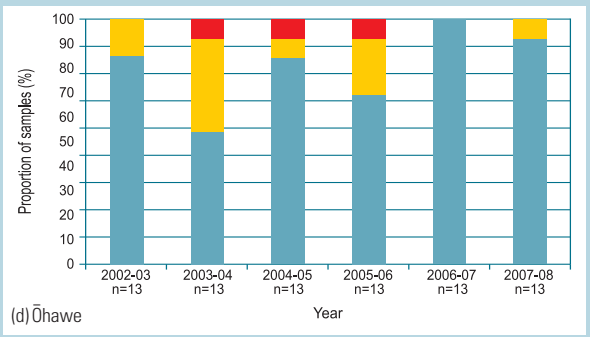
(a) Ōnaero



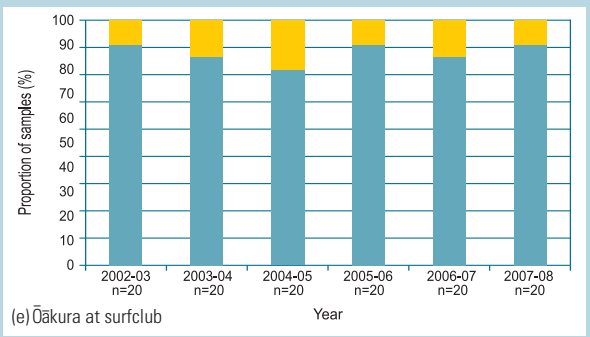
(b) Fitzroy



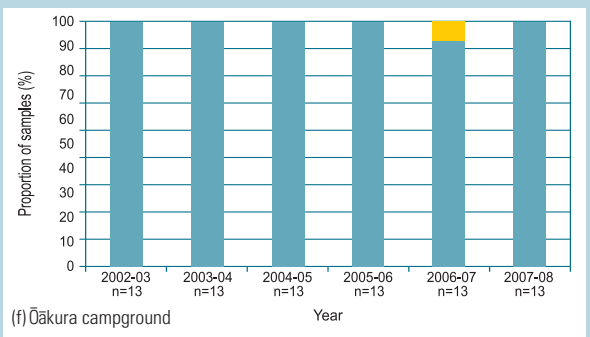
(c) Ngāmotu



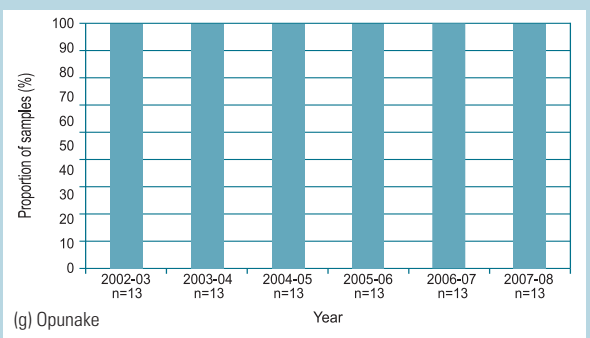
(d) Ōhawe



(e) Ōākura at surfclub



(f) Ōākura campground



(g) Opunake

Acceptable (<140 enterocci/100ml) Alert (141-280 enterocci/100ml)
Action (2 consecutive samples >280 enterocci/100ml)

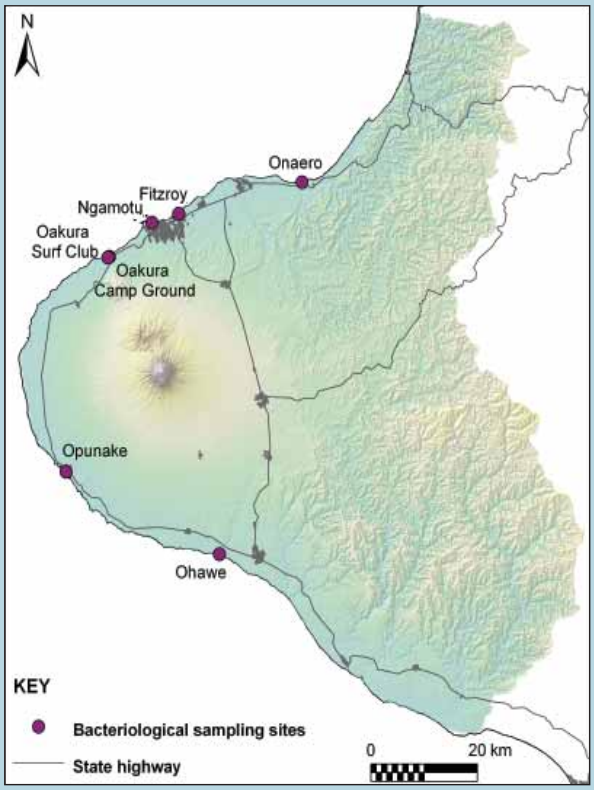


Figure 5.4: Beaches monitored for bathing water quality and results for the past six summers.

Table 5.1: Annual seasonal medians at the seven most popular Taranaki beaches (enterococci/100ml) for the past five years.

Site	Ōnaero	Fitzroy	Ngāmotu	Ōākura surfclub	Ōākura camp	Opunake	Ōhawe
2003-04	5	3	5	8	3	1	29
2004-05	15	4	14	25	6	1	23
2005-06	4	6	13	12	1	2	13
2006-07	7	3	12	11	3	1	7
2007-08	4	3	4	32	1	1	5

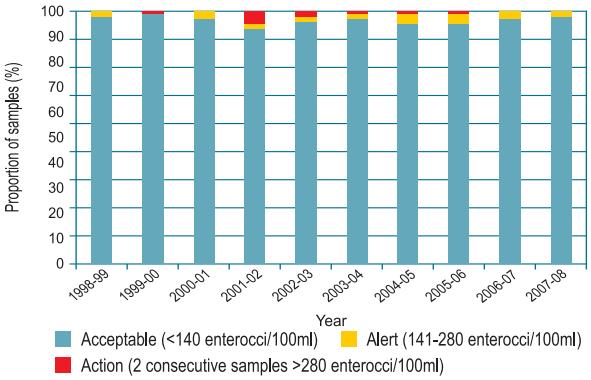


Figure 5.5: Proportion of all samples collected each year meeting guidelines.

While it is the frequency of individual samples that is most important in terms of measuring compliance with guidelines, the median (or middle) value provides an indication of the absolute levels of bacterial contamination. Table 5.1 summarises the results of monitoring bacteria levels at the seven most popular Taranaki beaches using just the 13 samples collected as part of the Council's state of the environment monitoring programme. This illustrates that the seasonal median for all seven beaches was very low, particularly for Opunake, Ōākura campground and Fitzroy.

Looking at the data over time, the good news is that no sites show a measurable deterioration in water quality. Fitzroy Beach, one of the region's most popular, showed a statistically significant improvement, although this trend is not that meaningful as water quality is already high.

Three Taranaki beaches, Ōākura, East End and Fitzroy, gained and held Blue Flag accreditation for the summer period. This is an internationally recognised award for beaches that meet the four criteria of high standards for water quality, environmental education and information, environmental management and safety and services. These were the first beaches in Australasia to obtain Blue Flag accreditation.

(D) COASTAL WATER QUALITY

Coastal water quality is highly influenced by the nature of water entering the coastal area through rivers. Rivers towards the north and south of the region are more sediment-laden as a consequence of draining more erodible catchments. A recent research project[11] was undertaken on the ecology of the sea floor around North Taranaki with a specific focus on the distribution of the brown kelp, *Ecklonia radiata* (see case study). The physical environmental factors quantified by the study included substrate, habitat complexity, wave energy, water turbidity and depth. These parameters were used to describe geographic trends and to investigate why *Ecklonia* was distributed where it was.

The research concluded that water turbidity is the primary factor that defines the *Ecklonia* distribution in Taranaki, although the wave energy and habitat complexity (such as the nature of the substrate) of the reef were also influential. *Ecklonia* was more abundant around Cape Egmont, with density and abundance decreasing along the coast towards Motunui in the north-east. The research found that wave action has the potential to limit the size and abundance of *Ecklonia* in shallow waters, but that water turbidity, or clarity, reduces the depth range that the kelp can occupy. The direct effect of fine sediments from rivers was thought to be the main limiting factor for kelp colonisation on the north-eastern reefs, particularly near the Waitara River.

One of Taranaki's renowned surf breaks.

Timaru Stream estuary.

11 Crofskey, E. 2007. *The Distribution of Ecklonia radiata Around the North Taranaki Headland and its Relationship with Key Physical Characteristics.* University of Auckland, MSc thesis.

Surveying the sea floor.

EMMA GETS HELP WITH THE KELP

If it takes a village to raise a child, it takes a region to raise a marine scientist.

When Inglewood-raised, Fitzroy surf lifesaver Emma Crofskey came to choose a research project in 2006 for her University of Auckland master's degree in marine science, there was no question where it would be – off the coast of Taranaki.

"I love the coast and the Taranaki coastline is so rugged and beautiful, it was a great excuse to get out there and explore it in more detail," she said.

And her home region embraced and supported its daughter. The local office of the Department of Conservation offered her a summer job, the use of a boat and skipper and a specially designed camera she could use for her study of kelp distribution along 60 km of the North Taranaki coastline.

Also weighing in with support were the George Mason Trust, the Taranaki Regional Council and marine consultancy ASR Limited.

The study involved dropping the 2 kg camera over the side of the boat almost 1,000 times, with Emma using a video recorder to intensively study the images she captured. "The project involved many hours out on the water, which was really enjoyable," she said. "The only frustration was having to wait for long periods when the weather wasn't suitable."

Emma said that the kelp is a good indicator of the state of the undersea reefs along the coast. "The more we know about the sea, the better the decisions we can make to safeguard it," she said.

The highest densities of kelp plants were found around Cape Egmont, although there weren't the vast kelp beds that she had expected. One of the study's conclusions is that kelp distribution is affected by water clarity, depth and wave velocity. The clearer waters at the Cape allowed for higher densities of kelp plants to grow, however the more vigorous wave action was detrimental to kelp growth at shallow depths.

The increase in cloudy water around the coast towards Waitara obstructed the sunlight reaching the seabed making it less attractive for kelp, which survives on photosynthesis.

Little is known about the subtidal ecology of North Taranaki. Earlier studies have found the area to be generally species-poor, often attributed to intensive wave action, high silt load from the region's rivers coupled with higher than average rainfall, and eroding sandstone cliffs.

(E) SHELLFISH TISSUE QUALITY

The Council monitors bacteria in shellfish collected along the Hāwera coast in relation to Fonterra and Hāwera waste discharges. There has been no measurable change in bacteria numbers in shellfish tissue at sites adjacent to the Fonterra outfall, and no increases of bacterial levels since the Hāwera wastewater discharge was added. Some individual samples have exceeded the guideline limit, probably due to wet weather when bacteria numbers in the coastal sea water increase due to the run-off from many small coastal streams and the nearby Tāngahoe River catchment[12]. However, median levels have been well within the acceptable guidelines.

Metals are tested in shellfish in compliance monitoring programmes. For example, shellfish are sampled from a few reefs around the New Plymouth wastewater treatment discharge every second year. Only low levels of metals around the coast have been found and generally levels in sites potentially affected by the discharge are as low as other sites[13]. Slight increases in zinc concentrations have been detected from both South and North Taranaki, but not at levels of concern.

The New Zealand Food Safety Authority runs a programme to test shellfish and water samples from around the New Zealand coastline every fortnight to make sure that shellfish are not contaminated with marine biotoxins from toxic algal blooms. Samples of shellfish are collected from three sites around Taranaki at Ōhawe, Ōākura and Mohakatino. Public warnings are issued when shellfish are not safe to eat, and sections of the coast are closed for shellfish gathering. Closures have been put in place over the summer of 2000, 2001, between September and December 2003[14], once in 2006-07 and once in 2007-08[15]. Reasons for algal blooms that led to these closures are unknown – they could be natural or related to water quality issues within the region or beyond it.

12 Taranaki Regional Council, 2008. *South Taranaki District Council Hawera Municipal Oxidation Ponds System Monitoring Report.* Technical Report 2007-93.
13 Taranaki Regional Council, 2008. *New Plymouth District Council New Plymouth Wastewater Treatment Plant Marine Outfall and Sludge Lagoon Monitoring Programme Annual Report 2007-2008.* Technical Report 2008-11.
14 Rush, M. 2006. *Netting Coastal Knowledge: A report into what is known about the South Taranaki-Whanganui marine area.* Published by the Department of Conservation, Wanganui.
15 Taranaki Public Health Officer, pers comm.

South Taranaki coast from Ōhawe.

Ensco offshore drilling rig and supply vessel.

5.1.2 HOW IS COASTAL WATER QUALITY MANAGED?

(A) REGIONAL PLANS

The *Regional Coastal Plan for Taranaki* gives the Council statutory responsibility for maintaining and enhancing the quality of coastal water. The plan contains policies and methods (including rules) for controlling waste discharges direct into coastal waters so that:

- contact recreation, shellfish gathering and fishing in Taranaki's coastal waters are not affected;
- marine ecosystems, particularly estuarine and intertidal areas, are maintained;
- accidental spills are minimised and clean-up operations are effective if spills occur; and
- the relationship of tangata whenua with the coastal environment, particularly the importance of the coast for gathering kaimoana and protecting wāhi tapu sites, is recognised.

The plan became operative on 1 October 1997. An interim review of the plan completed in 2002 found that the plan is effective and is achieving its purpose. A full review of the plan commenced in 2008.

The *Regional Fresh Water Plan for Taranaki* addresses the improvement of inland water quality, which ultimately affects the quality of water discharged into coastal waters. Significant parts of the plan deal with the control of discharges to rivers and streams. It also addresses the effects of run-off into rivers from agricultural land by promoting activities such as stream bank riparian planting.

(B) RESOURCE CONSENT MANAGEMENT

Direct discharges to the sea are managed and controlled through the resource consent process. This constitutes a large component of the Council's effort to implement the *Regional Coastal Plan*. Processing resource consents involves thorough investigations before consent is granted, consultations with affected parties (including iwi and hapū) and the identification of any special conditions that may need to be attached to a consent. Where appropriate, the Council involves iwi or hapū in the design and/or delivery of monitoring programmes to ensure compliance with consent conditions. Spill contingency planning is now a compulsory component of a discharge consent and is intended to reduce the impacts of an accidental spill into the coastal marine area.

There are currently six major discharges to the coastal marine area: The New Plymouth wastewater treatment plant discharges highly-treated effluent offshore. Effluent from Waitara is scheduled to be put through to the New Plymouth plant for a higher level of treatment by 2010. The Hāwera municipal and Fonterra Whareroa wastes are now combined and discharged though a long ocean outfall. There are small municipal discharges from Opunake, Manaia and Pātea.

There are currently 43 consents for discharges to the coastal marine area. These include the major discharges described above and discharges from stormwater or activities like dredging (Figure 5.6).

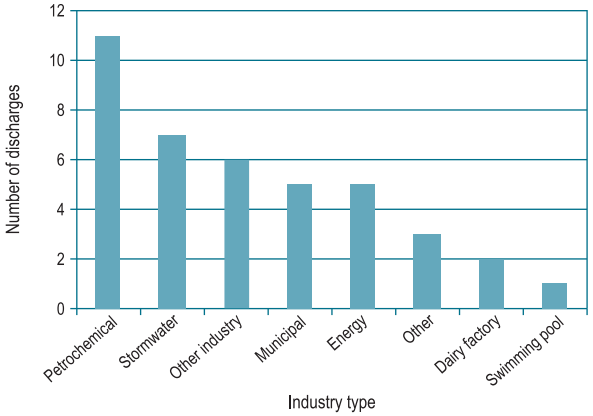


Figure 5.6: Discharges to the coastal marine area by type.

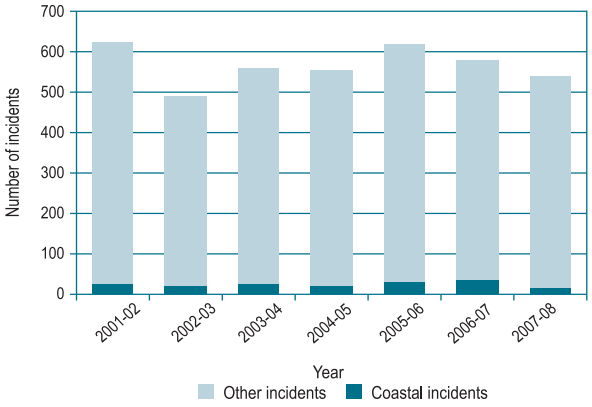


Figure 5.7: Number of coastal unauthorised incidents compared to the total number of incidents between 2001-02 and 2007-08.

(C) UNAUTHORISED INCIDENTS

The number of unauthorised incidents on the coast is also low, with coastal-related incidents making up only a very small proportion of the total number of unauthorised incidents that the Council responds to (Figure 5.7). In 2007-08, 17 incidents, 3.1% of all unauthorised incidents reported to the Council, were in the coastal marine area. A number of reported incidents each year, such as foams on beaches, are natural events. These are generally those classified as 'unknown'. Whilst the number of unauthorised incidents on the coast is low, the potential for a significant impact from a single event, such as an oil spill, can be significant (see the case study on the Ōkato oil spill incident).

(D) MONITORING

The Council has undertaken state of the environment monitoring in the coastal marine area since 1995. This involves monitoring bathing beach water quality and ecology of rocky reefs (described above) and ecology of estuaries (described in section 5.3). The monitoring programmes are designed to monitor progress against the objectives and desired results of the *Regional Coastal Plan*.

Ngāti Ruanui representative assisting with intertidal survey, South Taranaki.

The Council also undertakes monitoring of resource consents. The number of monitoring programmes carried out in 2007-08 with a coastal water quality component is set out in Table 5.2.

Table 5.2: Monitoring programmes with a coastal water quality component in 2007-08

Activity/Industry	Number of programmes
Municipal sewage	5
Beach motor camps	4
Petrochemical	1
Dairy processing	1
Coastal structures	2
Recreational	1
General industrial	6

Monitoring of the discharge of wastewater from Fonterra shows a marked improvement in the marine ecology in the vicinity of the discharge point since this discharge was discharged offshore through the long ocean outfall[16]. Monitoring in the vicinity of the New Plymouth and Waitara wastewater outfalls does not show any significant adverse environmental effects arising from the discharges[17,18]. Discharges associated with the Opunake, Pātea and Manaia wastewater treatment systems are also monitored, as are discharges from beach camps at Waiiti, Urenui, Ōnaero and Waiinu, with no significant effects detected.

(E) MARINE POLLUTION REGULATIONS

The Resource Management Act (Marine Pollution) Regulations 1998 are the responsibility of the Ministry for the Environment and are enforced by regional councils. These regulations deal with the dumping and incineration of waste and the discharge of sewage, garbage, ballast water and other wastes from ships and offshore installations.

(F) OIL SPILL PLANNING AND RESPONSE

Oil spill planning and response operates at two tiers. Tier I contingency plans are developed by individual companies or operators and set out the response to small spills, such as one developed by Port Taranaki. Tier II contingency plans, are usually developed by a regional body such as the Council, and set out the response to large spills beyond the ability of a company or operator to contain. The Council's tier II response plan, the *Marine Oil Spill Response Plan for Taranaki*[19], has been recently reviewed and approved. The objective of the plan is to safely mitigate the effects of a marine oil spill and, if possible, assist with the restoration of oil damaged environments.

(G) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on coastal water quality is summarised in Table 5.3.

16 Taranaki Regional Council, 2008. *Fonterra Whareroa Compliance Monitoring Programme Annual Report 2007-2008.* Technical Report 2008-39.
17 Taranaki Regional Council, 2008. *New Plymouth District Council New Plymouth Wastewater Treatment Plant Marine Outfall and Sludge Lagoon Monitoring Programme Annual Report 2007-2008.* Technical Report 08-11.
18 Taranaki Regional Council, 2008. *Waitara Waste Water Treatment Plant Monitoring Programme Annual Report 2007.* Technical Report 2008-03.
19 Taranaki Regional Council, 2008. *Taranaki Regional Marine Oil Spill Response Plan: A tier II marine oil spill contingency plan for the Taranaki coastal marine area.*

COAST WILD BUT ALSO VULNERABLE

The harshest of environments can also be vulnerable – as was dramatically illustrated when large amounts of crude oil washed up on the wild and windswept west coast near Ōkato in October 2007. It was the largest ever crude oil spill in New Zealand and the second largest oil spill in New Zealand in recent history.

Residents, iwi and the surfing community were alarmed as nearly 15 km of sand and rocks along the coast were fouled by the waxy oil, mostly in the form of small tarballs that melted in the sun.

Taranaki Regional Council staff began planning the clean-up operations under the *Marine Oil Spill Response Plan* within two hours of the oil being reported. They were later joined by a team from Australian Worldwide Exploration (AWE), which admitted responsibility for a 23-tonne spill from processing equipment associated with the Tūī oilfield it operates 60 km offshore.

While the spill was an unwelcome reminder of the coastline's environmental vulnerability, quick action and fortunate timing kept long-term effects to a minimum.

The oil came ashore on a spring tide, which meant most was deposited at the highest point possible on the beach – well away from the zone where marine life is active.

The waxy blobs were quickly scooped off beach surfaces so the fast-melting oil did not have a chance to penetrate deep into the sand. If it had, a far more extensive and expensive clean-up operation would have been needed.

The oil in the rocks was left to weather and break down, as any clean-up action would have caused more environmental damage. Beaches

Oil spill cleanup.

were monitored after every spring tide and oil that had dissipated from the rocks was cleaned up.

Sea water, sediment and kaimoana samples tested by Council staff and by the Cawthron Institute, the latter under contract to AWE, showed no significant increase in hydrocarbon or metal levels.

A feature of the response to this incident was the close liaison of the Council with other agencies, local residents, iwi and surfers, with all consulted as the monitoring programme was developed.

Coastal landowners were also very co-operative, despite it being a busy time of year for farmers. Council staff were given free access over their properties, and the farmers also made equipment available for the clean-up operation.

Maritime New Zealand has taken legal action over the spill. Both AWE and Prosafe (the operators of the floating offshore production station) have appeared in court and entered guilty pleas. The decision on sentencing was yet to come at the time of printing.

Table 5.3 Summary of progress: Implementing regional objectives and policies on coastal water quality.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Maintain and enhance coastal water quality.	• Widespread contact recreation, shellfish gathering and consumption, and fishing. • Maintenance of marine ecosystem. • Minimisation of occurrence of accidental spills and effective clean-up if spills occur.	• Preparing and implementing the *Regional Coastal Plan*. • Preparing and implementing the *Regional Fresh Water Plan*. • Issuing and monitoring resource consents for coastal activities. • Requiring or encouraging promotion of contingency plans. • Undertaking state of the environment beach bathing water quality programmes and coastal marine ecology monitoring. • Carrying out enforcement. • Preparing tier II oil spill response plan. • Requiring ballast water discharges beyond Port limits.	• *Regional Coastal Plan* made operative in October 1997. • *Regional Fresh Water Plan* made operative in October 2001. • Reduction in wastewater discharges to the coastal marine area – now only six significant discharges, down from 25 major discharges in 1975. • Improvements made in waste treatment and disposal systems. • Beach bathing bacteriological monitoring shows very good coastal water quality. • Monitoring of rocky shores indicates that ecological health is generally stable, it does get affected with sand inundation but returns to normal when the sand moves on. • Contingency plans have been developed at consent holder level (tier I) and at regional level (tier II).

Taranaki's coast is popular for surfing.

Opunake Beach.

5.1.3 HOW DO WE COMPARE?

Comparing Taranaki's rocky reef habitats with other regions is difficult as this would require identical, or at least similar, measures of diversity, sampling areas and sampling design and methodology. In addition, natural climate, physical and habitat conditions vary greatly from one region to another. As a result little information exists for comparison purposes. However, regional recreational water quality comparisons are possible due to the development of national recreational water quality guidelines and standardised sampling procedures and techniques. Table 5.4 compares bacteria counts at beach bathing sites in Taranaki and other regions for the 2007-08 summer. It should be noted, that despite standardised sampling procedures, not all councils use the same methodology to collect and analyse samples, and each council routinely monitors a significantly different number of sites. In terms of results, the table shows that the quality of marine bathing water quality in Taranaki compares well with other regions.

Table 5.4 Marine bathing water quality in Taranaki compared to other regions 2007-08 [20].

Location	No. of sites monitored	Range of enterococci/100ml	End of season enterococci medians	% samples complying
Taranaki	10	<1 - 1800	<1 - 42	98
Northland	44	<10 - 2005	<10 - 31	93
Waitakere	4	<10 - 1500	<10 - 20	99
Waikato	26	<1 - 3300	<1 - 11	96
Hawke's Bay	14	<1 - 3200	<1 - 5	96
Horizons	5	<10 - 450	<10 - 20	96
Tasman	16	<1 - >2000	<10 - 10	99
West Coast	8	<1 - 370	2 - 60	83
Canterbury	39	<2 - 3700	2 - 43	95
Otago	2	<1 -520	2 - 10	97
Southland	13	<10 - 6900	10 - 390	98

20 Data provided by other councils.

The spectacular North Taranaki coastline and distinctive fragments of eroded cliffs.

5.2 NATURAL CHARACTER

5.2.1 WHAT IS THE STATE OF THE NATURAL CHARACTER OF TARANAKI'S COAST?

Protecting the natural character of the coast is a matter of national importance under the *Resource Management Act 1991*. Natural character is present to some degree in every coastal environment, even those areas that are highly modified. The key components of natural character are natural processes (ecological processes), natural elements (geology, landforms, vegetation cover, seabed, foreshore etc.) and natural patterns, as well as intrinsic values and aesthetic values[21]. Small changes in a natural area surrounded by a highly modified environment may be more significant in terms of natural character than where it is surrounded by a largely natural environment.

Assessing and monitoring changes in the natural character of the coast are not yet the subjects of a formal state of the environment monitoring programme in Taranaki. The following section sets out an overview of natural coastal features and how these change around the coast. This is followed by a discussion of an inventory into regionally and locally significant sites and then indicators of pressures on coastal natural character – levels of coastal subdivision and consented activities.

(A) TARANAKI'S NATURAL COASTAL CHARACTER

Natural coastal processes in Taranaki's coastal environment that contribute to its natural character include currents, coastal erosion, sand movement, formation of dunes, and such matters as the combination of seabed shape, swell direction and wave power that produce nationally and internationally recognised surf breaks. Natural features include the black sands of the west coast, stranded eroding fragments of cliff now surrounded by sea, estuaries formed by meandering rivers and river mouths that spill directly into the sea.

As the Taranaki region is exposed to the west, high-energy wave and wind conditions dominate the coastal environment. Consequently there are few areas of sheltered water beyond estuaries (for example in the Tongaporutu, Waitara and Pātea rivers) and the confines of Port Taranaki. Almost the entire Taranaki coastline is subject to varying degrees of erosion from waves and wind. This has resulted in a predominantly cliffed coastline, with the western coast characterised by boulder cliffs and offshore reefs derived from erosion of volcanic material. In North and South Taranaki, erosion of marine sediments has resulted in a coastline of almost continuous papa cliffs and black sand beaches.

Estuaries are significant features along the coast, creating quite different habitat from the open coast conditions. In comparison with estuaries elsewhere around the country, Taranaki estuaries are relatively small, with the four largest estuaries, Tongaporutu and Mimi in the north, and Whenuakura and Waitōtara in the south, all less than 500 ha.

(B) NATURAL CHARACTER AROUND THE COAST

The Taranaki coastline falls into two large biogeographic regions (areas that are more similar to each other in terms of physical and biological characteristics) - the Western North Island and the North Cook Strait Coastal biogeographic regions (Figure 5.8). The Western North Island Coastal Biogeographic region extends from north of the Waikato to Cape Egmont. It is influenced by the northward flowing Westland current and the southward flowing west Auckland current, both of subtropical origin. The region is characterised by open, exposed sandy beaches interspersed by stretches of rocky platforms, bluffs and outcrops. The fauna has affinities with both warm-temperate, cool-temperate and sub-antarctic fauna.

The North Cook Strait Coastal Biogeographic region extends from Cape Egmont around Wellington and up the eastern Wairarapa coast. This region lies in a transition area between northern and southern flora and fauna, and has a high diversity of species. The tidal regimes each side of the strait are different and the water temperature is also very different. The northern side is greatly influenced by the easterly-flowing warm, saline D'Urville current and the cooler Southland current that travels northward through Cook Strait. The D'Uurville current also flows up the west coast and is deflected offshore by the Mount Taranaki ring plain, resulting in very different biota further north of Cape Egmont.

21 Maplesden, R. 2000. *Natural Character: Concept Development in New Zealand Law Planning and Policy.* Prepared by Boffa Miskell for Environment Waikato.

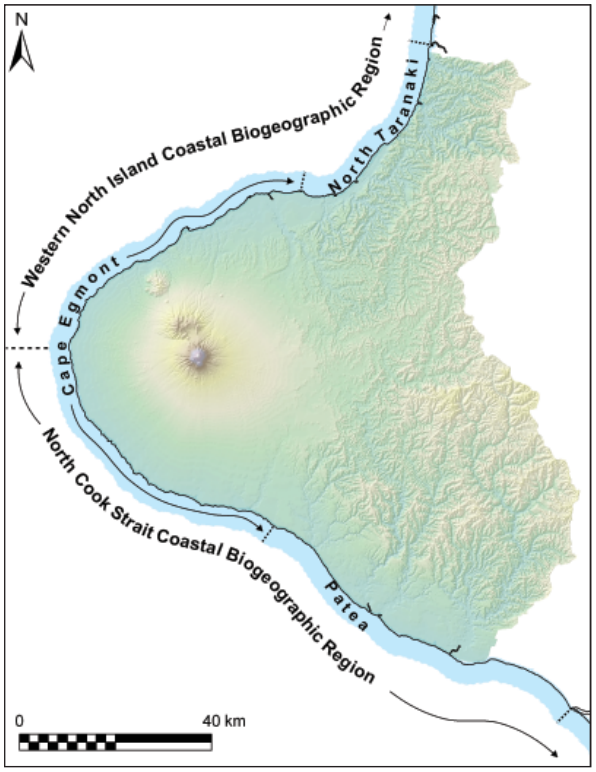


Figure 5.8: Biogeographic regions and coastal units.

The Taranaki coastal region can be further divided into three coastal units (illustrated Figure 5.8):

- North Taranaki (from the Mōkau River to Motunui), a section of narrow sand beaches, highly influenced by suspended sediments from river mouths and areas of rocky foreshore and intertidal reefs such as Pariokariwa and Epiha reefs;
- the Cape Egmont coastal unit (from Motonui around Cape Egmont to Hāwera), which includes the Sugar Loaf Islands and is highly influenced by the volcanic deposits forming reefs consisting of large boulders and cobbles; and
- the Pātea coastal unit, extending from Hāwera to just north of the Whanganui River mouth, a coastline dominated by sandy beaches and some limestone rock platforms, intertidal reefs and two significant reefs near Pātea (the North and South Traps) [22].

(C) SITES OF REGIONAL AND LOCAL SIGNIFICANCE

The coastal environment is the land between the mean high water spring mark and the first dominant ridge[23]. The width of the coastal environment is therefore influenced by the location of the ridgeline, or the area where there is a clear coastal influence.

An inventory has been prepared of sites of regional or local significance[24]. The inventory was collated by a working party consisting of representatives from the Taranaki Regional Council, district councils and the Department of Conservation. This identified 69 coastal areas, representing approximately 33% of the Taranaki coastline, as having features or qualities of local or regional significance.

To be identified as a coastal area of local or regional significance, an area had to be ranked as 'high' in relation to one or more of the following:

- **Amenity values.** Unique areas with significant natural, scenic, aesthetic, visual or rural amenity values (landscapes, seascapes, landforms and associated processes) were included.
- **Recreational values.** Areas included had high passive and/or active recreational use (eg, swimming, walking, fishing and boating) or areas unique and highly-valued for a particular recreational experience (eg, scuba diving or surfing).
- **Cultural/historical values.** This included places, sites and areas of special cultural or historical significance (eg, archaeological sites and/or areas or features of special significance to tangata whenua).
- **Ecological and scientific values.** This included places, areas or features of scientific interest, important or unique coastal environment ecosystems and/or spawning, nursery or feeding areas for marine mammals or birds. Estuaries in particular rated highly for ecological values.

Of the 69 coastal areas or sites identified as having local or regionally significant values, 48 sites (or 70%) were identified as being of local or regional significance based upon high amenity values. Forty-eight sites (or 70%) were also identified as being of local or regional significance for their high cultural or historical values and 41 sites (or 59%) were identified as being of significance based upon high ecological or scientific values. High recreational values were identified at 27 sites (or 39%). Many sites ranked highly in two or more attributes. For example, the Waitōtara estuary and dunes was recognised as having high amenity values, moderate recreational values (for whitebaiting), high cultural /historic values (with a ferry punt landing from early European settlement) and high ecological values (an unmodified estuary with sand dunes and a wetland, providing important habitat for threatened and migratory birds and sub-fossil tōtara stumps) [24].

Kayaking through the surf.

22 Walls, K. 2006. *Nearshore Marine Classification and Inventory – a planning tool to help identify marine protected areas for the nearshore of New Zealand.* Department of Conservation, Wellington.
23 New Plymouth District Council. 2006. *Coastal Strategy.*
24 Taranaki Regional Council. 2004. *Inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region: Summary and Discussion.*

Coastal subdivision, Stent Road.

(D) SUBDIVISION IN THE COASTAL ENVIRONMENT

The increasing popularity of living near the coast has brought increasing pressure to subdivide, particularly adjacent to low lying areas. This has the potential to impact on many aspects of the natural character of the coast, particularly in the more remote areas of Taranaki.

In the New Plymouth District, most of the subdivision has occurred around the New Plymouth periphery, with the rate of subdivisions being fairly consistent each year. The average lot size for rural coastal subdivision is around seven hectares. Coastal subdivisions are now occurring along the New Plymouth coastline at road ends, whereas in 2003 they were particularly centered in the Ōākura and Ōmata areas. Table 5.5 outlines the subdivision undertaken in the various coastal environment zones in the New Plymouth District. This highlights the significant and increasing demand for subdivision within 3 km of the coast.

South Taranaki appears to have less pressure to subdivide on the coast. However, there have been subdivisions near Waverley Beach, Ōaonui, Manaia, Pūniho, Opunake and Waiinu Beach since 1995.

The effects of urban and industrial development on the natural character of the coast are not felt to be significant at present, with the most modified parts of the coastline being in and around the city of New Plymouth.

In the future, however, the effects of urban and industrial development on the coast may become more significant. Some parts of the coast are more vulnerable to levels of urban development that may lead to a gradual loss in the natural, scenic and amenity values that attracted people to the area in the first place. This particularly applies to smaller coastal settlements such as Ōākura, Ōmata, Urenui and Opunake, which are becoming increasingly popular.

Table 5.5: Subdivision pressures within the New Plymouth District.

	Definition	Subdivision lots created between 1998 and 2006	% of subdivision within the whole New Plymouth District	General observation
Coastal Hazard Zone (CHZ)	For most areas within New Plymouth District this is 70 m wide but there are variations based on erosion data.	Four new lots created in 2004, one new lot created in 2005.	0.1%	There is not a great pressure on the CHZ with respect to subdivision.
Coastal Hazard Zone Buffer	Set as a distance of 250 m inland of the coastal hazard zone.	126 new lots created, averaging 14 per year. These peaked in 2003 (39 lots), 2004 (37) and 2005 (23).	3.8	There could be increasing pressure immediately inland of the CHZ.
Coastal Policy Area (CPA)	Is defined within the *New Plymouth District Plan* but typically is wider in the rural areas and narrower around urban centres on the coast.	88 new lots created: averaging 9.8 per year. These peaked in 2000 (12 lots), 2002 (10), 2003 (13) and 2005 (35).	2.6	Subdivision within the CPA may be an area to monitor in the future to more accurately determine the actual ongoing and cumulative effects of subdivision on the CPA.
Coastal Buffer	Is set at 3 km from the coast.	1502 new lots created, averaging 167 per year. These peaked in 2003 (297 lots), 2004 (476) and 2005 (347)	44.8	There appears to be a significant demand for subdivision within 3 km of the coast.

Data provided by the New Plymouth District Council.

(E) ACTIVITIES AND STRUCTURES IN THE COASTAL MARINE AREA

Most stretches of the Taranaki coastline are untouched by significant developments which might have a detrimental effect on the natural character of the coast. However, some areas such as Port Taranaki have been substantially modified. Furthermore, some development, such as ports, reclamation and offshore production platforms for the oil and gas industry can only be located in the coastal marine area.

Development in the coastal marine area has the potential to adversely impact on the coastline's natural character whilst also potentially providing wider benefits to the community such as protecting key assets or providing public access to the coast. The current number of coastal permits held for various activities and structures are set out in Table 5.6. There are a total of 252 coastal permits currently held, the majority (42%) are for coastal erosion protection structures.

Table 5.6: Total number of current coastal permits (including those current that were issued before the *Coastal Plan* became operative).

Type of coastal permit	Total current coastal permits	Percentage of total
Renourishment	0	0
Structure - access	2	<1
Structure - pipeline	7	3
Structure - boat ramp	11	4
Structure - intake	0	0
Structure - protection	105	42
Structure - outfall	10	4
Structure - stormwater outlet	7	3
Structure - wharf/marina/jetty	12	5
Structure - bridge	3	1
Structure - stream outlet	3	1
Structure - other	15	6
Discharge	43	17
Deposit	4	2
Disturb foreshore	10	4
Extraction	3	1
Occupy	6	2
Occupy and structure (boat ramp)	2	<1
Take, use, divert or dam	9	4
TOTAL	**252**	**100**

Installing structures such as pipelines, boat ramps, oil platforms, protection structures (i.e. sea walls), depositing material on the foreshore or disturbing the beach are examples of activities that are required to comply with the *Regional Coastal Plan for Taranaki*, either by meeting permitted activity standards or by getting a coastal permit.

The *Regional Coastal Plan* sets out the objectives and policies to ensure that natural character is safeguarded, in accordance with four distinct coastal management areas (Figure 5.9). A different set of rules governs activities undertaken in:

- areas of outstanding coastal value for natural features, landscapes or areas with significant habitat for biodiversity (Area A);
- identified estuaries (Area B);
- the open coast (Area C); and
- Port Taranaki.

The coastal management areas recognise the different natural and ecological values and types of community use in the coastal marine area. The number and type of coastal permits that have been issued in the four coastal management areas since the *Regional Coastal Plan* became operative are set out in Table 5.7. This illustrates that there have been a total of 238 coastal permits issued in Taranaki since the plan became operative: 27 in Coastal Management Area A, 28 in Coastal Management Area B, 148 in Coastal Management Area C and 35 in Coastal Management Area D. The high number and type of permits within the Port area reflects the industrialised nature of the Port and the fact that the natural character of this area has already been extensively modified for the economic wellbeing of the community.

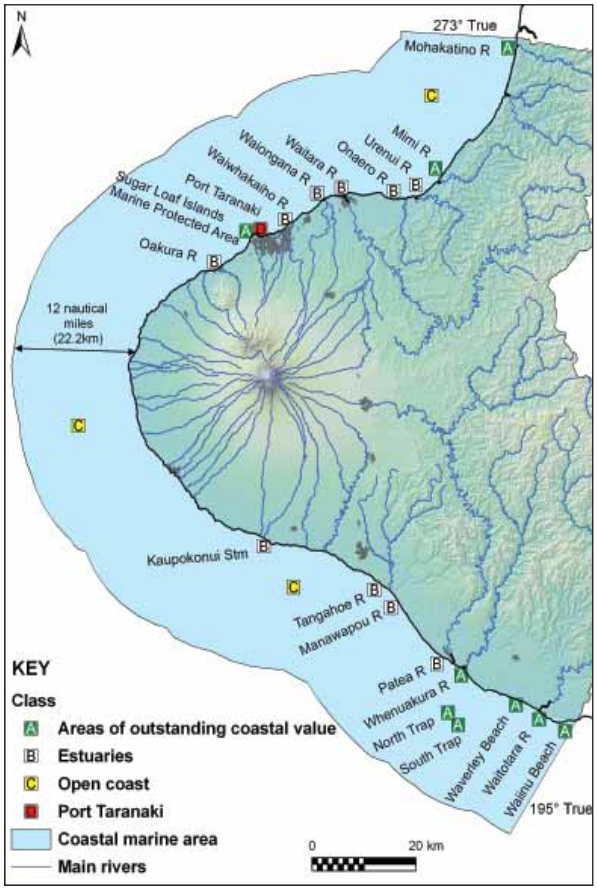


Figure 5.9: Coastal management areas in the *Regional Coastal Plan for Taranaki.*

Table 5.7: Coastal permits issued, reviewed or varied between October 1997 and June 2008.

Type of coastal permit	Coastal management area in the Regional Coastal Plan				TOTAL issued
	A Outstanding Coastal Value	B Estuaries	C Open Coast	D Port Taranaki	
Renourishment			1		1
Structure - pipeline		3	4		7
Structure - boat ramp		1	4	1	6
Structure - intake	1				1
Structure - protection	22	11	64		97
Structure - outfall		2	4		6
Structure - stormwater outlet		1	4	1	6
Structure - wharf/marina/jetty		1	2	2	5
Structure - bridge		1	1		2
Structure - stream outlet			1	2	3
Structure - other	2	1	10	1	14
Discharge	1	5	16	17	39
Deposit			6		6
Disturb foreshore	1		16	9	25
Extraction		2	1	1	4
Occupy			4		4
Occupy and structure (boat ramp)			2		2
Take, use, divert or dam			8	1	9
TOTAL	**27**	**28**	**148**	**35**	**238**

Sea wall and boat ramp, Ōnaero Beach.

The majority of coastal permits issued, reviewed or varied since the plan became operative (147 or 79%) have been for structures – pipelines, boat ramps, stormwater outlets, but particularly coastal erosion protection works.

There is an estimated 11.6 km of seawall protection structures, and about 2 km of these have been consented over the last five years. A number of these are subject to consent monitoring programmes. Historically, erosion protection structures have been established in areas where development has occurred close to the eroding coast. Protection works in the open coast area are a response to the erosive nature of the coastline and are undertaken to protect developments that have historically occurred in the coastal environment.

Sixty-four consents have been issued for protection structures along the open coast at Urenui, Middleton Bay, Ōākura, New Plymouth near Kawaroa Park, Bayly Road, Bell Block and Waihi Beach. Some consents issued have been for existing structures and others for renewals. In the estuary zones, consents for coastal protection structures have been issued for the Waitara, Urenui, Ōākura and Pātea rivers and the Te Henui Stream. In areas of outstanding value, 22 consents have been issued for coastal erosion protection purposes in the Mohakatino and Tongaporutu estuaries and on Waiiti Beach.

The effects of the protection works on the natural character of the coast are weighed against the need to protect assets. Wherever possible, the Taranaki Regional Council and the district councils encourage applicants wishing to undertake developments to avoid areas subject to erosion and so reduce the need for future erosion protection works.

Hard engineered structures are not the only answer to coastal erosion, and there has been considerable success in re-establishing dunes along Fitzroy Beach.

There are relatively few areas of natural dunes around the Taranaki coast. Some, such as at Ōākura and Sandy Bay, are subject to community-driven restoration projects (see case study).

Peter Johnston at Sandy Bay.

GETTING THE BIRDS BACK WHERE THEY BELONG

You could call it a project that aids homeless refugees. One of the visions of the Ngāti Tara Ōaonui Sandy Bay Society is to have seabirds nesting amidst the dunes instead of on neighbouring farmland – or worse not nesting at all.

"We had one pair of gulls nesting down in the dunes last summer, and around 30 up on the farm. We'd like to see them back where they belong," said Society President Peter Johnston, one of the neighbouring landowners.

As the only significant area of dunes along the rocky coastline between Opunake and Ōmata, Sandy Bay attracts not only black-backed gulls and oystercatchers, but also the endangered New Zealand dotterel.

The Bay is also home to the chronically threatened green gecko, gold-striped gecko and the rare native Taranaki moth *Notoreas* 'Taranaki Coast'.

It's a special place where for four years the Society has worked to counter the negative effects of erosion, introduced predators and unhelpful human activity. This follows earlier planting and pest-control work initiated by the Community Advisory Group for the nearby Māui production station run by Shell Todd Oil Services Ltd.

The Opunake Lions Club, Opunake Surf Club and students from Opunake High School have all been involved in planting to help restore natural dunes. Unfortunately much of the early work has been knocked out by storms but Peter said valuable lessons were learned and a new three-year planting and shaping plan will result in a low-forming spinifex/pīngao dune where there is currently a sand blow-out.

This work is being funded through the Department of Conservation's Biodiversity Condition Fund, with assistance from the Taranaki Regional Council and community and corporate donations.

Pest control work will also continue, and signs at key locations will advise visitors how they can best protect the habitat and the life it supports.

Sandy Bay is just 9 km from Opunake and recent residential development nearby has highlighted the importance of the Society's work to ensure the Bay's special natural character is protected and enhanced. Peter says access to biodiversity funding is making a difference and he's optimistic he'll soon see more of those seabirds setting up home exactly where nature intended.

5.2.2 HOW IS COASTAL NATURAL CHARACTER MANAGED?

(A) REGIONAL COASTAL PLAN

The preservation of the natural character of the coastal marine area, and protection of the areas from inappropriate subdivision, use and development, is a matter of national importance under the Resource Management Act 1991. The *Regional Coastal Plan for Taranaki* contains objectives, policies and methods to ensure that the natural character of, and public access to, the coastal environment are maintained. Methods include rules giving effect to the policies for each of the four coastal management areas, and general rules that apply to all coastal management areas.

(B) DISTRICT PLANS AND STRATEGIES

District councils are responsible for protecting the natural character of the coastal environment from inappropriate subdivision, use and development. The *New Plymouth District Plan* and *South Taranaki District Plan* have delineated coastal areas and have mechanisms in place to protect the coastal natural character.

In terms of land use and subdivision controls around the coast, both district councils have planning regimes that allow use and development, subject to specified terms, conditions and standards to address any environmental effects. District councils, when implementing those rules, have regard to policies in their district plans that address the consolidation of existing urban settlements, the protection of the natural character and the avoidance of inappropriate subdivision, use or development.

The New Plymouth District Council has prepared a *Coastal Strategy*, a non-statutory planning document, which sets out a vision for what the community wants the coastal environment to look like in 20 years[25]. The vision of the *Coastal Strategy* is for "A prosperous, growing coastal community, balancing the needs of people and environment within our high-energy untamed coast." The Strategy sets out more than 100 actions that have been prioritised over the next 20 years, and will be undertaken in partnership with other agencies and groups who also play a part in how the coast is managed. These actions address appropriate population growth along the coast; infrastructure compatibility with coastal values; sustainable economic growth; recreation; understanding and support of the tangata whenua role as kaitiaki; management of coastal hazards; and protection and enhancement of the natural environment and landscape values.

The South Taranaki District Council is undertaking a landscape assessment to review its coastal protection area in order to better define the coastal environment landscape.

(C) RESOURCE CONSENT MANAGEMENT AND MONITORING

Significant activities in the coastal marine area require a resource consent. Sixty three new coastal consents were issued between October 1997 and the end of 2002 (an average of 1.0/month), and 96 were issued between the beginning of 2003 and June 2008 (an average of 1.5/month). This indicates increased activity on the coast.

Consent conditions avoid or mitigate any adverse effects that may result from the activity. A monitoring programme is being developed for coastal structures involving a mixture of checking the integrity of structures and beach profiling[26]. In the 2007-08 year, coastal structure monitoring was commenced for a number of structures including groynes, sea walls, boat ramps and outlets[27].

The Council, in partnership with the district councils, is looking to undertake a coastal erosion assessment using changes over time in aerial photos to calculate rates of coastal erosion around the region.

(D) RESTORATION WORKS

The New Plymouth District Council has established Coast Care groups over the past 12 years to undertake large-scale dune restoration projects at New Plymouth, Waitara and Ōākura. Such projects restore natural character to a section of beach providing habitat for coastal biodiversity. Now that these projects have been completed, the emphasis is on small-scale, community and school dune plantings. Valuable lessons have been learned about restoring dunes and the role of restored dunes in managing coastal erosion. One such dune restoration project has been located at the Ōākura campground which has seen planting trials undertaken by the local Coast Care group and Ōākura School in an attempt to reinstate a resilient natural dune system better able to withstand the forces of erosion. However, recent storm events have had an impact on this restoration project.

Another type of restoration project involves the sand dumping trial offshore from New Plymouth city in an attempt to restore the natural functioning and character of the coast (see case study). It is expected that in the long term, Port Taranaki's sand deposition programme will have a positive effect on restoring the natural character of New Plymouth beaches where there are no sea walls. The ecological effects are being monitored through a resource consent monitoring programme undertaken by the Taranaki Regional Council.

Dredging in Port Taranaki.

Sand dune restoration, Ōākura Beach.

25 New Plymouth District Council. 2006. *New Plymouth District Coastal Strategy.*
26 Tonkin and Taylor. 2001, *Taranaki Regional Council Compliance Monitoring for Coastal Structures.* Prepared by Tonkin and Taylor and DTEC Consulting Ltd for the Taranaki Regional Council.
27 Taranaki Regional Council. 2008. *NPDC Coastal Structures Monitoring Programme Report. 08-44.*

SAND ON THE RUN

On the surface it seems a win-win situation: Material that's been dredged to maintain navigable channels at Port Taranaki is dumped near to shore so it can feed beaches that are starved of sand because the Port blocks the natural drift northwards of such material.

But when the idea was first suggested, iwi raised concern about the effects of such sand-dumping on kaimoana beds and other marine life.

A trial operation was approved in the late 1990s, however, and the Taranaki Regional Council developed a detailed monitoring programme in consultation with iwi, who were also involved in implementing it.

The monitoring showed the sand was not moving from the trial site in a large mass, rather it was being lifted and dispersed gradually. It also showed the sand was not moving inshore and smothering the kaimoana beds and other sea life.

In 2002 Port Taranaki Ltd (then trading as Westgate Transport) was issued a permit allowing it to dump up to 400,000 cubic metres of sand at a time in the specified area near Kawaroa Reef. The permit expires in 2029 but can be reviewed every four years.

The Council's monitoring programme is continuing, and includes repeated intertidal and subtidal surveys, kaimoana surveys and inspections of Arakaitia and Kawaroa reefs. Port Taranaki Ltd also carries out surveys involving the use of underwater sonar and cameras, and aerial photography.

Council staff and Ngāti Te Whiti carrying out a Kaimoana survey.

These surveys show that while the sand is definitely on the move in the way intended, the diversity and amount of marine life in the area have remained stable. Only a small amount of sand gets on to the reefs, and while there has been some variation in species richness and diversity, this is common at reef sites monitored by the Council around Taranaki. The causes are thought to be unrelated to the sand dumping. Numbers of pāua at the six reef sites surveyed have remained similar to, or increased when compared with pre-dredging numbers.

(E) INFORMATION, EDUCATION AND ADVICE

Regional and district councils provide information and technical advice relating to the protection of natural character, resource consent requirements and effects of structures on the coastal environment.

Under its sustainable land management programme, the Council prepares conservation plans for landowners on coastal sand country. These plans can contain methods to address localised erosion problems through planting and possible re-contouring.

(F) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on the natural character of the coastal environment is summarised in Table 5.8.

Table 5.8: Summary of progress: Implementing regional objectives and policies on the natural character of the coastal environment.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Natural character of the coast	• Preservation of the natural character of the coastal environment. • Provision for appropriate subdivision, use and development of the coastal environment. • Provision made for estuarine and open coastal natural processes, differing natural values, and different levels and types of use across the coastal marine area.	• Reviewing the *Regional Coastal Plan* in accordance with the revised *New Zealand Coastal Policy Statement*. • District councils to implement district plans provisions relating to coastal natural character. • Monitoring district council subdivision consent applications. • Attaching conditions to coastal permits to ensure that adverse affects from activities on the natural character are avoided, remedied or mitigated. • Coast Care groups continued. • Planting of native species and dune stabilisation methods undertaken at Sandy Bay.	• *Regional Coastal Plan* for Taranaki made operative in 1997. The plan contains policies and rules to maintain and enhance natural character. • District plans contain policies and rules relating to the preservation and enhancement of the natural character of the coastal environment. • A total of 252 coastal permits are currently held.

5.2.3 HOW DO WE COMPARE?

Most regions have coastal policies and plans and district plans that seek to protect the natural character of the coast from inappropriate subdivision, use and development. The Taranaki region has fewer development pressures on its coastline than other regions such as Northland, Auckland, Waikato, Bay of Plenty, Marlborough and Canterbury. Pressures from subdivision, urban development, recreation, tourism and aquaculture are much greater in these regions than in Taranaki.

In Taranaki, the primary response to coastal erosion threatening existing development is generally for engineering solutions and erosion protection structures rather than using alternative solutions such as recreating dunes as protection mechanisms. Nationally, many councils are now involved in the Dune Restoration Trust of New Zealand exploring alternative approaches to coastal erosion.

The New Zealand Coastal Policy Statement Board of Inquiry noted that the region's inventory of coastal areas of local or regional significance was a unique document. This document, prepared by a working party consisting of representatives from the Taranaki Regional Council, district councils and Department of Conservation will provide valuable assistance for implementing the revised *New Zealand Coastal Policy Statement* when the *Regional Coastal Plan for Taranaki* is reviewed.

5.3 COASTAL AND MARINE BIODIVERSITY

5.3.1 WHAT IS THE STATE OF COASTAL AND MARINE BIODIVERSITY?

The Taranaki region has a 295 km coastline, comprising steep cliffs, rocky shores and sandy beaches, subtidal reefs, rivermouths and estuaries. These provide a wide range of ecological habitats for native plant and animal species. This section describes the state of biodiversity of rocky reefs, estuaries, marine protected areas and threatened marine mammals.

(A) BIODIVERSITY OF THE ROCKY SHORE AND REEFS

Taranaki's intertidal reef systems have generally lower diversity and abundance of species compared to similar type systems elsewhere in New Zealand. This is due to the high wave energies typical of the Taranaki coastline, which give rise to abrasive and turbulent shoreline conditions, high water turbidity, suspended silt, and sand inundation. Notwithstanding that, associated with reef systems is a large diversity of marine life, including fish species and encrusting animals such as sponges and anemones.

Higher species diversity is found on rocky shores where larger rocks are present, as they provide plenty of habitat for rocky shore creatures to shelter under. This type of environment provides more suitable shelter and habitat when compared to sites with cobbles or sandy beaches. Taranaki has more intertidal rocky reefs than sandy beaches. Large, discrete reef systems are present around the Waitara River, New Plymouth, North Taranaki and around Cape Egmont. A smaller reef system lies south of the Waitōtara River. Large subtidal reefs called the

Intertidal biodiversity.

North and South Traps are located offshore from Pātea. A number of smaller offshore subtidal reefs also occur.

The rocky inshore marine environment provides a wide range of different habitats for a number of different aquatic species. This includes species such as starfish, sea anemones, crabs, crayfish, sea cucumbers, mussels, pāua, sponges, whelks and a number of seaweed species. The rock borer which bores into soft cliffs around Taranaki is a local feature.

Results from the Council's state of the environment monitoring of intertidal rocky shore sites have been described earlier in this chapter. The Department of Conservation's monitoring of subtidal reefs is described below.

(B) BIODIVERSITY OF SOFT SEDIMENTS AND ESTUARIES

Estuaries and river mouths make up approximately 16% of Taranaki's 295 km coastline. These are shallow, sheltered areas of productive 'nursery' habitats for a variety of marine life. Taranaki estuaries do not have a wide range of intertidal and subtidal habitats, and are well flushed with fresh water. This results in a high freshwater input/area ratio, creating a harsh environment for estuarine aquatic life that prefers things to be more salty. The low numbers and diversity of fish and shellfish found in Taranaki estuaries have been attributed to this more freshwater type estuary environment[28]. The Waitōtara and Whenuakura rivers drain mudstone catchments and are highly modified, with large areas of land cleared for farming, and they frequently flood. Both factors contribute to the high silt load in the rivers, a factor which reduces the number and diversity of species in the lower estuary. In comparison, the Tongaporutu and Mimi catchments are not as extensively modified.

The soft substrate of estuaries (consisting of sediment carried down by rivers mixed with detrital material such as leaves, sticks etc.) supports a range of burrowing fauna such as worms, cockles and pipis. Most of these animals feed on detrital material, and bacterial and algal films on the mud surface. These estuarine areas are ideal refuges for juvenile fish of many species and wading birds in search of fish and crustacea[29].

The Council monitors two estuaries in an estuarine monitoring component of the Council's state of the environment monitoring programme – Tongaporutu in the north and Waitōtara in the south. Some information is held about conservation values of a number of

28 Taranaki Regional Council, 2008. *State of the Environment Monitoring Hard-shore and Soft-shore Marine Ecological Programmes 2007-2008.* Technical Report 2008-07.

Tongaporutu township and estuary.

estuaries[30] but no information had been collected prior to this programme about the diversity and abundance of estuarine life in Taranaki. Previous studies by others[31], [32] were 'one-off' providing useful information about the ecological status of North Taranaki estuaries but contained no information on species persistence and community stability within the estuaries over time.

A variety of animal life has been identified within the sediment at both estuaries. The most dominant are sand-hoppers (*Paracorophium excavatum*), pipi (*Paphies australis*), cockles (*Austrovenus stutchburyi*), trough shells (*Mactra* sp.), marine bristle worms (polychaetes) and mud snails (*Amphibola crenata*).

Long-term trend analysis was undertaken on data collected at both Tongaporutu and Waitōtara estuaries. The analyses did not indicate significant positive or negative trends – indicating ecological conditions in both estuaries are generally stable[33].

In February 2004, extensive flooding occurred in the Waitōtara River which led to extensive silt movements in the catchment which were either largely deposited on flooded land, in the estuary or taken out to the ocean. As a result, very few animals were present in the April 2004 survey – with only 16 individuals found in 12 core samples. The estuary has slowly recovered over the past few years and results from the most recent samples collected in April 2008 contained the highest species richness to date, and included relatively high numbers of two common snails that had been present infrequently, or absent, for the previous several years.

(C) BIODIVERSITY OF THE OPEN OCEAN

The northward flowing Westland current and the southward flowing west Auckland current play important roles in determining the distribution and abundance of fish species in the open coast. The level of plankton productivity, and therefore food available for fish, is dependent on the availability of nutrients which can be enhanced by vertical upwellings of currents and local freshwater inputs[34]. The South Taranaki coast for example, receives nutrients from currents that spiral up off Farewell Spit[35].

Localised currents play a major role in the reproductive success of many kinds of fish. Snapper, flounder and trevally spawn off North Taranaki, and after spawning, snapper and trevally move up the Urenui estuary to feed. Recognising the importance of this area for spawning, Urenui Bay is closed for trawling. Recent research has highlighted the importance of estuaries beyond the region such as Kāwhia Estuary, for snapper spawning[36].

Over the summer months when warmer currents move down from the north, a number of ocean-going species visit the Taranaki coastline following the abundance of food. The most common species are sunfish, flying fish, marlin, albacore, skipjack and yellow-fin tuna, makō and blue sharks.

(D) BIODIVERSITY OF MARINE PROTECTED AREAS

The marine protected areas of Taranaki represent a range of marine habitats including intertidal and subtidal reefs, boulder fields and sand flats. There are two marine reserves (Parininihi Marine Reserve established in 2006 and Tapuae Marine Reserve established in 2008) and one marine protected area established in 1983 (Sugar Loaf Islands (Ngā Motu) Marine Protected Area).

The establishment of no-take marine reserves on the North Taranaki coast has created opportunities for scientific studies to be undertaken to compare areas impacted from uses such as fishing, with areas that are protected from fishing. Monitoring in marine reserves will determine if the sea life is influenced by human activities including fishing and development or if other factors such as the weather or habitat complexity play a more important role.

29 Taranaki Regional Council , 1991. *Taranaki Coastal Marine Area. Resource Description and Management Issues.*
30 Taranaki Regional Council, 1995. *Comparative Assessment of Ecological and General Conservation Values in the Tongaporutu Estuary.*
31 B. T. Coffey and Associates, 1991. *A Contribution to a Description of Biological Resources in Estuarine, Intertidal and Shallow Subtidal Habitats South of Mokau River to Tongaporutu, February – March 1991.*
32 Hayward, B. W., et. al., 1999. Marine biota of the North Taranaki coast, New Zealand. *Tane,* 37:171-199.
33 Taranaki Regional Council, 2008. *State of the Environment Monitoring Hard-shore and Soft-shore Marine Ecological Programmes 2007-2008.* Technical Report 08-07.

THE SECRET LIFE OF A TARANAKI ESTUARY

Some of them thrive on gardening. Some are hairy but handy swimmers. Others have an important and long-standing role in gastronomic tradition. And just about all are fussy about the quality of their home environment.

They are the shellfish, marine snails, worms and other tiny marine animals that make their homes in and around our estuaries. They may be out of sight and out of mind for most of us but they are vital as both maintainers and indicators of the quality of coastal waters.

And they've evolved some interesting strategies as they cope with the challenges of life in the zone where water, earth and air meet.

Titiko, or mud snails, are the gardeners, ploughing the bottom sediment at low tide, sucking in and excreting twice their body weight in an hour. In doing so they filter the mud, improving its properties to favour growth of the plants upon which they feed. They have few predators and live for a dozen years or more. And when mating, any individual can take the role of either gender. Very efficient.

What they don't like is pollutants, especially heavy metals. This is a sensitivity they share with many of their neighbours, including the well known and much-loved pipi.

A traditional favourite food of Māori (and more than a few non-Māori), the pipi sucks water to its gills to be strained for food. Young larvae settle at the high tide mark and move down into the estuary as they grow.

Pipi shells became tools for scaling fish and scraping flax, and were also used as rattles.

Other estuary shellfish found in Taranaki have similar cultural pedigrees. Whāngai karoro, or large trough shells, provided pendants as well as food. Tuangi (also known as 'tuangi cockles', though they are not a true cockle) saw use as delicate carving tools and rattles after their meat was consumed.

And the hairy but handy swimmers? They're the marine bristleworms, or polychaetes (rhymes with parakeets, though there the similarity ends), who use their fine bristles for swimming as well as holding themselves in their burrows. Some of these creatures are also the do-it-yourselfers of the estuary, constructing their own 'shell' in the form of a tube made of sand and shell segments, held together with a sticky secretion.

So they're a mixed bunch, these estuary dwellers, and they put the diversity into biodiversity. And together they make Taranaki's estuaries very much greater than the sum of their parts.

Tongaporutu estuary.

Titiko or mud snail *(Amphibola crenata).*

Pipi *(Paphies australis).*

34 Ministry of Fisheries, May 2008. *Fisheries Plan North West Finfish Fishery. Version 4.1*
35 Rush, M. 2006. *Netting Coastal Knowledge: A report into what is known about the South Taranaki-Whanganui marine area.* Published by the Department of Conservation, Wanganui Conservancy.
36 Morrison, M. 2008. Presentation to the Coastal Planners Group.

LOOKING FOR PATTERNS IN NATURE

Although he might be embarrassed at the comparison, Barry Hartley has a similar outlook on biodiversity that Darwin and his contemporaries would have had – everything in nature is fascinating, worthy of study and intrinsically connected.

Barry claims to have retired in 1993, but really that just meant being able to spend more time on his passion – gathering data and observations about the biodiversity, particularly of birds, and pondering the trends and patterns.

Barry is more than just a bird watcher. He also gathers data on when different plant species are flowering or fruiting, recognising that patterns of bird diversity will reflect the availability of food for them.

Since 1996, Barry has monitored bird visitors to nearby estuaries. Mōkau is the most fascinating and diverse. Others he watches include Urenui, Tongaporutu, Mohakatino and Awakino (technically both the Mōkau and the Awakino estuaries are in the Waikato region).

In 20 years he has observed more than 70 different types of birds using these estuaries. He has detected seasonal patterns – pied stilts that return each year to the South Island to breed, royal spoonbills that have looked at one stage like they might set up a nest, and dozens of other shore birds, some of which include Siberia or Alaska in their annual travels.

The dead birds that wash up on the South Taranaki coast also tell a story. Each month Barry surveys a 12.5 km stretch of coast between Ōkato and Opunake, gathering a lot of information about birds that make the wide oceans their home. The short-tailed sooty shearwaters migrate to the North Pacific to breed. When they get washed up on the South Taranaki coast, it could be due to storm conditions out at sea, or a lack of food.

Sooty shearwaters, or the muttonbirds, migrate past our coast twice a year, and again, the numbers turning up on the beach reveal information about the ocean conditions. Barry believes the data he collects could also provide information about changes in climate.

A few years ago, Barry collected 1,600 dead prions (small ocean-going birds), an unusual event compared to the one or two he would normally find. He attributes the deaths to starvation, maybe due to storms, maybe due to change in climate affecting food supply.

Barry Hartley monitoring seabirds.

Every so often, Barry picks up a dead bird that has been banded. This is like finding treasure, as tracing the bird's origins provides new information on its behaviour. A few years ago, he found a yellow-eyed penguin 700 km from where it had been banded. Fiordland penguins have also been found, rather a long way from home.

Barry's regular surveys reveal seasonal trends in several species. Little shags are known to breed in only two locations in Taranaki, but there are more of them around than these could account for. Where else do they go to breed? Kingfishers turn up in their numbers in the estuaries during winter targeting mudcrabs, maybe they need something salty in their diet. Black-fronted dotterels are normally rare north of the Turakina River, but one year, they were seen in reasonable numbers, for no apparent reason. Barry suspects it might have had something to do with feeding or breeding.

Red-billed gulls are another coastal bird with an interesting pattern. They breed on the Sugar Loaf Islands and are observed on the coast and around Lake Rotomanu. There is a real absence of them around the South Taranaki coast during the summer but in winter they can be there in flocks of up to 400.

Barry suspects there are two distinct populations – the North Taranaki birds and a southern population that returns to Kaikoura to breed (as evidenced by banded birds), only venturing up to South Taranaki for the winter.

Volcanic material has formed features on the land and under the sea.

Sugar Loaf Islands (Ngā Motu) Marine Protected Area (SLIMPA) and Tapuae Marine Reserve

The Ngā Motu/Sugar Loaf Islands, just offshore from New Plymouth, are eroded remnants of volcanic domes, forming a group of low sea stacks and seven islands that provide a unique semi-sheltered environment along a coastline that is generally very exposed. The subtidal marine habitats around the Sugar Loaf Islands include spectacular canyons, caves, rock faces with crevices and overhangs, large pinnacles, boulder fields and extensive sand flats. Distinct from the rest of the Cape Egmont coastal unit, these low sea stacks and islands provide the firmest and most stable substrate on the open Taranaki coast.

The Sugar Loaf Islands (Ngā Motu) Marine Protected Area and the recently gazetted Tapuae Marine Reserve take in these diverse range of habitats and sheltered areas for marine life around the Seal Rocks, and also intertidal and subtidal habitats typical of the Cape Egmont coastal unit (Figure 5.10).

The Sugar Loaf Islands are important for 19 species of seabirds, with approximately 17,000 seabirds nesting here. Prominent species include diving and grey-faced petrels, red-bill and black backed gulls, and white-fronted tern. The islands also have a small breeding colony of New Zealand fur seal. Reasonably static seal numbers have been recorded around the islands from 1990 to 2001[37].

Waters surrounding the islands are extremely rich in species diversity with at least 89 species of fish, 33 species of encrusting sponges, 28 species of bryozoans (small coral like organisms) and nine types of nudibranchs (small sea slugs). The northernmost records of some cooler water species as well as the southernmost records of some warmer water species are found in this area, reflecting the dynamic currents that influence this coast. Triplefins, and other reef associated fish (e.g., red moki, leatherjackets, butterfly perch, scarlet wrasse, spotty, blue cod) and short-tailed stingray reside here. Ocean species such as John Dory, kingfish, kahawai, gurnard, snapper, trevally and mullet are other fish species commonly seen. The area is also home to many rock lobster.

Fish, rock lobster and invertebrates have been monitored each summer since 1999 during the summer months (apart from 2003-04 due to unfavourable weather conditions). Information on the distribution of the kelp *Ecklonia radiata* has also been collected.

Results from the first three years of monitoring suggested that there were significantly more fish, and more types of fish within the marine protected area than outside it[38]. This was attributed to there being better habitat for fish within the marine protected area rather than to the various fishing restrictions. However, there did appear to be a greater abundance of snapper, blue cod and rock lobster, all of which are targeted by fishers, within the largely 'no-take' conservation area compared to the rest of the marine protected area and to the sites beyond it.

The Sugar Loaf Islands (Ngā Motu) Marine Protected Area.

Red moki and encrusting sponges.

37 Miller, R, Williams, B 2002. *New Zealand Fur Seal (Arctocephalus forsteri) Numbers at the Sugar Loaf Islands (Ngā Motu) Marine Protected Area, New Plymouth.* Published by Department of Conservation, Wanganui Conservancy.

38 Miller, R. Williams, B, Duffy, D 2005. *Reef Fish of the Sugar Loaf Islands (Ngā Motu) Marine Protected Area.* Department of Conservation Research and Development Series no. 226.

Parininihi Marine Reserve

The Parininihi Marine Reserve (Figure 5.11) includes a section of the wild high-energy North Taranaki coast. Along this part of the coast, sand is constantly on the move and the environment is forever changing. The expansive reef and surrounding sand and mud areas are home to a variety of fish species (such as blue cod, blue moki, red moki, gurnard, John Dory, leatherjackets, kahawai, red cod, tarakihi, trevally and snapper) and rock lobster populations.

However, what makes the area particularly special is its collection of rare and exotic sponges which spread in a vividly coloured carpet across reef ledges in the area. These dense assemblages cover about 75% of available reef surface and are among the densest and most diverse communities in New Zealand. One report has suggested that sites on the Pariokariwa Reef are important on a national and global level, comparable to sites in Antarctica[39].

Baseline surveys of both fish and rock lobsters in the Parininihi Marine Reserve area and on the adjacent Waikiekie reef were conducted in the 2006-07 and 2007-08 monitoring seasons, although they were somewhat limited due to the weather.

(E) THREATENED MARINE SPECIES.

New Zealand has 368 threatened marine species[40]. This includes 4.5% of the seaweeds, 2.4% of the invertebrates, 4.2% of the fish and 62.3% of New Zealand's 122 species of seabird (excluding waders and shorebirds). An estimated 16.7% of New Zealand's 48 species of marine mammals are threatened.

Great white sharks and basking sharks are the most at risk of extinction and are classified as gradual decline. Great white sharks occur throughout Taranaki and are fully protected in New Zealand waters under the Wildlife Act 1953. It is illegal to hunt, kill or harm them within the 200 nautical miles limit.

Encrusting sponges, Paraninihi Marine Reserve.

Threatened marine mammals observed in Taranaki waters include orca/killer whales (*Orcinus orca*), humpback whales (*Megaptera novaeangliae*), southern right whales (*Eubalaena australis*) and Māui's dolphins (*Cephalorhynchus hectori maui*). Māui's dolphin and orca are listed as nationally critical i.e. they have a very high risk of extinction, and southern right whales are listed as nationally endangered[40].

The Māui's dolphin is the world's smallest dolphin at 1.7 m long and with an overall population size of about 111 animals is the rarest. This small population size, together with biological factors including late maturity, slow reproductive rate, and longevity make the population particularly susceptible to premature deaths of individual animals. Māui's dolphins are found only along the west coast of the North Island of New Zealand and so have a limited habitat range. Fishing is the primary cause of human-induced mortality (set netting in particular) where the cause of mortality is known. However, other causes of mortality probably include pollution, plastic debris, and vessel strike.

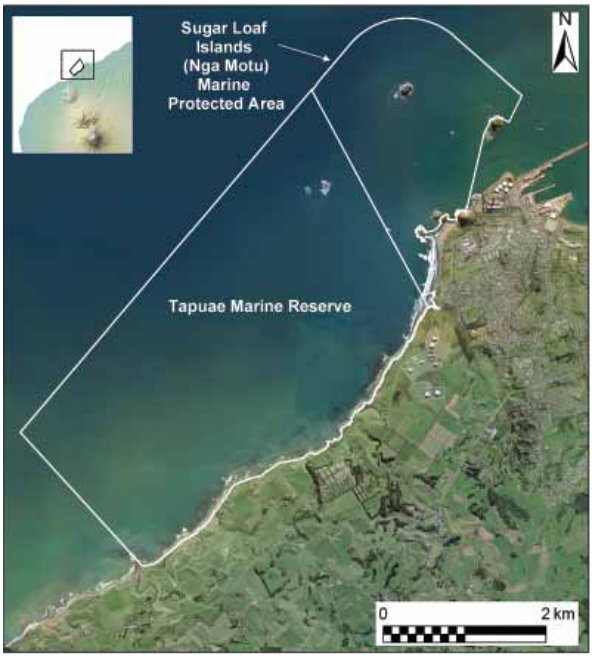


Figure 5.10: Sugar Loaf Islands (Ngā Motu) Marine Protected Area and Tapuae Marine Reserve.

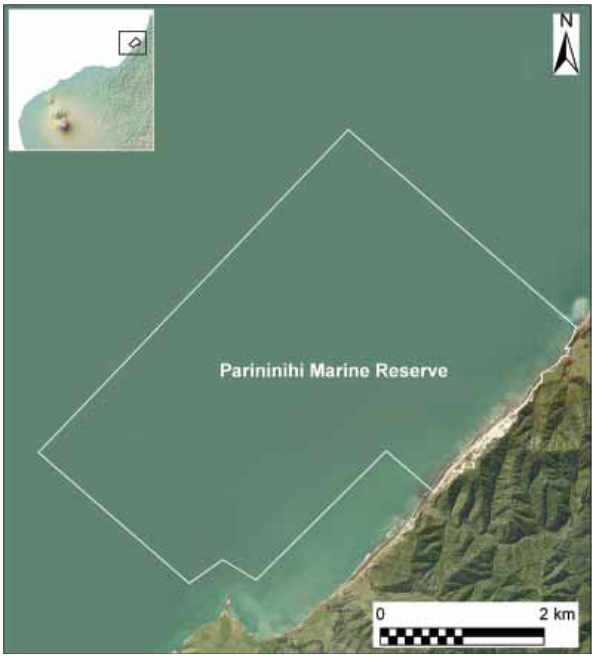


Figure 5.11: Parininihi Marine Reserve.

39 Battershill, C.N. and Page, M.J. 1996. *Preliminary Survey of Pariokariwa Reef North Taranaki.* Prepared by NIWA for the Department of Conservation.
40 Hitchmough, R; Bull, L; Cromarty, P. (Comps) 2005. *New Zealand Threat Classification System Lists. 2005.* Science & Technical Publishing, Department of Conservation, Wellington.

LATTER-DAY WHALE HUNTERS ON RIGHT TRACK

They're hunting southern right whales in Taranaki waters but it's nothing like the bad old days when an onslaught of hunters cleaned out what had been an important breeding ground.

Rather than deadly harpoons, darts are the weapon of choice these days as small tissue samples are collected from visiting southern right whales as part of a Department of Conservation / University of Auckland research project.

The aim is to find out whether the whales cruising local waters are genetically distinct from the 1,000-strong population that breeds near the remote Auckland Islands, nearly 500 km south of the South Island.

Evidence so far suggests the locals are a separate but desperately tiny group with as few as 11 breeding females.

It's a far cry from early colonial days when the South Taranaki Bight was known as Mothering Bay for the number of whales breeding in the area, and settlers complained about the noise of the large mammals. Adults average 14.5 m long and newborn calves are between 4.5 m and 6 m.

Southern rights, or tohorā, were hunted commercially from 1791 to the mid 1900s and have been protected by international agreement since 1935. Two whaling stations were established in New Plymouth, one near the Huatoki Stream and one at Ngāmotu.

The species' English name reflects its history: To whalers, they were the 'right' ones to kill – large, slow-moving, buoyant when dead and providing good quantities of bone and oil.

While the tohorā population around the Auckland Islands appears to be recovering well from the decades of mass slaughter, those closer to our home are evidently struggling.

Since 1990 there have been 30 reported sightings of southern right whales in Taranaki waters, seven of them cow-calf pairs. This indicates that local waters are an important breeding area for tohorā, who generally return to the same breeding grounds every three years[41].

Tohorā are mainly black, with no dorsal fin. Spray from their blowhole is V-shaped. Anyone spotting one off the coast should call DOC on 0800 362 468.

Southern right whale cruising along the Whanganui-Taranaki coast.

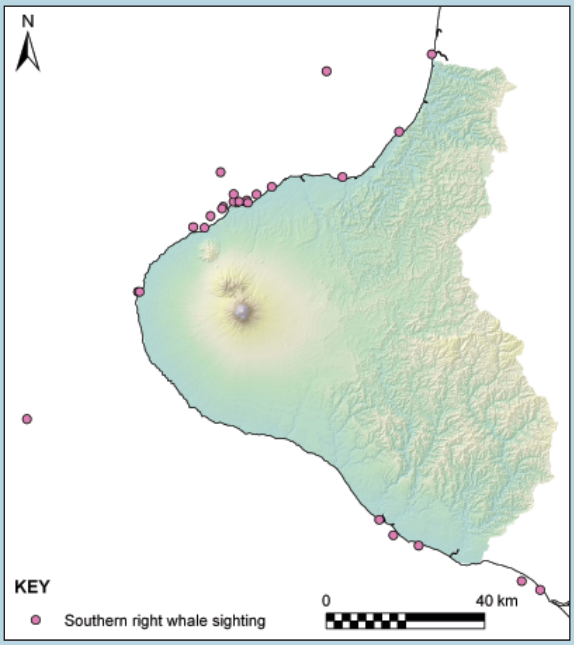


Figure 5.12: Sightings of southern right whales around the Taranaki coastline.

41 Patenaude, N. 2003. Sightings of Southern Right Whales Around 'Mainland' New Zealand. Science for Conservation 225.

Much of what we know about marine mammals has been determined from stranded animals. Scientists take measurements, determine their ages and diet and, from genetics, draw conclusions about the distribution and size of marine mammal populations. Thus stranded marine mammals are an important source of information about marine mammal diversity.

Since 1913 there have been 117 strandings of marine mammals recorded in the Taranaki region (Figure 5.13). These were individual animals in all but six incidents. Taranaki does not have mass stranding events like those that occur in places such as Golden Bay and Stewart Island. Three is the most animals that have stranded at any one time. Most are found dead and of those few found alive only one animal was refloated, a pygmy sperm whale, but it later re-stranded. The most frequently stranded species is the common dolphin (19 incidents).

Beaked whales are the least known of all the marine mammals. They are reclusive creatures that are not often seen at sea and new species have been discovered only in the past decade. Of interest is the fact that seven different species of beaked whales have stranded on Taranaki beaches in 31 individual stranding incidents (Figure 5.13).

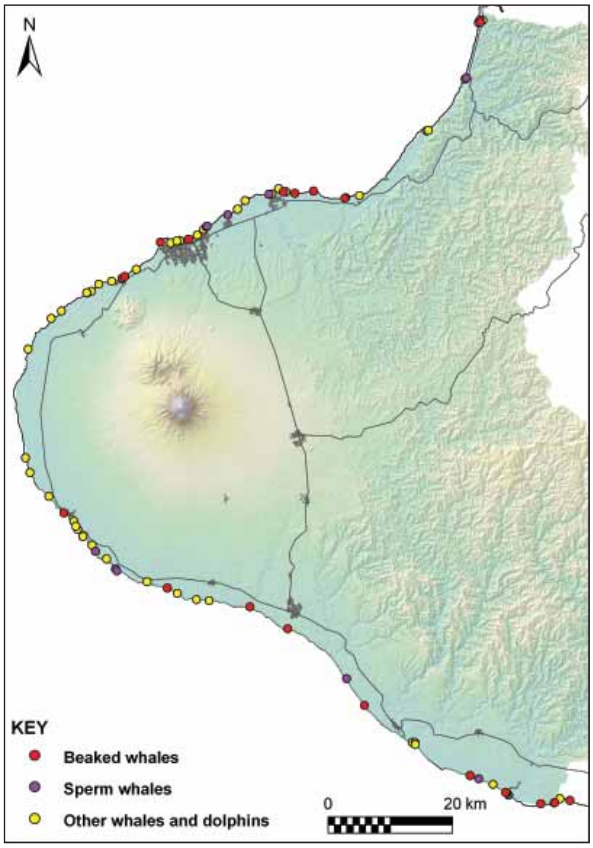


Figure 5.13: Stranded marine mammals recorded since 1913 around Taranaki.

Sperm whales have stranded on Taranaki shores 12 times with three whales stranding at Pīhama in 1988 and two at Waverley Beach in December 2007. Single sperm whales have stranded 10 times. There is a process in place to ensure precious customary materials are made available for iwi. It is illegal to remove any part of a stranded marine mammal unless the animal has been there for a long time, and decayed, and the bone has naturally separated.

5.3.2 HOW IS MARINE AND COASTAL BIODIVERSITY MANAGED IN TARANAKI?

(A) PLANS

The *Proposed Regional Policy Statement* identifies the importance of indigenous biodiversity, including that in the coastal and marine environment. The *Regional Coastal Plan for Taranaki* recognises the importance of safeguarding the coastal and marine biodiversity, particularly in the areas of significant conservation values. The *New Zealand Coastal Policy Statement* is currently in the process of being reviewed, and may have important implications for the review of the *Regional Coastal Plan for Taranaki*. Initial indicators are that the *New Zealand Coastal Policy Statement* will require coastal plans to give greater recognition to the protection of indigenous biodiversity in the coastal marine area.

The Taranaki region will be covered by two specific fisheries plans developed by the Ministry of Fisheries in collaboration with tangata whenua and relevant stakeholder interests: *Fisheries Plan North West Finfish Fishery*[42] and *Fisheries Plan North West Shellfish*. It is expected these plans will be implemented within the next two-three years. The finfish plan covers the inshore fisheries along the entire length of the North Island's west coast. Key species included in the plan are snapper, tarakihi, red gurnard, grey mullet, flatfish, trevally, school shark, rig, hāpuku (groper), kahawai and leatherjacket.

(B) COMMERCIAL FISHING MANAGEMENT

The Ministry of Fisheries primarily manages fishing through the quota management system (QMS). Under the QMS, a total allowable catch (TAC) is set for each fish stock to constrain overall catches. TACs are set at levels to ensure the long-term sustainable use of fisheries resources. When total allowable commercial catch levels are set, Māori customary fishing interests, recreational fishing interests in the fish stock concerned and all other mortality to that stock caused by fishing are considered.

The Taranaki region is a part of the generic Fisheries Management Area 8 that extends between Tirua Point in the north and Pukerua Bay in the south. Each management area is covered by statistical areas which are areas where the Ministry of Fisheries requires commercial fishers to report where they have caught fish.

42 Ministry of Fisheries, 2008. *Fisheries Plan North West Finfish Fishery. Version 4.1.*

The total allowable commercial catch (TACC) for the North Island west coast snapper fishery was reviewed and reduced in 2005 in an effort to bring about rebuilding rate for the snapper stock within a projected timeframe. Some Taranaki commercial fishers are experiencing problems with this measure as they are having difficulty in constraining their catches against the lower TACC due to high snapper abundance in the region. Total allowable catches for some other key species are listed in Table 5.9.

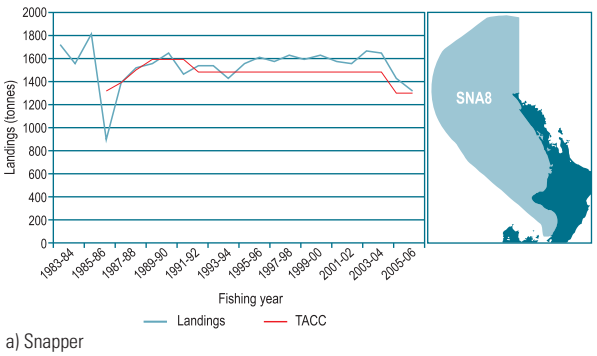
Figure 5.14 illustrates the commercial landings of five key fish species found off the Taranaki coast of greatest interest for both recreation and commercial fishers (snapper, tarakihi, gurnard and rig). Each graph illustrates the TACC and total landings. The maps beside each graph illustrate the quota management area for each fish stock.

Some of the fishing methods used on the North Island West coast, trawling in particular, involve the use of equipment that comes into contact with the seabed, and can therefore impact on the animals

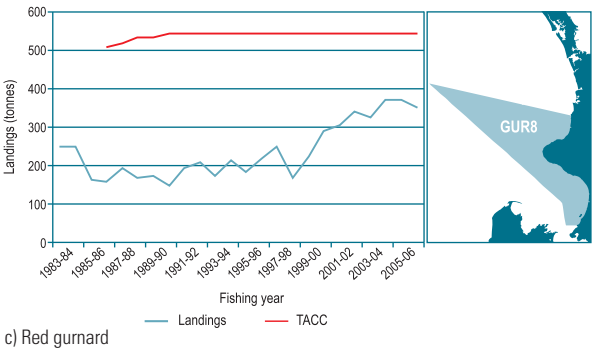
Table 5.9: North Island West Coast Total Allowable Catches (TAC)s, Total Allocable Commercial Catches (TACCs) and customary and recreational allowances for some finfish species(tonnes).

Stock	TAC	TACC	Customary allowance	Recreational allowance	Other fishing-related mortality allowance
Snapper (SNA8)	1785	1300	43	312	130
Tarakihi (TAR8)	-	225[1]	-	-	-
Gurnard (GUR8)	-	543	-	-	-
Rig (SPO8)	401	310	-	-	-
Kahawai (KAH8)	1040	520	115	385	20

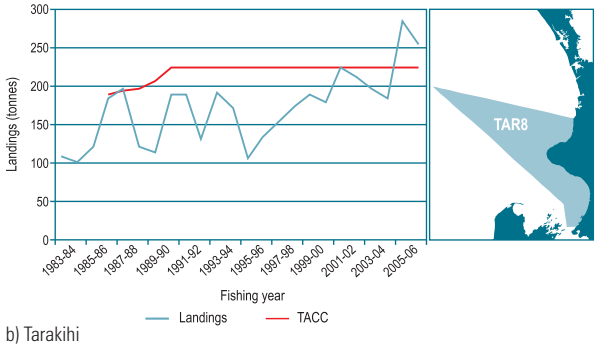
Data: Ministry of Fisheries. 2008.
Note 1: TAC not yet set, so the only allocation is to the commercial sector, non-commercial fishers are still entitled to fish for this species.



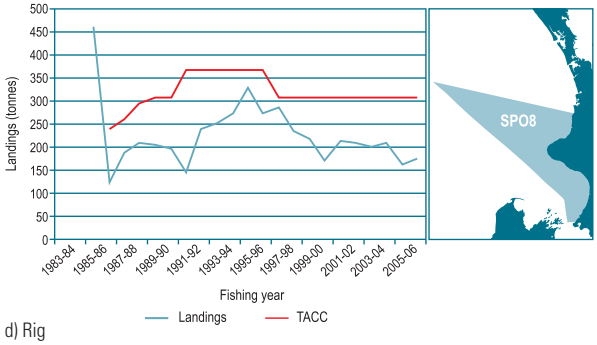
a) Snapper



c) Red gurnard



b) Tarakihi



d) Rig

SOURCE: Ministry of Fisheries 2008.

Figure 5.14: Commercial landings (tonnes) and Total Allocable Catches (TACC) (tonnes) of key fish stocks.

and plants living on or attached to the bottom of the sea. Some of this equipment is heavy enough to leave furrows through soft sediment and dislodge harder material. Figure 5.15 shows the distribution of bottom trawl, bottom pair trawl and mid-water trawl fishing activity on the North Island west coast. The map shows indicative fishing effort of bottom and mid-water trawl.

Commercial and recreational fishers are represented on the Taranaki Fisheries Liaison Committee. This is a long-standing multi-stakeholder fisheries forum which includes stakeholder representatives from all sectors within the region as well as the Department of Conservation and the Council. This committee is consulted by the Ministry of Fisheries on a number of fisheries management issues.

(C) MANAGING RECREATIONAL USE

Recreational fishing takes place for fun and for food to feed family and friends. Recreational fishing is primarily managed by daily bag limits, minimum legal sizes, method controls and area limits.

Unlike commercial fishers, recreational fishers are not required to report the quantities of fish that they catch. However, survey techniques are used to estimate recreational catch, which in turn provides an indication of recreational use. Table 5.10 shows estimates of recreational catches of some species. The estimates are derived from information obtained in diary surveys where a randomly identified group of fishers kept a diary for 12 months recording what they caught. Nationwide surveys were undertaken in 1996 and 2000. Accuracies for both surveys have been questioned – the 1996 estimates may be lower than the actual amounts and the 2000 figures are probably over-estimates. However, the point estimates and ranges do indicate the likely magnitude of the recreational catch particularly when compared with the actual commercial catch.

A recent study gathered information about the South Taranaki coast through a literature review, running workshops with local organisations, carrying out face-to-face interviews with people who were familiar with the coast and undertaking a postal survey[43]. Eighty-five people took part in face to face interviews, 55 people returned written questionnaires and seven groups took part in workshops. 68% of people responding to the requests for information[49] had more than 20 years experience of the area and many had lived, fished and enjoyed the coast for more than 40 years. The observations of change over that time, although anecdotal, are therefore based on many years. The majority of respondents (70%) used the coast for recreational fishing as the project approach targeted individuals with knowledge and experience of the coast.

Fishing has been important to the local pākehā and tangata whenua in South Taranaki since it was first settled. In recent years, improvements

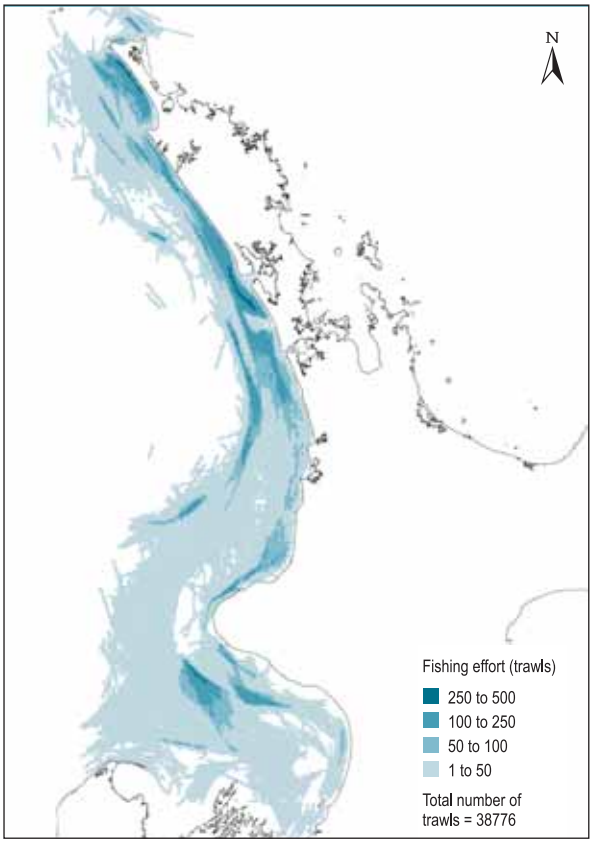


Figure 5.15: Trawl activity within the West Coast North Island.

in technology and the advent of more affordable boats have seen increased numbers of people enjoying this pastime. Participants were asked to identify what changes they had noticed in the area. More than 50% of survey respondents believed that fishing had got harder

Diving for crayfish.

43 Rush, 2006. *Netting Coastal Knowledge: A report into what is known about the South Taranaki-Whanganui marine area.* Published by the Department of Conservation, Wanganui Conservancy.

Table 5.10: Recreational catch estimates for key North Island West Coast stocks with commercial catch as a comparison.

Fish stock	Range (tonnes) 1996	Estimate (tonnes) 1996	Range (tonnes)	Estimate 2000	Actual commercial catch - 2000
Snapper (SNA 8)	215-255	240	215-255	661	1500
Tarakihi (TAR8)	25-35	28	25-35	30	225
Gurnard (GUR8)	23-35	28	25-35	40	534
Kahawai (KAH8)	no data	204	no data	441	272

SOURCE: Ministry of fisheries. 2008.

in recent years. This they attributed to improved technology (e.g. fish finders, better boats etc.), the management of fishing through the quota management system, the number of trawlers – past and present – the increased number of fishers, and sand covering reefs. Twenty five percent of respondents considered that fishing was getting easier. This they attributed to improved technology, the management of fish through the quota management system and the voluntary trawl agreement. The remaining 25% of respondents felt that fishing was as good as it had ever been. They attributed this to the weather limiting access and so preventing over-fishing and to improved technology such as better boats so that they could travel further to fish.

Those respondents that felt that fishing had changed made one or several of the following observations:

- a decrease in the shoreline fish stocks;
- a change in the amount of shellfish such as tuatua, mussels and pāua;
- an increase in the number and size of paddlecrabs;
- a decline in the kahawai;
- an increase in the number of spiky dogfish;
- a decrease in the number and size of groper or hāpuku; and
- that to catch blue cod you had to go further off shore.

The Ministry of Fisheries notes that there has been no evidence of a decrease in shoreline stocks, in fact, snapper have become extremely abundant in Taranaki. There is also no data to support a decline in kahawai abundance nor the need to travel further offshore to catch blue cod. However, the Ministry of Fisheries collects information at a larger scale (such as at the level of the quota management areas) than at the scale of this study.

(D) CUSTOMARY FISHING

Fishing and the gathering of other kaimoana was, and remains today, a fundamental part of being Māori and living on the Taranaki coast with tangata whenua holding a very strong relationship with the sea. Traditional management entails a whole body of knowledge about the resource and how and when to access it. The report into the South Taranaki coastal area referred to above noted that customary management has had to adapt to new circumstances, and while there may have been some loss of adherence to traditional management practices in the past, there is evidence that this may well return with the efforts of local iwi. Customary knowledge is held sacred by tangata whenua and only passed on to those who will look after that knowledge.

Traditional management governing fishing practices within an area of significance to tangata whenua can be undertaken using the Fisheries (Kaimoana Customary Fishing) Regulations 1998. Customary rights provided for under these regulations allow tangata whenua to establish management areas (mātaitai reserves) where they can create bylaws to oversee fishing within these designated reserves and to create management plans for their overall area of interest. The kaimoana customary fishing regulations take effect in an area after tangata whenua successfully notify tangata kaitiaki and boundaries of their rohe moana and awa. If tangata whenua choose not to utilise the kaimoana customary fishing regulations they can still exercise their customary right through issue of a customary fishing permit under the Fisheries (Amateur Fishing) Regulations 1986. The identification and notification of tangata kaitiaki and rohe moana requires considerable consultation and to date no appointments have been made within the Taranaki region.

Ministry of Fisheries-led fisheries plans, including the North West Finfish Fishery, North West Shellfish, and North Island Eel (tuna) fisheries plans recognise important taonga species, including hāpuku, kahawai, pātiki, toheroa, kina, green-lipped mussel, pipi and tuna. These and other species are listed in deeds of settlement reached with various iwi and hapū within the Taranaki region.

(E) MARINE PROTECTION

Marine reserves are the highest level of protection. Two marine reserves have been established in Taranaki: Parininihi Marine Reserve (1,844 ha) and Tapuae Marine Reserve (1,404.3 ha). Together they cover an area of 3,248.3 ha. Marine parks represent another level of protection. The Sugar Loaf Islands (Ngā Motu) Marine Protected Area covers 489.7 ha.

Other forms of protection include cable and pipeline zones where certain types of fishing are restricted. They stop netting and prohibit anchoring. The different types of areas around the Taranaki coast with some form of protection from fishing activities are set out in Table 5.11. However, fishing restrictions tend not to be enforced in all areas.

Table 5.11: Area-based fishing restrictions in Taranaki.

Area restriction	Area	Length of coastline affected between Patea and Awakino	Fishing sector effected
Parininihi Marine Reserve	1,844 ha	5.6 km	• All fishing prohibited. • Shape of marine reserve still allows surfcasting along 3km of coastline.
Tapuae Marine Reserve	1,404.3 ha	5km	• All fishing prohibited.
Sugar Loaf Islands (Ngā Motu) Marine Protected Area	489.7 ha	2 km	• Commercial fishing (except trolling for kingfish and kahawai) prohibited. • Recreational set netting and longlining prohibited. • i.e. recreational fishing, diving and potting for rock lobster permitted.
Pohokura pipelines and platforms	872 ha	1 km	• All vessels greater than 9 m in length prohibited from anchoring. • Trawling prohibited. • No restrictions on any other fishing.
Māui pipeline – Ōaonui	14,100 ha	8 km	• No fishing or anchoring except for fishing vessels being used to set or lift nets or rock lobster pots, or paua or kina fishing as long as these activities are carried out in daylight hours and do not involve attachments to the seabed and are within 2 miles of low watermark. • Note this restricts commercial set nets as they leave gear out overnight.
Māui A and B pipelines	Not calculated	NA	• Restricted area for all New Zealand ships.
Urenui no trawl zone	15,340 ha	45 km	• Prohibits trawling (Fisheries (Central Area Commercial Fishing) regulations 1986. • Does not impact any other fishing sector.
New Plymouth to Awakino no trawl zone	9,100 ha	25 km	• Voluntary no trawl zone. • Does not impact any other fishing sector.
Cape Egmont to Rangitikei river no trawl zone	36,000 ha	99 km	• Voluntary no trawl zone. • Does not impact any other fishing sector.
Set net ban – Pariokariwa Point to Maunganui Bluff.	not calculated	37 km	• Recreational set netting prohibited to 7 nautical miles. • Commercial set netting prohibited out to 4 nautical miles, with some limited commercial netting beyond that.

Māui's dolphin *(Cephalorhynchus hectori maui).*

(F) THREATENED SPECIES MANAGEMENT

To protect Maui's dolphins, fisheries regulations are in place that ban set netting within seven nautical miles of the coast from Maunganui Bluff (north of Dargaville) to Pariokariwa Point (north of New Plymouth) (Figure 5.16). Some limited commercial netting can still continue outside four nautical miles. A threat management plan is being prepared setting out strategies to reduce those threats to Maui's dolphins which are human-induced. The plan introduces proposals to manage threats including fishing related options, a marine mammal sanctuary, research and monitoring. The Taranaki region is at the southern end of their distribution and although there are not large numbers of dolphins seen here, small numbers of deaths can have drastic implications for the survival of the population. A West Coast North Island Marine Mammal Sanctuary has recently been gazetted for the area from Manganui Bluff (north of Kaipara Harbour) to Ōākura Beach out to 12 nautical miles. This contains restrictions on the use of acoustic devices and mining (other than for petroleum) within two nautical miles.

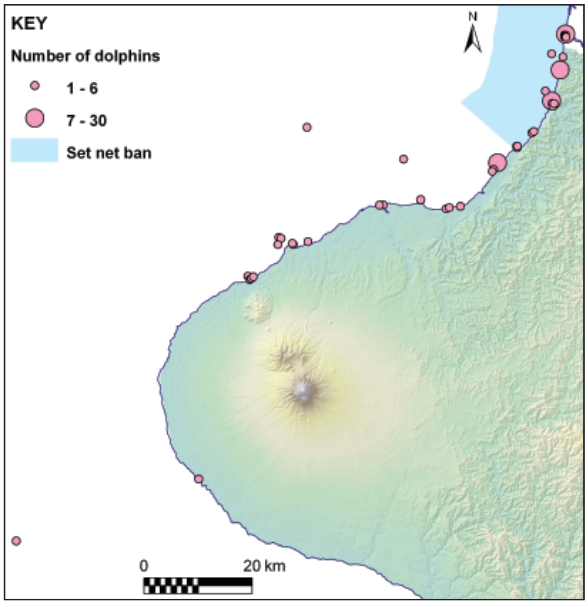


Figure 5.16: Map of Māui's dolphin sightings and set net ban.

The invasive *Undaria pinnatifida.*

(G) EXOTIC PEST MANAGEMENT

The discharge of ship ballast water and ship hull cleaning have been identified as the two significant potential causes of the introduction of exotic marine organisms into New Zealand waters. Taranaki is vulnerable to the introduction of organisms from overseas through the port. The majority of port trade involves the movement of international ships. Ships are required to discharge ballast water outside of the coastal marine area (12 nautical miles) prior to entering Port Taranaki.

Undaria pinnatifida, well known to miso soup lovers everywhere as 'wakame', has been found in Port Taranaki, and is now identified as an eradication pest plant in the *Pest Management Strategy for Taranaki: Plants*. The plants have been found concentrated mainly around the public boat ramp and jetty areas in the eastern corner of the port. *Undaria* is an invasive seaweed species that can reach an overall length of 1-3 metres. The plant matures in 40-60 days and produces millions of spores. *Undaria* spreads by fouling ship hulls and can rapidly colonise many different substrate, ranging from rocky reefs, mobile cobble habitats, soft sediments, other seaweeds, ropes, buoys, wharf piles and on ship hulls.

Given that *Undaria* is very fast growing, no New Zealand native seaweeds can compete with it, giving *Undaria* a free reign to invade gaps in the substrate, grow on other organisms and change the natural character of the area. The seaweed can form dense forests resulting in competition for light and space which may lead to the exclusion or displacement of native plant and animal species.

An initial trial was undertaken where *Undaria* was removed and jetty piles were cleared and wrapped with black plastic in order to prevent anything growing back on them. The trial was partially successful, but did not eradicate *Undaria* completely. A programme of on-going monitoring and removal has been implemented and is undertaken by the Taranaki Regional Council, the Department of Conservation and Port Taranaki Ltd.

Pīhama, South Taranaki.

Midhirst School students learn about the coastal environment.

(H) INFORMATION GATHERING AND MONITORING

Since the *2003 State of the Environment Report*, a working party consisting of the regional and district councils and Department of Conservation, completed an inventory of coastal areas of local or regional significance in the Taranaki region. This inventory, primarily prepared to look at public access, also collated existing information on ecological values of a number of sites[44].

In 2004, in a joint project between the Taranaki Regional Council and the Department of Conservation, an inventory was developed of all reports, scientific research and information relating to the Taranaki coastline[45]. All stakeholders and consultants who work or have worked within the coastal area were contacted for a list of all research they had either commissioned or conducted. 275 reports were recorded onto a database which is searchable via the Council's website. This showed that a large amount of information exists on the Taranaki marine environment that was not previously well known, with some research dating back to the early 1900s. Information was greatest about intertidal ecological monitoring, beaches, erosion, sea floor life, sediment, water quality, the petrochemical industry and ocean outfalls. A gap analysis of the information gathered revealed that there was little information on various aspects of biology – fish tagging, seabird nesting, crayfish, shellfish – and little on aspects of marine weather, marine historical areas, and beyond the 12 nautical mile zone.

In 2006, a community-based project team was formed to research more about the marine environment along the South Taranaki coast. This was facilitated by the Department of Conservation and included representatives from Taranaki Regional Council, Ngā Rauru, Ngāti Ruanui, the Ministry of Fisheries and a number of recreational boating and diving clubs. The team conducted research into what was recorded about the coast and what local people knew about their coastal and marine area[46].

The Taranaki Regional Council carries out state of the environment monitoring in estuaries and at rocky shore sites recording the diversity of invertebrates. The Department of Conservation carries out monitoring in the marine reserves and marine protected area. Results from these programmes are described earlier in this chapter.

The Ministry of Fisheries gathers information from commercial fishers, as well as carrying out research into recreational fishing.

(I) COMPLIANCE AND LAW ENFORCEMENT

The Ministry of Fisheries enforces the regulations around the taking of fish, shell fish and aquatic life. The Ministry of Fisheries and the Department of Conservation undertake joint compliance work in the Sugar Loaf Islands (Ngā Motu) Marine Protected Area. This work is assisted by members of the public who keep an eye out for those fishing in the wrong areas.

Although there have been reports of illegal fishers in the Parininihi Marine Reserve, the level of compliance has generally been good. Local fishers have been active in discouraging poachers from the reserve and as yet there have not been any prosecutions.

(J) INFORMATION, ADVICE AND EDUCATION

As part of its environmental education programme, the Council works with teachers and school children to raise awareness of rocky shore issues and encourage wise and sustainable use of the coast. The Council provides a unit of work and a teaching resource kit to teachers that link water studies to the New Zealand curriculum. The Council also offers support and equipment for rocky shore field trips where children participate in monitoring or beach clean-up or monitoring activities.

Seaweek, held annually in March, provides a focus for raising awareness in the community on coastal and marine biodiversity issues. The week is facilitated by the Department of Conservation and includes the New Plymouth and South Taranaki district councils, the Ngā Motu Marine Reserve Society, Forest and Bird and corporate sponsors such as McDonald's and local book stores. Public talks, walks, beach clean-ups, competitions and events are held to raise public awareness.

44 Taranaki Regional Council, 2004. *Inventory of Coastal Areas of Local or Regional Significance in Taranaki.*
45 Taranaki Regional Council, 2004. *Coastal Information Inventory for the Taranaki Coast.*
46 Rush, 2006. *Netting Coastal Knowledge: South Taranaki-Whanganui Marine Area.* Published by the Department of Conservation, Wanganui Conservancy.

Students getting a hands-on experience of the rocky shore.

The Ministry of Fisheries undertakes a number of activities aimed at increasing and improving fishers' knowledge about fishing legislation and the consequences that may arise from breaching the regulations. Improving fishers' knowledge and understanding of these regulations will help maximise voluntary compliance across the sectors (commercial, recreational and customary).

(K) COMMUNITY INVOLVEMENT

The Ngā Motu Marine Reserve Society Incorporated is a diverse community group representing scientific, educational and recreational interests. Their objectives are to establish a network of marine reserves in the Taranaki region, to ensure the marine life and other natural resources within the region are protected, to encourage the scientific study of marine life on the Taranaki coast and to foster community awareness of the coastal environment by education. The Society was the applicant for the Tapuae Marine Reserve established in 2008.

Forest and Bird advocates the importance of looking after little blue penguins along the coast by promoting the importance of keeping dogs under control and building penguin boxes.

Community coast care groups work with district councils on sand dune restoration programmes.

(L) SUMMARY OF PROGRESS

A summary of progress in implementing regional objectives and policies on coastal and marine biodiversity is set out in Table 5.12 below.

5.3.3 HOW DO WE COMPARE?

The Ministry for the Environment has recently reported on the proportion of mainland coastal biogeographic regions protected through marine reserves[47]. This highlights that no mainland region has more than 0.4% of its total area in marine reserve. The Western North Island region and the North Cook Strait regions have just over 0.1% and just over 0.15% of their areas in marine reserve respectively.

Table 5.12: Summary of progress with objectives and policies on coastal and marine biodiversity.

Issue	What do we want to achieve	How is it measured	What progress are we making
Reducing threats to marine habitats, flora and fauna.	• An increase in the number and areal extent of ecosystems, habitats and areas with regionally significant indigenous biodiversity values in the Taranaki region, and which are formally protected. • Maintenance and enhancement of the ecological condition of ecosystems, habitats and areas with regionally significant indigenous biodiversity values.	• Extent of the territorial sea (ha) protected through marine reserves or marine protected areas. • Levels of consented activities in areas of significant conservation values. • Biosecurity monitoring and surveillance undertaken.	• The Sugar Loaf Islands (Ngā Motu) Marine Park was established in 1983 and the protection status of the area was upgraded in 1991 to SLIMPA. Parininihi Marine Reserve came into effect October 2006, followed by the Tapuae Marine Reserve in 2008. • Levels of compliance in the reserves have been good and they are generally self-policing. As yet there have not been any prosecutions. • 27 coastal permits have been granted, reviewed or varied in coastal area A (areas of outstanding coastal value) since the *Regional Coastal Plan* was made operative. • Port surveillance programme and *Undaria* control programme.

47 Ministry for the Environment, 2007. *Environment NZ, 2007.*

Paragliding, Back Beach New Plymouth.

5.4 PUBLIC ACCESS

5.4.1 WHAT IS THE STATE OF PUBLIC ACCESS TO TARANAKI'S COAST?

(A) RECREATIONAL USE OF THE COAST

The Taranaki coastal environment offers an extensive and important recreational resource for fishing, diving, swimming, surfing, windsurfing, walking and boating.

Due to Taranaki's high-energy coastline most swimming activities occur at major recreational beaches where surf-lifesaving patrols operate (e.g. Fitzroy, East End, Ōākura, Opunake and Ōhawe). Other swimming locations include Waiiti, Mimi, Urenui, Ōnaero, Waitara, Ngāmotu, Back Beach, Greenwood Road, Komene, Kaupokonui, Waverley and Pātea. Public access to these major recreational beaches is easy, access to other beaches can be over private land which requires the permission of the landowner.

Boating on the coast relies on the access provided by boat ramps. Public boat ramps are situated at Tongaporutu Estuary, Urenui Estuary, Waitara Estuary, Port Taranaki, Ōhawe and Pātea Estuary. Boat ramps where access is restricted through permits to occupy the coastal marine area, are situated at Middleton Bay, Bayly Road and Warea.

Fishing is also a very popular past-time with a lot of anglers utilising boats to access the deep-sea fishing opportunities that Taranaki has to offer. Alternatively, surfcasting off beaches and fishing off jetties or wharfs are also popular.

Surfing is also a favourite activity for many Taranaki locals and visitors alike. Surfing can occur at many locations in Taranaki, with the number of surfers increasing in the region through growing awareness of Taranaki's unique surfing environment and international surfing competitions now being held in the region. This has resulted in increased pressure for facilities and infrastructure at popular surfbreaks (e.g. Kūmara Patch, Pūniho Road, Paora Road, Arawhata Road, Mangahume and Stent Road). In many cases, access to these areas requires landowner permission. An artificial surf reef is being developed at Opunake, reflecting strong community interest and the tourist potential of surfing within the Taranaki region.

Walking and cycling have become increasingly popular activities along Taranaki's coastline, especially with the development of the coastal walkway in New Plymouth. Access to the coast has therefore been an important element in encouraging more people to walk and cycle as both a means of getting to/from work, as well as an important recreational activity.

Diving is another recreational use of the coast. A study into the coastal marine values of the South Taranaki-Whanganui coast noted that dive spots in South Taranaki were rated anecdotally as amongst some of the best in New Zealand[55].

Survey results of sport and physical activities undertaken by Taranaki residents showed that activities such as walking for enjoyment or exercise, swimming and fishing were in the top 25% of activities listed by Taranaki residents[56]. Surfing and bodyboarding appeared in the second quartile of most popular activities. Walking for enjoyment or exercise, which was listed by almost 60% of respondents, will often involve walking along or near the waterways.

A postal survey carried out by the Taranaki Regional Council over the summer of 2007-08 found that Fitzroy, Ngāmotu and Opunake beaches were the locations most people have visited, with nearly one-third of all respondents having visited each of these beaches[57] (see case study).

Waverley Beach.

Proud fisherman.

55 Rush, 2006. *Netting Coastal Knowledge: A report into what is known about the South Taranaki-Wanganui marine area.* Published by the Department of Conservation.
56 Sport Taranaki. 2006. *The Regional Sport and Physical Activity Strategy.*

This was a change from when a similar survey was undertaken in 1984 which found that Ōākura Beach was the location most visited.

This study also asked people the main activity they undertook at individual beach sites. The most popular reasons for visiting a beach were to walk (61% of respondents), swim (50% of respondents), relax (44% of respondents), fish (25%), picnic (24%) and to admire the scenery (20%).

Observations were also made at a number of Taranaki coastal sites over the 2007-08 summer to see what activities were the most popular. Table 5.13 illustrates the range of activities observed at Taranaki beach and estuary sites, and the relative popularity of certain beaches.

The survey found only 10% of respondents had not been able to gain access to rivers, lakes or parts of the coast in Taranaki that they wanted to in the last year. The main reasons people could not gain access was because the access or entrance was closed, access was too difficult or too dangerous. Only 1% of respondents had been denied access by the landowner or occupier. It appears that road access has not changed significantly from when the last survey was undertaken in 1984. However, substantial car parking, facility upgrades and development of walkways have occurred.

Table 5.13: Main activities observed at coastal locations over the 2007-08 summer recreation survey.

Location	On beach/ river bank	sea swim	river swim	surfing	fishing	sail craft	power craft	walking dogs	other	average total users
Fitzroy Beach	69	56		9			2	2	3	122
Ngāmotu Beach	60	20		3	5	8	2	1	6	86
East End Beach	48	30		5		5			3	83
Opunake Beach	31	16		9	2		2		19	63
Ōākura Beach	30	21		9	1		1	4	5	62
Back Beach	19	7	2	19	2	1		4	2	43
Timaru Stream	14	5	8	6	2	7		2	2	33
Corbett Park, Oakura	20	3	17					2	3	32
Ōnaero Beach camp	14	6	12		4				3	29
Pātea Beach	13				8			1	10	26
Everett Park	16		13		1				5	25
Kaupokonui Mouth	11	3	5	3	6				4	24
Ōaonui beach, Kina Rd	4			4		3		2		10
Ōhawe Beach	6	2		2	1				5	10
Waverley Beach	6				3				1	10
Waiiti beach	4									5

Opunake beach and motor camp.

Swimming in the Ōākura River at Corbett Park.

57 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*

WE SHALL COUNT THEM ON THE BEACHES

The people's verdict is in: The level of public access to the Taranaki coastline is about right. That's one of the conclusions of an investigation into the recreational use of coast, rivers and lakes in the region[58].

The investigation was carried out in the summer of 2007-08 and involved analysis of more than 400 responses to a postal questionnaire, and a series of observation counts at popular recreational sites. It was the first such survey for more than two decades.

The postal survey's 15 questions included several on the issue of access. Most significantly, 90% of respondents indicated the level of public access to coast, lakes and rivers is "about right", with 8% saying it is inadequate and 2% believing it is too great. A similar satisfaction rating was found in a New Plymouth District Council-commissioned survey of 402 residents by the National Research Bureau in February 2008[59].

Asked about the level of access to the natural environment (including rivers, lakes, the mountain and the coast), 58% of respondents were "very satisfied" and 37% "fairly satisfied", giving a total satisfaction rating of 95%.

This investigation also touched on the number of visits and factors that discourage visits. Public access is not a major issue in the latter:

Road ends provide access to remote surfing spots.

People say the main reasons they don't get out are work commitments, lack of time, family commitments and cost, but ill health, mobility issues and lack of transport were also cited.

Some 90% of respondents reported having been to a beach, river or lake in the preceding 12 months. This was down from 99% in the Taranaki Regional Council's previous survey in 1984. Despite this fact, the earlier survey had only around half the number of respondents, while the 2007-08 investigation had a greater representation of older age groups.

Overall, results from the survey indicate that public access is not a major limitation to public usage of the coast.

Recreational use at particular parts of the coast depends upon a number of factors such as an area's physical characteristics, its uniqueness, its recreational values and qualities, its proximity to urban areas or rural communities, and the quality of public access. For some areas demand and expectation are that facilities and infrastructure will be provided to enhance use and access to the area (e.g. seating, walkways, shelter, boat ramps and car parking) or safeguard the area from the effects of that use (e.g. toilet and rubbish collection facilities). Any development of the coast may adversely affect other recreational experiences (e.g. walkers preferring solitude or the wilderness aspect) and, in some cases, may lead to a gradual loss of the scenic, amenity and natural character of that part of the coast.

(B) COASTAL AREAS OF LOCAL OR REGIONAL SIGNIFICANCE

Access to the coast in Taranaki relies upon both formal access (via public lands and roads) and informal access (via private land where there is no public right of access). An inventory of coastal areas of local or regional significance was prepared in order to see if there was a need to discourage public access (from sites vulnerable to disturbance for example), identify any safety issues and gain an understanding of people's knowledge of access points[60]. The relative ease of access to each of the 69 sites identified was assessed.

Twenty-nine of these sites (or 42%) were evaluated as having excellent public access. Most of the main recreational beaches in Taranaki, or areas close to New Plymouth and other coastal settlements (e.g. Ōākura and Opunake) were identified as having excellent public access. For public access to be ranked as 'excellent' these sites had to be a short distance from a formed public road, easily accessible at high and low tide, and with reserves and public access clearly defined and identifiable.

A further 11 (16%) coastal areas were identified as having good public access. These sites had to be a short walk from a formed public road, along a clearly defined and traversable track (this is important as access is sometimes constrained by tides), and connected by reserves or clear public access points.

The remaining 29 coastal areas (or 42%) were rated as having poor public access. Access to these sites usually involved a long walk from the nearest formed road, pathways were generally unclear, involved rough or difficult topography, or involved the need to obtain a landowner's permission to cross land.

58 Taranaki Regional Council, 2008. *Recreational Use of Coast, Rivers and Lakes in Taranaki 2007-2008.*
59 New Plymouth District Council, 2008. *New Plymouth District Council Communitrak™ Survey February 2008.*
60 Taranaki Regional Council. 2004. *Inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region.*

Access to remote areas is often restricted by cliffs and tides.

Picnic at Bell Block Beach.

(C) PHYSICAL CONSTRAINTS TO PUBLIC ACCESS ALONG THE COAST

Access along the coast can be physically constrained where there is a significant natural impediment to public access to an area (or part of an area) such as to areas offshore (e.g. reefs, islands and the Alexandra shipwreck) or to areas surrounded by high cliffs or accessible only at low tide. For example, the Tongaporutu coast is accessible only via the estuary two hours either side of low tide.

Almost the entire Taranaki coastline is subject to varying rates of erosion from waves and wind. This has resulted in a predominantly cliffed coastline derived from the erosion of lahar and other volcanic material. In North and South Taranaki, the erosion of marine sediments has resulted in a coastline of almost continuous papa cliffs.

In such areas, the provision of public access may not be practicable or appropriate. Indeed, the relevant agencies may wish to discourage public access because of health and safety considerations.

In some localities, an area or site is designated as a reserve for the purpose of protecting from human interference the values associated with that area. In such areas restrictions on public access are appropriate. For example, the Sugar Loaf Islands is a conservation area with diverse and abundant marine and bird life, and underwater habitats. They also include several archaeological sites. Public access therefore needs to be prevented or minimised to restrict the level of disturbance and resultant diminished values.

In addition to these islands, which are formally protected, there are other areas or sites that are ecologically or culturally sensitive, but which are either not protected or there is good to excellent public access. For example, the Ōeo cliffs contain unprotected coastal herbfields, which are the habitat of a threatened moth. Private and public land within the coastal environment may also contain unprotected areas or sites that are important to Māori for cultural or spiritual reasons (e.g. wāhi tapu sites), or which contain other taonga (treasures). For such areas, public access needs to be managed and, in some cases, restricted.

(D) FORMAL ACCESS ALONG THE COAST

Public roads offer the greatest degree of public access to the coast. Roads, along with the creation of reserves and strips, provide formal access options to the coast.

There is a perception that subdivisions and other types of use and development have 'alienated' large stretches of the coastline – reducing the quality of public access to the coast. However, New Plymouth and South Taranaki district councils both have policies and methods to set aside land for public access purposes or to negotiate public access arrangements with developers or coastal land occupiers. In most circumstances, district councils, at the time of subdivision, consider the creation of esplanade reserves and esplanade strips to ensure continued public access to the coast. Accordingly, public access through the provision of esplanade reserves or esplanade strips is believed to have increased over time.

Subdivisions have been created on the coast since 2002. In the New Plymouth District these coastal subdivisions are occurring all along the coast. In South Taranaki these are located near Waverley Beach, Ōaonui, Manaia, Pūniho, Opunake and Waiinu Beach. There are some 47 coastal esplanade reserves or strips in the New Plymouth District and a number in the South Taranaki District. Esplanade reserves and strips tend to be unevenly distributed in the region. In the New Plymouth District, coastal esplanade reserves or strips are concentrated along the coast north of the Stony (Hangatahua) River, at Ōākura, Otaraoa and Turangi Roads and at Ōnaero and Urenui. In the South Taranaki District, coastal esplanade reserves or strips are concentrated in the areas of Opunake, Rahotū and Pūniho.

There are also many local purpose reserves, recreational reserves, existing esplanade reserves and Department of Conservation reserves, situated along the coast, which provide formal access.

The patchwork of public roads and reserves providing public access to the coast is therefore a historical accumulation rather than a logical network. There has never been a strategy or agency responsible for

overseeing the implementation of the various mechanisms available for enhancing coastal public access. As a consequence, the right of access to the coast is often discontinuous.

The single most significant factor constraining public access to coastal areas of local or regional significance in Taranaki is that formal public access routes are often not clearly defined or difficult to identify (e.g. there are no signs or formed roads), making it difficult to distinguish public from private access. While some of the larger reserves are signposted, smaller reserves (such as esplanade strips) which could give access to the coast are often unmarked and their existence not well known.

Unformed roads (land set aside and owned by the relevant district council for roading purposes, but not maintained by the council) have the potential to provide public access to the coast. However, these unformed roads, commonly known as 'paper roads' are usually identified only on survey maps and their existence is often not well known and the actual pathway can be difficult to ascertain from the adjacent privately-owned land. For example, the Stony (Hangatahua) River mouth has unformed roads providing for public access along both the left and right banks but the actual location of these roads is unclear.

There are also cases where legitimate public access using unformed paper roads is impeded by the landowner – sometimes deliberately, sometimes through a lack of awareness. Both formed and unformed roads have the same legal status – that is, the public has the right to pass along the road without hindrance.

Te Rewa Rewa Pa site, Waiwhakaiho River, Lake Rotomanu and New Plymouth.

PARTNERSHIP ENSURES TREASURES ENDURE

North Taranaki coastal treasures, ancient and modern, are being preserved and enhanced under a ground-breaking management agreement that has won national acclaim.

The ancient treasure is Te Rewa Rewa Pā, for generations a focal point for Ngāti Tawhirikura hapū before its site and surrounds near the mouth of the Waiwhakaiho River were taken over for defence purposes, eventually becoming a New Plymouth District Council reserve.

The modern jewel is the New Plymouth coastal walkway, which has quickly become a popular attraction for locals and visitors alike.

Under the Rewa Rewa Agreement signed in June 2007, the hapū and New Plymouth District Council are jointly managing the 26 ha reserve. This arrangement allows Ngāti Tawhirikura to plan developments for the cultural benefit of the hapū as well as the wider community, while the Council can use a coastal strip to extend the coastal walkway towards Bell Block.

Rangi Kipa, who chairs both the hapū and the Joint Management Committee, said the arrangement was working well and the Committee had been intensely involved with planning for the coastal walkway extensions and the construction of a new pedestrian bridge over the Waiwhakaiho River.

"We were really happy to return to this land and to be welcomed back to it holding hands with the Council," he said.

At the signing ceremony in 2007, Ngāti Tawhirikura Trustee and Te Tai Tonga MP Mahara Okeroa called the agreement a 21st century solution to an issue. "It's not a compromise. It's more than just the shadow of the land – it's more substantive than that, and we will work on it together," he said.

On the Council side, New Plymouth District Mayor Peter Tennent is also enthusiastic. "When we signed this management agreement, we knew we were showing the country a new way for mana whenua and local government to work together for the interests of the wider community," he said.

"By taking a new approach to ancestral land, Ngāti Tawhirikura and New Plymouth District Council have established an enduring gift for the enjoyment of many generations to come."

The Rewa Rewa Agreement won a 2008 Institute of Public Administration Sector Excellence Award, in the Crown-Māori relationships category. It has also been commended in the New Zealand Post Management Excellence Awards.

The New Plymouth District Council's Iwi Relationships Co-ordinator, Aroha Chamberlain, said the awards acknowledge the leadership and vision of both the Council and the hapū, and are also important for recognising and sharing best-practice. "This may result in benefits for other local government and mana whenua groups."

(E) INFORMAL ACCESS TO THE COAST

Informal public access (i.e. where access is over privately-owned land) is also an important part of providing access to the coast in Taranaki, although access relies on the goodwill of adjacent landowners. Generally most private landowners are happy to allow people to cross their land. However, changing social conventions, increased responsibilities on landholders in relation to occupational health and safety, as well as changes in land uses and recreational patterns, often mean that informal public access to previously accessible beaches, surfing or fishing spots is becoming increasingly restricted. Problems can also occur when the landowners' property rights are not respected (e.g. failure to obtain the permission of the landowner, close gates or disturbance of livestock). Reasonable and responsible access is desirable. There is a need to respect private rights – if this is done fully and properly, informal access can remain an important part of continuing public access to the coast where other methods might not be practicable or cost effective. Increased public awareness for both landowners and the general public is the key.

COASTAL ROUTE IN CLASS OF ITS OWN

When Diana Reid says the South Taranaki coastline has enormous potential as a visitor attraction, you can be assured she's walked the talk.

The Hāwera High School geography teacher won a research fellowship that enabled her to take a year away from the classroom in 2006 to walk more than 160 km from Waitōtara to the Stony River, assessing the potential for a coastal walkway or network of walkways.

Her conclusion: This could be one of New Zealand's great walks, but bringing it into reality will require much work.

The research fellowship was awarded by the Royal Society of New Zealand and funded by the Ministry of Research, Science and Technology. Armed with a GPS device and taking photos, notes and recordings as she went, Diana stayed as close to the coast as possible and walked some sections twice. She says the highlights of her many journeys were beautiful beaches and coves, the wildlife ranging from seals to crabs, and shipwreck remnants.

And with an office and support provided by the South Taranaki District Council, she also consulted many community groups and reviewed information on wāhi tapu and historic sites, coastal ecology, land ownership, hazards, access points and facilities along the route.

Her feasibility study includes a database of information about the proposed walkway, with the most suitable routes shown on maps prepared with the help of the Taranaki Regional Council.

She also points to statistics highlighting the popularity of walking and high public opinion of walkways and cycleways. She believes a series of linked walkways spanning the South Taranaki coastline would be a hit with locals and visitors alike.

Diana Reid plotting her course.

"South Taranaki's coastal history, geology and geography are all very interesting, and the landscape is varied and beautiful," Diana said. "The coastline is walkable and it would appeal to a wide range of people. There would be economic benefits for all the communities along the way, and a walkway would also be something that locals could be proud of."

The concept, which has been accepted in principle by the South Taranaki District Council, involves 24 sections or stages, each of which would require its own level of development. Some parts, notably around Cape Egmont, are already mostly in place. But others would have to be started from scratch.

Diana said much work still needs to be done, especially around issues such as land ownership and wāhi tapu sites. "I ran out of time to cover this in any depth."

Because of land ownership and wāhi tapu issues, the South Taranaki District Council will work closely with iwi and landowners as it considers the best methods to advance the project stage by stage. The idea is to encourage involvement by community groups and businesses. If the walkway proposal were to progress, the cost is estimated to be around $3 million spread over five to 10 years.

Surfcasters head for the beach.

5.4.2 HOW IS PUBLIC ACCESS TO THE COAST MANAGED?

(A) REGIONAL PLANS

The *Regional Coastal Plan for Taranaki* recognises that the maintenance and enhancement of public access within the coastal marine area are important issues. The plan therefore contains objectives, policies and methods to ensure that public access to the coastal environment is maintained. Methods include rules which give effect to the policies for each of the four coastal management areas (as outlined earlier in this chapter), and general rules that apply to all coastal management areas. Such methods may include putting conditions on coastal permits to maintain or provide for public access, advocacy to improve public access to the coast (including advocacy to district councils for the continued implementation of esplanade strips and reserves) and the provision of information on where the location of public access points are.

(B) REGIONAL WALKWAYS AND CYCLEWAYS STRATEGY

A *Regional Walkways and Cycleways Strategy for Taranaki* has been developed to promote the leisure, recreational, commuter and tourism opportunities provided by walking and cycling, including access to the coast[61]. Current and potential routes are identified that together would make up a network offering pedestrian and cycle access to the region's natural attractions, as well as population centres. Some of the new routes foreseen in the strategy that might increase access to the coast include extensions to the New Plymouth coastal walkway and a possible coastal pathway and cycling route in South Taranaki.

(C) DISTRICT COUNCILS

Both the *New Plymouth District Plan* and the *South Taranaki District Plan* contain objectives, policies and methods to safeguard public access to the coast. These include such matters as maintaining access through esplanade reserves or strips set aside at the time of subdivision, or by other means.

Clifftop walkway, Waverley Beach.

District councils also maintain roads, tracks, paths, reserves and walkways that provide public access to, and along, the coast. In New Plymouth and other parts of the region there have been ongoing maintenance and upgrades of walkways and other facilities.

For example, the 7 km New Plymouth coastal walkway has been developed over an eight-year period from 1995-2003 and extends from the Waiwakaiho River mouth in the east to Port Taranaki in the west (Figure 5.17). The whole project included development of an extensive walkway, a main pier, finger piers, and a Len Lye sculpture, at an approximate cost of $24 million. The project is ongoing with a planned extension to Bell Block. The project has been awarded the Gold Design Award 2002 (New Zealand Institute of Landscape Architects National Awards), Outstanding Project Award 2003 (New Zealand Recreation Association), George Malcolm Award 2006 (New Zealand Institute of Landscape Architects) and Eastern Region Awards 2005 (International Federation of Landscape Architects).

Figure 5.17: Map of New Plymouth coastal walkway.

61 Taranaki Regional Council, 2007. *Regional Walkways and Cycleways Strategy for Taranaki.*

Spectators on the New Plymouth walkway.

Yachts leave Port Taranaki on the Solo Trans-Tasman Yacht Race to Mooloolaba.

The New Plymouth District Council has recently prepared a coastal strategy, with the central purpose of guiding future development and change in the district[62]. One of the actions in the strategy is to prepare a coastal access action plan to guide investment, protection and development for providing public access to the coast. One other action identifies the need to make information available to the public about where all existing reserves (including esplanade reserves) are in the coastal area.

The South Taranaki District Council has accepted in principle a proposal to explore options for enhancing public access and walking opportunities around the South Taranaki coastline (see case study).

(D) NAVIGATION SAFETY BYLAWS

The Taranaki Regional Council has prepared navigation bylaws for Port Taranaki and its approaches. These bylaws apply only to Port Taranaki and the immediate environment and have been made for the purpose of regulating navigation and safety in this high-use area.

As Port Taranaki is the single largest facility on the Taranaki coast, which raises navigation safety issues, it is important that appropriate speed regulations and access are provided for both recreation and commercial users alike. The current volume of shipping and mix of commercial and recreational uses in the Port therefore justify the need for this level of regulation and control. Future port development will also lead to an increase in shipping volumes as a result of dairy, forestry and container shipping in the next 10 years.

(E) WALKING ACCESS COMMISSION

Central Government is investigating options for establishing a New Zealand Walking Access Commission to lead and co-ordinate the provision of public access to the outdoors, especially around the coast, lakes, and along rivers. The Commission's responsibilities would include the provision of information about the location of existing public access, the provision of a code of responsible conduct for the guidance of the public and landholders in respect of recreational access to the outdoors, and the facilitation and funding of negotiations for new public access across private land. The implications of these activities for the Taranaki region will be assessed in due course once the Commission commences operations.

Sunrise over Sugar Loaf Islands.

62 New Plymouth District Council, 2006. *New Plymouth Coastal Strategy 2006.*

(F) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on public access to the coast is summarised in Table 5.14.

Table 5.14: Summary of progress: Implementing regional objectives and policies on the maintenance and enhancement of public access.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Maintenance and enhancement of public access	• Increased formal public access to and along the coastal marine area. • Maintenance and enhancement of public access along the coastal marine area, where this is practicable.	• Esplanade strips and reserves established in the coastal environment as part of the subdivision process. • Review navigation bylaws for Port Taranaki and its approaches. • Providing information and advice when appropriate and necessary on access points to the coastal marine area.	• *Regional Coastal Plan for Taranaki* made operative in 1997. The plan contains policies and rules to maintain and enhance public access within the coastal marine area. • District plans in place which recognise public access to the coast as an important matter to be considered. • Navigation bylaws in place to regulate navigation and safety within Port Taranaki.

5.4.3 HOW DO WE COMPARE?

Most regions have coastal policies and plans, as well as district plans, that seek to protect public access to the coast from inappropriate subdivision, use and development. The Taranaki region has fewer development pressures on its coastline than other regions such as Northland, Auckland, Waikato, Bay of Plenty, Marlborough and Canterbury. Coastal development and subdivision pressures have increased in Taranaki, as they have elsewhere, and may continue to do so into the future. The issue of public access to the coast is one that will require ongoing monitoring.

CHAPTER 6

ATMOSPHERE

Photo: Rob Tucker

AIR QUALITY

Taranaki people enjoy clean fresh air and this is an important and valued part of our quality of life. In summary:

- on the basis of national guidelines, air quality in Taranaki is rated as excellent, enabling the Taranaki community to enjoy one of the healthiest regions in New Zealand in terms of air quality;
- there are no significant widespread pressures on air quality in the region so levels of monitoring of general air quality have been reduced, although the Council still carries out comprehensive monitoring of consented activities;
- 306 air discharge permits are held in Taranaki (compared with 230 in 2003);
- consent conditions are generally more stringent, reflecting better control options and heightened community expectations;
- major air discharge permit holders continue to make significant investments in emission controls and production technology; and
- a few concerns exist about specific discharges to air, primarily involving odours, but these are managed to reduce effects on neigh-bours as far as possible.

The Council's *Regional Air Quality Plan*, made operative in 1997, contains policies, methods and controls to maintain and enhance air quality in Taranaki. It is in the process of being formally reviewed.

CLIMATE

Gases such as carbon dioxide, methane and nitrous oxide have the ability to trap infra-red energy that would otherwise be radiated off the earth's surface. The accumulation of these greenhouse gases in the upper atmosphere is leading to global warming and global climate change. Average New Zealand temperatures have increased by 0.3-0.7ºC since 1950. In Taranaki:

- the significant sources of greenhouse gases are agriculture, energy and petrochemical industries;
- industry is the largest source of carbon dioxide emissions and agriculture is the largest source of methane;
- emissions from industry and livestock are decreasing but emissions from soil and fuel use are increasing;
- climate in Taranaki is expected to become marginally wetter overall, with increased frequency of extreme weather events; and
- climate change is expected to result in an increase in pasture productivity and an increase in cropping in the region.

The Government and members of the international community are addressing climate change through a range of initiatives including those to implement the Kyoto Protocol. Initiatives at the regional level include management of point source emissions through the *Regional Air Quality Plan*, and advocacy for sustainable land management which may lead to increased tree planting which will mitigate greenhouse gas emissions, and better management of fertiliser (which will reduce greenhouse gas emissions).

Taranaki has excellent air quality.

OUR ATMOSPHERE

Clean fresh air is an important and valued part of Taranaki's environment and quality of life. To Māori, the air is a taonga and odours and other contaminants can affect wāhi tapu sites.

Overall, Taranaki has excellent air quality. This is because of Taranaki's windy and exposed nature, together with its dispersed and low population, absence of heavy industry and its low number of vehicles. However, air quality in some locations is reduced through point source discharges or diffuse discharges of contaminants to air.

Diffuse sources of emissions are the biggest contributors of emissions to air. These include natural sources (sea spray, vegetation, landcover and farm animals) and human sources such as industries, homes or motor vehicles. Natural sources emit far greater quantities than human sources.

Point source emissions such as from industry are more obvious than diffuse source discharges. Point source discharges in Taranaki come from a range of sources such as the petroleum industry, pig and poultry farming and abrasive blasting. Many point source emissions are located in the industrial parts of the region's urban centres, particularly New Plymouth and Hāwera. Increased levels of hydrocarbon exploration and production have led to increased consents for air discharges.

Emissions to air, in the form of odours, smoke, dusts or toxic contaminants, may affect air quality. The effects of such emissions range from visual effects and offensive odours to actual or potential effects on human and ecosystem health.

Greenhouse gases are gases such as carbon dioxide, methane and nitrous oxide, which have the ability to trap infra-red energy that would otherwise be radiated off the earth's surface.

There is now a very strong consensus of scientific opinion that the accumulation of greenhouse gases in the upper atmosphere is warming the lower atmosphere. Over time this will result in rising sea temperatures and sea levels, the melting of glaciers and ice caps (which will also increase sea level) and greater extremes in weather patterns such as storms of greater intensity and longer droughts. Paradoxically, some parts of the planet may in fact become cooler, as wind patterns and sea currents shift their distribution. Temperatures in New Zealand have increased by 0.3-0.7°C since 1950.

6.1 AIR QUALITY

6.1.1 WHAT IS THE STATE OF AIR QUALITY IN TARANAKI?

The relatively windy and exposed nature of Taranaki, together with its dispersed population and the absence of heavy industry and high motor vehicle densities, means that the region enjoys naturally high standards of air quality. The main influence on regional air quality is natural – sea spray drift from our energetic coastline and volatile emissions from vegetation.

In the past the Council monitored key indicators of ambient, or overall, air quality in the region at up to 30 representative sites, including urban areas, rural and coastal areas and pristine areas. The indicators reflected emission sources of particular interest in those areas. These included: sulphur oxides, nitrogen oxides, carbon monoxide, formaldehyde, suspended particulates and inhalable particulates.

Monitoring was reported on in detail in the *2003 State of the Environment Report*[1]. The results, indicating high air quality, have reduced the need for extensive air quality monitoring, and therefore over the past five years the Council has scaled down the state of the environment monitoring programme and concentrated instead on compliance monitoring. Information below on the current state of air quality in the region is therefore largely summarised from the 2003 report with additional comments from compliance monitoring undertaken since then. The categories used to describe air quality, and recommended actions for each category, are set out in Table 6.1.

Monitoring air quality in Stratford.

1 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region.*

Table 6.1: Categories of regional air quality[2].

	Action	Alert	Acceptable	Good/Excellent
Definition	Above the guideline	66-100% of the guideline	33-66% of the guideline	Good: 10-33% of the guideline Excellent: 0-10% of the guideline
Action required	Achieve guideline value within shortest possible timeframe; investigate and monitor comprehensively	Reduce further, where practicable, and monitor	Maintain, reduce where practicable and monitor periodically	Maintain and monitor occasionally

(A) CURRENT STATE OF AIR QUALITY

Particles

Fine particles may come from smoke, mining and abrasive blasting, volcanic activity, wind-blown dust, and sea spray. Fine particles are called inhalable particulate materials (PM10) and can adversely affect human health. These particles are too small to see (about 10 microns in diameter (microns are micrometres or one millionth of a metre). Five would fit across the width of a human hair. These fine particles can penetrate the body's natural defences against dust, and enter the lungs. There they are associated with loss of lung function, respiratory distress and disease.

As part of a national state of the environment monitoring programme established by the Ministry for the Environment, the Council undertook monitoring of inhalable particulates over the winter of 2003[3].

The monitoring showed that all results met the acceptable category, and 80% of samples met the good/excellent category (refer Table 6.1). One cluster of results showed higher than expected results – potentially influenced by nearby roading works. Removing these samples from consideration, the average concentration (over 24 hours) measured in New Plymouth across all measurements was 20% of the Ministry's guideline and so was rated as good (as per criteria in Table 6.1).

There was a strong influence from sea salt. The average levels of PM10 were 66% higher during on-shore winds than during off-shore winds.

These results were consistent with earlier monitoring reported on in the *2003 State of the Environment Report* that concluded that Taranaki air quality in relation to ambient levels of fine particulates is rated as good/excellent.

Sulphur dioxide

Sulphur dioxide is primarily generated from the combustion of fossil fuels containing sulphur (e.g. coal, diesel). It also occurs naturally during volcanic and geothermal activity. Sulphur dioxide can cause throat and eye irritation and trigger asthma attacks and bronchitis. Its acidity can also affect paint, building materials and vehicles.

Previous monitoring of sulphur dioxide, reported on in the *2003 State of the Environment Report*, rated ambient levels of sulphur dioxide in Taranaki as excellent. Subsequent consent monitoring undertaken by the Council has confirmed these findings.

Nitrogen oxides

Nitrogen oxides are products of fossil fuel combustion. In humans they can reduce the body's resistance to infections and can affect breathing. Nitrogen oxides are also toxic to plants and contribute to brown haze and photochemical smog.

Previous monitoring of ambient levels of nitrogen oxide, described in the *2003 State of the Environment Report*, rated levels in Taranaki as generally excellent. Subsequent consent monitoring undertaken by the Council has confirmed these findings. The highest emission levels of nitrogen oxide were recorded in the middle of the Kāpuni petrochemical complex, but air quality there still met the good category.

Formaldehyde

Formaldehyde is a product of fossil fuel combustion (e.g. from motor vehicles). A suspected carcinogen, it is known to irritate the eyes, skin and mucous membranes of the upper respiratory tract.

Again, previous monitoring of ambient levels of formaldehyde, rated levels in Taranaki in the areas of highest traffic flows as excellent.

Carbon monoxide

Carbon monoxide is a product of incomplete fossil fuel combustion, for example, in motor vehicles or home heating. Carbon monoxide can affect concentration and physical performance. Higher concentrations cause dizziness, aggravate heart conditions and can be fatal. The Ministry for the Environment guidelines are based on the need to protect sensitive or vulnerable people.

Screens enclose St Andrews Church spire in New Plymouth during restoration work.

2 Ministry for the Environment. 2002. *Ambient Air Quality Guidelines.*
3 Taranaki Regional Council. 2004. *Inhalable Particulate (PM1 toring Programme Report 2003 Technical Report 2003–99.*

Previous monitoring of ambient levels of carbon monoxide, reported on in 2003, rated levels in Taranaki as excellent. Subsequent consent monitoring undertaken by the Council has confirmed these findings.

Dioxins and other organochlorines

Dioxins and other similar organochlorine substances (e.g. polychlorinated biphenyls (PCB), the pesticides DDT, aldrin, dieldrin, chlordane and lindane, and chlorophenols) are products or by-products of organic chemical synthesis, use, and combustion. Such substances pose a risk to human health due to their toxicity, carcinogenic risk and potential effects on reproduction and immunological systems.

National studies on dioxins and other organochlorines confirm that concentrations from these chemicals are not a significant issue in Taranaki and that the risks to the environment and human health are negligible. Levels in Taranaki are generally much lower than many other places in New Zealand[4]. Median levels in rural Taranaki (Te Wera) were about one-quarter of those in urban areas and less than one-twentieth of those in major industrial areas.

Levels of organochlorine pesticides, and the wood preservative PCP, in rural Taranaki were similar to other pristine and rural sites around New Zealand, and up to eight times lower than the country's main urban centres.

(B) EMISSION SOURCES

Point source discharges

The number of air discharge consents held in Taranaki has increased from 230, reported on in 2003, to 306. Applications for new consents to cover emissions during hydrocarbon exploration activities continue to be significant in number (Figure 6.1). The number of consents for emissions from hydrocarbon exploration has increased over the past five years from 76 to 145. Only a few of these are exercised at any one time, and most companies continue to hold consents for exploration sites after the initial drilling, in case they wish to return and drill further exploration wells. The main potential effect of exploration emissions is from flaring (smoke, odour, soiling).

The past five years has seen a reduction in the number of consents for emissions from landfills (dust, odour, landfill gas) and from piggeries (odour). This follows closure of a number of municipal landfills and piggeries in the region.

Thermal power stations require air discharge consents. Nitrogen oxides are the main concern with thermal power emissions. Over the past five years consents have been granted for a second combined cycle station at Stratford, for emissions from a cooling tower at a 'peaking' station at Stratford (the main emissions from this station are covered by an existing consent), and a possible energy centre at Whareroa. The New Plymouth power station was closed in 2007, but partly reactivated in 2008. The air consent remains in force while an application for a second consent for this station for emergency firing of oil has been withdrawn.

Poultry farming continues to be a growth industry with a small increase in the number of consented emissions – odour and dust are the main concerns for these farms.

The National Environmental Standards for air quality[5] have forbidden the use of school incinerators unless a resource consent is held. Emissions from the incinerators give rise to concerns over products of incomplete combustion, smoke, and odour. Consequently, all schools in Taranaki (around 80) have ceased use of their incinerators having found better ways of managing their waste.

Unauthorised incidents

Air quality complaints recorded, and followed up, by the Council are another useful indicator of the state of air quality. The number of air incidents compared with the total number of other complaints is illustrated in Figure 6.2. It shows that the number of air pollution incidents has been relatively stable.

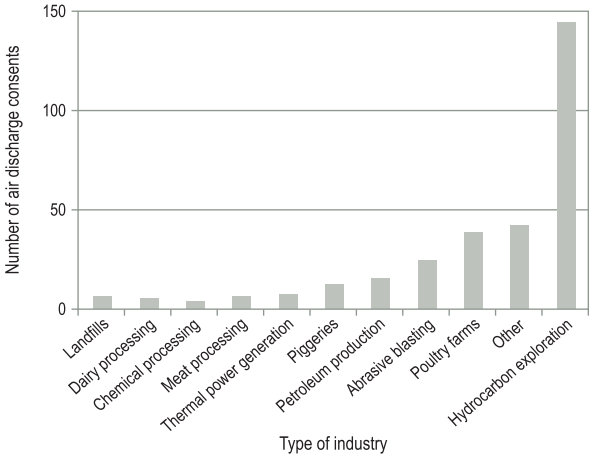


Figure 6.1: Air discharge permits held by industry type.

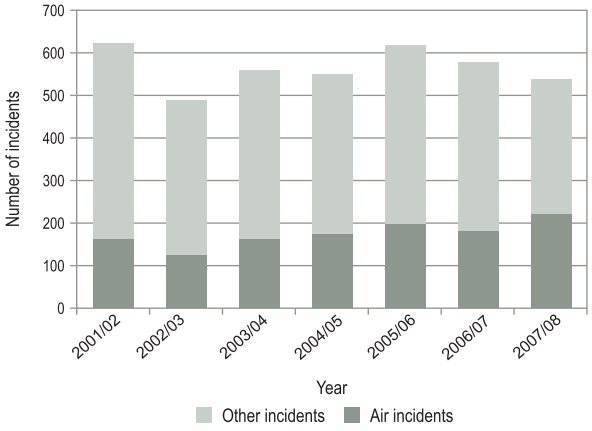


Figure 6.2: Number of air incidents over time compared to the number of incidents reported each year.

4 Ministry for the Environment, 1999. *Ambient Concentrations of Selected Organochlorines in Air.*
5 Resource Management (National Environmental Standards relating to certain air pollutants, dioxins and other toxics) Regulations 2004.

Table 6.2: Total number and top eight sources of air incidents from 2003-04 to 2007-08.

	2003-04	2004-05	2005-06	2006-07	2007-08	% of all air incidents 2003-04 to 2007-08
Total air incidents	162	176	199	182	222	
% of all incidents	29.0	31.9	32.2	31.5	41.1	
Abrasive blasting *dust*	7	8	10	10	7	4.5%
Fertiliser storage/use *dust, odour*	6	4	2	5	6	2.6%
Rendering *odour*	26	48	43	34	56	20.0%
Piggeries *odour*	8	5	14	16	17	5.5%
Poultry farming *odour*	2	11	2	6	15	5.3%
Dairy Farm *dust, odour*	5	3	29	13	9	5.7%
Vermiculture/composting *odour*	13	20	1	2	3	4.8%
Private housing	15	9	22	19	21	7.9%

Table 6.2 sets out the total number of air incidents over the past five years and shows the top eight sources of air incidents, which accounted for 56% or all air emission incidents over the period. The majority of air quality incidents relate to offensive odours. Other causes of complaint include suspended and deposited dust, smoke, and concern over toxicity or the type of smell.

Since the *2003 State of the Environment Report* landfills have ceased to be a source of emission complaints, with the extension of the New Plymouth landfill at Colson Road and the closure of the Stratford landfill. Complaints relating to specific meatworks and fertiliser works have also reduced, as have the number of complaints relating to poultry farming and composting. However, there has been a significant increase in the proportion of complaints generated by a rendering plant and an increase in the proportion of piggery-related complaints. Most sources of air quality complaints generate only one or two complaints in any one year. This suggests that the cause was just a one-off incident, or that follow-up action by the operator and Council resolved the cause of the complaint.

Diffuse sources

Diffuse sources are those that individually may not be significant in their immediate locality, but in combination with other identical sources or cumulatively across the region may impact upon air quality. Such sources include 'natural' sources such as the sea (suspended particulate and various chemical compounds), pasture (carbon dioxide and volatile organic compounds), the soil (dust, nitrous oxide), ruminant animals especially cows (methane), and bush (carbon dioxide and volatile organic compounds). Other sources include domestic heating by combustion (wood fires, gas heaters), the burning of vegetation on production land (carbon dioxide, organic compounds), and vehicles (nitrogen oxides, formaldehyde, carbon dioxide and other organic compounds).

By their nature it is extremely difficult to quantify the volumes of emissions from these sources. However, a study reported on in the *2003 State of the Environment Report* showed that diffuse sources far outweighed point sources in regard to emissions of contaminants in Taranaki[6]. Soil is the largest emitter of nitrous oxide (93% of the region's inventory), while plants emit significant quantities of non-methane hydrocarbons (97%) and other nitrogen oxides (27%). Animals are responsible for 99% of the region's methane emissions, while motor vehicles account for 71% of the carbon monoxide and 29% of the inhalable particulate. Home heating accounts for 56% of the inhalable particulate and 85% of the region's hydrocarbons.

Livestock emissions

In terms of trends in emissions from farm animals in Taranaki, the number of dairy cattle from 1996-2006 has decreased by 10%, from 531,953 to 479,238[7]. The number of beef cattle has decreased from 180,000 to 129,000 - a decrease of 28%, and sheep numbers fell from 874,000 to 688,000, or 21%[8]. Thus overall, emissions from animals have fallen.

Vehicle emissions

The number of vehicles that each Taranaki household has access to has substantially increased from 51,300 in 1996 to 60,900 vehicles in 2006, a 19% increase[9]. The number of households with access to one vehicle has fallen by more than 2,000 households, but the number of households with access to two vehicles has increased by 2,500 and the number with access to three or more vehicles has risen by 2,200.

6 Kuschel, G and Petersen, J, 2000. *Air Emissions for the Taranaki Region in 1998.* Prepared by NIWA for the Taranaki Regional Council.
7 LIC New Zealand Dairy Statistics.
8 Statistics NZ.
9 Statistics NZ.

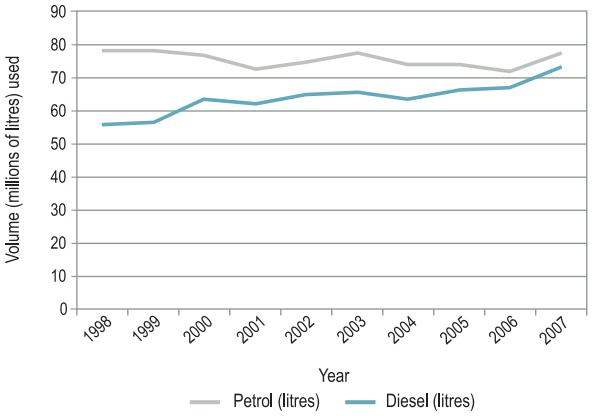


Figure 6.3: Annual volumes of petrol and diesel used in Taranaki.

Over the past decade petrol use in the region has remained constant, with an average of 77.9 million litres used annually in the two-year period 1997-99 and an average of 74.6 million litres used annually over the 2005-07 period (Figure 6.3).

However, diesel use has increased 25% in the same period, from an average of 56.4 million litres used a year in 1997-99, to an average of 70.1 million litres used annually in 2005-07. In the 2006-07 year, the highest volume of diesel was used to date (73.2 million litres). Diesel fuel is associated with emissions of sulphur dioxide and particulate matter. While the sulphur content of New Zealand fuel diesel has been reduced recently, it is still higher than for petrol.

Household heating emissions

The method used for household heating can cause different levels of air emissions. The use of solar energy, electricity, or gas is better for local air quality than coal or wood. Changes in methods used to heat households within the Taranaki region from 1996 to 2006 are shown in Table 6.3.

Almost all of the shift from electricity to wood for heating purposes has occurred within the past five years. To comply with the 2004 National Environmental Standards for air quality, almost all wood burners on the market now comply with the certification standard for efficiency and reduced air emissions, thus reducing the adverse air quality effects (when compared with gas or electricity) of burning wood.

While there has been a fall in the number of households using mains gas, the number of households using bottled gas has risen sharply (more than matching the decline in use of electricity and mains gas combined). This suggests that the connection costs of mains gas are acting as a disincentive to its continued use. Indoor air quality can suffer with the use of bottled gas unless it is properly exhausted to the outside.

The use of coal in the region has declined sharply (the biggest fall in percentage terms of any method of household heating), and the use of solar heating has increased sharply (the biggest uptake in percentage terms of any method of heating). From the perspective of local air quality, both these trends are to be welcomed. However, in both cases the number of households concerned is small in absolute terms.

6.1.2 HOW IS AIR QUALITY MANAGED IN TARANAKI?

(A) THE REGIONAL AIR QUALITY PLAN

The *Regional Air Quality Plan for Taranaki* was made operative in 1997. The plan has a 10-year life and is therefore now undergoing a process of review. The existing plan contains policies, methods and rules for addressing air quality management, with the objective of maintaining and enhancing air quality in the region.

The plan contains rules setting out environmental standards and conditions for all industrial and trade premises (including intensive pig and poultry farming and waste management processes), agrichemical spraying on farmland and public amenity areas, and burning. The plan also contains codes of practice for piggeries and poultry farming, agrichemical spraying, vegetation burn-off and industrial process chimney heights.

Rules in the plan provide for special consideration to be given to protect areas particularly sensitive to discharges to air (e.g. residential areas, parks and reserves or wāhi tapu sites). Some activities such as the burning of waste oil and tyres and burning at landfills – activities that are potentially significant source of dioxins – are prohibited.

The new plan is likely to reflect advances in technology and improved industry practice, the 2004 National Environmental Standard for air quality, and increasing knowledge and awareness of the implications for human health of air pollution from various sources. For example, it is now considered that no 'absolutely safe' concentrations exist for contaminants such as inhalable particulate matter and dioxins. Therefore future air quality management will focus on reducing levels of these to the lowest practicable level, even if existing air quality is otherwise already generally good.

Table 6.3: Trends in methods of home heating 1996-2006.

Method	Elect	Gas Mains	Gas Bottled	Wood	Coal	Solar	None	Total households
% change from 1996	-5.7%	-7.4%	+43%	+6.5%	-22%	+51%	+31%	1996 38769
Number change from 1996	-1254	-1131	+2781	+1092	-309	+124	+138	2006 40281 (+3.9%)

(B) NATIONAL ENVIRONMENTAL STANDARD

National environmental standards for air quality were established in 2004[10]. These regulations apply across the whole of New Zealand and set receiving environment limits for several toxic gases. They ban outright the burning of tyres, landfilled wastes, bitumen, and coated wire, and oil in open air. They ban the use of incinerators at schools unless resource consent has been granted, and they ban the operation of high-temperature incinerators (other than crematoria and the incinerator used by Dow AgroSciences in New Plymouth). Wood-burner heaters on residential sections and small lifestyle blocks are allowed only if certified as meeting a particular standard.

(C) RESOURCE CONSENT MANAGEMENT

As described above, 306 air discharge consents are currently held in Taranaki. Figure 6.4 illustrates the number of air consents granted since 1997. The large numbers of consents granted in 1997-98 were due to consents being required for certain industries once the *Regional Air Quality Plan for Taranaki* became operative (largely for piggeries and poultry farms). 2004-05 was an especially busy year for air discharge consents from the hydrocarbon exploration industry.

The Council assesses the effects of air discharges and places conditions on consents to control effects on the environment. Applicants are advised to consult with affected parties, including tangata whenua, and these parties are involved in the consent process and in discussions on consent conditions.

The resource consent process has enabled the Council to promote significant upgrades in emission controls or production technologies used by major air discharge permit holders. These improvements have involved significant investments in emission controls or production technology. Over the past five years, region-wide capital investment in air quality control almost doubled from $14 million (1997-2002) to $27.5 million (2002-07)[11]. Such investment has included the installation of biofilters and new driers at rendering plants in Taranaki to reduce odour emissions, the installation of wet scrubber systems at dairy processing/manufacturing plants and engineering sites to reduce odour and dust emissions and the upgrade of a gas turbine for electricity generation to reduce CO_2 emissions.

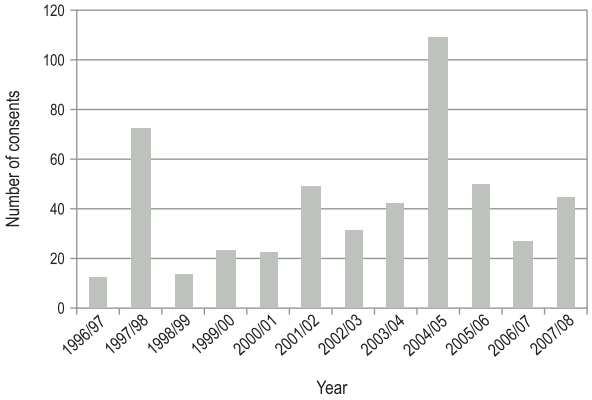


Figure 6.4: Number of air discharge permits granted over the past 10 years.

(D) MONITORING

When the Council grants a consent for a significant activity, it implements an annual compliance monitoring programme to ensure the consent holder meets the conditions set out on the consent. These conditions usually relate to the manner of operation, the quality of the discharge, and the permitted extent of effects in the receiving environment. In the 2007-08 year, the Council undertook 51 individual monitoring programmes that had an air quality component. Sites included sewage plants, petrochemical and petroleum production facilities, landfills, composting and vermiculture sites, milk factories, metal smelting and galvanizing plants, meatworks, rendering plants, wood and coal-fired boilers, fertiliser storage and distribution centres, asphalt plants, feedmills, abrasive blasters, quarries, crematoria, agrichemical formulation facilities, piggeries, poultry farms, and gas-fired power generation stations. In some cases a monitoring programme will incorporate multiple sites within a single catchment programme for efficiency.

The Council employs a variety of techniques for air quality monitoring, including inspections of process and operational records, odour surveys, public odour diaries, stack (discharge) sampling for suspended dust and chemical constituents, deposition monitoring, ambient (downwind) gases and particulate monitoring, and video recording (e.g. of smoke and dust sources and cooling tower plumes). In the 2006-07 year the

There has been a significant increase in the poultry industry in Taranaki.

The Vector Kāpuni gas treatment plant.

10 Resource Management (National Environmental Standards relating to certain air pollutants, dioxins and other toxics) Regulations 2004.
11 Wu, J; Sanderson, K. 2008. *Community Investment in Environmental Improvements in Taranaki*. Prepared by Business and Economic Research Limited for Taranaki Regional Council.

Calibrating nose sensitivity.

THESE NOSES KNOW WHAT A BAD SMELL IS

If you complain about an offensive odour in Taranaki, not just any old nose is likely to investigate.

Taranaki Regional Council inspectorate and technical staff have had their noses calibrated to allow them to make objective assessments of odour complaints.

The noses thus measured include that of Compliance Manager, Bruce Pope, who was found to be in the mid-range rather than having a highly sensitive nose or a 'dead' one.

"The calibration involves a two-hour test in which the nose is exposed to gradually increasing amounts of n-butynol gas," Bruce said. "The odour laboratory staff at Lincoln Ventures Limited, based at Lincoln University in Canterbury, can assess and calibrate nose sensitivity from the sniffer's reaction."

Odour panellists can generally detect the n-butanyl at between 20 and 80 parts per billion. With nose calibration certified, Council staff are able to offer odour-intensity evidence of a standard acceptable in a court of law.

Geoff Warren, of Lincoln Ventures, said it could be useful to have a range of nose sensitivity among a group of environmental inspectors. "Line up several calibrated individuals around an odour nuisance site and while Bruce may represent the 'average' individual, it may be that even the less sensitive nose can detect the odour, or that it appears very strong even to the more sensitive person."

Of the 540 environmental incidents investigated by Taranaki Regional Council officers in 2007-08, a total of 222, or 41%, related to air quality. A quarter of these centred on meat and by-product processing operations and around 10% related to activities at private houses. Other complaints involved piggeries, poultry farming and building construction.

"When we get a complaint about odour, we look at its source and do a 360-degree check around the site to get an idea of the characteristics," said Bruce. "We also look at how people nearby are reacting to it."

He said it was a good idea to keep an 'odour diary' if you were experiencing repeated problems from the same source.

Bruce said most incidents were resolved without the need for enforcement action. "Very often, we find that people become so de-sensitised to the odour at their workplace that they are completely unaware of how offensive it is to others."

Council undertook approximately 170 analyses of air in conjunction with site-specific compliance monitoring. 42% of all sites monitored under a site-specific programme achieved a high level of environmental performance and consent compliance, while another 51% showed a good level i.e. 93% of all sites had, at worst, a minor (short-term and inconsequential) environmental effect, and a positive and co-operative attitude towards compliance.

In the *2003 State of the Environment Report* it was noted that 80% of all sites were achieving a 'good' or 'high' level of environmental performance. Despite increasingly stringent consent conditions, the overall compliance and environmental performance of consent holders has improved in the past few years. Nineteen out of 20 consent holders operate their activities well in any year.

(E) RESOURCE INVESTIGATIONS

In April 2005 and again in April 2006, Council staff conducted visual surveys of the eastern ring plain to determine the environmental significance of the burning of vegetation on production land. In particular, farmers may burn stubble from forage crops and trimmings from shelter belt pruning and tree clearance. While on most surveys one or two fires could be observed, the practice was not so widespread or offensive that regulatory intervention was required.

(F) UNAUTHORISED INCIDENTS

When consent holders advise the Council of unauthorised emissions, or complaints are received from the public, or inspections show that consent conditions or rules in the *Regional Air Quality Plan* are breached, Council staff assess the incident and seek to resolve the situation in conjunction with the responsible party involved. Enforcement action is taken where appropriate. Enforcement action may involve the issuing of abatement notices, infringement notices and/or prosecution. Incidents are recorded on the Council's register.

(G) INFORMATION, EDUCATION AND ADVICE

Information and advice are intended to raise awareness of issues and problems and provide simple cost-effective solutions enabling resource users to make well-informed decisions that prevent or minimise the effects of emissions that impact on air quality.

Table 6.4: Summary of progress implementing objectives and policies on air quality.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
• Loss of air quality when contaminants are discharged • Emissions from industrial and trade premises • Unwanted effects of using agrichemicals • Unwanted effects of burning vegetation • Emissions from domestic sources • Emissions from vehicles	• Maintenance and enhancement of Taranaki's existing high air quality. • Dealing with effects involving health risk, offensiveness, and other effects. • Provision of special protection to human health, enjoyment, sensitive ecosystems, sensitive areas, crops and animals, and other important places. • Management of use of agrichemicals. • Reduction in the possibility of smoke affecting people and soiling property. • Reduction in effects on people and property.	• Implementing the *Regional Air Quality Plan* 1997 • Issuing and monitoring resource consents for discharges to air. • Requiring improvements in process and abatement technologies through resource consent processes. • Monitoring the general air quality in Taranaki including in pristine, rural and urban areas and high traffic movement areas. • Monitoring air pollution events in Taranaki and their causes. • Providing information and advice. • Monitoring the number of air discharge permits for agrichemical application and complaints caused by their misuse. • Advocating improvements in vehicle emissions.	• Preparing for review of *Regional Air Quality Plan* in 2008 • Taranaki's air quality is rated 'excellent' according to MfE categories. • Significant improvement made in process and pollution abatement technologies. • Resource consents monitored. 93 % of air permit holders routinely achieve a 'good' or 'excellent' performance (up from 80% in 2003). • Air pollution events monitored, causes investigated and actions taken. • Information and advice provided and guidelines prepared. • Advocacy undertaken on air quality issues. • Few problems experienced with agrichemical use over the past six years. • Fuel usage monitored.

The Council has produced:

- a guide to the requirements of the *Regional Air Quality Plan for Taranaki* for all farmers in the region. The guide covers effluent disposal, burning, spraying, fertiliser applications and pig and poultry farming;
- information on air quality included in its *Environmental Management Guide* for businesses and industries;
- guidelines for spray painters, commercial kitchens, and the design and operation of small domestic and school incinerators;
- guides for small industry and the oil and gas industry on plan requirements; and
- information on its web pages.

The public notification of the *Proposed Regional Air Quality Plan* will be accompanied by a publicity campaign.

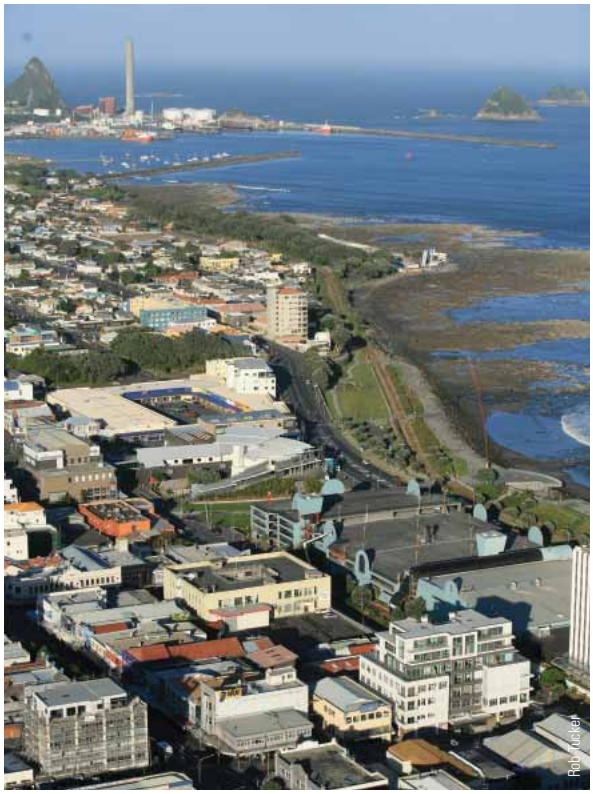
(H) SUMMARY OF PROGRESS

A summary of progress, assessed against the issues and desired outcomes set out in the *Regional Air Quality Plan*, is provided in Table 6.4.

6.1.3 HOW DOES TARANAKI AIR QUALITY COMPARE?

In the national study on levels of particulate material described above, the air in New Plymouth (taken as representative of the air across the ring plain of Taranaki) was shown to be excellent to good according to the categories used by the Ministry for the Environment.

In terms of the effects of air quality upon human health, a study released in 2007 has established that Taranaki is one of the healthiest regions in New Zealand[12]. The study assessed and quantified the health risks due to exposure to air pollution in 67 urban areas of New Zealand, covering



Clear sky over New Plymouth.

73% of the country's population. New Plymouth and Hāwera were two of the areas investigated.

The study found that air pollution-related deaths varied from a rate of 0.18 per 1,000 people per year in New Plymouth (low pollution levels

12 Ministry for the Environment, and Ministry of Transport. 2007. *Health and Air Pollution in New Zealand,* Joint report for Health Research Council of New Zealand.

due to its very exposed location) to a rate of 0.74 per 1,000 people in central Christchurch (due to its sheltered meteorology and high rate of wood burner use). Nationally, one in 20 people (4.8%) die earlier than they would have because of air pollution compared to one in 30 people (2.9%) in New Plymouth or one in 9 people (11.8 %) in Christchurch.

Of the 67 urban centres studied, Hāwera also made the top 10 in terms of low air pollution-related mortality, behind New Plymouth with the lowest.

Nationally, the greatest single cause of premature mortality is fine particulate levels (sourced from combustion). It is estimated that each year an average of 1,100 people die prematurely due to exposure to air pollution across New Zealand.

Under the national environmental standards, regional councils are obliged to establish air management areas or airsheds for areas that do not meet the ambient air quality criteria stipulated in the standards. Forty-two such airsheds have been created around New Zealand. Along with Gisborne, the Taranaki region is one of only two in New Zealand that have not had to gazette an airshed. The region is in this position because of its high air quality.

Nationally, about 53% of New Zealanders live in areas that from time to time do not meet ambient air quality standards, primarily because of emissions from vehicles and from coal and wood used for home heating[13]. Main centres such as Auckland, Hamilton, Christchurch and Dunedin all have poor air quality. The main pollutant of concern is inhalable particulate materials. As noted above, in Taranaki the main source of such particles is sea spray, and Taranaki's air is rated good to excellent with respect to this pollutant.

Nationwide, 44% of homes burn solid fuels (wood and coal) for home heating. This is the same level as in Taranaki.

6.2 GREENHOUSE GASES AND CLIMATE CHANGE

6.2.1 WHAT IS THE STATE OF GREENHOUSE GASES IN TARANAKI?

Greenhouse gases include carbon dioxide, methane and nitrous oxide, which have the ability to trap infra-red energy that would otherwise be radiated off the Earth's surface into the atmosphere. These gases originate from industry, wastes, farming and fuel.

(A) CHANGES IN EMISSIONS

Industry

The level of emissions from industry varies year by year, especially in the energy sector in those years when gas-fired power stations are used to make up the shortfall in generation from other generators, such as hydropower stations.

The New Plymouth power station was a 600 MW capacity station operating on gas. When operating at a capacity of 75-80%, the station would have emitted 2.4 million tonnes of carbon dioxide annually. In 2007, Contact Energy announced the permanent closure of the station, although in 2008 parts of the station were temporarily used for emergency electricity generation.

A 200 MW gas turbine station at Stratford was closed in August 2001 and subsequently dismantled. In 2007 Contact Energy announced that it would build a new high efficiency open cycle gas turbine peaking station of 200 MW generation capacity on the site. Peaking stations are not generally intended for continuous operation but rather only for short-duration operation to satisfy demand at peak periods or to provide cover for the country's hydropower stations during periods of low hydro storage. Assuming a 40% load factor for the 200 MW power stations (i.e. recognising that they were/are not baseload stations), the old power station would have emitted 560,000 tonnes of carbon dioxide per year, and for the same load factor, the new station will emit 350,000 tonnes per year, a reduction of 210,000 tonnes per year (38%).

Methanex owns two methanol plants in Taranaki, located in the Waitara Valley and at Motunui. The two sites would have emitted 0.5 and 1.6 million tonnes of carbon dioxide per year, respectively. The Motunui site was closed in 2004, with limited production continuing at Waitara Valley. In 2007 Methanex announced its intention to refurbish and re-open half the capacity of the Motunui site during 2008. The intention is that the Waitara Valley site will be closed. The net change in combined maximum annual emissions will be a reduction from 2.1 million tonnes to 0.64 million tonnes.

Hydrocarbon production stations use natural gas as a fuel for on-site energy requirements, and as a purge gas burnt from flares as a plant safety procedure. Gas may also be discharged during plant trip-outs or if unsaleable (e.g. LPG from time to time). Over the past 15 years, the hydrocarbon production and treatment plants in Taranaki have reduced carbon dioxide emissions by reducing everyday flaring, recovering more hydrocarbon fractions as sales stock, and improving plant stability. For example, at one production station annual CO_2 emissions have been reduced 85% since 1996, and at another, 55% since 2001.

Methanex methanol plant and the Pohokura production station in foreground, Motunui.

13 Ministry for the Environment, 2007. *Environment 2007.*

Wastes

The decomposition of organic wastes in landfill releases methane, a potent greenhouse gas. While composting leads to some release of carbon dioxide, the volume of gas and its warming potential are far less than if the material is landfilled. The volumes of waste being disposed of to landfill in the region has risen over the past six years (refer to Chapter 9: Waste). Increasingly, green and other organic wastes are composted instead of going to a landfill.

Farming

Methane, a potent greenhouse gas, is produced by animals such as cows, sheep, deer and possums through their digestive processes. The highest rate of methane generation is from dairy cows, and animals are responsible for about 87% of all New Zealand's methane emissions. Animals also produce urea in their urine which turns into ammonia, nitrous oxide and nitrates. While the actual volumes of nitrous oxide are quite small, it is a very potent gas (over 300 times as potent as carbon dioxide).

In terms of trends in emissions from farm animals over the past 10 years, the number of dairy cattle, beef cattle and sheep numbers has decreased (see section on livestock emissions earlier in this chapter). Thus it can be reasonably assumed that the overall greenhouse emissions from animals will also have decreased.

Fonterra has advised the Council that milk production in Taranaki fell to 1,576 million litres in 2007-08 from 1,696 million litres the previous year, due in part to the drought of summer-autumn 2008. The Ministry for the Environment[14] considers that in the period 1990-2005, methane emissions per head of dairy cattle rose 11%, per beef 12%, and per sheep 19%.

Thus overall, methane and nitrous oxide emissions from animals may have fallen in Taranaki (based on the numbers of animals) but more robust measurement and monitoring techniques are required for calculating regional greenhouse gas inventories (given possible changes in methane emissions per animal).

Nitrogenous fertiliser such as urea also decomposes to ammonia, releasing nitrous oxide. While the quantity of nitrogen applied to pasture from urine is much higher on intensively grazed pasture than the quantity from fertiliser, the latter is generally applied in two single applications rather than all year round, and so can result in proportionally greater amounts of nitrous oxide gas.

The Ministry for Agriculture and Forestry[15] suggests that the ratio of animal wastes to fertiliser as comparative sources is 6:1. Data obtained from MAF and Statistics New Zealand show that quantities of nitrogenous fertiliser applied in the region have risen substantially over the past two decades and are still increasing. Twenty-six times more urea was applied than in the mid-1980s, and five times more di-ammonium phosphate (after peaking at 10 times more in the mid-1990s) (refer Table 6.5).

Table 6.5: Trends in nitrogenous fertiliser use in Taranaki (units: tonnes annually).

	Di-ammonium phosphate	Urea	Ammonium sulphate
Mid 1980s	1,700	900	2,250
Mid 1990s	17,000	12,100	3,600
2004	8,830	26,400	1,000

Research is showing that the rate of methane generation per animal and of nitrous oxide per hectare of soil is hugely variable, both for the same animal day by day and comparing one animal with another (and similarly for land use). Research is underway into measuring differences and understanding the reasons behind variability. The Government's intention is that by 2011 the emissions from individual farms will be able to be calculated accurately.

Motor vehicles emissions

The burning of petrol, diesel, and natural gas (CNG and LPG) as fuel in vehicles releases carbon dioxide. Over the past 10 years, the number of motor vehicles used on the road in the region has increased from 51,300 to 60,900. Over the same period, the volume of petrol used annually in the region has remained constant, at around 77 million litres resulting in 177,000 tonnes of carbon dioxide. However, the volume of diesel

The highest rate of methane generation is from dairy cows.

The number of vehicles in New Plymouth continues to increase.

14 Ministry for the Environment, 2007. *Projected Balance of Emissions Units During the First Commitment Period of the Kyoto Protocol.*
15 Ministry of Agriculture and Forestry, 2003. *Abatement of Agricultural Non-Carbon Dioxide Greenhouse Gas Emissions.*

fuel used has increased 25% in the same period, from an average of 56.4 million litres to 73.2 million litres used in the 2006-07 period, now resulting in 191,583 tonnes of carbon dioxide. Thus, over the past 10 years, emissions of carbon dioxide from transport fuels have increased by 48,000 tonnes annually in the region, due exclusively to increased use of diesel fuel.

Summary

Table 6.6 summarises the general trends in greenhouse gas emissions by sector based on the above discussion.

Table 6.6: Summary of overall trends in greenhouse gas emissions by sector, 1998-2008.

Industry	Wastes	Livestock	Soil	Fuel
☺	😐	☺	☹	☹

(B) CONSEQUENCES OF CLIMATE CHANGE

The international picture

The Intergovernmental Panel on Climate Change has released its *Fourth Assessment Report*, covering the scientific evidence for climate change manifestation, impacts, vulnerability and adaptation, mitigation options, and a synthesis report[16]. The report states that scientists consider 'with high confidence' (i.e. certainty) that impacts of climate change are now being seen around the world, in phenomena such as changes to natural ecosystems, increasing stresses upon water supply, reduced seasonal snow cover, and glacier shrinkage.

Taranaki may become windier with climate change.

The national picture

Across New Zealand as a whole since 1950 there has been a warming of 0.3-0.7° C with more frequent heat waves, fewer frosts (10-20 fewer per year), more rain in the south-west and less in the north-east of the country, and a rise in sea level of about 70 mm. One quarter of the alpine ice mass has vanished, and beech forests are showing increased seed production. NIWA state that it is virtually certain (more than 99% probability) that New Zealand will continue warming, with heat waves and fire risk increasing in intensity and frequency, more frequent and intense floods, landslides, droughts, and sea storm surges, and increasing rain in western regions and increasingly dry in the east[17].

Over the next few decades, climate change may benefit New Zealand in some ways – enhanced pastoral production due to higher carbon dioxide in the atmosphere, longer growing seasons, and less frost risk, opportunities for horticultural diversification, reduced energy demand and better public health in winter, and greater water flows benefitting hydro-electricity and irrigation supply. However, even by 2020, natural ecosystems are likely to become stressed, with more invasive species, habitat change and loss, and species extinctions (e.g. in alpine areas), as the rate of climate change will outstrip the rates at which ecosystems can adapt. Sea level rise and coastal storm surges will affect coastal development and infrastructure.

The regional picture

A single drought or extreme weather event (such as the summer drought of 2008 or the tornado swarm of July 2007) do not of themselves 'prove' or necessarily arise from climate change (nor would a severe cold spell 'disprove' it). It is the overall pattern observed over several years or decades that is significant. The NIWA report found that climate change is predicted to lead to a number of changes in Taranaki.

Storm surges may be more frequent as Taranaki's climate changes.

16 IPCC. 2007. *Fourth Assessment Report on Climate Change.*
17 NIWA. 2007. *Climate change IPCC Fourth Assessment Report.* Leaflet produced by the NIWA National Climate Centre, in collaboration with the Royal Society of New Zealand.

Wind Wand, New Plymouth.

Cropping may increase in Taranaki as the weather becomes warmer.

A temperature increase will push species south. The bush-clad eastern hill country allows easy migration of flora and fauna along corridors north to south, while riparian planting will do likewise. Alpine species on Mount Taranaki will come under pressure, but given that there is no permanent snow cover in any case, they may well have some degree of robustness already. Freshwater wetlands might well be enhanced.

In terms of weather and climate, Taranaki is expected to become marginally wetter overall. The greatest pressure may come from an increasing frequency of extreme weather events. Westerly winds will increase in frequency and possibly strength.

A study into the region's rainfall between 1930 and 2004 found that there has indeed been an increase in westerly winds over this period, as predicted[18]. In the eastern hill country, the number of rain days, the number of days when heavy rain fell, the total amount of rain falling on those days, and the amount of rain falling on the days of heaviest rain, have all increased. The only decrease noted was in the number of consecutive dry days each year. For northern Taranaki the same, although weaker, pattern emerges with an increase in the number of days of heavy rainfall at New Plymouth, and an increase in the amount of rain falling on the days of heaviest rain. The number of consecutive dry days each year has decreased (i.e. the dry spells are generally becoming shorter).

South of the mountain, there is no evidence of a trend in any index that is statistically strong enough to be deemed significant, but all indications are moving towards dryness, with reductions in the number of wet days and the amount of rain falling on those days. While the number of days experiencing heavy rain is not changing, the amount of rain falling on these days appears to be reducing.

In terms of pastoral farming, productivity is expected to increase by 10-20% over the next two decades due to warmer weather, a longer growing season, and increased CO_2 in the atmosphere. However, warmer and wetter weather may mean an increase in fungal diseases, and pastoral species such as paspalum and kikuyu may become a bigger problem in pasture. In horticulture, increased vegetative growth may adversely affect fruit quality and yield. Warmer weather may allow an increase in cropping in the region.

On the coast, more regular and more vigorous swells are expected. With few low-lying centres of population and development, Taranaki is not highly vulnerable in this regard. Coastal erosion rates will increase.

In terms of the infrastructure and the built environment, oil and gas production and electricity transmission utilities will have to take into account the possibility of more severe weather. The increased westerly winds will very likely enhance wind generation potential and local hydro generation, especially in winter. Increased storm severity and frequency may lead to increased insurance premiums and increased storm damage being more widespread and severe. This Council may need to review the degree of protection afforded by its flood protection works. Increased natural erosion could lead to more sediment and sand movement deposited into the coast (including into the Port).

Plantation forestry productivity is expected to increase (warmer and wetter, and increased CO_2 in the atmosphere).

Taranaki is not expected to be an area where tropical and sub-tropical diseases or disease vectors might become established. Diseases (human and animal) spread by bacteria may increase due to warmer, wetter weather. On the other hand, warmer winters are expected to lead to a reduction in mortality rates.

6.2.2 WHAT STEPS ARE WE TAKING TOWARDS MANAGING CLIMATE CHANGE?

Climate change is being addressed by the Government and other members of the international community through the Kyoto Protocol, which sets targets for the reduction of greenhouse gas emissions. The target for New Zealand is that greenhouse gas emissions during the years 2008-2012 should on average be the same as they were in 1990.

18 Griffiths, G.M. 2007. Changes in New Zealand daily rainfall extremes 1930-2004. *Weather and Climate* 27:47-66. Published by the NZ Meterological Society.

(A) REGIONAL POLICY STATEMENT AND PLANS

The *Proposed Regional Policy Statement for Taranaki* includes recognition of the effects of climate change as a significant issue for the region, and has policies relating to adaptation and mitigation of the effects of climate change and methods for both the regional council and district councils to implement.

The *Regional Air Quality Plan* is also in the process of being reviewed. The plan could include measures that produce overall reduction of emissions from various sources of products of combustion since these measures have air quality benefits in any case, other than solely reductions of greenhouse gas emissions. This will also provide some incentive to reduce greenhouse gases. The plan could include provisions to improve energy efficiency, favour processes that emit fewer greenhouse gases, the promotion of vehicle efficiency, restrictions on activities such as flaring at hydrocarbon exploration and production sites, and controls on emissions from landfills.

The Council is a signatory to the Communities for Climate Protection Programme. This voluntary programme aims to empower local government to reduce greenhouse gas emissions from councils' operations and from their communities. The programme has five milestones to achieve. The first two of these milestones (an inventory of greenhouse gas emissions and setting a reduction target and timeframe) have been adopted. The Council is currently in the process of preparing a local action plan towards the third milestone which will outline specific measures to meet greenhouse gas reduction targets.

The petrochemical industry is a significant activity in Taranaki.

(B) RESOURCE CONSENT MANAGEMENT

Over the years there has been uncertainty in some quarters about the role of regional councils with regard to greenhouse gas emissions. However, the Government has confirmed that because climate change is an international issue, it should be dealt with at a national level. In 2004 the Government amended the Resource Management Act to essentially remove consideration of greenhouse gases and climate change effects from resource consent assessments[19], other than when considering applications relating to activities involving renewable energy.

That said, consent holders of air discharge consents for industrial sites are required to report on emission reduction and energy efficiency options they have investigated and implemented.

(C) SUSTAINABLE LAND MANAGEMENT

The Council works with farmers to encourage the provision of riparian vegetation along stream banks, and on hill country to identify sustainable land use practices. On steeper or more unstable country this means plantation forestry or allowing reversion to native bush. The Council's sustainable land management programme outlined in Chapter 3 will, over time, mean more trees in the ground which will ultimately help absorb carbon dioxide emissions.

(D) INFORMATION, ADVOCACY, EDUCATION, RESEARCH, AND ADVICE PROGRAMMES

In terms of emissions from soils, nitrous oxide emissions can be reduced by measures such as nutrient modelling and budgeting, the use of nitrification inhibitors, better herd management especially when soils are saturated and appropriate choice of supplementary feeds with low nitrogen content. These are measures the Council is investigating and supporting through channels such as the Clean Streams Accord with the dairy industry, and trials on research farms. The Council is also supporting research into control of the clover root weevil, a pest that reduces nitrogen fixation by clover, and hence forces farmers to use nitrogen fertiliser as an alternative (see case study in Chapter 3 on the clover root weevil). It is also anticipated that purchases of nitrogenous fertilisers will reduce given that prices are rising sharply.

During the past six years, the Council has advocated on eight occasions for what it considers to be regionally effective and efficient statutory, policy, and economic measures in connection with options for emissions trading schemes or other economic measures such as carbon taxes,

19 Resource Management (Energy and Climate Change) Amendment Act 2004

amendments to the RMA, the role of forestry, and emissions reduction options. It has also submitted in relation to renewable energy policies and options.

(E) REGIONAL TRANSPORT

The Council contracts a public passenger transport service in the wider North Taranaki urban areas (New Plymouth, Waitara, Bell Block and Ōākura). In the 2006-07 year, over 320,000 trips were made. Patronage on almost all services for almost all types of passenger category has increased over previous levels. Once-a-week bus services have been established between Waverley and Hāwera, Opunake and Hāwera, Opunake and New Plymouth and Inglewood and New Plymouth.

(F) SUMMARY OF PROGRESS

Table 6.7 summarises the progress with measures to mitigate greenhouse gases and adopt to climate change as a region.

Climate change may have implications for wildlife.

Table 6.7: Summary of progress: implementing regional objectives and policies on greenhouse gases.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Greenhouse gas emissions	• Reduction or minimisation of emissions of greenhouse gases, in a manner consistent with national policies and statutes • Minimisation of adverse effects of greenhouse gases	• Preparing and implementing the *Regional Air Quality Plan for Taranaki* (1997) • Preparing and implementing a new Air Plan (2008-09) • Addressing climate change in the new *Proposed Regional Policy Statement* • Advocating actions on climate change, with a particular focus on encouraging central government to prepare and implement national strategies and/or policies to manage emissions. • Providing advice and information. • Encouraging reforestation.	• *Regional Air Quality Plan* currently being reviewed. • Decrease in regional greenhouse gas emission potential over the past five years. • Central Government ratified the Kyoto Protocol. Economy-wide Emissions Trading Scheme, other government initiatives (Sustainable Land Use, Afforestation Grants Scheme, Permanent Forests Scheme) in effect from 2008 • All major emitters in the region hold consents requiring reporting of energy efficiency measures, and emission reduction investigations. • No local effects of greenhouse gas emissions in vicinity of major sources. • Council promotion and regional uptake of riparian and hillcountry farm plans.

6.2.3 HOW DOES TARANAKI COMPARE?

On a per capita basis, Taranaki emits about four to four and a half times the national average of methane, and three to five times the national average of carbon dioxide. This is because of Taranaki's relatively small population, significant pastoral industry, and the location of national/international energy and petrochemical facilities within the region. Compared with other regions, Taranaki's contribution from the transport sector is very small but its contribution from its farming sector is very large.

Over the past five years, the regional greenhouse gas emissions inventory has probably reduced overall, because of the closure of some large energy and industrial sources and the declining or static size of livestock herds.

Nationally, emissions from the transport and energy sectors continue to grow rapidly, and the Government expects that by 2012 the country will be emitting 70% more than in 1990[20]. From 1990 to 2005, nationwide agricultural emissions rose 15%, energy and transport 42%, and industry 32%, for a net overall increase of 25%, with a 10% increase in the five years 2000-2005.

20 Ministry for the Environment, 2007. *Projected Balance of Emissions Units During the First Commitment Period of the Kyoto Protocol.*

Hill country farmers gather at the Douglas seminar.

SOMETHING NEW IN THE AIR

Greenhouse gases may be the ultimate ill wind, but they are resulting in remedial actions that promise to be good for earth and water as well as air. And even good for the wallets of landowners.

New environmental and economic opportunities are presented by climate change initiatives – and they have been explored at seminars organised by the Taranaki Regional Council.

The carbon farming seminars were held in all four corners of the region between November 2007 and March 2008. Hillcountry farmers were the main target, with turn-outs of 60 at Urutī, 80 at Douglas and 40 at Waverley.

Some background: trees play a big role in new climate change initiatives. Simply put, forests reduce the level of greenhouse gases by removing carbon from the atmosphere and turning it into wood.

A major aim of the new approach is to keep land in trees and to promote the growth of new trees. So harvesting incurs a new cost (the surrender or repayment of the new carbon credits) unless the felled trees are replaced.

Speakers from the Taranaki Regional Council, MAF, the forestry industry and carbon brokers took part in the carbon farming seminars, and their major emphasis was on the business opportunities that exist for landowners in climate change initiatives such as the Forestry Emissions Trading Scheme, the Permanent Forest Sink Initiative and the Afforestation Grants Scheme.

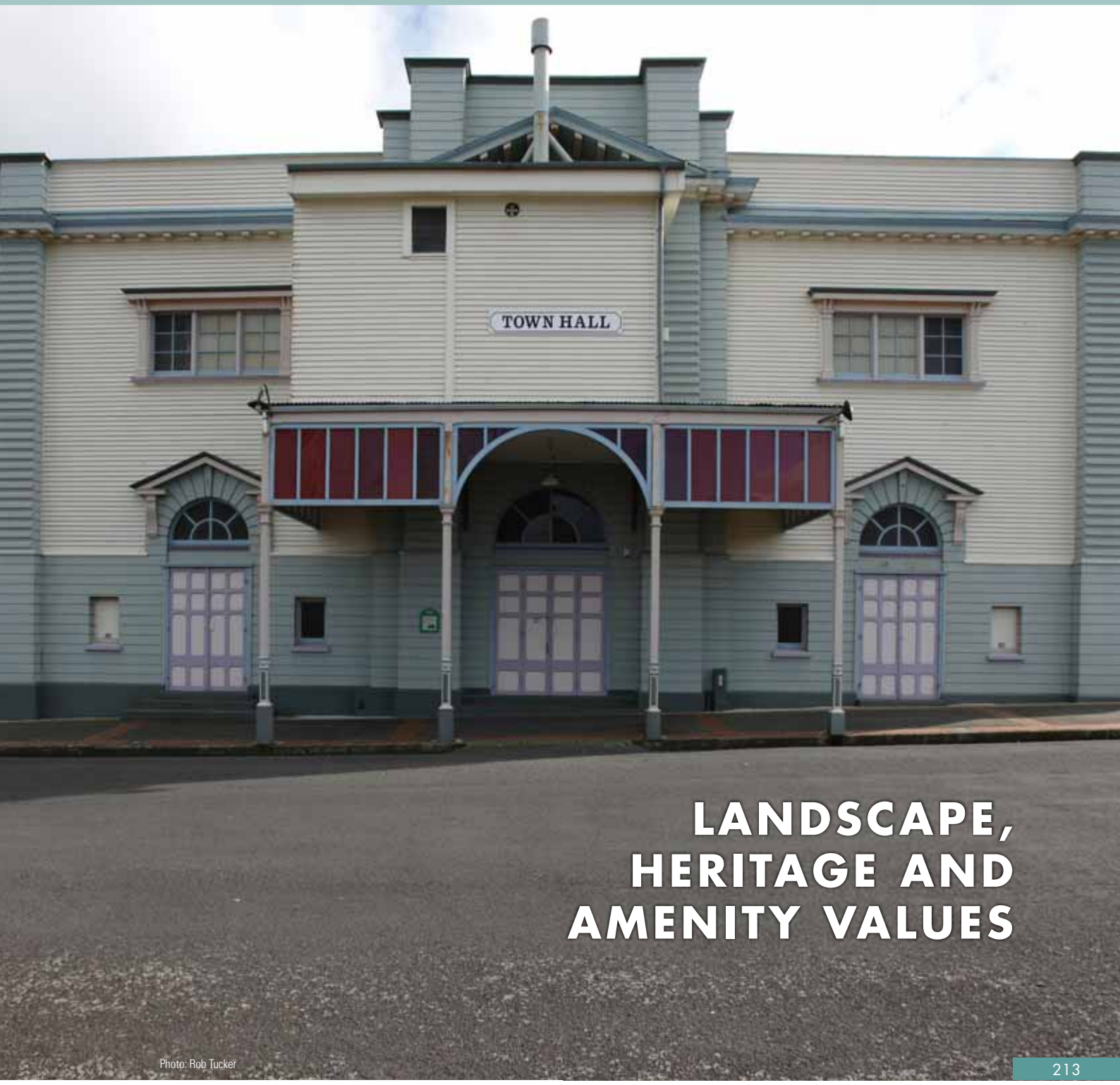
The Permanent Forest Sink Initiative in particular offers hillcountry landowners new scope for developing useful new income streams off steep, highly erosion-prone, infertile land – while at the same time meeting the sorts of soil conservation objectives pursued by the Council. There is flexibility, too, so the landowner can decide which land pockets might be best for reversion to scrub and which would be best for planting trees.

No matter what the option, such vegetation in this steep country will help to prevent sediment run-off into streams and so enhance water quality throughout the entire catchment.

The Council may be able to assist in a variety of ways – for example by supplying historical photos that may be needed by those thinking of taking up one of the climate change initiatives and who need to prove that their forest did not exist prior to 1990, which is the nominal starting point for these initiatives.

Private companies are positioning themselves to work with landowners to take advantage of the new initiatives, and representatives of some of them were among speakers at the Council's carbon farming seminars, although this did not imply Council endorsement of any particular company, and landowners were encouraged to seek independent advice.

CHAPTER 7



LANDSCAPE, HERITAGE AND AMENITY VALUES

Photo: Rob Tucker

LANDSCAPE

Taranaki has a number of outstanding and regionally significant landscapes. Mount Taranaki dominates the landscape and together with the Kaitake and Pouākai ranges is of national and international significance. Outstanding landscapes are identified in each district plan. For most areas identified in the New Plymouth District, there have been no significant changes, since 1995, that have adversely affected landscape qualities. Although landscape values on the ring plain on the northern slopes of the Kaitake and Pouākai ranges have been affected to some degree by increased building density. While there have been some developments along State Highway 3 in the past five years, these have not had significant adverse effects overall on landscape qualities identified for the Stratford District. South Taranaki District Council is to undertake a landscape assessment of the district.

HERITAGE

The Taranaki region has significant historic heritage resources that provide important links with the past. Historic buildings, structures, places, wāhi tapu or other sites have archaeological, historic, architectural, cultural, scientific and technological value or significance. In summary:

- a total of 1,345 heritage buildings or structures and 1,774 archaeological sites have been identified;
- 193 historic heritage sites are protected by the three district councils through their district plans;
- the New Plymouth District Council has identified 80 Category A heritage buildings which have not been damaged over this period, although a number of category B and C heritage buildings have been destroyed;
- archaeological sites in Taranaki are susceptible to damage from land uses and development and a number have suffered damage from stock, erosion, bulldozing for farm tracks, or in some cases by earthworks for buildings, roads and quarries.

AT A GLANCE

AMENITY VALUES

Amenity values are those natural and physical qualities and characteristics that contribute to people's appreciation and enjoyment of the environment. Taranaki residents place high value on the region's clean and quiet environment, the scenic, aesthetic and recreational opportunities provided by parks, reserves, farmland, waterways, coastal areas, bush and walkways, a pleasant environment free of nuisance from excessive noise and odour, and attractive development of the built environment. Community facilities such as sporting and entertainment venues, libraries and museums also contribute to attractive towns and urban areas and their cultural and recreational attributes.

Over the past five years there has been continued provision, development or upgrading of a number of community recreational and cultural facilities such as events centres, the coastal walkway, public gardens and upgrades of most business districts in the region.

From every angle Mount Taranaki dominates the landscape.

OUR LANDSCAPE, HERITAGE AND AMENITY VALUES

Taranaki's landscapes, historic heritage and amenity values are important aspects of the environment because they contribute to our quality and enjoyment of life. These features or values hold important social, emotional, historical or cultural significance to people living within and outside the region – and they make Taranaki unique. They are also important economically, attracting many domestic and international visitors to the region.

Mount Taranaki, a landscape of national and international significance, dominates the Taranaki landscape and is the subject of many pictures and postcards. Taranaki's rural hill country landscapes, coastal and marine natural features and rivers and lakes are also distinctive and highly valued. They form an integral part of the region's identity, natural character and appeal. Many have cultural significance for Māori.

The Taranaki region has significant historic heritage resources that provide important links with the past and contribute to an understanding of our history. Historic buildings, structures, places, wāhi tapu and other sites have archaeological, historic, architectural and cultural value. For example, many pre-European archaeological sites include middens, ovens, village or pā sites and urupā (burial grounds). Remnants of early European history include features associated with timber extraction, railway construction, land wars and dairying.

Various use and development activities can impact on landscape, heritage and amenity values. For example, increasing levels of subdivision and building development can impact on landscape values. Site-specific developments may affect wāhi tapu, archaeological sites, heritage buildings and neighbourhood amenity values. Activities such as building, quarrying, logging, grazing and roading development can have varying effects depending on the scale and location of the activity and the degree of sensitivity of the surrounding environment in which the development takes place. Some development activities can also enhance historic and amenity values by protecting or improving those values.

One of the challenges of effectively managing landscape, heritage and amenity values is that it is often hard to define these values. There may also be a lack of information and awareness of important sites or values. For example, archaeological sites may show indistinct surface features not easily recognised by landowners or may not be visible under vegetation. Good information is necessary to define sites, areas or values, and advice and assistance to landowners and owners of heritage buildings or structures are required to assist in the protection of these values.

7.1 WHAT IS THE STATE OF NATURAL FEATURES AND LANDSCAPES?

The term 'landscape' refers generally to a combination of traits that distinguish a particular area. These include landform (which reflects topography, geology etc.), land cover (including vegetation and water bodies) and land use (such as farming). Spiritual and cultural associations that give added meaning to places are also components of landscape[1].

The protection of outstanding natural features and landscapes from inappropriate subdivision, use and development is a matter of national importance under the Resource Management Act. However, there is no universally accepted definition of outstanding natural features and landscapes. What is outstanding is a subjective judgement which depends on social and cultural perceptions. Landscape is an aspect of the environment that includes natural and physical features as well as social and cultural factors. Important criteria for assessing the significance of natural features and landscapes include:

- natural science factors such as geology and topography and ecological and dynamic components;
- aesthetic values, including memorability and naturalness;
- expressiveness – how obviously the landscape demonstrates the formative processes leading to it;
- transient values such as the occasional presence of wildlife or its values at certain times of the day or year;
- value to tangata whenua; and
- historical associations[2].

Because landscape assessment involves subjective judgements, it is not possible to apply strictly quantitative measures to describe the current state or condition of natural features and landscapes in Taranaki. However, there are recognised techniques of assessment and evaluation used by landscape architects and other experts in the field. We do know through various studies, public surveys and consultation processes that many natural features and landscapes in Taranaki are highly valued for their scenic, visual or aesthetic appeal or for their social, cultural and historical associations. We know that Mount Taranaki is a landscape of national and international significance[3] and that many other features and landscapes maintain a quality and condition that make them of regional significance.

1 Ministry for the Environment, 2000. *The Impact of Development on Rural Landscape Values.*
2 Pigeon Bay Aquaculture Ltd v Canterbury Regional Council 1999 NZRMA 209, Environment Court.
3 Department of Conservation, 2002. *Egmont National Park Management Plan 2002-2012*

District councils in Taranaki play a primary role in managing and protecting landscapes, historic heritage and amenity values.

(A) SIGNIFICANT LANDSCAPES IN THE NEW PLYMOUTH DISTRICT

Mount Taranaki and the Kaitake and Pouākai ranges within the Egmont National Park are identified in the *New Plymouth District Plan* as outstanding landscapes within the district. The plan considers that these landscapes are not under threat from current activities although larger scale developments within the park could have adverse visual effects.

The plan also identifies the following regionally significant landscapes:

- Coastal terrace between Mohakatino and Whitecliffs;
- Whitecliffs and associated conservation forest;
- Sugar Loaf Islands and Paritūtū; and
- eight river mouths: Mohakatino, Tongaporutu, Mimi, Urenui, Ōnaero, Waiongana, Tapuae and Stony (Hangatahua).

The plan notes that while threats to these landscapes are low, there is the possibility of development activities, such as the construction of buildings, that would have high visual impacts on these landscapes.

In 2006, the New Plymouth District Council undertook a review of changes in rural landscape character in the district since 1995[4] to contribute to an upcoming review of provisions in the district plan relating to the rural area. The review concluded that generally landscape qualities and values had not significantly changed (Table 7.1). However, landscape values of the ring plain, particularly on the northern slopes of Mount Taranaki and the Pouākai and Kaitake Ranges had been affected to some degree by increased building density, and whilst this area had not lost all its rural character it was an area in transition from a purely rural area to something else.

Mimi River mouth.

Table 7.1 Changes in rural landscape character in New Plymouth District since 1995[4].

Landscape unit	Observed changes
Mount Taranaki	No noticeable change to landscape qualities or values
Pouākai and Kaitake Ranges	No noticeable changes
Sugar Loaf Islands and Paritūtū	No changes observed in the past 11 years
Coastal terraces and hills: Whitecliffs north to Mohakatino	No significant changes identified
Whitecliffs: cliffs and coastal hills	No noticeable changes
River mouths north of New Plymouth	Very little change has occurred. In one or two places an additional bach has been added but otherwise these landscapes remain unchanged
Eastern hill country–bush	No noticeable changes except for some new landslips
Eastern hill country–mixed uses	Some new buildings have been introduced but have not adversely affected landscape qualities and values
Frontal hill country and Waiiti coastal hills	Some additional buildings on the slopes above the Mimi River mouth but pastoral farming activities prevail
Ring plain	Landscape change has occurred which has affected landscape character and values. New development and scattered buildings have occurred up to the bush line of Mount Taranaki and the northern slopes of the Pouākai and Kaitake Ranges. Building density has increased since 1995 and is beginning to affect the area's rural and landscape character. The area is showing signs of becoming a 'threshold area' - an area in transition from a rural character
Waiiti coastal flat	Small amount of new development to the east of the Mimi River mouth around Urenui and at Waitoetoe and Waiiti Stream mouth
Waitara coastal plain	Retains a mixed use character – Motunui plant, settlements, railways, factories and airport as well as pasture, rivers and streams. Highly visible by residents and state highway traffic

4 LA4 Landscape Architects, 2006. *Review of the New Plymouth District Landscape Assessment*. Report to the New Plymouth District Council.

Mount Taranaki and rural landscape, Stratford District.

(B) SIGNIFICANT LANDSCAPES IN THE STRATFORD DISTRICT

Mount Taranaki and the Egmont National Park dominate the landscape in the Stratford District. The hill country in the eastern portion of the district also possesses significant scenic natural features and landscape qualities. Scenic landscape qualities of particular significance include views of Mount Taranaki from State Highway 3, Pembroke Road, Monmouth Road, Opunake Road and Manaia Road north of Opunake Road and the views of both the mountain and the hill country from Sangsters Hill and from the Strathmore, Pohokura, Whangamomona and Tāhora Saddles along State Highway 43.

There have been some developments along State Highway 3 in the past five years but these have not had significant adverse effects overall on landscape qualities.

(C) SIGNIFICANT LANDSCAPES IN THE SOUTH TARANAKI DISTRICT

Mount Taranaki is visible from many parts of the South Taranaki District and so, not surprisingly is regarded as a significant landscape feature. Other key landscape features in the district include:

- the Egmont National park noted for its significant indigenous forest and associated habitat;
- the volcanic ring plain surrounding the mountain including the distinctive lahar mounds in the northern part of the district;
- the coastal strip which runs the entire length of the western and southern boundaries of the district and includes dunelands and uplifted marine terraces;
- the rivers flowing from the mountain in a distinctive radial pattern; and
- the rugged eastern hill country comprising strongly rolling to steeply dissected hills.

These natural features and landscapes contribute to the high quality of the environment in the South Taranaki District and feature prominently in what residents like most about living in South Taranaki[5].

The South Taranaki District Council is to undertake a landscape assessment of the district to enable it to protect and enhance outstanding landscapes from the adverse environmental effects of activities in the future.

7.2 WHAT IS THE STATE OF HISTORIC HERITAGE?

The protection of historic heritage from inappropriate subdivision, use and development is a matter of national importance under the Resource Management Act. The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga is also a matter of national importance that must be recognised and provided for.

A total of 1,345 heritage buildings, structures or items have been identified by the three district councils (Table 7.2), a reduction from the 1,405 sites identified in the 2003 *State of the Environment Report*[6]. Heritage buildings include houses, churches, towers, memorials and commercial buildings. Historic heritage items identified include a wide range of elements important to the district's historic heritage and which may be architectural, cultural, historic, scientific or technological in nature.

Mount Taranaki and lahar mounds, coastal South Taranaki.

5 Hastings, A and N. Newman, 2008. *Taranaki Community Survey.* Report to the Future Taranaki Facilitation Group by the Nielsen Company.
6 Taranaki Regional Council, 2003. *Taranaki-Our Place, Our Future. Report on the State of the Taranaki Environment - 2003*

Manaia Memorial Band Rotunda and old Post Office building, South Taranaki District.

Heritage buildings, structures or items are not limited to those listed on the New Zealand Historic Places Trust Register. Of all the identified heritage sites in Taranaki only 150 are listed on this register. This is because the New Zealand Historic Places Trust targets heritage at a national level and has limited funds to maintain the register and to purchase heritage items. A total of 193 historic heritage sites are protected by the three district councils through their district plans.

Archaeological sites are historical sites that pre-date 1900. They include sites from early Māori settlement such as middens, pits, ovens, horticultural sites, defensive pā sites and burial grounds as well as sites from early European settlement such as flour milling, historic settlements and shipwrecks.

The New Zealand Archaeological Association Site Recording Scheme was established in 1957 and is an important database of information for planning and legal decision-making. A total of 1,774 archaeological sites are now identified in Taranaki on this database (Table 7.3), an

Archaeological excavation of Elizabeth Jury's farmhouse at Ōmata near the site of the Battle of Waireka during the first Land Wars in March, 1860.

increase from the number recorded in the 2003 *State of the Environment Report* which identified 1,651 sites. This increase has come about due to an increasing amount of archaeological work being undertaken for resource management purposes and also from a project to update the data undertaken by the New Zealand Archaeological Association in conjunction with the three district councils, the Taranaki Regional Council, iwi, hāpu and landowners[7]. Sites discovered through roadworks or other excavations will continue to be added to the database which can never claim to be a complete list of all archaeological sites within the region.

The greatest number of archaeological sites occur in the South Taranaki District (Table 7.3), with 920 sites and in the New Plymouth District (727 sites). The most common type of archaeological site in Taranaki is defensive pā (745 sites) and pits or terraces (461 sites).

Table 7.2 Number of historic heritage and archaeological sites in Taranaki.

District	Historic heritage buildings, structures or items			Archaeological sites	
	Number identified[1]	Listed in district plans	Listed in NZHPT Register[2]	Number identified[3]	Listed in district plans
New Plymouth	805	80	75	727	694
Stratford	284	30	11	127	127
South Taranaki	256	83	64	920	*
Totals	1,345	193	150	1,774	821*

1 By district councils
2 Includes historic places, historic areas, wahi tapu and wahi tapu areas
3 By the New Zealand Archaeological Association in its Site Recording Scheme
* None currently listed in *South Taranaki District Plan*

7 Greig, K, 2006. *NZAA Site Recording Scheme Upgrade Project. New Plymouth District Council Stage 4 Final Report.*

Table 7.3 Types of archaeological sites in each district area.

Site type	New Plymouth District	Stratford District	South Taranaki District	Total
Agricultural/Pastoral	3		2	5
Art	3		7	10
Artefact find	10	22	17	49
Botanical evidence	1	2	1	4
Burial/cemetery	9	1	7	17
Cave/rock shelter	1		1	2
Defensive – military	58		28	86
Defensive – pā	405	17	323	745
Defensive – Island/swamp pā			4	4
Fishing			2	2
Flax milling			5	5
Flour milling	7		11	18
Forestry	1			1
Gold mining	1			1
Historic – domestic	16	1		17
Historic – settlement/township	1	6	8	15
Industrial (unspecified)	5		1	6
Māori horticulture	10		60	70
Marae	1		3	4
Midden/oven	51	53	59	163
Mission station			1	1
Pit/terrace	86	8	367	461
Shipwreck	9		3	12
Source site	4		1	5
Traditional site			5	5
Transport/communication	5		1	6
Unclassified	38			38
Whaling station	1			1
Working area	1	17	3	21
Total	**727**	**127**	**920**	**1774**

(A) HISTORIC FEATURES OF THE NEW PLYMOUTH DISTRICT

Heritage sites within the New Plymouth District include those from early European settlement, the 1860s land wars and the dairy and energy industries. Heritage sites are categorised into 3 categories A, B and C – with A being the 'best of the best' and afforded protection under the New Plymouth District Plan.

Eighty Category A sites are recognised in the district plan, an increase from the 68 recorded in 2003. These sites include early colonial houses and commercial buildings, the Bertrand Road Suspension Bridge, Inglewood Railway Station and Town Hall and St Mary's Church and grounds.

A total of 75 sites in the New Plymouth District are registered by the New Zealand Historic Places Trust (up from 66 such registrations in 2003) with 10 buildings including St Mary's Pro Cathedral and grounds, Hurworth cottage, Pridham Hall at New Plymouth Boys' High School, and the Gables, registered as Category 1 historic places[8].

The historic wooden Bertrand Road Bridge over the Waitara River.

8 A Category 1 historic place is the highest classification given to historic places in New Zealand by the New Zealand Historic Places Trust

Apart from its 80 Category A heritage buildings and items, the New Plymouth District Council has identified 621 Category B heritage buildings and items and 104 Category C buildings and items. Category B and C buildings and items are not regulated under the district plan. The New Plymouth District Council has advised that 30 Category B and 8 Category C heritage buildings and items have been destroyed since November 1998 but that no Category A heritage buildings or sites have been demolished over this period.

When the New Zealand Archaeological Association upgraded its site recording scheme in the New Plymouth District in 2006 it was noted that the condition of the sites visited was variable[9]. Most recorded sites in the district are located in rural areas, with the land used mainly for grazing. Although many of the rural sites remained relatively unchanged except for slow natural infilling, a significant number had been damaged, predominantly by bulldozing for farm tracks or had surface features smoothed to varying degrees by repeated cultivation. In extreme cases, sites had been destroyed by bulldozing as part of farming activities or by earthworks for building platforms, roads and quarries.

It was also noted that sites along the coast were subject to ongoing coastal erosion and that residential subdivision in coastal areas is an increasing threat to site survival. Other works in coastal areas such as erosion management and escarpment enhancement can also affect archaeological sites.

St Mary's stone church and churchyard, New Plymouth.

HI-TECH MEETS HERITAGE

Hi-tech has met heritage in central New Plymouth as part of efforts to protect and enhance New Zealand's oldest stone church.

Ground-penetrating radar has been used to search for unmarked graves in the grounds of the 162-year-old St Mary's Pro Cathedral, which has a Category 1 Historic Places Trust listing and Category A heritage status in the *New Plymouth District Plan*.

St Mary's remains the focal point for New Plymouth's Anglican congregation today as it has been since the 1840s, when it was built on land acquired by Bishop Selwyn and subsequently overseen for decades by the Rev. Henry Govett. Features of the church and its grounds are tombstones and memorials reflecting the turbulent times of the Land Wars.

Although St Mary's has been considerably enlarged and modified over the years, the various sections blend into a harmonious whole in the Gothic Revival style.

Protecting and enhancing its heritage value have been high on civic and ecclesiastical agendas this decade, especially since the preparation of a conservation plan that, according to Vicar David Hollingsworth, is "an inch thick".

The church has already been granted nearly $25,000 in New Plymouth District Council heritage funding to cover the ground-penetrating radar survey, repair of gravestones and repair of the front wall and railings.

Its heritage protection in the district plan has also been extended from the exterior to interior features that pre-date World War I. This gives the Council the ability to ensure any alterations are consistent with the building's historic status.

The Rev. Hollingsworth said that implementing the conservation plan was a long-term project but one being tackled with enthusiasm, especially as St Mary's moves towards full cathedral status in 2009.

Malone Memorial Gate, King Edward Park, Stratford.

(B) HISTORIC FEATURES OF STRATFORD DISTRICT

Key features of historic heritage values in the Stratford District relate to early attempts at coal mining and farming, war memorials and community or commercial buildings. These sites include the Douglas brickworks downdraught kiln (which has a New Zealand Historic Places Trust Category I registration), the Municipal Chambers (including the Hall of Remembrance) and Kings Theatre in Stratford and memorial gates at Victoria and King Edward Parks. Since 2005, seven sites have been added to the list of known heritage resources of significance identified for protection in the *Stratford District Plan*. The total number of identified sites has not changed since 2003.

Most recorded archaeological sites in the Stratford District are in rural areas on land used for grazing or forestry or within areas of regenerating native bush. The condition of sites visited in 2005 as part of the New Zealand Archaeological Association Site Recording Scheme upgrade was noted as variable with most suffering from stock damage and erosion to some degree[10].

The Stratford District has very few recorded archaeological sites that relate to European settlement, but it is highly likely that sites from this period (for example the remains of extractive industries and early farm settlements) still exist[10].

9 Greig, K, 2006. *NZAA Site Recording Scheme Upgrade Project. New Plymouth District Council Stage 4 Final Report.*
10 Grieg, K and Molloy, N, 2005. *NZAA Site Recording Scheme Upgrade Project. Stratford District Council District Summary.*

The refurbished St Peter's Church, Pūrangi.

ENDURING LINK WITH TIMES PAST

It's high-profile urban locations that generally make the heritage headlines but a lot of quiet work also takes place to protect and enhance the historic value of sites out in the backblocks.

One example is at Pūrangi in Taranaki's east, closer to Whangamomona than to Stratford as the crow flies.

On a hill overlooking the village is 102-year-old St Peter's Church, steeped in history beyond its years and listed in the *Stratford District Plan* as a significant heritage building.

St Peter's was built to replace a church established in nearby Pukamahoe by Māori missioner the Rev. Henry Govett in the 1850s.

This had fallen into disuse during the land wars and was destroyed in a bushfire in the 1890s.

The original church's bell, however, hangs outside the front door of St Peter's, whose altar cross is made from the old Pukamahoe centre pole.

St Peter's was well looked after by its parishioners over the decades. That parish, however, has now dwindled so resourcing for the latest maintenance work had to come from further afield.

The work involved lifting and repiling the church, replacing rotten weatherboards and painting the exterior. The entry porch decking and steps were also replaced.

Hawera architect Clive Cullen – no stranger to heritage projects – drew up the plans and Stratford District Council expedited the consent process, satisfying itself that the outcome would be in keeping with the building's historic status.

The project's cost of $21,000 was funded largely by a Taranaki Electricity Trust grant of $20,000 and donations from the families of former settlers and others.

The church is in the Stratford Anglican parish, which is responsible for its upkeep. Ian and Laurel Aitken whose farm surrounds the site, are unofficial custodians and keep an eye on it for the parish.

All these efforts have ensured an enduring future for a material link with a sometimes turbulent past.

(C) HISTORIC FEATURES IN THE SOUTH TARANAKI DISTRICT

A range of heritage sites can be found throughout South Taranaki, with many dating from early European settlement. The *South Taranaki District Plan* identifies 83 heritage items for protection, up from 78 in 2003. The number of heritage items identified in heritage schedules held by the South Taranaki District Council totals 256 (258 in 2003).

Heritage items in the South Taranaki District include private dwellings, banks, town halls, churches, courthouses, the Cape Egmont lighthouse, the World War I Memorial Band Rotunda in Manaia and the old library in Kaponga. Three buildings have a New Zealand Historic Places Trust Category 1 registration - the Hāwera Water Tower, St George's Anglican Church in Pātea and the Waverley Railway Station.

Turuturu Mokai near Hāwera was the site of a group of three pā.

The South Taranaki District contains more than half of all archaeological sites identified in Taranaki on the New Zealand Archaeological Association's site recording scheme, with defensive pā and pits and terraces making up 75% of all sites (Table 7.3). The majority of sites are located on private land. The condition of those sites visited in late 2005 and 2006 as part of the New Zealand Archaeological Association's upgrade project was noted as variable[11]. While a number of pā sites checked during the project exhibited robust features, many had suffered some degree of damage from bulldozing for farm tracks. There were also cases where pā had been quarried for gravel or levelled to make way for more productive grazing areas. A number of storage or borrow pits had been infilled or 'smoothed' to varying degrees by repeated cultivation.

Erosion is a significant threat to archaeological sites in South Taranaki. During the upgrade project, long-time residents indicated that up to 50 m of land had been lost from coastal margins over the past 20 years[11]. A number of coastal pā are subsequently showing signs of damage or have completely eroded away. Ridge sites in the district are also vulnerable as a result of slips or slumps caused by extreme weather conditions.

Flooding in recent years, particularly around Waitōtara, has impacted on sites in low-lying areas.

11 Molloy, N, and Grieg, K, 2007. *NZAA Site Recordi pgrade Project. South Taranaki District Council Stage 4 Final Report.*

Hāwera water tower.

TOWER POWER HAS HĀWERA STANDING TALL

The people have voted with their feet: Refurbishing the Hāwera Water Tower was a fine idea.

The tower was reinforced, re-clad and re-opened to the public in 2004 and by August 2008 there had been nearly 20,500 visits by people keen to have a look.

The tower had been closed in 2000 because of safety concerns over falling concrete. The South Taranaki District Council commissioned a conservation plan and refurbishment began in March 2004.

Some 3,000 townsfolk turned out to celebrate its reopening in October 2004, an occasion that culminated in a spectacular laser light show.

The $1.1 million refurbishment project was funded by the South Taranaki District Council with support from the TSB Community Trust ($263,000), the Lottery Grants Board ($250,000) and Telecom and Vodafone ($100,000 each).

The tower has Historic Places Trust Category I rating. It has national historic importance for the technical skill in design and construction, for both the way the structure is exposed with columns, brackets and tank readily visible, and the raw, off-the-boxing concrete.

Construction started in 1912 with the aim of improving water supply after two devastating fires in Hāwera. Ironically, the advent of the Inaha water scheme meant the tower was never used for the purpose intended.

But it's become an enduring landmark for the district, surviving a number of calls for its demolition. After the 2004 project its future seems secure.

Among those happy about that is Miranda Cullen, who has lived within the shadow of the tower for most of her life. "It's an important link with those who've gone before us," she said. That's particularly important for Miranda, whose father Dr. Alastair Buist was a noted South Taranaki historian.

Like many in South Taranaki, she sees the tower as part of her identity.

It's also looking to be a significant visitor attraction. Of those 20,500 visits to the end of July 2008, nearly 3,000 were by overseas people and the rest were evenly split between locals and those from other parts of New Zealand. Never underestimate tower power.

7.3 WHAT IS THE STATE OF TARANAKI'S AMENITY VALUES?

Amenity values are those natural and physical qualities and characteristics that contribute to people's appreciation and enjoyment of the environment.

Taranaki residents and visitors enjoy very high levels of amenity values. Amenity values are characterised by the region's pleasant environment and the relative absence of noise, odours and dust. With well maintained and accessible parks and reserves, walkways, outstanding landscape features and community and recreational facilities, the region has an uncluttered rural feel.

People have different ideas about what constitutes a pleasant and enjoyable environment. This variation makes the management of amenity values challenging.

A survey of Taranaki residents carried out in July 2008 provided useful information about amenity values by asking what residents liked and disliked most about where they lived[12] . (Table 7.4).

When asked what they liked most about the area they live in, New Plymouth residents cited the close proximity to sea and beaches (32%).

In comparison, Stratford and South Taranaki residents like the quiet, peaceful and relaxing environment, and the fact that they do not live in an overcrowded area (27% and 28% respectively). For all districts, the proximity to Mount Taranaki was one of the top three aspects residents liked most about the area they live in.

A quiet, secluded black sand beach.

12 Hastings, A, and Newman, N 2008. *Taranaki Community Survey 2008.* Report to the Future Taranaki Facilitation Group by the Nielsen Company.

Table 7.4: What people like or dislike most about where they live[13]

What people like most about the area they live in	What people dislike about the area they live in
• Close to sea/beaches • Quiet/peaceful/relaxing/not overcrowded • Close to mountain • Friendly/helpful people/know everybody • Close to town /city • Nice place to live/good area/like Taranaki • Weather/climate/good summers • Size of community (small, not too large) • Always lived here/born here/lived here a long time • Everything we need is here/have all facilities/amenities/services • Friends and family are here	• Nothing (over 30% of respondents) • Weather/climate • Traffic issues (congestion, heavy transport, speeding, boy racers) • Roads/footpaths (poor condition, potholes)/road access • Concerns with council (unnecessary spending, poor decisions, infighting, lack of consultation) • Isolated/distance to travel to other places.

On a positive note, around a third of residents in each district said there was nothing they disliked about the area they live in. Aside from the weather and climate, the most disliked aspect in New Plymouth District is traffic issues and the state of roads and footpaths (8% dislike these aspects the most). The shopping environment (lack of shops and/or late closing hours) is the most disliked aspect of the Stratford and South Taranaki districts (8% and 10% respectively).

A survey of the recreational use of the coast, rivers and lakes in Taranaki carried out by the Council in the summer of 2007-08 showed that 90% of respondents had visited a beach, river or lake in the preceding 12 months[14]. Common activities undertaken were walking, swimming, relaxing, scenic appreciation and picnicking. The main reasons for visiting these areas (after 'close to home') was the natural character of the area, the peace and quiet and suitability of the site for specific activities such as surfing.

Pukekura Park and Poet's Bridge.

(A) AMENITY VALUES OF THE NEW PLYMOUTH DISTRICT

The *New Plymouth District Plan* mentions a number of potential adverse effects on amenity values that it aims to avoid, remedy or mitigate. These include light overspill and glare, noise, dust, traffic effects and anti-social effects associated with liquor.

The community has identified the spacious, low-density character of rural areas, pleasant urban environments, the natural character of the coastal environment, vegetation and trees, landscapes (mountain, sea and bush) parks, reserves, walkways and other open spaces and recreational areas, traffic and pedestrian issues and public views as being important amenity values within the New Plymouth District.

The total number of trees recorded in the *New Plymouth District Plan* as 'notable trees' for protection exceeds 1,800. Many of these trees are

Table 7.5 Levels of public satisfaction with New Plymouth District Council services and facilities.

Service or facility	% satisfied	% not very satisfied	% don't know
The ability to drive around the district quickly, easily and safely	78	19	3
The quality and safety of footpaths	78	18	4
The quality of parks and reserves including the Coastal Walkway and Pukekura Park	93	5	2
The quality of sportsgrounds and playgrounds	90	2	8
The quality of the New Plymouth living environment is being maintained	87	9	4
The quality of entertainment, cultural and sporting events in the district and the venues they are held in	94	2	4
The maintenance and presentation of urban landscapes and streets	92	7	1

13 Hastings, A, and Newman, N, 2008. *Taranaki Community Survey 2008.* Report to the Future Taranaki Facilitation Group by the Nielsen Company.
14 Taranaki Regional Council, 2008. *Recreational use of Coast, Rivers and Lakes in Taranaki, 2007-08.*

good examples of their type, have visual or landscape value or heritage or botanical values that add to the amenity values of the district.

A survey of residents of the New Plymouth District carried out in 2008[15] showed high levels of satisfaction with facilities or amenities as shown in Table 7.5.

In 2008, New Plymouth was judged the country's top town by *North and South* magazine, and the best place to 'live, love, work and raise a family[16]. New Plymouth went on to win the 'best and most liveable community in the world (population 20,001-75,000) at the 2008 International Awards for Liveable Communities. Awards were also won for the coastal walkway, and community sustainability[17].

VISTAS COME WITH HISTORY ATTACHED

A major refurbishment at a historic Taranaki property has extended its appeal beyond the attractive gardens and beautiful vistas it has long been known for.

Tūpare, on Mangorei Road at New Plymouth's outskirts, now offers an authentic taste of life in the mid 20th Century heyday of the two prominent and strong-willed men who shaped the property's original development.

James Chapman-Taylor, the renowned 'arts and crafts' architect, designed Tūpare's stylish house for businessman Sir Russell Matthews in 1932. Unusually for the architect, though, he relinquished control of its construction to Matthews, who had firm ideas about what he wanted.

The result was a unique stately home with the unmistakeable Chapman-Taylor stamp but also reflecting the dreams and aspirations of the innovative Matthews, whose accomplishments included laying the first bitumen road in New Zealand.

Changes crept in over the ensuing years and now the property is owned and administered by the Taranaki Regional Council, which launched a renovation project in 2007 as it implemented a new management plan.

"We've taken out some of the later influences that have impacted on the house over the years," said the Council's Regional Gardens Manager, Greg Rine.

"Visitors can now get an authentic insight into the work of James Chapman-Taylor, the vision of Sir Russell Matthews, and the lifestyles of their era. It really cements Tūpare as a cultural and historical attraction.

"Experiencing what life was like for the Matthews family back in the 1950s certainly adds depth and character to the functions that the house is hired for."

The work on the house was part of a wider project at Tūpare, which also included major restoration work on the hillside property's landscaped garden containing majestic trees, a water feature and extensive plantings in different settings.

The cottage is now the interpretation centre for the property and a gathering point for garden workshops.

The project also included a new car park and gatehouse, new paths and lookouts and a new glasshouse.

Visitors explore the splendour of the gardens.

The fish pond is an original feature of Tūpare.

Tūpare has been restored to the original Matthews' style.

15 National Research Bureau Ltd, 2008. *Communitrak Survey: Public Perceptions and Interpretations of Council Services and Representation.* Report to the New Plymouth District Council
16 North and South, October 2008, ACP Magazines
17 New Plymouth District Council website: www.newplymouthnz.com

(B) AMENITY VALUES OF THE STRATFORD DISTRICT

The *Stratford District Plan* identifies a number of important amenity values in the district. The residential areas within the district have a high standard of amenity in relation to such things as spaciousness and access to daylight and sunlight, private outdoor space and off-street parking. The low-density development and 'country feel' of rural areas is an important aspect of existing rural amenity. Rural/residential areas are also characterised by a low density of development which contributes to a generally open landscape and an important buffer between residential and rural areas.

Within the commercial centre, the visual and physical linkages created by the pedestrian areas are important amenity features of Stratford.

The Stratford District Council has identified 223 notable trees for protection under the *Stratford District Plan*. They have significant historic value or are particularly good, unusual or rare examples of their type in the district. Such trees contribute to the overall amenity values of the district.

Lake Rotokare, South Taranaki District.

(C) AMENITY VALUES OF THE SOUTH TARANAKI DISTRICT

The *South Taranaki District Council District Plan* notes that the community places considerable value on the character and quality of the residential and recreational environments in the district. Reserves are seen as important for the enhancement of amenity values, and protection of natural values, ecology, landscapes and the margins of lakes and rivers. Other important amenity issues in the district are the control of the adverse effects of signs and the control of noise emissions and industrial development both of which reflect the amenity values of surrounding environments.

Seventy one notable trees are identified for protection under the *South Taranaki District Plan*. Equal numbers of native and introduced species are identified, selected for protection on the basis of their condition (health), amenity (community benefit) and notability (distinction).

A survey of residents of the South Taranaki District carried out in 2007 showed that 85% of residents were satisfied with the district's parks and reserves, 81% were satisfied with local roads and 67% were satisfied with footpaths in the district[18].

7.4 HOW ARE LANDSCAPE, HERITAGE AND AMENITY VALUES MANAGED IN TARANAKI?

(A) REGIONAL POLICIES AND PLANS

The *Regional Policy Statement for Taranaki* contains objectives, policies and methods relating to the management of landscape, historic heritage and amenity values. The objective in relation to landscape is to "protect the outstanding and regionally significant natural features and landscapes of Taranaki" and identifies some of these important areas. The *Policy Statement* also has as objectives to maintain and enhance the amenity values of the Taranaki environment and to protect the heritage values of the region. The Council's regional plans and resource consent processes also recognise and provide for landscape protection and for protection of heritage and amenity values in relation to the Council's functions and responsibilities.

The Council's *Regional Fresh Water Plan, Regional Coastal Plan and Regional Air Quality Plan* all provide for the protection of outstanding natural features and landscapes and heritages and amenity values.

(B) DISTRICT POLICIES AND PLANS

The New Plymouth, Stratford and South Taranaki district councils are responsible for managing land use. They therefore play an important role in the protection of Taranaki's natural features and its landscape, heritage and amenity values through provisions in district plans and related land use and subdivision consents. The district councils also provide information and are engaged in environmental education initiatives to raise awareness of these issues.

New Plymouth District Council

The *New Plymouth District Plan* identifies and lists outstanding and regionally significant landscapes in the district, heritage buildings and items (Category A), wāhi tapu and archaeological sites and notable trees. The plan provides criteria for or explanation of their selection and contains rules relating to structures, earthworks, outdoor storage of materials, vegetation and subdivision of land to provide for the protection of landscape, historic heritage and amenity values.

Bowl of Brooklands, New Plymouth, a spectacular outdoor venue.

18 National Research Bureau, 2007. *Communitrak Survey: Public Perceptions and Interpretations of Council Services and Representation.* Report to the South Taranaki District Council.

The 'low density' character of the region is an important amenity value.

The New Plymouth District Council has established a heritage inventory and a heritage fund to provide financial assistance for the protection and maintenance of heritage buildings and items and notable trees. Between 1996-97 and 2006-07 the New Plymouth District Council approved 62 applications and more than $430,000 in expenditure from the Heritage Protection Fund for work on buildings and other heritage items. This has included funding for maintenance work on St Mary's Pro Cathedral (see case study), the Combined Taranaki Club and the Bertrand Road Bridge. In addition, between 2003 and 2007, the New Plymouth District Council issued building consents valued at more than $4 million for private landowners to undertake maintenance or upgrade work on historic buildings.

The New Plymouth District Council will also consider rates relief for protection initiatives. Other non-statutory provisions include education, provision of information and advice, and advocacy.

In relation to broad amenity values, the New Plymouth District Council has identified areas (e.g. industrial, open space environment areas) within their district plan and established standards for each area specifying requirements in relation to building height and coverage, light and noise, signage, landscaping, hours of operation, traffic generation and parking.

A coastal policy area has been defined to protect the natural character and amenity values of the coast.

Stratford District Council

The *Stratford District Council District Plan* seeks to control adverse effects on landscape, heritage and amenity values through rules and standards, and conditions on resource consents relating to structures, excavation, filling planting, noise, lighting and glare, vegetation clearance close to important heritage sites, and subdivision.

Other methods include a heritage fund to provide assistance for heritage protection, requiring financial contributions in the form of land for reserves, walkways, play areas and buffer strips, or cash for future acquisition of reserve land to enhance amenity values and rates relief for the voluntary protection of historic heritage resources. The Council also promotes awareness and encourages landowners and developers to take into account landscape, heritage and amenity values in the planning and design phases of proposals.

Over the past five years the Stratford District Council has issued building consents to the value of $15,000 for work on heritage buildings, all in relation to restoration work on St Peter's Church, Pūrangi (see case study).

South Taranaki District Council

In relation to landscape and heritage resources, the South Taranaki District Council has adopted policies and methods, including rules, voluntary methods and rates relief for voluntary protection, to protect and enhance outstanding natural features and landscapes. Heritage inventories have been compiled covering the urban settlements and rural areas of the district. The *South Taranaki District Plan* includes a schedule of heritage items (buildings, objects and areas and notable trees) for protection and includes a range of regulatory and non-regulatory methods to protect the district's heritage resources. These include rules in the district plan, education and information, rates relief and the consideration of the waiving of fees for heritage order requirements that are lodged on the basis of community benefit.

Methods have been adopted for maintaining and enhancing amenity values. These include the use of district plan performance standards and requirements for landscaping, provision of yards and controls on noise, lighting and signage. The district plan also identifies a defined pedestrian area where standards encourage the development and retention of retail and business activities. The coastline and Lake Rotorangi have been identified as areas where significant amenity values exist and their protection has been addressed in the plan.

The restoration of the Hāwera Water Tower was completed in 2004 at a total cost of $1.1 million with 40% of the funding coming from the South Taranaki District Council and the remainder from corporate and other sources. In the past five years there has also been considerable refurbishment work done on the Eltham Town Hall at a cost of approximately $250,000, again with funding coming from various sources (see case studies). In June 2008 the steeple of St George's Church in Pātea was put back in place after the community had raised $230,000 to have it restored.

Over the past five years the South Taranaki District Council and community boards have approved another $70,000 for the protection of the district's heritage.

Eltham Town Hall.

ELTHAM ELEGANCE CAPTURES HEARTS

Nearing the grand old age of 100, she still captivates people – and there's still plenty of life left in her.

'She' is the Eltham Town Hall. "Everybody refers to this building as 'her', and she's a very elegant lady," said Karen Christian. So elegant and captivating that Karen has not only written a book about her, but joined Don Drabble and other Friends of the Eltham Town Hall in putting countless hours into an ongoing restoration project for which about half a million dollars has been raised.

Even after nearly a decade on the project, they marvel at the workmanship that's gone into the building, designed in 1910 by Hāwera architect John Alfred Duffill and built in only six months by Manaia firm John A Ryan and Sons.

"She was built soundly and there's got to be at least another 100 years in her yet," said Don. "It's amazing when you think the builders had none of the modern power tools. And they did it in such a short time."

Karen points to the attractively curved proscenium arch that frames the big stage. "That was created using small widths of timber and shaped with plaster. And it's still in original condition – it didn't need renovating."

Other features of the hall include a fly tower (so named because it allows curtains and scenery to 'fly in' from above) soaring more than 12 m above the stage, and a fine dress circle. A grand tōtara facade fronts corrugated iron sidewalls and the floors are constructed of matai.

Besides being a venue for live drama, music and dance, the hall has served time as a movie theatre (Don was a projectionist), as a temporary hospital during the flu epidemic of 1918-19, and as the place where townsfolk gathered to hear big announcements about wars or elections – delivered from a balcony at the front.

The renovation effort began in earnest after a conservation plan was drawn up by Auckland conservation architects Salmond Reed in 2001, with Don contributing the historical introduction. The foyer has been renovated and rebuilt to Duffill's original design, many of the original seats have been refurbished and re-covered, and storage areas and the manager's office have been turned into display spaces and a home for the Friends' group.

Now the Friends have their eyes on the stage area itself, and would also like to pay some attention to the frontage.

Big donors over the years have included the Taranaki Electricity Trust and the Lottery Grants Board. To the delight of the Friends, TSB Community Trust recently funded the purchase of a new waterfall curtain for the stage.

South Taranaki District Council has also supported the restoration efforts. And most importantly, so has the community. "At some stage, every community group in Eltham has been involved in this project," said Karen. "That's very significant."

Supporters have included former movie patrons who have funded the restoration of their favourite seats in the dress circle.

The building has a New Zealand Historic Places Trust Category 2 listing. But it is no museum piece. The flat auditorium floor gives it versatility and it remains the venue for a wide range of activities including art exhibitions, performances, corporate meetings, even dinners. NZ Ballet and NZ Opera have performed there. Dave Dobbyn played there in 2007 and it was on the touring itinerary of Gary McCormick and Tim Shadbolt in 2008.

"What we've found since the renovations started is that users respect the building more now," said Don.

There's sure to be a big hooley when the Eltham Town Hall turns 100 in 2011 – with lots of love evident, as well as respect.

Friends of Eltham Town Hall Les Parish, Karen Christian and Don Drabble.

Parihaka International Peace Festival.

Other agencies

The Department of Conservation plays an important role in managing landscape, historic heritage and amenity values through its management of national parks and other conservation land in Taranaki. DOC manages 146,973 hectares of public conservation land in Taranaki (21% of the total land area of the region) under the Conservation Act, National Parks Act and Reserves Act. Management plans are prepared for these areas and activities within them controlled to manage natural and historic resources for conservation purposes or for purposes consistent with the National Parks Act or Reserves Act.

The Historic Places Trust, established under the Historic Places Act 1993, has a number of functions in the area of historic heritage. These include responsibilities to identify, record, investigate, assess, register, protect and conserve historic places, historic areas, wāhi tapu and wāhi tapu areas, to advocate the conservation and protection of these areas and to foster public interest and involvement in historic places protection. The Trust also manages historic places, buildings and other property owned or controlled by the Trust or vested in it.

All archaeological sites are afforded protection under the Historic Places Act and it is unlawful for anyone to destroy, damage or modify an archaeological site without first applying to the Trust for an authority to do so.

(C) DEVELOPMENT OF COMMUNITY FACILITIES

All district councils have been involved in the provision, development or upgrading of community amenities and facilities within their districts. For example there have been continuing upgrades of business districts or streetscapes in New Plymouth, Stratford, Hāwera, Inglewood, Eltham, Kaponga, Opunake, Pātea and Waverley which have all contributed to improved amenities in these areas.

Sanford Events Centre, Opunake.

There has also been ongoing community investment in recreational and cultural facilities over the reporting period including further development of the coastal walkway in New Plymouth, the Sandford Events Centre in Opunake, and investment by the Taranaki Regional Council in development of Tūpare (New Plymouth), Hollard Gardens (Kaponga) and Pukeiti Gardens.

Work commenced early in 2008 on The Hub, South Taranaki District Council's $22.7 million vision for a multi sports, leisure and events centre at Hicks Park in Hāwera. These developments have followed significant community investment in major recreational and cultural facilities in the previous reporting period, including the Puke Ariki Library and Museum complex, Yarrow Stadium, and upgrades of the TSB Showplace, and Bowl of Brooklands in New Plymouth, the TET Stadium at Jubilee Park in Inglewood and the TET MultiSports Centre in Stratford.

The development of such facilities contributes to the amenities enjoyed by the people of Taranaki and visitors alike, and promotes the economic and social well-being of the community.

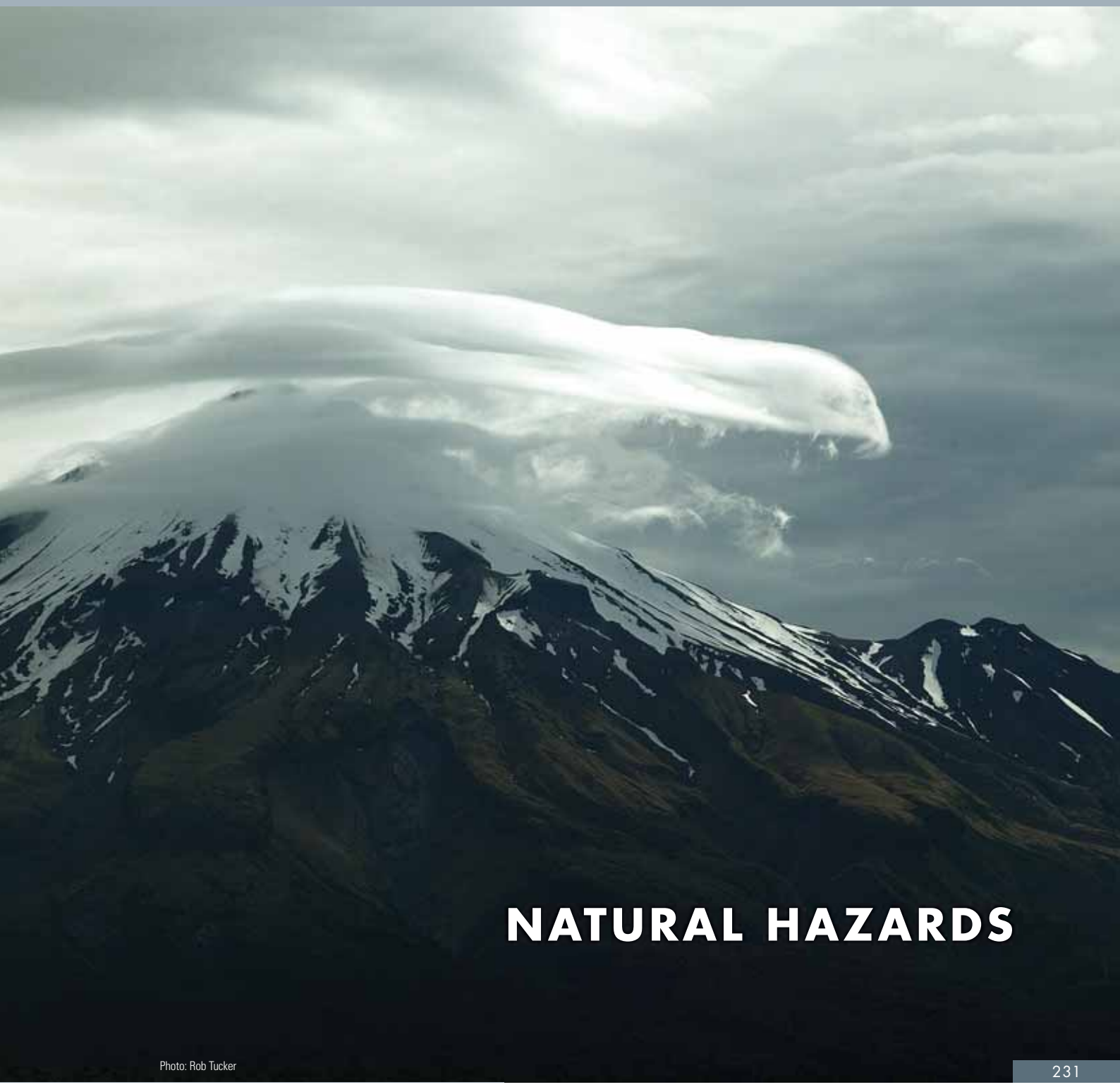
(D) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on landscape, heritage and amenity issues is summarised in Table 7.6.

Table 7.6 Summary of progress: implementing regional objectives and policies on landscape, heritage and amenity values.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Protecting our outstanding natural features and landscapes from inappropriate subdivision, use and development Having regard to other natural features and landscapes of importance	Protection of our outstanding natural features and landscapes Promotion of the protection of other natural features and landscapes of importance Increased awareness of outstanding and regionally significant natural features and landscapes	• Objectives, policies and methods included in the *Regional Policy Statement for Taranaki*. • District councils have identified outstanding or significant features or landscapes and included provisions for their protection in district plans. • Conditions are imposed on resource consents. • Information and advice are provided. • Advocacy and promotion to other agencies and to landowners is undertaken.	• The region has high quality natural features and landscapes. • There have been no significant changes in landscape qualities and values of outstanding or regionally significant landscapes over the reporting period. • Some landscape change has occurred in the ring plain landscape unit in the New Plymouth District but it retains much of its natural character. • Conditions are imposed on resource consents to protect landscape values. • Information and advice are provided.
Identifying and raising awareness of historic heritage and promoting its protection Managing the adverse effects of activities on Taranaki's historic heritage Promoting active management of archaeological sites and heritage buildings	Protection of the region's historic heritage values including buildings, structures features, places and areas of heritage value	• District councils have compiled lists of heritage sites. • Significant sites are included in district plans and are protected by rules. • Resource consents are issued to upgrade or maintain heritage sites. • Conditions are imposed on activities to protect heritage sites or values. • Funding is available to assist landowners to protect heritage values. • Information and technical advice is provided. • Investigations are carried out to identify heritage sites and values and to update records.	• 1,345 heritage buildings, structures or items and 1,774 archaeological sites have been identified in Taranaki. • 193 heritage buildings and items and 821 archaeological sites have been identified for protection in district plans. • 150 heritage items are listed in the New Zealand Historic Places Trust Register. • Funding has been made available to assist landowners to protect heritage values. • The number of heritage items identified by district councils has decreased since 2003, and the number of archaeological sites identified and listed on the NZAA's Site Recording Scheme has increased since 2003. • The condition of archaeological sites in Taranaki is variable and are affected by development and farming activities. • Resource consents are issued and conditions are imposed to protect heritage values. • Information and advice are provided.
Maintaining and enhancing amenity values Adverse effects of activities on amenity values	Maintenance and enhancement of amenity values	• District plans contain policies and rules to control bulk and location, noise, light, traffic and other aspects of amenity. • District plans contain policies and rules to protect notable trees. • Regional plans contain policies and rules to maintain amenity values. • Information and advice are provided. • Enforcement action is undertaken to maintain amenity values. • Community facilities are developed and open spaces are provided.	• Amenity values are high in Taranaki. • Public perception surveys show high levels of public satisfaction with amenity values and community facilities. • 2,125 notable trees have been identified for protection in district plans. • Information and advice are provided.

CHAPTER 8



NATURAL HAZARDS

Photo: Rob Tucker

NATURAL HAZARDS

Taranaki is subject to a range of natural hazards, the most significant of which are flooding, volcanic activity, earthquakes, high winds and tornadoes and land instability. The Taranaki Regional Council operates an extensive river level monitoring and flood warning system, as well as wind and rainfall recorders. In addition, eight seismometers (instruments used to measure earthquakes) are located around Mount Taranaki to monitor potential seismic and volcanic activity. Over the past five years:

- monitoring has shown no volcanic activity;
- four significant flood events and a number of minor events have occurred in the region;
- 102 special weather warnings were issued by the Meterological Services;
- 200-300 earthquakes were recorded on average each year in Taranaki, but only a few were felt; and
- the swarm of tornadoes that hit Taranaki in July 2007 triggered a declaration of a state of emergency. The emergency response systems functioned well.

Both regional and district plans identify natural hazards and contain controls to reduce hazard risks. Significant hazards and risks to be managed by the Taranaki Civil Defence Emergency Management Group are identified in the *Taranaki Civil Defence Emergency Management Plan*. A volcanic strategy has also been prepared and updated. The Taranaki Regional Council has prepared and updated a flood event standard operating procedure. In addition community awareness promotion and education on natural hazards, risk reduction measures and responses are carried out on an ongoing basis.

Many natural hazards are weather related.

OUR HAZARDOUS ENVIRONMENT

A natural hazard can be defined as any atmospheric, earth or water-related occurrence including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding that adversely affects or may adversely affect human life, property or other aspects of the environment[1]. Natural hazards are environmental events that happen independently of human influence. Natural events become hazards only when they have the potential to affect people and property and other valued aspects of the environment.

New Zealanders live on the active Pacific-Australian Plate boundary, which passes through New Zealand, producing earthquakes and volcanoes, and shaping the landscape. New Zealand has not suffered major social disruption or serious economic setback due to geological hazards since the 1930s and early 1940s, a period in which large shallow earthquakes repeatedly struck the country. The historical evidence and scientific research show that risk to the population and economy from geological hazards is significantly greater than experience from more recent years would indicate.

New Zealand also has a varied climate and is subject to a large number of meteorological hazards. These are weather-related events, such as floods, droughts, landslides, winds, frost, extreme temperature, hail, lightning and fire.

Potential increases in the severity and frequency of natural hazards such as flooding and rising sea levels are expected as a result of climate change. Global warming effects are expected to accumulate during the 21st century, and enhance already observed changes in regional climate. Projections out to 2100 for New Zealand include: increases in westerly winds, increases in temperature of between 0.5 and 3.5°C, decreases in frost risk, wetter in the west and drier in the east, and increases in the frequency of extreme daily rainfalls[2]. The increased rainfall is likely to lead to more severe floods, landslides and erosion. The higher temperatures are likely to lead to droughts and wildfires.

Predictions for likely changes to Taranaki's climate have been made[3]. Rainfall in Taranaki is predicted to decrease in summer and increase in winter with a likely increase in extreme rainfalls through the 21st century as the temperature increases. South Taranaki is likely to become drier on average, in terms of the moisture available for pasture growth, with more frequent droughts. Gale and storm force winds from the west are likely to increase.

A major event almost anywhere in the country would affect the whole of society and economy because of the small size of the country and the interdependencies of infrastructure, logistics and business. Preparing for and responding to natural hazards in terms of reduction, readiness, response and recovery are key components in a 'secure and healthy Taranaki', one of the seven community outcomes identified by the Taranaki community[4].

8.1 WHAT IS THE CURRENT STATE OF NATURAL HAZARDS IN TARANAKI?

The Taranaki region is susceptible to significant adverse effects from natural hazards. Natural disasters can result in heavy losses of property and a threat to lives, forcing communities to learn to live with these hazards. While it is not possible to reduce the incidence of natural hazards, steps can be taken to reduce the vulnerability of the community to their impacts.

Taranaki is subject to a wide range of natural hazards, all of which have potentially significant consequences for public safety and physical, social and economic wellbeing. The most significant of which are flooding, earthquakes, volcanic activity, high winds, and land instability and erosion (including coastal erosion). Other potential hazards include tsunami, drought, fire and lightning.

Natural hazards are a constant threat to the Taranaki region because it has many areas of coastline exposed to erosion and flooding, steep erodible slopes in river catchments in the eastern hill country and a potentially active volcanic area. The region is also exposed to prevailing westerly winds and can experience some of the highest wind speeds in the country along its southern coast.

(A) FLOODING

Frequent heavy rain and the steep gradients of many Taranaki river catchments in the eastern hill country can result in significant risks arising from flooding. Flood risk on the ring plain and coastal terraces along the northern and southern coasts is relatively low as high-velocity flood flows are contained largely within deeply incised stream channels. However, urban development can constrict flow and cause flooding risks in some areas.

1 Resource Management Act 1991.
2 Thompson, C; Salinger, J; Burgess, S; Mullan, B. 2006. *Climate Hazards and Extremes – New Plymouth District, Storms and High Intensity Rainfall, Extreme Rainfall Statistics.* Report prepared by NIWA for New Plymouth District Council.
3 Baldi, M; Salinger, S. 2008. *Climate Trends, Hazards and Extremes – Taranaki. Synthesis Report.* Prepared by NIWA for NPDC, TRC and STDC.
4 Community Outcomes Project Team. 2004. *Future Taranaki: A report on Community Outcomes.*

One kilometre of forest was destroyed when a lahar breached the Maero Stream on Mount Taranaki. April 2008.

Several major floods and a number of minor events have occurred since 1980. The more significant of these occurred in 1986 (Mangamingi), 1987 (Waitōtara), March 1990 (Cyclone Hilda – north, east and south-east Taranaki), April 1995 (New Plymouth, the 'Big Wet')[5], and July-October 1998 (the 'Long Wet')[6].

Four significant flood events and a number of minor events have occurred since the *2003 State of the Environment Report*. The most significant of these occurred in 2004 (Waitōtara), 2006 (Waitōtara) (see case study), May 2007 (New Plymouth and Ōākura)[7], and April 2008 (Ōākura to Opunake).

The Taranaki Regional Council maintains a flood warning log for monitoring flood events. Alarms are triggered when flows in rivers reach critical levels. Table 8.1 shows the number of special weather warnings issued by the Meterological Service (102) and the number of flood warning events logged (12) during the period 2002-03 to 2007-08. The issuing of special weather warnings does not necessarily result in flood alarms, and equally, flood warning alarms can be triggered without special weather warnings being issued.

Table 8.1: Flood warning events 2002-03 – 2007-08[8].

Year	02-03	03-04	04-05	05-06	06-07	07-08
Special weather warning	15	25	19	12	17	14
Flood warning alarms	1	0	2	1	1	7

Data from Taranaki Regional Council flood warning log.

There is likely to be an increase in extreme rainfall events in the New Plymouth district in the future as a consequence of climate change. What is an extreme rainfall in the current climate might occur about twice as often by the end of the 21st century under a mid-range temperature change scenario, and up to four times as often under a high temperature change scenario[8].

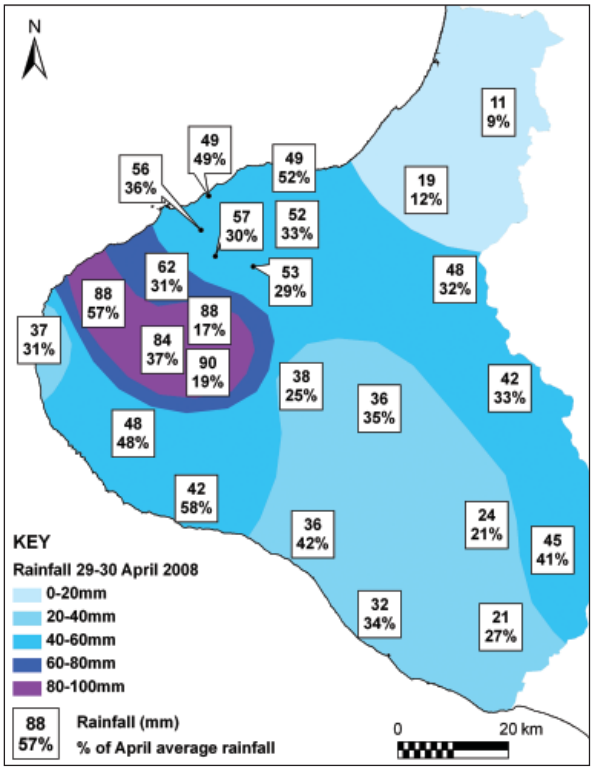


Figure 8.1: Rainfall event of April 2008.

An example of an extreme rainfall event and its consequences was felt in April 2008. The event occurred during 29-30 April 2008 and was centred on the ranges and western and southern flanks of the Egmont National Park, between Ōākura and Opunake (Figure 8.1). Rainfall of 55 mm in one hour was recorded at the monitoring site at the Mangatete Bridge over the Stony (Hangatahua) River (the highest one-hour rainfall intensity on record). High rainfall was also recorded at Dawson Falls (45 mm in one hour), North Egmont (45 mm in one hour) and Kahui Hut at the top of the Kapoaiaia catchment (46.5 mm). Other sites in the area recorded rainfall in the range of 30-50 mm per hour. The highest ever peak flow in the Stony (Hangatahua) River (530 cubic metres per second was recorded during this event.

The short duration, high intensity rainfall resulted in a number of watercourses suffering considerable damage from high flows. The Stony River burst its banks at two places upstream of Ōkato village. In the same area, the Mangatete Stream also flooded, causing property damage. Further south, the Ōaonui Stream burst its banks in its upper reaches in Egmont National Park, sending water into the Waiau River.

The high flows caused erosion and deposition within and adjacent to watercourses. High flows collected and transported trees and debris. The debris caused blockages to structures and resulted in surge flows and over topping, resulting in damage to a number of structures including bridges, culverts, fords and fences.

5 Taranaki Regional Council, 1996. *State of the Environment, Taranaki Region, 1996.*
6 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region – 2003.*
7 G & E Williams Consultants Ltd, 2008. *Oakura River, Lower Reaches – Hall Terrace, Flood Hazard.*
8 Thompson, C; Salinger, J; Burgess, S; Mullan, B. 2006. *Climate hazards and Extremes – New Plymouth District, Storms and High Intensity Rainfall, Extreme Rainfall Statistics.* Report prepared by NIWA for New Plymouth District Council.

Flood damage, Waitōtara Township, 2004.

Willow clearing, Waitotara River.

LESSONS LEARNED FOR THE NEXT DELUGE

The heavens opened in 2004 as Waitōtara Valley suffered its worst flood in living memory – and the responses ranged literally from the valley floor to the sky above.

All farms in the valley were affected, with severe damage throughout the valley floors and hill country. Forty-one of the 47 houses in Waitōtara township were hit, with 14 later condemned. Little escaped the floodwaters – marae, the store, the hotel, school, town hall, church and Plunket rooms were all damaged, along with vital infrastructure such as roads, power and telecommunications links.

Emergency management staff took to the air in a chopper in the flood's immediate aftermath, checking on the welfare of stranded residents and ferrying in food and other supplies.

This immediate response stretched out to more than a month as flood-hit residents were assisted through issues and complications arising from evacuation, flood damage to homes and businesses, trauma and loss of income.

Meanwhile, there was a long, hard look taken at the river itself and what happened to it in the flood. It was obvious, for example, that the obstruction caused by willows blocking the channel added to the turbulence of the flow and the severity of the flooding.

The Taranaki Regional Council drew up a long-term channel clearance programme for the catchment which, with shared funding assistance from the South Taranaki District Council, saw work start immediately on clearing willows from priority areas, downstream and upstream of the township.

The Taranaki Regional Council also installed two more rainfall recorders in the catchment, taking the total to four.

The Council's land management programme in the catchment was also expanded, with farmers encouraged to take action to prevent slips and erosion and thus reduce silt in river channels.

Fast forward two years: the heavens opened again in July 2006, and while rainfall patterns in the main catchment and various sub-catchments differed from those in 2004, overall there was even more rain, and more water in the river.

However, Waitōtara township was spared significant flooding. The main reason for this, said Taranaki Regional Council Special Projects Manager Dex Knowles, was the removal of willows from the river channel resulting in greater channel capacity.

"Observations and photographs clearly show a consistent river cross-section flow at Waitōtara and not the turbulent flow associated with willow obstructions," he said. "Certainly, informal feedback shows the community appreciated the value of the willow clearance."

The Council's flood warning system also worked well enabling notification of the flood to affected parties.

Catchment clearance work is continuing so that damage and trauma can be kept to a minimum the next time the heavens open.

Silt covers the Waitōtara River flats after the 2004 flood.

Mount Taranaki, a volcanic cone.

(B) VOLCANIC ACTIVITY

The Egmont Volcanic Centre is one of eight volcanic districts in the North Island. Mount Taranaki last erupted in about 1755 after eight eruptions in the previous 300 years. Deposits around the base of the volcano record intermittent volcanic activity for the past 130,000 years. Moderate or major eruptions have occurred on average every 340 years, while numerous smaller events have taken place at more frequent intervals.

On three occasions, twice within a very short period of geological time, former cones have collapsed to the north-east, south-east and the west. In each instance extremely large volumes of material flowed more than 40 km across the landscape and reached the present coastline. These flows created the distinctive mounds or hummocks on the lowlands surrounding the volcano.

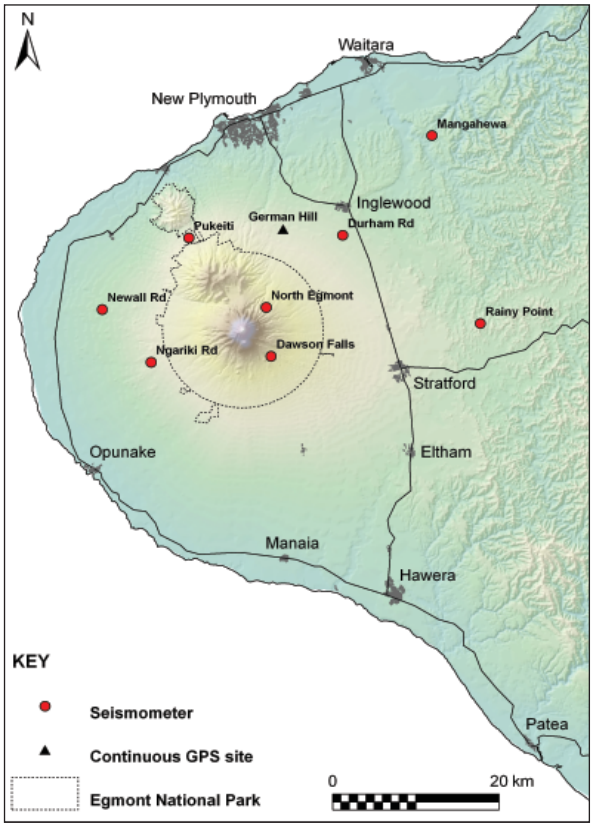


Figure 8.2: Location of earthquake monitoring sites.

There is no evidence to suggest that Mount Taranaki has become extinct. Rather it must be regarded as an active volcano in a state of dormancy[9].

The approximately 100,000 people who live within an 80 km radius of Mount Taranaki have made a considerable investment in farms, forests and urban and industrial infrastructure. Consequently, the potential effect of volcanic activity in Taranaki, particularly from airborne ash, lahars and floods, represents a major threat to the community.

The Institute of Geological and Nuclear Sciences, with support from the Council, operates a network of seismometers (instruments to measure earthquake and volcano activity) in and around the volcano (Figure 8.2). This network provides an early warning system. The network is funded by the Earthquake Commission. A continuous GPS site is operated by GNS to measure ground deformation (the change in the shape of the ground prior to, during, or after an eruption).

No volcanic activity was recorded over the past five years.

(C) EARTHQUAKES

Although not located in the most seismically active part of New Zealand, Taranaki has felt the effects of a number of moderate earthquakes over the past few decades[10].

There are least five known active onshore surface faults in the region (Inglewood, Norfolk, Ōaonui, Waverly and Ararata), along with a number of offshore faults. These active faults are the likely source of large, shallow earthquakes that originate in the region. High intensity earthquakes do not occur frequently.

Since the installation of the earthquake monitoring network in 1992, between 200 and 300 earthquakes a year in Taranaki have been recorded. Only a small fraction of these were felt. In the 12-month period to June 2008, 191 earthquakes were recorded[11]. This accounted for 1-2% of the earthquakes located in New Zealand in an average year. Most of the earthquakes occurred along the coastline west of Mount Taranaki, between New Plymouth and Opunake, and east of Stratford. The distribution is similar to that recorded in recent years. Only four of these earthquakes were felt - two deep earthquakes off Hāwera and Pātea and two shallow earthquakes, one near Cape Egmont and one near New Plymouth.

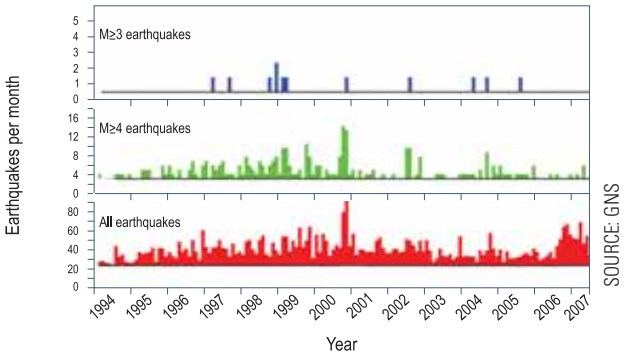


Figure 8.3: The number of earthquakes recorded in Taranaki from January 1994 to June 2007. All detected earthquakes are shown in the lower graph, those of magnitude 3 and above (centre) and those of magnitude 4 and above (top).

9 Taranaki Regional Council, 2000. *Taranaki Regional Volcanic Contingency Plan 2000.*
10 Taranaki Regional Council, 1996. *State of the Environment, Taranaki Region, 1996.*
11 Sherburn, S; Scott, B; Miller, C. 2007. *Data from the Taranaki Volcano-Seismic Network: July 2006 to June 2007.* Prepared by GNS for Taranaki Regional Council.

Apart from periods of above average activity in early 2000 (a sequence of earthquakes about 20 km north-east of Stratford), and May 2005 to March 2006 (widespread activity west of Mount Taranaki), the rate of earthquake activity in Taranaki is relatively low and has remained fairly constant since detailed monitoring began. Figure 8.3 shows the number of earthquakes recorded in Taranaki from January 1994 at different magnitudes. Most earthquakes recorded were small (under magnitude 3)[12]. Figure 8.4 shows the distribution of earthquakes with a magnitude of 2.7 and larger. Shallow earthquakes tend to be to the west of Mount Taranaki whereas deeper earthquakes follow the Waverley fault-line.

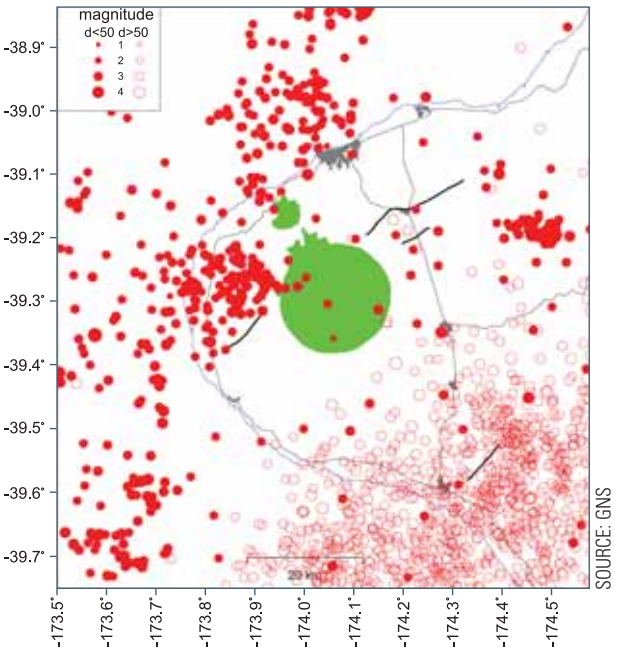


Figure 8.4: Earthquakes of magnitude 2.7 and larger in Taranaki between January 1994 to June 2007. Closed circles indicate earthquakes less than 50 km deep and open circles are those more than 50 km deep. The larger the circle the greater the magnitude.

(D) HIGH WINDS AND TORNADOES

High winds and tornadoes in the Taranaki region are determined by its position in relation to the large-scale weather patterns affecting New Zealand. Furthermore, the region is dominated by Mount Taranaki and is often influenced by wind effects related to air flows over and around Mount Taranaki.

High winds occur over Taranaki when vigorous fronts, troughs, deep depressions or cyclones cause strong northerly to westerly airflows, or southeasterly airflows over the region. In the former case the region is exposed to winds coming in from the Tasman Sea. In the latter case winds from the central North Island can be very strong, causing substantial damage.

The highest wind speeds in Taranaki tend to occur in spring or autumn. Occasional cyclonic storms (such as that associated with Cyclone Bola in 1988) may cause serious and widespread damage.

The roof from Placemakers landed across the street after the 4 July tornado.

Approximately 30 cyclones of tropical origin passed near (within approximately 550 km) or over New Plymouth between December 1968 and April 2005[13]. The peak period for cyclone type weather systems is usually during February and March due to warmer sea surface conditions in these months.

Periods of high winds experienced in Taranaki over the past five years have caused only minor or localised damage.

With climate change the frequency of tropical cyclones is uncertain. The strongest cyclones in the tropics are predicted to increase in intensity, with stronger winds and more intense rainfall. It is unknown how these cyclones, or accompanying weather patterns, will affect New Zealand but it is likely that there will be some higher intensity ex-tropical cyclones producing larger storm impacts as the 21st century progresses[13].

A tornado is a violently rotating column of air called a vortex, extending from the base of a thunderstorm cloud to the ground, and on a local scale, it is the most intense of all atmospheric circulations. Tornadoes are amongst the most intense and destructive winds. In New Zealand, a tornado will typically last for a few minutes, track across the land for 2-5 km, have a diameter of 20-100 m, and have spinning wind speeds of 32-50 m/s (116-180 km/h).

From 1951 to 2006 (56 years) 57 tornado events were reported in Taranaki with 81% causing damage and 21% causing major structural damage[14]. On average about one tornado will occur annually in the region, with severe tornadoes occurring about once in four years[15]. A swarm of tornadoes struck Taranaki in July 2007 causing widespread damage across the region (see case study). The majority of the tornadoes recorded in Taranaki had maximum wind speeds in excess of 180 km/h. Typical weather conditions indicate the presence of low pressure and associated frontal activity to the west or over Taranaki with winds from the north and west.

Taranaki is susceptible to significant adverse effects from tornadoes. New Plymouth District may be more affected by tornadoes than other parts of the region as the area is exposed to thunderstorms and unstable northwest air masses that originate over the Tasman sea. Damaging tornadoes have also occurred in many towns and rural areas throughout Taranaki. Tornadoes can result in losses of property and be a threat to lives, forcing communities to learn to prepare for them.

12 Magnitude: A measure of the energy released by an earthquake at its source. Magnitude is commonly determined from the shaking recorded on a seismograph. Each unit of magnitude on the scale represents a substantial increase in energy, for example a magnitude 5 releases 30 times more energy than a magnitude 4.
13 Burgess, S; Salinger, J; Gray, W; Mullan, B. 2006. *Climate Hazards and Extremes – New Plymouth District, Cyclones of Tropical Origin.* Prepared by NIWA for New Plymouth District Council.
14 Salinger, J; Burgess, S; Turner, R; Moore, S. 2007. *Climate Hazards and Extremes in Taranaki – Tornado Update.* Prepared by NIWA for New Plymouth District Council.
15 Burgess, S; Salinger, J; Turner, R; Reid, S. 2007. *Climate Hazards and Extremes – Taranaki Region, High winds and tornadoes.* Prepared by NIWA for New Plymouth District Council.

A resident surveys damage from the 5 July tornado, Ōākura.

TARANAKI COMMUNITY TACKLES TORNADOES

Nature threw a tantrum in July 2007 – and Taranaki mobilised to clean up the mess left in its wake.

Besides the severity and randomness of the damage and the miraculous lack of death or serious injury, a notable feature of the tornado swarm that struck Taranaki in July 2007 was the community response.

Taranaki people may shrug that off but outsiders were impressed. After visiting the badly damaged Ōākura Kindergarten, the then Civil Defence Minister Rick Barker told a media briefing that "there were quite a number of people who were from out of the area helping the kindergarten because they had kindergartens themselves and said 'if my kindergarten was damaged like this, I would want other people to come and help me too'."

An unknown number of tornadoes struck the region on 5 July 2007, a day after one had devastated a building in the New Plymouth CBD. Region-wide, some 73 properties were damaged across a wide area including Motunui, Stratford, Hāwera, Kaponga, Okaiawa, Normanby and Rahotū. But it was Ōākura that bore the brunt of the damage.

Like Rick Barker, Fire Chief Pat Fitzell was impressed with the way the community rallied around in the aftermath. "Not only the community out at Ōākura but the community in greater Taranaki. We've had people arriving with hammers, with nails, saying 'I'm here to help' from Urenui, from Stratford, from all over Taranaki. So it's been fantastic," he said the day after the swarm.

Clean-up operations after the 5 July tornado hit Ōākura.

The mess was devastating, enough to awe even those experienced and trained to cope with disasters.

"We saw trampolines up trees," Taranaki Civil Defence Emergency Management Group Controller David Lean said after visiting Ōākura. "We saw glass embedded in steel. Literally embedded in steel."

"We saw a 40 ft container – a fully loaded container – blown some 60 ft down into a swamp. We saw a garage that had been moved 100 m over the neighbour's fence and into a paddock, and the lawnmower was still sitting in the place where somebody parked it … how nobody got hurt beats me."

A state of emergency was declared by the Taranaki Civil Defence Emergency Management Group at 8pm on Thursday, 5 July 2007 and terminated at 10am on Saturday, 7 July 2007.

Insured losses from the tornadoes were put at more than $8 million.

The event was the first major test for a new regional Civil Defence Emergency Management structure in Taranaki and all those involved agreed it worked well. But it was the community as a whole that earned the most credit.

"I just have to say the people of Taranaki have rallied around magnificently," said Rick Barker. "I think they should all take a bow. As a community they have performed just outstandingly. Couldn't have asked for anything better."

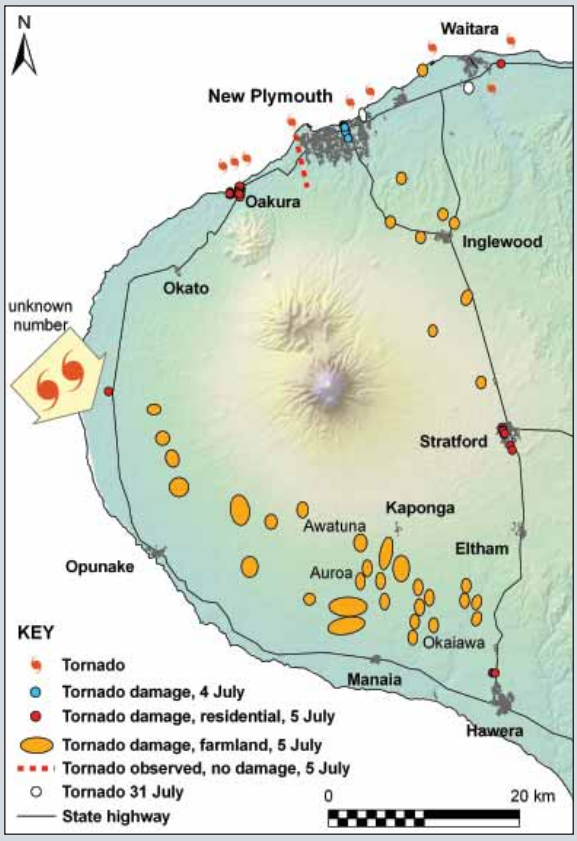


Figure 8.5 Location and path of tornadoes across the Taranaki region.

Coastal farmer Peter Johnson surveys his dry pasture. Summer 2007-08.

(E) DROUGHT

Drought is a very real climatic hazard, imposing significant effects. Unlike natural hazards such as earthquakes and high winds which can strike quickly, droughts do not usually have a sudden beginning or end. They are an insidious hazard caused by a period of abnormally dry weather, persisting long enough to produce serious adverse effects.

A prolonged dry spell over the summer of 2007-08 saw rivers in some parts of Taranaki reach historically low levels. A feature of the dry spell was its early beginning, with rainfall tapering off in November. Areas south and east of the mountain and on the coast were particularly hard hit. A drought was declared over a large part of the region – the area of coastal Taranaki extending south from Ōkato, through all of South Taranaki District to the region's southern boundary, and southern and eastern parts of the Stratford District.

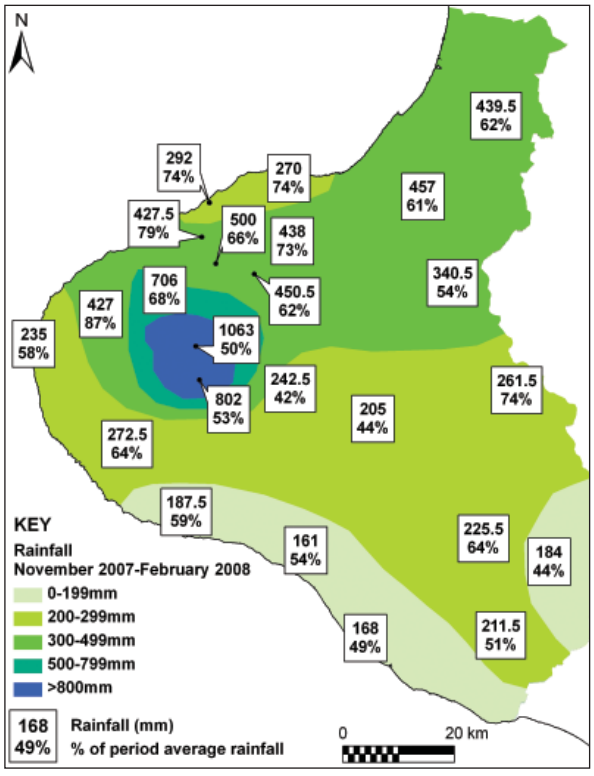


Figure 8.6: Map of rainfall between Nov 07 – Feb 2008 .

All three district councils in the region were forced to impose water restrictions, although in the case of New Plymouth District these were confined to Ōkato, and a water conservation notice issued in Inglewood.

In the four months from 1 November 2007 to 29 February 2008, Stratford received 243 mm of rainfall, or just 42% of average (Figure 8.6). Rainfall gauges at Huinga, Rimunui and Pātea also measured less than 50% of the usual average. The coastal strip from Hāwera to Cape Egmont received not much more than half the average rainfall for the period. North of the mountain, the deficit was in the range of 60% to 75%. Toko had its lowest February rainfall since records began in 1997. The February rainfall at Cape Egmont at 22.5 mm, was 23% of normal. Interestingly, January and February 2008 were actually wetter than the corresponding months in 2007. However, the summer's rainfall was still below average and the effect was worse because the previous two months of 2007 had been considerably drier than November and December in 2006.

Among rivers to reach their lowest February levels since records began 30 years ago were the Waingongoro River at Eltham Road and the Waiwhakaiho River at Egmont Village.

Across the region, average river flows were up to four times lower than their normal monthly flows. The flow in the Manganui River at Everett Park during February 2008 averaged 4,974 litres a second, compared with its average February flow of 19,882 litres a second.

River temperatures were also above normal, with the Waiwhakaiho at Egmont Village recording a new high of 25°C.

As a result of the low summer rainfall and river flows, the Council invoked three of the four steps in its water shortage management procedure[16], effectively ending the taking of water for pasture irrigation in most areas. The Council closely monitored the situation to determine if there was a need to take the final step of the procedure, the issuing of a water shortage direction under the Resource Management Act, but fortunately this was not necessary.

The estimated loss of farm gate income of this drought event for the entire North Island was estimated at $1.24 billion in March 2008[17].

(F) COASTAL EROSION

Waves, currents and tides can contribute to significant changes in land form over a relatively short time. Increased wave heights during storms contribute to increased erosion and in some cases extensive flooding.

The generally eroding nature of the Taranaki coast is a result of the natural process that the community must live with and adapt to. Protection structures are situated in areas where development has historically occurred close to the eroding coast.

Seventy three consents have been issued, renewed or varied for structure protection walls in Taranaki between 2003 and 2007. In total, 135 consents have been issued in Taranaki for structure protection walls covering an estimated 11.6 km of coast.

16 Taranaki Regional Council, October 2000. *Water Shortage Event Standard Operating Procedure.*
17 Baldi, M; Salinger, S. 2008. *Climate Trends, Hazards and Extremes – Taranaki. Synthesis Report.* Prepared by NIWA for NPDC, TRC and STDC.

Coastal walkway and sea wall, New Plymouth.

(G) LAND INSTABILITY

Land instability can occur on a spectrum from very suddenly to slowly, and may be triggered by both natural and human-induced changes in the environment, most commonly slope loading or excavation, land use change, such as deforestation, and hydrological changes, such as increased seepage. These factors, when combined with the forces of gravity, can cause instability. If areas vulnerable to landslides or slope instability can be identified, land use planning can be an effective part of managing the risk of such events occurring.

The landslide hazard has recently been assessed for the New Plymouth District[18]. The study concluded that only 9% of the district (about 183 km^2) is likely to be affected by landslides.

Climate change is likely to increase extreme rainfall events in the region. With increasing landslide-inducing rainfall events, the probability of landslides is likely to at least double during the 21st century, with more areas affected.

8.2 HOW ARE NATURAL HAZARDS MANAGED IN TARANAKI?

A sustainable management approach is taken to hazards and risks in Taranaki. This involves enabling communities to achieve acceptable levels of risk, as well as planning and preparing for emergency response and recovery. Predictions of increased hazards arising from climate change have important implications for agricultural industries (in terms of anticipating increased droughts) and planning for stormwater systems, flood management and infrastructure (in light of likely increased high intensity rainfall events)[17].

(A) REGIONAL PLANS

Under the Resource Management Act the Taranaki Regional Council has responsibility for managing hazard risks through the resource consent and regional planning processes, and for ensuring risk assessments are undertaken if further site-specific research is required to clarify the level of risk. Part of managing hazard risks involves the preparation and implementing of risk mitigation plans for specific sites. This has seen the development of flood plans for the Waitara and Waitōtara rivers and a volcanic strategy.

The Council's responsibilities for avoiding or mitigating natural hazards are addressed through objectives and policies in the *Proposed Regional Policy Statement*, and through its regional plans.

The *Regional Coastal Plan for Taranaki* contains policies and methods in relation to natural hazards in the coastal marine area, notably coastal erosion and flooding or erosion of riverbanks in estuaries with adjacent residential areas or utilities. The plan promotes the avoidance of natural hazards, reduced risk from coastal erosion, and criteria and rules regarding coastal hazard protection works.

The *Regional Fresh Water Plan for Taranaki* contains policies and rules to address river bank and river bed erosion and flooding. Rules set out requirements relating to discharges to land and water, the building of structures or carrying out of works in riverbeds and land drainage activities, to avoid or minimise natural hazards. The plan also emphasises the avoidance of hazard-prone areas, the provision of information and advice on known or likely flood hazards and the retention or planting of forest cover in upper catchments and riparian margins as a component of flood and erosion management.

The *Regional Soil Plan for Taranaki* deals with soil erosion issues, particularly in the more erosion-prone areas of the inland hill country. Emphasis in the plan is placed on the Council's property planning services under its Sustainable Land Management Programme (refer to Chapter 3 of this report).

(B) DISTRICT PLANS

The Resource Management Act tasks district councils with the responsibility of developing objectives, policies and methods for controlling the use of land to avoid or mitigate natural hazards. The three district plans all deal with natural hazards.

A wide range of natural hazards have the potential to adversely affect the New Plymouth district. The *New Plymouth District Plan* identifies natural hazards in the district. The planning maps in the plan identify ponding areas, flood detention areas, spillways, fault lines, and coastal and volcanic hazard areas. Rules specify standards to control buildings and other structures, subdivisions and excavations and soil filling within or close to hazard areas.

The *Stratford District Plan and Proposed District Plan* contain rules, standards and conditions to control subdivision and development in areas identified as being at risk from natural hazards. Hazards identified as being significant in the district include areas or sites susceptible to flooding, erosion, subsidence, slope instability and volcanic or seismic activity.

18 Schmidt, J; Salinger, J; Woods, R. 2007. *Climate Hazards and Extremes – New Plymouth District, Landslide Hazard Assessment.* Prepared by NIWA for New Plymouth District Council.

The *South Taranaki District Plan* contains rules and performance standards concerning the location and erection of buildings in areas of known or anticipated natural hazards, and site works on erosion-prone land identified in the district. Natural hazards of particular concern include erosion, land instability, subsidence, flooding and earthquakes.

In addition to district plans, district councils apply the Building Act 2004 and the Building Code in relation to the construction of buildings within identified hazard areas. District councils also make hazard information available in Project Information Memorandums (PIM) prepared under the Building Act 2004 and Land Information Memorandums (LIM) under the Local Government Act 1974.

(C) CIVIL DEFENCE EMERGENCY MANAGEMENT

Civil defence emergency management involves the application of knowledge, measures and practices to ensure the safety and wellbeing of the public and protection of property. It includes planning and preparation for emergencies, as well as response and recovery in the event of an emergency. The Civil Defence Emergency Management Act 2002 requires an 'all hazards' approach to emergency management, rather than a previous focus on geophysical and meterological hazards alone. Under this Act, the Taranaki Regional Civil Defence Emergency Management Group (CDEM Group) was established. This group is made up of representatives from the Taranaki Regional Council and the three district councils. The CDEM Group must undertake a number of functions, including:

- identifying, assessing and managing hazards and risks;
- consulting and communicating about risks;
- identifying and implementing cost effective risk reduction; and
- responding to and managing the adverse effects of emergencies in its area.

The goals of the Taranaki CDEM Group are to increase community awareness, understanding and participation in civil defence emergency management; to reduce the risks from hazards in Taranaki; and to enhance the region's capabilities to manage and then to recover from disasters.

In addition, every CDEM Group must prepare and approve a *Civil Defence Emergency Management Group Plan* in order to provide for an "all hazards" approach to emergency management planning and activities within their regions. The *Group Plan* identifies the significant hazards and risks to be managed by the CDEM Group in Taranaki; the emergency management functions necessary to manage the hazards and risks; and the reduction, readiness, response and recovery actions to be undertaken by the individuals, organisations and agencies involved in civil defence emergency management.

Early identification of hazards by the Taranaki CDEM Group combined with public education will help the Taranaki region to make informed decisions on land development options that avoid the risk from hazards.

Other initiatives of the CDEM Group include:

- commissioning research into hazards in the region;
- running regional exercises;
- participating in national exercises; and
- supporting a study into the vulnerability of utility networks (such as gas pipelines).

(D) COMMUNITY AWARENESS AND EDUCATION

In 1995 a community survey on civil defence public awareness and preparedness indicated that only 37% of the community perceived a threat from volcanic eruption in Taranaki. After this survey a comprehensive awareness campaign was carried out and the volcanic hazards map of Taranaki was completed and published.

A further community survey in 2000 revealed that 79% of the Taranaki community perceived an earthquake as a hazard that could result in a civil defence emergency, followed by volcanic eruption at 68%, flooding 57% and storms 28%[19]. This indicated that the public awareness work had led to an increase in community understanding of the likely threat of a natural disaster. Furthermore, 88% of those polled had the necessary survival items in their homes, and 48% said they would contact the "Council" with any civil defence enquires. Only 13% indicated they did not know what to do in a major disaster.

Five years later in 2005, a further community survey of the state of public awareness of natural hazards and preparedness for emergency situations was carried out[20]. The survey revealed that 79.1% of the Taranaki community perceive a volcanic eruption as a hazard that could result in a significant emergency, followed by an earthquake at

Public seminar on the impacts and recovery from volcanic activity.

19 Taranaki Regional Council, 2000. *Report on Civil Defence Public Awareness and Preparedness.*
20 Taranaki Regional Council, 2005. *Civil Defence Emergency Management Public Awareness/Preparedness Survey Report 2005.* Prepared by a working group of the district councils, the Regional Council and Fire Services.

59.7%, flooding 37% and tsunami at 25.2%. A high proportion of those polled (86.80%) had the necessary survival items in their homes, however only 30% had these items in one place, i.e. a 'survival kit'. Of those interviewed 63.9% said they would contact the "council" with any civil defence enquiries. Only 8.9% indicated that they did not know what to do in a major disaster.

The *Taranaki Civil Defence Emergency Management Public Education Strategy* was developed in 2004 to provide a strategic direction for the Civil Defence Emergency Management Group public education activities. The Strategy outlines the vision, goals and objectives of the public education programme, and strategies to achieve those objectives. A public education plan has been developed to implement the strategy. It focuses on increasing community awareness, understanding and participation in civil defence management in Taranaki. In particular, the plan concentrates on increasing preparedness and understanding of the significant hazards in Taranaki and making sure that individuals know what to do and where to find guidance before, during and after an emergency. A further key message is the need for the public to participate in rebuilding and restoring communities after the emergency event has passed.

The Taranaki CDEM Group identifies and provides information to agencies that manage emergencies, and to the community, to reduce the risk to people. Examples of initiatives undertaken recently by the Taranaki CDEM Group include:

- workshops and public seminars providing information and advice on hazards in the region, e.g. the public seminar 'Will it bang, bubble or fizz?' – a seminar on the nature and consequences of an eruption of Mount Taranaki;
- a mass public texting system that broadcasts free text alerts from the Taranaki CDEM Group to all those who subscribe to the service. As of 30 June 2008, there were over 2,700 subscribers to this regional service;
- community awareness programmes (e.g. civil defence emergency management open days); and
- developing and maintaining a web page.

A civil defence open day promoted the need to be prepared.

(E) REGIONAL VOLCANIC STRATEGY

The *Regional Volcanic Strategy*[21] sets out the overall philosophy and approach towards the volcanic hazard in the region. It describes principles for response, an analysis of potential risk, monitoring systems and protocols and mechanisms for integrating the emergency plans of other agencies. The strategy is updated every four years, and is currently under review.

(F) RIVER CONTROL AND FLOOD PROTECTION

Three major flood protection schemes have been established in Taranaki. The New Plymouth scheme involved the construction of detention dams on the Waimea, Huatoki and Mangaotuku Streams, the construction of a diversion tunnel on the Mangaotuku Stream and other works. The scheme was completed in 1990.

The Waitara Flood Control Scheme was initially constructed in 1970-71. The scheme was the subject of a comprehensive review in 1990-91. A major upgrade of the scheme was completed in 1995. This involved realignment of the river and the construction of seven large rock groynes to hold the river in its new course downstream of SH3.

Flood protection works on the lower Waiwhakaiho River.

Significant flood protection works on the lower Waiwhakaiho River and Mangaone Stream in New Plymouth were completed by 1998. These works offer flood protection to the lower Waiwhakaiho retail and industrial area.

In 2006, following consultation with the South Taranaki District Council, local land occupiers and the local community, the Council adopted the document *Reducing the Risk – Proposed River Clearance and Maintenance Programme for the Waitōtara*. This document sets out an agreed programme of channel clearance and maintenance works in the Waitōtara River, including funding arrangements.

Forty-two structures for flood protection/erosion control have been issued over the past five year period. A total of 152 consents are in place for flood protection/erosion control in Taranaki.

21 Taranaki Regional Council, 2004. *Taranaki Regional Volcanic Strategy.*

(G) SUSTAINABLE LAND MANAGEMENT PROGRAMME

Through the Council's sustainable land management programme, the Council is working with land holders to adopt land use practices and techniques that avoid or minimise soil erosion (land instability) in the hill country and which maintain and improve water quality in ring plain streams. As at 30 June 2008, the Council had prepared a total of 269 comprehensive farm plans and 24 agroforestry plans, which together cover 178,580 ha of privately-owned hill country land.

(H) HAZARD MONITORING

The Council operates 35 hydrological stations (two are shared with NIWA) that continuously record water level and flows, water temperature, rainfall, wind direction, speed and maximum wind gusts, soil moisture and temperature. From this network of monitoring sites, and the earthquake monitoring network (described above), the Council has good information to enable monitoring of potential natural hazards. Hydrological information is provided on the Council's website, www.trc.govt.nz and on the GNS website for earthquake information, www.geonet.org.nz.

The Omahine rainfall recorder at Moana Trig helps provide flood warning for the Waitōtara Catchment.

(I) SUMMARY OF PROGRESS

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Reducing the risks to the community from natural hazards	• Increased public awareness of and planning for natural hazards. • Reduction in the costs of natural hazard events, emergencies or disasters.	• Providing education, information and advice to reduce hazard risk. • Establishing hazard mitigation works. • Advocating, when appropriate for new development to be located away from hazard zones. • Carrying out investigations and monitoring.	• Regional Coastal, Fresh Water and Soils plans made operative. • District plans prepared and notified. • Public information programmes established. • Three significant river and flood control schemes, 35 river, rainfall and wind stations, eight seismometers and one continuous GPS site operated. • Volcanic strategy reviewed and updated. • Flood event standard operating procedure reviewed and updated.

8.3 HOW DO WE COMPARE?

All regions have a civil defence emergency management plan in place and most district plans have rules in place that deal with natural hazards. All CDEM group plans are coming up for review in the next couple of years. The Ministry of Civil Defence and Emergency Management is in the process of developing a guideline for second-generation CDEM group planning. These guidelines are being developed consultatively with end-users.

Second-generation CDEM group plans will have a strong focus on reducing the likelihood of severe adverse effects from natural hazards. This will aim to enhance the link between planning work undertaken by district councils and regional councils, their long term council community plans and the work programmes of CDEM groups.

CHAPTER 9

WASTE

Photo: Rob Tucker

WASTE

The term 'waste' describes materials or substances that are no longer needed or have lost their economic value and require disposal. In our increasingly consumer driven society, with its throwaway philosophy, the management of waste is a major issue, with the challenge being to find new uses for materials no longer required (i.e. recycling) or to find ways of cutting down on the quantity of materials that end up being discarded (i.e. minimising the amount of waste generated). There is also a need to ensure that large volumes of waste can be safely disposed of. In Taranaki:

- the whole region is now serviced by just one landfill, at Colson Road in New Plymouth, maintained to 'best practice' standards, with a future site secured;
- this compares with the situation 15 years ago when the region was serviced by about 20 sites, some of them just 'dumps';
- the quantity of waste discharged to the landfill has increased by 20%, between 1996 and 2008;
- suitable wastes are increasingly discharged to cleanfills, which have grown in number from 13 (in 2003) to 23;
- approximately 70,000 used tyres are produced per year, but demand for uses such as silage pit covers and culverts, is matching supply;
- council kerbside recycling collections have expanded in the region with a kerbside green waste collection now being offered in South Taranaki;
- since 1991, the Taranaki Regional Council has collected and disposed of more than 40 tonnes of redundant, unknown or hazardous wastes; and
- waste minimisation and recycling is being promoted in the region and increasingly businesses are taking up the challenge.

The *Regional Waste Strategy* has been prepared and adopted by all four councils in the region. The strategy provides specific waste minimisation and management goals for local authorities, industry and the community on matters relating to waste minimisation, hazardous wastes and waste disposal.

The regional landfill at Colson Road, New Plymouth.

OUR WASTE

Waste can be defined as any material – solid, liquid or gas – that is unwanted and/or unvalued, and has been discarded or discharged by its owner[1] .

Solid waste is more than just post-consumer rubbish. It may also include substances that are a by-product of one manufacturing process that can be reused in the same process, or recovered and used as raw material for another process. It can also include materials that do not currently have an alternative end use.

In past years, the focus was on addressing the adverse environmental effects of solid waste disposal in dumps (e.g. odour, seagulls, pollution leaching to groundwater). However, over the past two decades, most environmental issues associated with solid waste disposal have been addressed through measures such as the closure of almost all small municipal landfills, and through improved landfill engineering and management practices at remaining or new sites. Fifteen years ago the Taranaki region was serviced by about 20 sites, some of them were just 'dumps'. The focus has shifted from better waste disposal, to reducing the amount of waste disposed of. Reducing the volume of waste generated in the first place, or reusing materials that might otherwise be discarded, is far more efficient than trying to manage the waste once generated.

To manage wastes, the principles of minimisation, recovery, and recycling have been adopted, in order to both minimise environmental problems associated with solid waste disposal, and also avoid the depletion of critical resources. This means all sectors of our community must be engaged in waste management awareness and implementation. It is no longer a case of leaving it to the local council rubbish truck crew.

9.1 WHAT IS THE CURRENT STATE OF WASTE IN TARANAKI?

(a) GENERATION AND DISPOSAL

While other regions are finding it difficult to provide security of access to landfill capacity for municipal wastes in the medium term, in Taranaki the Colson Road landfill in New Plymouth serves as the regional landfill and has an estimated seven years capacity left at current filling rates (as of January 2008). It is classified as a Class A landfill, one of 11 in the country (as of 2002) that are considered to meet good current practice in its design and management [2].

The quantity of wastes generated annually in the New Plymouth District, both total tonnages and amounts per person is illustrated in Figure 9.1. Reliable figures are not available for this period for the region as a whole.

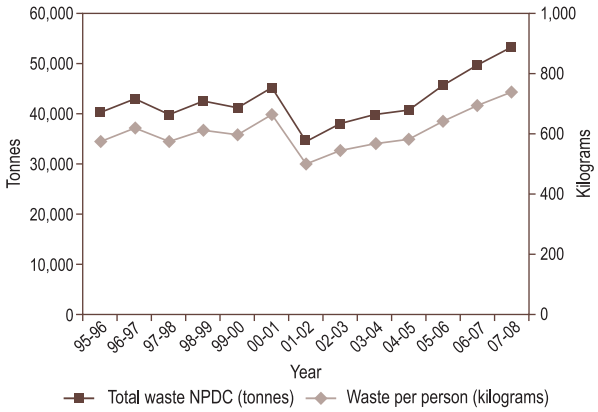


Figure 9.1: Trends of waste to landfill from New Plymouth District.

The majority of these wastes was disposed of in the Colson Road landfill. The significant drop in the 2001-02 year was due to the opening of the New Plymouth Transfer Station, associated price increases for disposal, and restrictions on access to the Colson Road landfill. Quantities gradually increased after this, taking approximately five years to return to the 2000-01 level of 45,300 tonnes. The largest volume to date has been during the past year for which there was complete data, 2007-08, with 53,200 tonnes discharged to the landfill. This was a 20% increase over the 12 years since 1995-96 (using the moving three-year average).

On a per person basis, waste to landfill has increased 17% over the same 12 years (again using the moving three-year average), with per person quantities following the same trend as overall waste to landfill (also illustrated in Figure 9.1).

Analysis of the data indicates that the change over the entire 12-year period was not statistically significant, but there was a statistically significant trend over the past seven years from 2001-02 to 2007-08.

Economic activity in the New Plymouth District over this period increased 35% (National Bank regional economic activity index). It is generally considered that refuse volumes reflect economic activity. This is because more economic activity means more manufacturing with more waste produced, and more consumption so more products discarded at the end of their life. In Taranaki the amount of waste disposed has not increased by the same amount as has economic activity. Reasons for this have not been analysed, and could include limited manufacturing industry in Taranaki, the introduction of kerbside recycling collections in the New Plymouth District in 1992, diversion of compostable wastes to other facilities, the proliferation of cleanfills to receive inert wastes such as soil, gravel, and concrete, and more efficient use of raw materials in manufacturing processes.

1 Ministry for the Environment, 2000. *The New Zealand Waste Strategy.*
2 Ministry for the Environment, March 2003. *The 2002 Landfill Review and Audit.*

An analysis of the nature, source and type of waste disposed of to the Colson Road landfill was carried out in April 2005. Five primary waste categories were separated and measured: organic, cardboard/paper, timber, construction and demolition, and residual waste.

Results showed the waste from the municipal kerbside collection was 38% organic, 19% cardboard, and only 4% construction and demolition and timber waste. Waste collected from the transfer station was 32% timber and 15% construction and demolition materials, and only 9% organic.

The results show that there is considerable scope to reduce the quantity of materials currently being discharged to landfill, through recovery and recycling of materials such as the composting of organic wastes.

(B) CLEANFILLS

Engineering and managing landfills comes at some considerable cost. Cleanfills are sites where inert material can be disposed of in a way that will not affect the environment or people when left unmanaged. Materials appropriate to dispose to cleanfill include natural materials such as clay, soil and rock as well as other inert materials such as concrete or brick. With increasing costs of landfills, cleanfills are being used as an alternative for these 'inert' or stable waste types. This then frees up space in engineered sanitary landfill for materials more likely to affect the environment.

A cleanfill is not simply a cheap or second-class version of a landfill or a small old-fashioned rubbish dump. As cleanfills provide no engineered barriers or safeguards for the environment it is critical that the types of wastes discharged are carefully controlled.

There are currently 23 consented cleanfills in the region. The *Regional Fresh Water Plan for Taranaki* also allows some cleanfilling activities to proceed without a consent, as long as they meet stringent restrictions on the types of wastes that are accepted.

Cleanfills operate under less comprehensive controls than landfills because of the restricted types of waste they can receive. Therefore less information is available on volumes of wastes diverted to them. In some cases cleanfill operators may be receiving only wastes they themselves generate (e.g. earthmoving contractors). In other cases they may also receive wastes from others. Sites used for cleanfilling may include the rehabilitation of former quarries and the conversion of gullies into pasture.

Most cleanfills in the region operate to a good to high standard. Others, however, have been found, through monitoring, to accept prohibited wastes. The Council instigates enforcement action in these cases, including successful prosecutions and requirements for closure.

Sorting waste for analysis at Colson Road landfill, 2005.

(C) SPECIAL WASTES

The Taranaki Regional Council undertook a study into the management of used tyres in Taranaki[3]. It found that each year the region produces approximately 70,000 used tyres. With the closure of retreading services in New Zealand, the high number of used imported cars, and the import of partially worn tyres for resale, disposal of tyres elsewhere in New Zealand has become a major issue. However, the survey showed that generally this has not occurred in Taranaki. Demand still matches the supply of old tyres, for uses such as silage pit covers and culverts. No tyre dealer identified disposal as an issue.

The capacity to re-process glass collected for recycling into bottles in New Zealand is strictly limited, due to large volumes of glass being imported and high rates of recycling, so that there is effectively an over-supply of recovered glass. Local councils are exploring alternative end-uses for glass in the region, such as sand blasting or incorporation into roading materials. Issues include long-term liability, health and safety concerns, and added handling expense. Experiments with a mobile crusher at Taranaki's largest recycling depot, and feasibility evaluations are being pursued.

The use of used tyres on farms means their disposal is not yet an issue in Taranaki.

3 Taranaki Regional Council. 2004. Memorandum to Policy and Planning Committee. 4 February 2004.

Simone, Janet and Geoff Genner and their car powered by used vegetable oil.

AFTER THE FRIES, THIS CAR FLIES

When it comes to individual environmental initiatives, never under estimate the value of a well-publicised trail-blazing exercise.

In 2006, alternative fuels enthusiast James MacDonald drove from Bluff to Cape Reinga in a car powered by used vegetable oil – and New Plymouth woman Janet Genner followed the media coverage with growing interest and excitement.

"What a cool idea. We could easily run a car on used vege oil," she told husband Geoff and daughter Simone.

Indeed they could. As New Plymouth franchisees for McDonald's, the Genners have plenty of used cooking oil literally on tap.

First they had to find a suitable vehicle – a diesel motor is needed but Janet didn't fancy anything too big and certainly didn't want an SUV. Finally they settled on a 2001 Peugeot 307 hatchback.

Bluff-to-Cape driver James MacDonald, who lives in Palmerston North, did the fuel conversion job for $2,500, though Geoff Genner says off-the-shelf conversion kits are now available for around $2,000.

Then it was simply a case of 'fill 'er up'. In 18-plus months of running, the Genners are delighted with the car and have had no major problems. "Performance is no different from a normal car."

Diesel is used to start the car and warm the engine up before switching to vegetable oil, stored in a 20-litre tank at the back. They're getting around 250 km per tank, with the car used mainly by Janet.

Geoff is so pleased that when his own car is due for replacement in 2009, he's likely to go the vege oil way. "We're just thinking about what we will do."

A couple of other Taranaki motorists are fuelling vehicles with used oil from the busy McDonald's restaurant, the rest is recycled through a tallow operator.

The 'McVege car' is decorated with bright sunflower decals drawing attention to its motive power – though Geoff says the best fuel has proved to be cottonseed oil. "But pictures of fluffy cotton plants wouldn't get the same idea across."

The Genners concede that not everyone has such easy access to used vegetable oil. But all the same, their initiative is seen as a good example of a family seeing and acting upon a sustainability opportunity within their own particular lifestyle circumstances.

(D) AGRICULTURAL WASTES

The Council surveyed the rural sector in 2004 to determine waste management practices and issues[4]. The survey showed that most farmers used a mix of burning and burying wastes for disposal on farm, while a surprising number (23%) used off-farm options such as occasional or regular use of waste management contractors to remove rubbish. There was considerable waste re-use (e.g. of empty plastic containers or building materials). On-farm inspections and conversations indicated that those surveyed had only small amounts of agrichemicals, and little or no quantities of unwanted or redundant agrichemicals. All participants knew of the regional hazardous waste collections carried out previously. There was a high level of willingness for a farm plastics collection service if provided, even if it required some small levy.

Over three quarters of all farms surveyed were using bale silage. The discarded plastic wrap was burned (70%), buried (14%), or disposed of to landfill (16%). Burning was also the main method of managing empty agrichemical containers (56% of all farmers).

The Council has supported (both financially and through staff time and advice) the development of a national agrichemical container recovery programme (AgRecovery). Progress toward its commencement has been slower and less comprehensive than anticipated, but by mid-2008, two sites were in operation, at a Transfer Station in Waitara and at a private waste and recycling business in Hāwera. An agricultural spray contractor in Stratford is also acting as a depot for contractors' containers.

A New Zealand pilot programme has been run for Agpac by the Central Taranaki Employment Trust in Stratford which collected 10.5 tonnes of plastic wrap by late 2007, over the first two years of operating. Following this programme, the collection of used silage wrap is now being offered commercially throughout Taranaki via four rural contractors and a private enterprise recycling centre, with 47 bins deployed in the region. These initiatives address an issue identified as a priority in the rural wastes survey.

4 Taranaki Regional Council. 2005. Memorandum to Planning and Policy Committee 17 March 2005.

Sharemilker Greg Topless stores plastic wrap to be recycled.

RAPT OVER WRAP SOLUTION

When the question is disposing of silage wrap, the answer for sharemilker Greg Topless is not blowing in the wind – and he couldn't be more pleased.

Greg's on a Toko property that's been signed up for the Agpac scheme, under which a large bin and liners are supplied to contain the plastic wrap until it is picked up for recycling.

"The whole thing is great. It means you don't have all this plastic blowing around the farm, getting dirty, being buried or burned, or worse," he said.

Burning or burying have been the traditional methods of disposing of silage wrap but both cause environmental damage.

Under the Agpac system, farmers are urged to bin their plastic immediately after it comes off the bale instead of leaving it to lie around and become excessively contaminated with manure, dirt and other material.

The bin liner is made of the same material as the silage wrap, so the whole unit needs no further processing before being presented at a recycling plant.

The scheme operates two streams. The first includes baleage wrap, silage pit covers, small feed and fertiliser bags, plastic packaging and shrink wrap. The second includes bulk feed or fertiliser bags that have woven PP outer bags and LDPE inner bags.

Bins have gone on to around 50 properties in Taranaki since 2005 and upwards of five tonnes of wrap a year has been collected for recycling.

Farmers can buy a bin ($480 + GST) and liners ($10 + GST), then either drop off the full liner ($20 + GST) or arrange to have it collected ($40 + GST).

The scheme operates nationally and in Taranaki it is delivered through four contractors: Ken Moratti in Inglewood,
Mark Hinton or Barry Taunt in Stratford,
and Michael Silson in Kaponga.

(E) HAZARDOUS WASTE MANAGEMENT

The Council has organised hazardous wastes collection for the rural sector driven by concern to safeguard public health and the environment from contaminants. Previous collections in 1991, 1995-1997, and 2001 had been well supported, and showed a trend of a considerable reduction in the quantities of intractable wastes (such as DDT, arsenic treatments, and lindane) gathered in each subsequent collection.

In the 1991-92 collection, Council staff visited each of the 84 farms that had advised they had wastes to collect. Nine tonnes of waste were collected with a high proportion (about 55%) of hazardous wastes such as DDT.

In 2001, farmers were invited to bring wastes to collection centres set up in the main towns of the region. While more than 13 tonnes were collected (from almost 1,000 participants from both urban and rural sectors), the proportion of hazardous wastes was much lower.

The 2004 collection used a mobile unit that visited 10 small rural centres around the region, to maximise convenience of access for farmers. Over 16 tonnes of waste were collected. The greatest quantities collected were paints, waste oil, dairyshed cleansers, and animal treatments, with smaller volumes of various agrichemicals such as weedkillers. The proportion of the most hazardous wastes was very low (500 kg, or about 3%), indicating these have now largely been removed from the region. This was confirmed during the survey into farm wastes discussed above.

In total, the Council has collected and disposed of more than 40 tonnes of redundant, unknown, or hazardous wastes since 1991 (from both rural and urban collections)[5]. It is estimated there could be about two tonnes of residual wastes left (across 4,000 farms), meaning that future specific collections would not be cost effective or efficient. The district councils continue to offer a drop-off service for hazardous wastes through selected transfer stations. A charge applies for commercial quantities.

Council staff collect hazardous waste for recycling or safe disposal. Douglas, April 2004.

5 Taranaki Regional Council/Ministry for the Environment. 2004. *Cleaning Up the Leftovers- Hazardous Waste Collections in Taranaki.*

Kerbside recycling, New Plymouth.

Cardboard sorted for recycling.

(F) MUNICIPAL WASTES

All three districts now provide a kerbside recycling service for urban households, in some cases extending into nearby rural areas. Each district has a different level of service, which is reflected in the quantities collected.

In 1993-94, the New Plymouth District Council began a district-wide kerbside collection service for recyclables, as part of its municipal refuse service. Householders place recyclables out in supermarket bags for a weekly collection. In the first year, 6.76% of the total kerbside quantity collected was recovered for recycling. In 2007-08, the recyclables collected as a percentage of the total volume of materials (recyclables plus wastes) collected in the New Plymouth Council kerbside collections had risen to 17.1% – more than double.

South Taranaki District Council started kerbside recycling in 2001 on a fortnightly basis using 120-litre bins. This was expanded in 2006-07 to give households the option of a green waste collection using 240-litre wheelie bins. In mid-2007 the recycling collection doubled in frequency, from fortnightly to weekly. Taking green waste into account, 39% of all material collected within South Taranaki through the kerbside collection service is recovered for recycling, with the remaining being discharged to landfill.

Stratford District Council began kerbside recycling in 2002. The collection is monthly using 240-litre wheelie bins.

Quantities of waste, recycling and green waste collected per household in council kerbside collections in each district are illustrated in Figure 9.2. The recycling figures for South Taranaki District Council also include school recycling. Figure 9.2 does not include recycling or waste collected at the kerbside in New Plymouth from private contractors as this data was not available. It is estimated that privately contracted waste collections may amount to about 28% of households in New Plymouth.

Figure 9.3 shows the quantities and types of recyclable materials collected from domestic kerbside recycling in the region from July 2007 to June 2008. This highlights that the greatest amount of recyclable materials is paper.

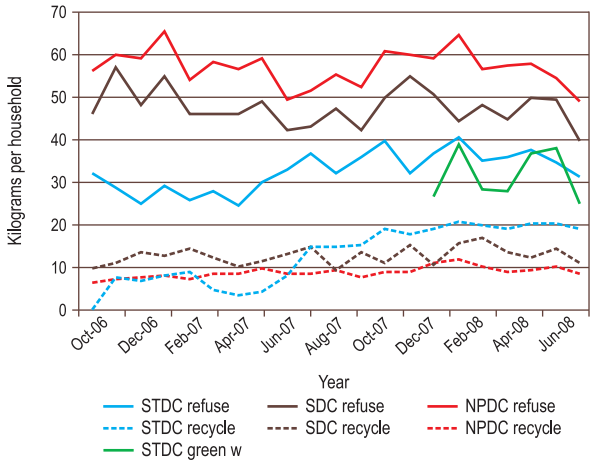


Figure 9.2: Amount of waste, recycled material and green waste disposed per household in council kerbside collections from October 06 to June 08.

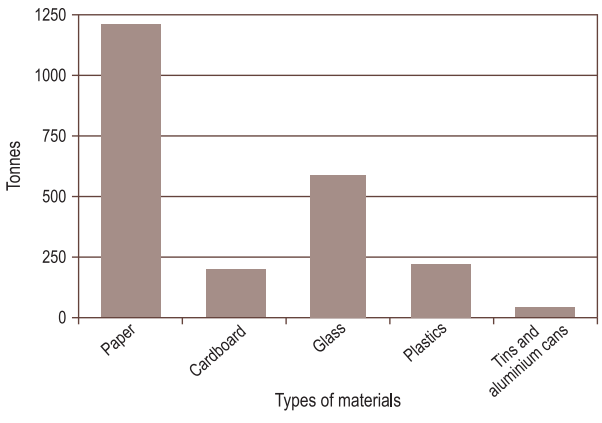


Figure 9.3: Domestic kerbside recyclable materials recovered between July 07 and June 08 for Taranaki.

Students manage the recycling system at St Joseph's Primary School, Hāwera.

RECYCLING MORE THAN JUST THE FOURTH 'R'

An environmental imperative … an educational project … a financial strategy ...

For St Joseph's Primary School in Hāwera, recycling is all of the above.

The school has an award-winning recycling system that grew out of concern at the cost of waste disposal and the level of student apathy about the problem.

A waste audit in 2005, carried out with the help of Taranaki Regional Council staff, revealed it would be possible to recycle much of the material the school was sending to landfill.

Deputy Principal Rik Allen realised that it was time to bring the students on board and he had his class survey the rest of the school to discover the best ways to encourage more students to recycle.

The result: a system that is essentially run and owned by the students. Each class has access to brightly labelled containers for non-recyclable waste, recyclable waste and food waste. And each month, a different class takes responsibility for collection and sorting, with the food scraps made into compost on site.

The children also visited all classes and the school office with advice on reducing waste, such as reusing single-sided paper, turning off lights and computers, efficient use of cardboard, and reusing resources for other purposes.

Rik Allen said that the system was functioning well and the children were even using the compost when planting shrubs and flowers. As well as being enormously educational, the new system has drastically reduced the cost of waste disposal.

The school incorporates environmental education into other teaching programmes and its successes earned it a Taranaki Regional Council Environmental Award for 2008.

9.2 HOW IS WASTE MANAGED IN TARANAKI?

(A) PLANNING

The *Proposed Regional Policy Statement for Taranaki* identifies the minimising of waste and the managing of its disposal as issues, for the region. It includes an objective and policy targeted at encouraging waste minimisation practices and measures to safely manage the adverse environmental effects of waste disposal.

The councils of the region work together through the Regional Solid Wastes Working Party that includes senior executive staff and political representation from the four councils, and a forum made up of operational staff. The forum meets regularly to progress the development and implementation of the *Regional Waste Strategy* and district waste plans.

The *Regional Waste Strategy* was prepared in 2003 and adopted by all four councils in the region. While it was based on the goals and objectives of the *New Zealand Waste Strategy*, the *Regional Waste Strategy* is specific to Taranaki. The strategy provides specific waste minimisation and management goals for local authorities, industry and the community. It includes targets derived from the *New Zealand Waste Strategy* for waste minimisation (particularly for organic wastes, special wastes and construction and demolition waste), hazardous wastes (particularly for contaminated sites, organochlorines and trade wastes) and waste disposal.

In 2005 the district councils collaboratively developed district waste management plans, reflecting the *Regional Waste Strategy*. These set out the services and funding provisions for waste management in each district. Developing them through a collaborative approach has been more efficient and addressed consistency issues between the districts.

(B) WASTE AND RECYCLING SERVICES

Commercial service providers now play a major role in waste management in the region. The kerbside collection of recyclables and residual wastes is by contract to the district councils, as is the operation of transfer stations and the Colson Road landfill. The recovered recyclables are processed by another company. There are a number of waste contractors offering private collection and recycling services for materials such as cardboard, shrink wrap, vehicle batteries, and scrap metal. In some cases contractors will pay for materials delivered to them (scrap metals were in high demand worldwide before the recession hit), while in other cases they may take materials free of charge (e.g. paper and cardboard), or may charge to recover handling and processing costs (e.g. rechargeable batteries).

While involvement of commercial operators puts waste management activities on an economically sustainable footing, it can cause problems with access to reliable data on recycling, as councils then have access to only some of the data on recycling within the private sector.

Large volumes of paint have been recovered from within the region for recycling via the Placemakers/ Enviropaints scheme, promoted by the Council. As noted above, the Council has collected (and subsequently recycled) considerable volumes of paint through its hazardous wastes collections. Useable paint is also put aside at some transfer stations for the public to access. Electronic wastes (computers and cellphones) are recycled within Taranaki through such events as the national e-waste collection programme held in 2008.

(C) INFORMATION, ADVICE AND EDUCATION

The Regional Waste Minimisation Officer position was established in 2003 in order to promote waste minimisation and recycling throughout the region. It is jointly funded by the four councils.

Waste minimisation assessments have been conducted in a number of sites throughout the region: publishing, medical, hospitality (training and retail, especially cafes and restaurants), marae, sports clubs, boat making and joinery, petrochemical, large public events, electricity generation, sporting, retail, and education (primary, tertiary, and outdoor pursuits). Recycling options have been explored including tallow/cooking oils for re-processing, food wastes for stock feed, paper, cardboard, and glass. A total of 52 assessments were prepared over 2006-08.

Adoption of waste minimisation practices by businesses can be slow and variable, due to lack of awareness or willingness, little appreciation of the opportunities to reduce costs, lack of knowledge of resources available or just the day-to-day pressures of running a business. However, responses to the waste minimisation assessments have been positive. Of the 45 followed up to June 2008, nearly half had reduced their waste as a result of either the visit or the follow-up phone calls, mainly by starting recycling or increasing the range of materials recycled. Councils, too, are getting on board with in-house waste minimisation programmes, such as paper re-use and recycling, recovery of canteen wastes for composting, and mulching of vegetation/landscape wastes.

Volunteers sort some of the 39 tonnes of e-waste during the Taranaki eDay collection. New Plymouth, October 2008.

The National Environment Standards for Air Quality (2004) now bans the use of un-consented school incinerators. The Taranaki Regional Council assisted a Ministry for Education review of waste disposal practices carried out by schools in the region, and identified alternative waste disposal options for schools. In the light of this work, all schools in the New Plymouth and South Taranaki districts now have recycling bins and free kerbside recyclable collection services, and schools in Stratford District are provided with recycling bins on request. All schools in

Festival patrons sorting waste for recycling at one of the many recycling stations. March 2008.

WORLD OF MUSIC, ARTS AND DANCE – AND RECYCLING

It's quickly become an event that defines Taranaki almost as much as the mountain does. And now WOMAD is adding status and standards to the zero waste campaign.

Thanks to a year of planning and the efforts of 40 volunteers, three-quarters of the almost 15 tonnes of waste material generated in the three-day festival in 2008 was diverted from landfill for recycling or composting.

Festival food sellers were required to use recyclable or biodegradable packaging and utensils, recycling centres were set up around the Bowl of Brooklands site and the volunteers were busy both behind the scenes and also out the front, helping festival patrons sort their rubbish.

As befitting a festival that promotes harmony, patrons were happy to co-operate and impressed by the resulting cleanliness of the site.

The Taranaki Arts Festival Trust Chief Executive, Suzanne Porter, said the effort was hard work but very worthwhile.

"We were really impressed with the volunteer support. Their enthusiasm was contagious and the concept caught on among everyone at the festival – patrons, artists, traders and staff.

"We're also conscious we've set a benchmark for other large events, locally and nationally. People who were at WOMAD will be expecting to see this elsewhere, so event organisers need to take notice."

The operation was supported by the Ministry for the Environment Sustainable Management Fund, and the success of the Trust and the volunteers was marked with a Taranaki Regional Council Environmental Award.

BENCHTOP COMPOSTING NOT A LOT OF ROT

You've heard of desktop publishing, but how about benchtop composting?

It's an idea whose time may have come, if the results of a South Taranaki District Council trial are anything to go by.

Solid Waste Supervisor Clive Margetts found enthusiastic support during the trial in early 2008, when 40 of his Council colleagues used specially designed benchtop composting units at home for 10 weeks.

The compact "Biobins" are well ventilated and have breathable, biodegradable liners which reduce odour and allow the content to dehydrate, and thus shrink and become less heavy. The bag and its contents can be put straight into the garden compost.

"The trial was a big success," said Clive. "They all liked using the bins and they all wanted to keep on using them."

The 'guinea pigs' included the Council's Environment and Information Services Group Manager, Graham Young, who said the Biobin proved fantastic.

"The capacity of the bin was excellent and the fact that there was no smell whatsoever was also excellent," he said.

A compact 'Biobin'.

Clive is now working on ways to bring the Biobins into wider use, perhaps starting with those who already pay for a fortnightly green waste collection by the Council contractor.

"It would cost us virtually nothing and for each household using them, it would get three to six kilograms out of the waste stream each week," he said. "That's a good return."

Possible future development of a commercial composting facility may allow Biobin bags to be disposed of in greenwaste wheelie bins.

Taranaki have ceased use of their incinerators. Councils have presented workshops and guidelines on waste management to teachers, students and property managers.

(D) RESOURCE CONSENT MANAGEMENT

The past 15 years have seen a staged reduction in the number of operational municipal landfills in the region, so that the days of the local rubbish tip are now well past. In 1992 there were 19 operational municipal wastes disposal sites in the region. By 1998 the number had reduced to eight. In 2008 there are three – one regional facility, and two others with consents allowing only restricted or emergency use (in case of forced temporary closure of the Colson Road landfill facility).

Closed landfills have been rehabilitated, with minimal (and reducing) residual adverse effects on either public health or the environment. Consenting and monitoring at closed sites continue until it is established that any effects are, and will be, negligible. There are currently 18 consented closed sites in the region.

The Colson Road landfill is expected to reach capacity around 2015, although this depends on the success of measures such as diversion of organic waste to composting which will extend its life. To secure access to landfill capacity in the future, all consents are in place for a site at Eltham to be opened and operated as a regional facility. This has been achieved since the *2003 State of the Environment Report*. The facility is estimated to have a lifetime capacity of 25 years at current (2007) filling rates for the Colson Road landfill. Before this landfill is committed, a further review will determine whether a regional landfill within Taranaki remains the best option for disposal. By maintaining local authority ownership of landfill facilities now and into the future for the region, the councils have avoided a commercial monopoly control of landfill access in the region.

In the *2003 State of the Environment Report*, the Taranaki Regional Council noted its intention that by 2005 all cleanfills in Taranaki would comply with cleanfill disposal guidelines. This has subsequently been achieved, and there has been a further refinement of best cleanfill consenting and operational practice in 2007. Cleanfill operators are expected to meet best current national practice. In some cases cleanfilling serves also to rehabilitate and landscape old quarries.

Through its regional planning documents, the Council pursues region-wide consistency in siting, management practices, consent conditions and environmental performance for all existing and future landfill and cleanfill facilities. Annual monitoring of consent conditions at all municipal and privately-owned landfills and cleanfills is carried out to assess their environmental effects.

Collette Holgate and her brother Jock Holgate sort waste for recycling.

THE LIFE OF A 'GARBOLOGIST'

By Collette Holgate

My role involves sorting all the waste delivered to the Stratford Waste Transfer Station.

When people think of rubbish dumps or waste transfer stations, they tend to think of big burly men, machines, mud and gross things like rats. Well, I'm female and 5 foot nothing. My shed is clean and tidy and my yard looks like a park. I conduct school tours and give the children puzzles, games and certificates for being helpful.

This is more than 'just a job' to me. I believe that putting a bit of thought into what could be done with 'rubbish' is good for the environment, as well as benefiting the community – particularly people in need.

There are three Rs in my job – reduce, recycle and re-use.

I reduce by separating out material which could be used in other ways – for example, wood which could be used in domestic fires or for building and other purposes.

A lot of the material left at the Station can be recycled – plastic, glass, cardboard and paper. After sorting, this is collected by a commercial waste management company.

I also receive lots of things which can be re-used. I send blankets, clothing, toys and furniture to a variety of charities.

I believe my three Rs are the future. Over the past few years, people coming to the Transfer Station have become much more aware and supportive of what we are doing here.

I have a sign on my desk which says, "Don't be a tosser if it's recyclable." Which are you?

An employee of Waste Management Ltd, Collette has sole charge of the Stratford Transfer Station which is notable for the absence of litter and odour and for its flowers, shrubs and sculptures – all of the latter retrieved from material brought to the station for disposal.

Passionate about her work and about the wider environmental issues it involves, Collette demonstrates how the actions of one person can make a dramatic difference.

She wrote this article for a corporate publication.

(E) SUMMARY OF PROGRESS

Progress implementing regional objectives and policies on solid waste management is summarised in Table 9.1. The material in this table is based on the targets set out in the *Regional Waste Strategy.*

9.3 HOW DO WE COMPARE?

The *New Zealand Waste Strategy* was released in 2002 by the Ministry for the Environment. It set out 30 targets intended to provide improved waste management, minimisation, and resource efficiency. Progress on implementing the *New Zealand Waste Strategy* has been evaluated[6]. The regional progress towards the targets in both the national and regional waste strategy documents was reviewed, and compared with the national report[7].

The review showed a considerable range of waste management activities being undertaken across the region, with good progress towards a better and more effective level of service. It showed that the region is generally doing as well as, if not better than other regions.

The management of 'contaminated land', of cleanfills and landfills, and of waste water treatment in the region, looks to be well ahead of the national scene. Taranaki appears to be at the forefront of certain initiatives such as the completion of several regional hazardous waste collections (particularly emphasising organochlorines such as DDT and dieldrin), the trialing of agricultural plastics recovery, and the established vermiculture industry and application of chicken litter and drilling wastes to land for soil enhancement in the region. Waste tyre disposal is problematic elsewhere but in Taranaki there continues to be a high rate of utilisation on farms and a tyre granulation process recovering crumbed rubber for re-processing is about to become operational. Increased diversion and recovery of organic wastes appear to be viable options to pursue further in Taranaki. There is a high level of co-ordination and joint programming between the four councils of the region.

Mulching green waste.

6 Ministry for the Environment, 2006. *Targets in the New Zealand Waste Strategy. 2006 Review of Progress*
7 Taranaki Regional Council, 2007. Agenda Item presented to the Policy and Planning committee meeting on 30 August 2007.

Table 9.1: Summary of progress: implementing regional objectives and policies for solid waste.

Issue	What do we want to achieve?	What are we doing about it ?	Where are we at ?
Quantities of solid waste	Reduction of the relative quantities of residual waste for disposal, and enhance waste minimisation and resource recovery for the region	• By December 2003 a Regional Waste Minimisation Officer will be appointed to facilitate reaching the targets of the *Regional Waste Strategy.* • Developing waste minimisation and management initiatives with industry in Taranaki including the dairy and petrochemical industries. • District councils will continue to make provision for transfer stations throughout Taranaki that provide cost incentives for the diversion of recyclables and green waste from landfill. • Working with the commercial sector to reduce organic waste going to landfill by 50% of 2002 levels by December 2007. • All councils will develop and implement in-house waste minimisation programmes for the facilities they manage to show lead initiatives toward achieving the targets of the *Regional Waste Strategy.*	• Regional Waste Minimisation Officer (RWMO) position filled since July 2003. • RWMO engages with at least six sectors each year. Dairy and petrochemical initiatives include landfarming and composting of oily wastes, and advocacy for silage wrap and agrichemical container recycling schemes. • Transfer stations provide free or reduced charges for recyclables and green waste. • Commercial schemes for recycling organic wastes in place. Joint STDC-Waste Management proposal for all green waste in South Taranaki under consideration. • All councils have in-house programmes.
Adverse effects of disposal of solid waste	Availability and utilisation of environmentally appropriate disposal options for each type of waste	• By December 2005 it is anticipated that there will only be one operational landfill in Taranaki at Colson Road that will: - continue to meet industry best practice standards; - continue to enforce the policy of non-acceptance of hazardous waste at landfills; and - continue to divert inert material where possible. • District Councils will review their cost pricing policy from time to time • By January 2004 all cleanfill consents will be amended to comply with cleanfill disposal guidelines.	• The Colson Road landfill a regional facility that achieves a 'high' environmental performance rating from the Council in respect of consent compliance, it does not accept hazardous wastes. • District council kerbside collections promote diversion of recyclables. Landfill pricing provides incentive for diversion of inert material. • District council waste services reflect actual costs. • Cleanfill consents reviewed in 2003-04 to reflect MfE guidelines, and again in 2007 to reflect best practice.
Management of hazardous and special wastes	Reduction in volume and improvement in management	• District councils will provide at least one dedicated hazardous waste collection facility per district.	• Regional hazardous waste collections since 1991, current drop-off facilities in each district. Over 40 tonnes removed from region to date (farms, households), estimates of two tonnes left. Electronic waste collection undertaken in 2008. • The Council delivers both RMA and HSNO advice, controls and monitoring.

In other matters such as waste oil, glass, old paint recovery, construction and demolition wastes, and electrical and electronic wastes, the region's dispersed population, small population base, and distance from major processors and markets, impede the development of a sustainable waste recovery industry. However, several smaller businesses operating transfer stations, or otherwise dealing with waste, are extracting increasing amounts of recyclable or reusable materials such as timber. With increased commercial involvement in waste management, local authorities have less direct control of what happens, and have to rely on advocacy, education, and promotion. Uptake of cleaner production principles by commerce and industry remains just as problematic in Taranaki as elsewhere.

Information has been gathered nationally on the siting, design, monitoring and operation of landfills[8]. Data from the census is reported in Table 9.2. The relevant information for Taranaki or specifically for the Colson Road Landfill has been inserted for purposes of comparison.

Some regional comparisons can be made with the national state of waste management [9]. Regionally the amount of wastes landfilled from all sources is equivalent to about 604 kg per person per year. This is 23% lower than the national average of 790 kg per person per year. This could potentially be explained by limited manufacturing industry in the region, lower generation of construction and demolition wastes than some other regions, and the proliferation of cleanfills.

Table 9.2: National Landfill Cenus and the Colson Road information.

National data **Taranaki data**	**1995**	**1998-99**	**2002**	**2006-07**
Total number of operating sites Taranaki	327 8	209 8	115 -	60 1(1)
Sites with consent to operate Taranaki	- 8	157 8	104 1	60 3
Leachate management system				
Engineered liner Colson Rd	- no	4%	20%	54% yes
Leachate collection system Colson Rd	13% yes	35%	47%	77% yes
Stormwater management system				
Stormwater diversion Colson Rd	41% yes	67%	74%	- yes
Stormwater monitoring Colson Rd	- yes	23%	50%	- yes
Stormwater treatment Colson Rd	9% no	27%	36%	- yes
Landfill gas management system				
Landfill gas monitoring Colson Rd	3% yes	11%	27%	- yes
Landfill gas collection (flaring or beneficial use) Colson Rd	- vented (2)	5%	10%	22% vented (2)
Landfill fires Colson Rd	52% no	24%	17%	0% no
Hazardous waste management				
Hazardous waste accepted Colson Rd	33% No (must be rendered non-hazardous)	20%	-	50% No (must be rendered non-hazardous)
Quantifying waste; disposal charges				
Measuring the quantity of waste Colson Rd	39% yes	63%	83%	93% yes
Disposal charges Colson Rd	- yes	45%	82%	93% yes

Notes: – information not requested
(1) one regional landfill, two others with minimal use/emergency use only
(2) re-use considered – not economically viable

8 Ministry for the Environment, 2007. *The 2006-07 National Landfill Census.*
9 Ministry for the Environment, 2007. *Environment New Zealand.*

CHAPTER 10

ENERGY

Photo: Rob Tucker

ENERGY

Taranaki, the energy province, produces energy, from both non-renewable fossil fuels (oil, gas, coal) and from renewable sources such as water (hydro-electricity), wind, solar or biomass. The following summarises the key facts about Taranaki's production and use of energy:

- all of the oil and gas produced in New Zealand is from Taranaki;
- Taranaki uses 3.2% of the total energy used in New Zealand;
- 477 resource consents have been issued by the Taranaki Regional Council relating to petroleum exploration activities over the past five years and 48 relate to production stations;
- four hydroelectric power generation schemes in Taranaki can produce up to 47 megawatts;
- Taranaki has currently no wind farms, although one has been proposed in South Taranaki;
- industry uses 38% of all energy used in Taranaki, with households using the next greatest proportion (28%);
- petrol use in Taranaki has remained relatively stable over the past six years but use of diesel has increased;
- significantly more use is made of mains gas in Taranaki for home heating (35%) than across New Zealand as a whole (13%); and
- little is known of the state of energy efficiency in Taranaki compared to the rest of New Zealand as no regional data is collected.

Energy production and use are primarily managed by Central Government (e.g. the Ministry of Economic Development). Two national level strategies guide energy development, transmission and use: *The New Zealand Energy Strategy to 2050* and the *Energy Efficiency and Conservation Strategy*. At the local level, energy, and effects associated with the production of energy, are managed under the *Proposed Regional Policy Statement*, and regional and district plans.

AT A GLANCE

Maui A production platform and supply vessel, offshore from Opunake.

TARANAKI THE ENERGY PROVINCE

Energy in the scientific sense of the term, is the capacity of something to do work and overcome resistance. In everyday usage the word energy is usually taken to mean a source of power, such as electricity for industrial processes and home heating or petrol and diesel for our cars. Energy is derived from other natural and physical resources such as non-renewable fossil fuels (oil, gas, coal) or from renewable sources such as water (hydroelectricity), wind, solar or biomass.

The Taranaki Regional Council and the region's three district councils have responsibilities under the Resource Management Act 1991 to promote the sustainable management of natural and physical resources (which includes energy) when carrying out their environmental management functions. Recent amendments to the Act require greater consideration of the benefits to be derived from the use and development of renewable energy. Wider issues concerning the security of energy supplies and ensuring competitive and efficient pricing of energy production, distribution and supply are the responsibility of Central Government agencies such as the Ministry of Economic Development, the Electricity Commission, the Energy Efficiency and Conservation Authority and Transpower (NZ) Ltd.

Total primary energy supply is the amount of energy available for energy transformation (e.g. natural gas to electricity) and end use. New Zealand's total primary energy supply in 2006 was 741 petajoules (PJ)[1]. A petajoule is a unit of energy roughly equivalent to what a coastal oil tanker carries – about 20,000 tonnes of oil. This was a drop in the primary energy supply of 0.8% from 2005, and was largely a result of a decrease in the supply of oil and coal from New Zealand. Most of New Zealand's primary energy supply is provided by non-renewable fossil fuels namely oil and oil products (37%) (most of which is imported), gas (21%) and coal (12.5%). A further 12% is supplied by geothermal, and by hydro (11%), and other renewables such as wind, biogas and wood (6.3%).

Consumer energy is that used by final consumers. It excludes energy used or lost in transforming the energy and in bringing the energy to consumers. Total consumer energy demand in New Zealand in 2006 was 499 PJ, an increase of 1.5% from 2005[1]. Oil and oil products make up 51% of consumer energy demand and most of this (93%) is imported. Transport accounted for the largest share of consumer energy in 2006 – about 44% of the total, and accounted for the largest increase – up 4% from 2005. The next largest consumer in 2006 was the industrial sector which used 30% of the total consumer energy followed by residential (12.6%), commercial (9.1%) and agriculture (4.3%).

Demand for energy will inevitably increase over time. Under business-as-usual assumptions with no major changes in policy, New Zealand's energy use is projected to increase by 35% by 2030 with demands for transport predicted to increase the most. Under these assumptions, oil use would grow by about 35%, geothermal energy supply by about 75% and wind energy by about 1000%[2]. However this scenario is not the Government's desired outcome. Under the *New Zealand Energy Strategy*[3] the Government proposes to increase the proportion of renewable energy used in electricity generation and transport, reduce reliance on imported fossil fuels, increase energy efficiency and reduce emissions of greenhouse gases from the energy sector.

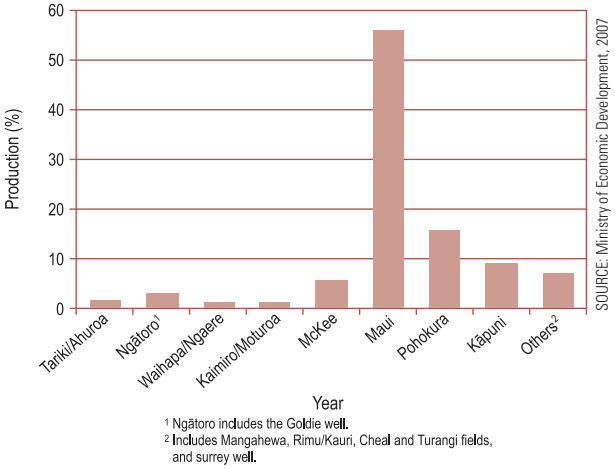
The challenges for Taranaki in the years ahead are to produce energy efficiently and environmentally sustainably from a variety of sources, and then use that energy wisely.

10.1 WHAT IS THE CURRENT STATE OF ENERGY IN TARANAKI?

(A) NON-RENEWABLE ENERGY IN TARANAKI

Oil and gas

All of New Zealand's producing oil and gas fields are located in the Taranaki basin – an area of about 100,000 square kilometres. Most of the basin is offshore although the majority of producing fields are onshore.



[1] Ngātoro includes the Goldie well.
[2] Includes Mangahewa, Rimu/Kauri, Cheal and Turangi fields, and surrey well.

Figure 10.1 Oil production by field for 2006.

1 Ministry of Economic Development, *New Zealand Energy Data File 2007.*
2 Ministry of Economic Development, 2006. *New Zealand's Energy Outlook to 2030.*
3 New Zealand Government, 2007. *New Zealand Energy Strategy to 2050. Powering Our Future.*

Vector Kāpuni gas treatment plant (foreground) and Ballance ammonia-urea plant, Kāpuni.

Most fields, including the large Māui and Kāpuni fields, contain mainly gas but nearly all fields produce a proportion of oil and condensate. The main offshore fields are the Māui, Pohokura, Kupe, Maari and Tūī fields while onshore fields include Kāpuni, McKee, Kaimiro, Ngātoro, Tariki/Ahuroa, Waihapa/Ngaere, Stratford, Mangahewa and Rimu/Kauri fields (see Figure 2.8 in Chapter 2: Taranaki People and Place). Recent discoveries include the onshore Surrey and Kahili fields (2002) and the offshore Tūī oil field (2003).

Oil production is dominated by the offshore Māui field which began producing oil in 1979 and supplied 56% of New Zealand's total oil production in 2006. The Kāpuni field provides 9% of total oil production, while the McKee field provides 6%. The remaining 29% is produced by a number of smaller fields (Figure 10.1).

In 2006, total New Zealand production of crude oil and condensate (and naphtha) was 38.9 PJ, a decrease of 2.4% from 2005. New Zealand's oil production from the Taranaki fields continued to decline from the peak in 1997 mainly as a result of declining production in the Māui field (Figure 10.2).

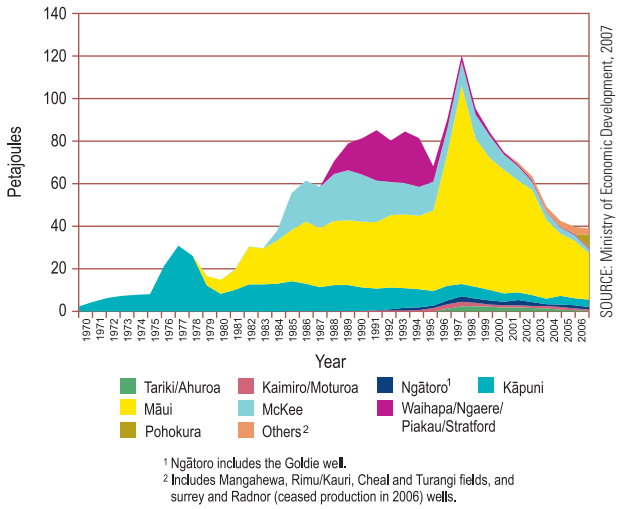


Figure 10.2 Annual crude oil, condensate and naphtha production by Field.

In 2006, 86% of all our crude oil, condensate and naphtha was exported, much of it to Australia, Japan and Korea, because Taranaki's higher quality oil and condensate can be sold at higher prices on the international market. The remaining 14% was used for feedstock at Marsden Point refinery to produce refined products such as petrol, diesel and fuel oil.

Estimated reserves of 55 million barrels of oil remain in existing producing fields and an estimated 147 million barrels in known non-producing fields[4]. Oil production is set to increase significantly in 2008-09 as new developments such as Maari and Kupe come on line.

As with oil production, all gas produced in New Zealand comes from the Taranaki region. The Māui field produced 57.1% of all gas produced in 2006. Other major producers were the Kāpuni field (17.3%) and Pohokura (8.6%) which commenced production in 2006 (Figure 10.3).

Total gas produced in Taranaki in 2006 was 163 PJ, an increase of 2% over 2005. Total annual gas production by field is shown in Figure 10.4.

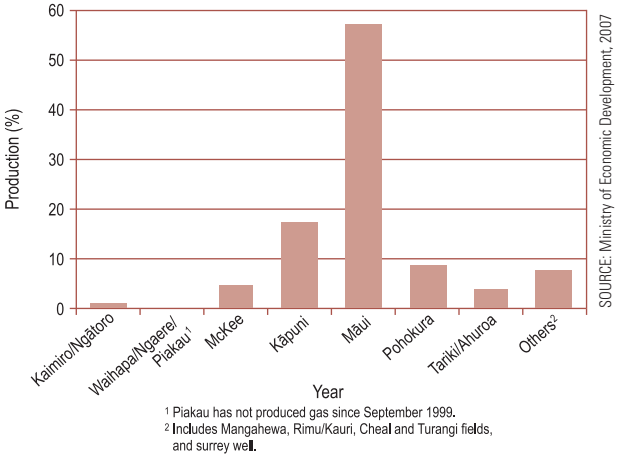


Figure10.3 Gas production by field for 2006.

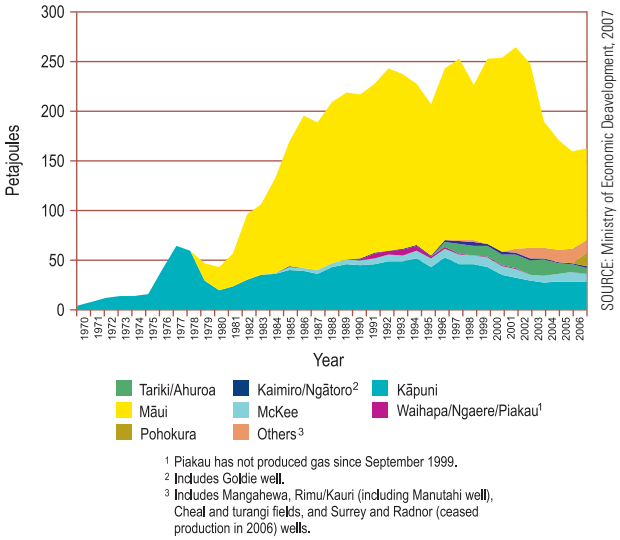


Figure10.4 Annual total gas production by field.

4 www.crownminerals.govt.nz/cms/petroleum/overview

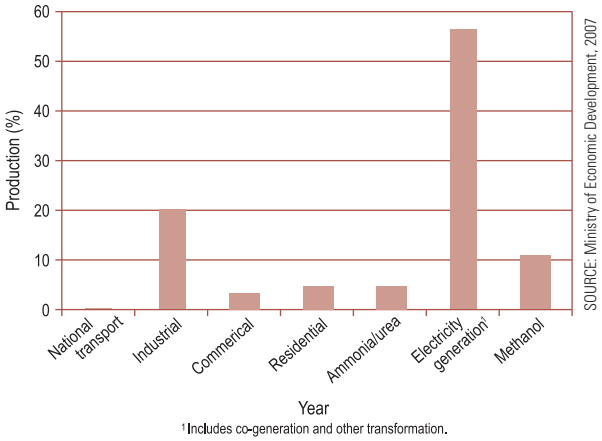


Figure 10.5 Gas consumption by sector for 2006.

About 56% of New Zealand's natural gas produced during 2006 was used for electricity generation (Figure 10.5). Contact Energy Ltd (Otahuhu B, Taranaki Combined Cycle at Stratford and New Plymouth Power Station) and Genesis Power Ltd (Huntly Power Station) were the main thermal electricity generators in New Zealand using natural gas. The amount of gas used for electricity generation increased by 12% from 2005 to 2006.

In December 2007 Contact Energy Ltd decided to permanently close the New Plymouth Power Station because of asbestos-related health and safety issues but the station was partly reopened in mid-2008 to meet electricity demand. Final decisions on the decommissioning of the station are still to be made. It was commissioned in 1976 and because of its age and relative inefficiency operated largely when other plants were not operating or when demand for electricity was high. By contrast, the newer combined cycle power station at Stratford completed in 1998, at 55.5%, has one of the best fuel efficiencies of New Zealand's thermal power stations[5].

Industrial users throughout the North Island used 20.2% of gas produced in 2006, and the petrochemical sector another 15%. The petrochemical sector use of gas included Methanex's methanol plants at Motunui and the Waitara Valley and the Ballance Agri-Nutrients ammonia/urea plant at Kāpuni. Methanex New Zealand produced about 400,000 tonnes of methanol during 2006, up from 340,000 tonnes in the previous year. This was despite the Motunui Plant having shut down in November 2004 because of a lack of natural gas supply at a competitive price, and the temporary closure of the Waitara Valley Plant in July 2006 (which re-opened in September 2006). Methanex New Zealand has since re-opened its Motunui Plant.

The residential sector accounted for about 5% of all gas used in 2006, with the number of residential consumers throughout the North Island totalling about 229,000. The remaining 3% of gas was used by about 8,000 commercial users (including transport) spread throughout the North Island.

Estimated gas reserves remaining in currently producing fields are of the order of 1,048 billion cubic feet with a further 1,144 billion cubic feet of estimated reserves in non-producing fields[6]. Gas yields from the maturing Māui field have been declining from the peak recorded in 2001.

The Taranaki Basin is under explored by international standards and exploration interest in the region for both oil and gas remains high.

Responsibility for issuing permits to undertake prospecting and exploration of petroleum minerals, such as oil and gas, and for issuing permits and licences to mine oil and gas resources, lies with the Ministry of Economic Development. The various permits and licences to explore for and extract petroleum resources are processed by the Ministry under the Crown Minerals Act 1991. Table 10.1 shows the number of petroleum prospecting, exploration and mining permits and licences, and the number of wells drilled between 2002 and 2006.

Table 10.1 National summary of petroleum exploration and mining activity 2002-06.

Number (national totals)	2002	2003	2004	2005	2006
Wells drilled	21	16	33	34	30
Petroleum prospecting and exploration permits	82	86	105	104	79
Petroleum mining permits and licences	12	12	14	19	21

SOURCE: Ministry of Economic Development, 2007.

Almost all wells drilled and petroleum permits issued were in the Taranaki Basin, although in the past five years an exploration well was drilled in the offshore Canterbury Basin and some prospecting or exploration activities have been undertaken in the Great South Basin offshore from Southland and South Otago and in the Ruakumara Basin off the North Island's East Coast.

Another indicator of the state and pressures on oil and gas resources in the region is the number of resource consents issued under the Resource Management Act 1991. Table 10.2 shows the number of resource consents issued by the Taranaki Regional Council for oil and gas exploration activities, and oil and gas production stations over the past five years. These resource consents deal with the environmental effects of oil and gas exploration and production activities (for example, effects on water and air quality) and do not deal with managing the oil and gas resources themselves which is the responsibility of the Ministry of Economic Development.

Table 10.2 Number of resource consents issued by the Taranaki Regional Council for oil and gas exploration activities and production stations 2002-03 to 2006-07.

Number of resource consents issued[1]	2002-03	2003-04	2004-05	2005-06	2006-07
Petroleum exploration	75	112	902[2]	138	62
Production stations	16	8	8	9	7

1 Includes water permits, discharge permits, land use consents and coastal permits.
2 Excludes 68 changes to resource consents to reflect changes to the Resource Management Act regarding greenhouse gas emissions reporting.

In 2002-03 consents were issued to Swift Energy New Zealand Ltd for exploration sites associated with the onshore Kauri oil and gas field

5 www.contactenergy.co.nz
6 www.crownminerals.govt.nz/cms/petroleum/overview

and 17 consents were issued to Shell Todd Oil Services Ltd for the offshore Pohokura gas field development. Forty two consents were issued to Swift Energy NZ Ltd for exploration activities associated with the Manutahi exploration sites in South Taranaki in 2003-04, and six consents were issued for the Natural Gas Corporation New Zealand Kahili Production Station. Resource consents for a number of new onshore exploration wellsites across the region were issued in 2004-05 and in 2005-2006. In 2004-05, 17 consents were issued to Origin Energy Resource (Kupe) Ltd for development of the offshore Kupe field and associated onshore production station.

Compliance by the oil and gas industry with the conditions of resource consents is generally very high. In 2006-2007 the Council carried out 135 inspections of exploration wells, 80 inspections of producing wellsites and 72 inspections of production stations. In all cases activities were in compliance with resource consent conditions at the time of inspection and no re-inspections were required[7].

Coal

The Taranaki Coal Region comprises five coalfields mainly between Taumarunui and Mōkau on the west coast - Mōkau, Aria, Waitewhena, Ōhura-Tangarakau and Retaruke. Only part of the Mōkau field lies within the boundaries of the Taranaki local government region. Coal-in-ground resources in these fields total 380 million tonnes (2.4% of New Zealand's total coal-in-ground resource) of which 173 million tonnes are estimated to be recoverable[9]. Most of the resources are in the Mōkau coalfield where there is potential for opencast and underground mining.

Various exploration and mining feasibility assessments of the Taranaki Coal Region took place in the early to mid-1980s. However, the relatively remote location of the coalfields and consequently high transport costs have limited development. A preliminary mining feasibility study of the Mōkau coalfield in 1985 for a 1,000 MW power station defined saleable reserves at 36 million tonnes opencast and 71 million tonnes underground[8].

(B) RENEWABLE ENERGY IN TARANAKI

Taranaki's climate, topography and other physical features mean that the region has a number of potential sources of renewable energy. The main sources are hydro, wind, solar, biomass, geothermal and marine.

A number of barriers slow the uptake of renewable energy, particularly the high capital cost as projects must include the cost of fuel gathering as well as energy conversion. Some technologies are new and have not reached a stage of commercial application or do not yet have economies of scale in plant construction compared with conventional energy sources. Other potential constraining factors are long development times, competition with other users for the same resource and environmental impacts.

Hydropower

Taranaki currently has four hydroelectric power generation schemes in Taranaki with a total installed capacity of 47 megawatts (MW) (Table 10.3). In addition, a small scheme in Normanby on the Waingongoro River is in the process of being recommissioned with a potential capacity to generate an additional 2 MW.

Table 10.3 Developed hydro-electric schemes in Taranaki.

Scheme	Catchment area	Scheme rating (MW)
Pātea	Pātea	30.7
Opunake	Waiaua	7.0
Motukawa	Manganui, Waitara	4.8
Mangorei	Waiwhakaiho	4.5
Total		**47.0**

SOURCE: Sinclair Knight Merz, 2006.

A large number of rivers and streams flow off Mount Taranaki and out of the inland Taranaki hill country. However, development of large-scale hydroelectric power schemes is constrained by the relatively small river flows in the region's waterways and the lack of topographical features where substantial head can be gained or sites that would allow diversion of flows to neighbouring catchments. Constraints are also imposed because large areas of the region are located in public conservation land which has significant biodiversity values.

There are opportunities for micro and mini schemes and hydro-generation in the lower reaches of rivers at locations with steep river reaches or local drops.

There have been a number of assessments of hydroelectric power generation potential in Taranaki over the years. One report concluded that the remaining hydro potential in Taranaki from schemes outside public conservation land was almost 60 MW in mini, small and medium scale projects[9].

Wind

Wind power generation has become a significant contributor to electricity generation in many parts of the world, especially Europe and the USA. There has been substantial growth in electricity generated by wind power in New Zealand in the past 10 years but the installed wind power capacity of 170 MW (in 2006) nationwide is still relatively low and provides only about 2% of New Zealand's electricity needs. Predictions estimate that there is potential for 2000 MW of additional capacity from wind power in the next 10 years providing about 17% of New Zealand's installed capacity[10].

There are currently no wind farms in the Taranaki region but some wind farm developers have shown interest in Taranaki as a possible area for

Wind turbine.

7 Taranaki Regional Council, 2007. *Annual report: Compliance monitoring 2006-07.*
8 www.crownminerals.govt.nz/cms/coal
9 Sinclair Knight Merz, 2006. *Renewable Energy Assessment: Taranaki Region.* Report to the Energy Efficiency and Conservation Authority
10 Electricity Commission quoted in Parliamentary Commissioner for the Environment, 2006. *Wind Power, People and Place.*

development. In 2007, Waverley Wind Farm Ltd applied to the South Taranaki District Council to establish a 45-turbine wind farm (135 MW) on a coastal site on Stewart Road, Waverley. The application has yet to be heard by the South Taranaki District Council.

Wind speeds in Taranaki are not among the highest in the country, which are generally found in the southern parts of the North Island. However, some areas of Taranaki are likely to have average wind speeds of above 8 metres/second which is currently the approximate minimum wind speed required for economic wind farms. The Taranaki coastline is an area with sufficient wind speeds, with generally more wind on the region's western and southern coast.

However, a range of other factors, such as the location of important natural features and landscapes, proximity to population and site availability, determine what areas are suitable for wind farm developments. It is unlikely that very large wind farms (greater than 300 MW) will be developed in Taranaki due to the region's even distribution of population and dwellings. However, it has been suggested that if carefully planned, approximately 300 MW of wind capacity could be installed over a number of years with environmental impacts that were broadly acceptable to local communities, focused along the South Taranaki coastline. The report also noted that the technically available wind potential in Taranaki is much great than 300 MW and that small-scale wind turbines (less than 10 KW) could be operated successfully in areas with lower wind speeds than those required for larger turbines.

Solar

Solar radiation (energy from the sun), in Taranaki is amongst the highest in New Zealand and higher than most areas in Europe (Table 10.4).

Solar radiation for New Plymouth is approximately 1,500 Kilowatt-hours (kWh) per square metre per year. There are no large variations in solar radiation across the region. However, solar radiation varies greatly over the year, being highest in January and lowest in June.

A standard solar thermal system can produce about 55% of a household's water heating, and households account for 32% of electricity demand in the Taranaki region[11]. The installation of solar thermal technologies, therefore, has the potential to contribute to the region's overall energy supply.

Solar energy.

Table 10.4 Typical values for total solar radiation for several sites.

Site	Solar radiation (kwh/m^2/yr)
Gisborne	1,497
New Plymouth	1,485
Kaitaia	1,469
Paraparaumu	1,403
Christchurch	1,360
Invercargill	1,292
Sydney	1,708
Melbourne	1,473
Germany	1,003

SOURCE: Sinclair Knight Merz, 2006.

Solar thermal systems are most economic when installed in new buildings. The number of occupied dwellings in Taranaki increased by more than 1,300 between 2001 and 2006. There is therefore potential to increase the uptake of solar thermal use in the Taranaki region.

Given Taranaki's high levels of solar radiation there is also potential to make increased use of passive solar heating through building orientation and design (both commercial and residential) to maximise the absorption of solar energy.

Biomass

The resources for the production and use of biomass as a renewable energy resource include agricultural crops, dairy and livestock farming, forestry and the wastes associated with production and processing.

An assessment of renewable energy in Taranaki in 2006 concluded that while Taranaki does not have a particularly suitable climate for intensive cropping and is not therefore likely to be a major source of crop-derived biomass, there is potential for the production of ethanol or electrical energy from woody biomass derived from lower-grade forestry[11]. That report also noted potential biomass energy from the region's dairy processing residues, meat processing by-products (e.g. tallow), municipal solid waste, and sewage biogas and sludge.

One Lepperton piggery operator is in the process of developing a system to harness the biogas generated from piggery waste to enable electricity generation for use in the piggery. Biogas is a term that refers to gases extracted off anaerobic ponds which are made up of methane, CO_2 and hydrogen sulphide.

Geothermal

Taranaki does not contain high temperature geothermal fields of the sort found in the Taupō Volcanic Zone. However, because of the region's volcanic history, higher than average heat flows are found in parts of the region. Temperatures of over 150°C can occur in some deep oil and gas exploration wells. It is more likely however that the temperatures and flow rates obtained from geothermal sources in Taranaki would be too low for power generation but could be used for direct heat applications such as horticulture (greenhouse) heating, aquaculture, timber drying and space heating[11].

11 Sinclair Knight Merz, 2006. *Renewable Energy Assessment: Taranaki Region*. Report to Energy Efficiency and Conservation Authority.

Marine

Various studies have been carried out throughout New Zealand on tidal energy and wave energy. Given weather patterns, water depths and wave energies in Taranaki, it has been estimated that the capacity potential from wave energy in Taranaki (ignoring environmental constraints and conflicts with other maritime users) is in the 1000 MW range[11].

Information available regarding tidal flow patterns in the region is limited but indicates that the tidal flows seen within the region are insufficient for power generation.

Marine energy.

Teacher Warwick Foy and student Abbie Fowler with the environmental award presented by Council Chairman David MacLeod (right).

STUDENTS SWITCH ON TO ENERGY EFFICIENCY

Inglewood High School has been supplementing the three Rs with CGE – conservation, generation and education – in the cause of energy efficiency and sustainability.

They were the three strands of a $100,000 Enviropower pilot programme at the 380-student school funded by Venture Taranaki and the Ministry for the Environment supported by EcoInnovation and Enviroschools. It was believed to be the first of its kind in New Zealand and it earned a Taranaki Regional Council Environmental Award in 2008.

The most obvious sign of the project is a 10 m wind turbine in the school grounds, a renewable source for electricity that is used on site. The school also has two sets of solar panels – one to generate electricity and one for water heating.

According to teacher Warwick Foy, the turbine generates about 800 watts on the average breezy day in Inglewood, while the photovoltaic solar panels can produce 300 to 1,000 watts and the hot water panels can supply the needs of the administration block.

On the conservation side, the school has eliminated unnecessary hot water heating by wrapping, timing and in some cases turning off cylinders. More energy-efficient lighting and computer systems have been introduced and power consumption is constantly monitored, allowing students and staff to see immediately the result of efficiency measures.

Tangible benefits of the year-long project included a 17% reduction in power consumption, exceeding the target of 15%. Biggest gains were made in daytime consumption, especially at weekends. Energy use is down 22% on weekdays and 57% in weekend daytime.

But it's the third strand of the project, education, that was probably the most important, said Warwick.

Students have been involved in many aspects of the project – wrapping the cylinders, digging the turbine foundations and so on – and they have taken real ownership of the project.

That zeal has been taken back to their homes, where they have been monitoring the family power consumption and generally raising awareness and promoting efficiency. This will have real long-term benefits.

The school also incorporated Enviropower aspects in geography, social studies, maths, science and art lessons, with a four-week social studies unit covering issues such as peak oil and gas, global warming, renewable and non-renewable energy and sustainability issues.

The Enviropower project was a great learning experience for all involved, said Warwick. "As we enter into a future of energy and environmental uncertainty, it's good to know that our students will be better prepared."

The programme was designed to support the Government's Energy Strategy, and Venture Taranaki was delighted with the enthusiasm demonstrated by teachers, pupils and the wider school community in the project. Venture Taranaki is considering what the next stage will be.

(C) ENERGY TRANSMISSION AND DISTRIBUTION IN TARANAKI

The Taranaki region contains a highly developed energy transmission and distribution network associated particularly with its oil and gas resources and electricity generation.

Pipelines link oil and gas fields to production stations such as those at Ōaonui, Waihapa, Rimu and McKee and from there to Port Taranaki. High pressure gas pipelines distribute natural gas to major gas users in Taranaki and from Taranaki throughout the North Island. In total there are more than 3,400 km of high pressure gas transmission pipelines in New Zealand and more than 2,800 km of intermediate, medium and low pressure gas distribution pipelines connected to the high pressure transmission system.

Transpower (NZ) Ltd, operates the national electricity transmission network (the national grid). In Taranaki this includes high voltage 220 kV transmission lines from New Plymouth to Stratford, inland from Stratford, and south to Waverley. 110 kV lines link New Plymouth, Motunui, Stratford, Hāwera, Opunake and Waverley south.

Bar Manager Michelle Trainor in the chiller. Furlong Manager Margaret Bailey shows the length of the chiller before the area was reduced.

ENERGY EFFICIENCY A COSY IDEA

The Furlong Motor Inn in Hāwera has become a cosier place and it's all in the name of energy efficiency.

In the past year, measures to cut electricity and gas consumption have included reducing the space in regular public use by a third – achieved by closing one bar, using another only for functions and moving the house restaurant into a smaller area.

The impact was almost immediate when heating, lighting, and bar fridges and bowsers were turned off in the redundant areas.

The same idea was applied to two large walk-in chillers at the Furlong. A considerable amount of this space was previously under-used but internal walls have now been installed, reducing by about two-thirds the area that needs to be kept refrigerated.

These were big steps for the business to take but manager Margaret Bailey says they have paid off, with a 40% reduction in electricity costs over the past year.

Other measures to reduce energy consumption have included insulating hot water pipes and raising staff awareness of the need to turn off lights and other electrical equipment when not in use.

The Furlong has also cut by around half the amount of waste it sends to landfill, by paying greater attention to recycling possibilities and finding new users or uses for food scraps, used cooking oil and green waste.

The establishment's successes in energy efficiency and waste minimisation were marked by a Taranaki Regional Council Environmental Award this year.

(D) ENERGY USE

Taranaki consumes about 15.36 petajoules of energy per year, 3.2% of New Zealand's total energy use (487.07 PJ)[12]. Table 10.5 shows energy use by sector and compares Taranaki's energy use with the national totals.

Table 10.5 Taranaki and New Zealand end use energy consumption (PJ)

Sector	Taranaki end use energy consumption	% Taranaki total	New Zealand end use energy consumption	% New Zealand total
Agriculture	2.28	14.8	35.31	7.3
Commerce	1.11	7.2	54.55	11.2
Household	4.31	28.1	157.99	32.4
Industry	5.89	38.3	166.24	34.1
Transport and storage	1.77	11.5	72.99	15.0
Total	15.36	100.00	487.07	100.00

Note: Data sourced from the Energy End Use Database maintained by the Energy Efficiency and Conservation Authority. This database includes residential household transport energy consumption in the Household category. The Energy Data File maintained by the Ministry of Economic Development referred to at the beginning of this chapter includes residential household transport in the national transport category.

12 Energy Efficiency and Conservation Authority. Energy End Use Database. www.eeca.govt.nz.

Table 10.5 shows that in Taranaki the greatest amount of energy is used in the industry and household categories. The amount used in the agricultural sector is twice the percentage used nationally and reflects the strong agricultural base to the region's economy. Energy use by industry in Taranaki is also higher than the national average reflecting Taranaki's petrochemical and related engineering industries. Energy use by households and commerce is proportionately lower.

Taranaki's use of fossil fuels for non-transport activities such as agricultural production is 35% of all energy used, significantly higher than the national average of 25%. Our use of fossil fuels for transport is similar to the national average.

Petrol sales in Taranaki have been relatively stable over the past six years with a total of 77.3 million litres used in 2006-07. Diesel sales have increased by about 12% from 65.1 to 73.2 million litres between 2001-02 and 2006-07 (refer Figure 6.3 in Chapter 6: Atmosphere). In addition, the number of households that have access to two or more vehicles has increased over the past ten years contributing to an overall increase in petrol and diesel sales.

National energy use figures show that household use annually is about 13% of all energy used (excluding household transport). More than one-third (34%) of this is used to heat dwellings[13]. The fuel types used to heat dwellings are therefore an important indicator of energy use in Taranaki. Figure 10.6 shows the types of fuels to heat dwellings in Taranaki compared with New Zealand as a whole.

Figure 10.6 shows that electricity is used to heat a little over half (51%) of dwellings in Taranaki compared to almost three quarters (71%) of private dwellings nationwide. Significantly more use is made of mains gas in Taranaki (35%) than across New Zealand as a whole (13%). Taranaki residents also make more use of wood to heat their homes but use less bottled gas and coal. Over the past 10 years there has been a decrease in the use of electricity and mains gas to heat homes in Taranaki and an increase in the use of bottled gas. There has also been an increase in use of solar heating in Taranaki in the past 10 years but the number of households concerned remains small (see also Chapter 6 Air Quality).

Transport (including household transport) uses 44% of energy used nationally. Over half of all transport energy is used by passenger transport modes (as opposed to freight transport).

Figure 10.7 shows the most common means of travel to work for people in Taranaki compared to New Zealand as a whole. This shows that in Taranaki, as well as nationally, the main means of travelling to work is either the private car or company vehicle. The use of public transport in Taranaki is lower than for New Zealand generally reflecting better public passenger transport services in large metropolitan centres where population numbers and densities make them a more viable transport option. Taranaki workers made greater use of motor cycles or walking and jogging to work than New Zealanders as a whole.

(E) ENERGY EFFICIENCY

Little is known of the state of energy efficiency in Taranaki or whether Taranaki is any more or less energy efficient than other parts of the country, as no regional level data is collected.

One of the important energy efficiency programmes run by the Energy Efficiency and Conservation Authority (EECA), is the Energywise Home Grants Scheme. This programme gives grants for energy efficiency improvements to low income families and landlords of properties with low income tenants. These improvements include underfloor insulation, sealing, cylinder wraps and pipe lagging. Over 40,000 pre 1977 homes throughout New Zealand have been retrofitted under the scheme. To date some 2,500 homes in Taranaki have been retrofitted (see case study).

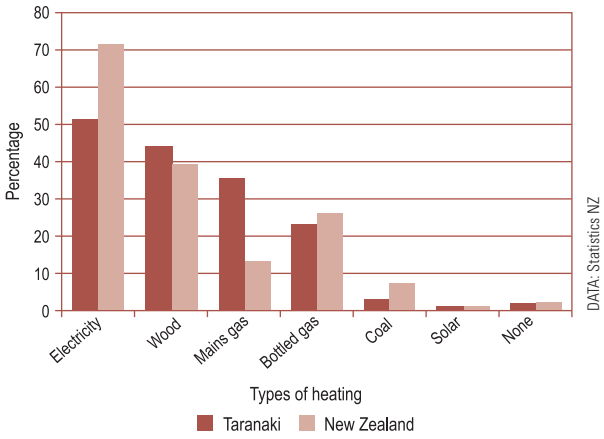


Figure 10.6 Percentage of fuel types used to heat private occupied dwellings.

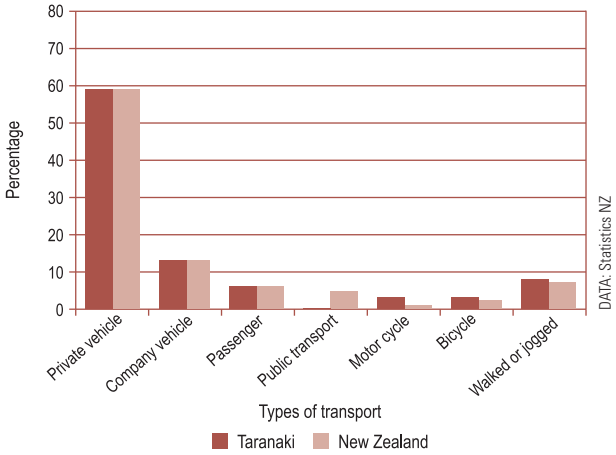


Figure 10.7 Main means of travel to work as percentage of totals for Taranaki and New Zealand.

13 New Zealand Government, 2007. *New Zealand Energy Efficiency and Conservation Strategy.*

Harley Meston of Better Homes installing ceiling insulation.

ENERGY-SAVER ON MORE THAN ONE LEVEL

An ambitious, multi-agency project is under way to cut energy consumption in thousands of Taranaki homes, and at the same time reducing the energy expended by staff at hospitals and doctors' clinics.

The Healthy Homes Taranaki project, launched in January 2007, aims to have all the region's houses insulated by 2014. That's a big retrofitting job as an estimated 29,000 of Taranaki homes were built before 1977 and therefore are without insulation.

Besides reducing energy consumption and costs, the project's aims include reducing respiratory illnesses and other serious health problems brought on by cold and damp living conditions, and making houses safer for children and the elderly.

The project is being delivered by Waitara-based community charitable trust Better Homes and follows an earlier pilot project which saw 100 cold and draughty Waitara homes improved with insulation.

"The pilot project showed there were definite benefits to be had from improving the internal ambient temperatures in these Waitara homes, such as fewer respiratory issues," said Better Homes General Manager Steve Wharehoka. "We now want to bring these benefits to all homes in Taranaki".

He said that the work depended on the needs of the dwelling and occupants, but could include the installation of roof and underfloor insulation and moisture barrier, draught-proof doors and windows, cylinder wraps, energy-saving light bulbs, pipe lagging, fire alarms, safety latches and security stays for houses with young children, and grab rails and barriers for elderly and less mobile occupants.

Occupants can also be referred to other appropriate programmes run by the funding agencies.

The project got off to a flying start in its first year, when 476 houses across the region were retrofitted. Of these, less than a third were spending under $150 a month on heating and nearly a quarter were paying $200 or more.

Uninsulated homes lose 42% of their heat through roofs, 24% through walls, 12% through windows and 10% through the floor. Taranaki's yearly energy spend totals $260 million, of which $34 million is for domestic energy.

Strategic partners in the project are the Energy Efficiency and Conservation Authority (EECA), Peak Health Taranaki, the New Plymouth District Council, Work and Income, Housing NZ, the ACC and the Taranaki District Health Board. Major funders include the TSB and TET community trusts and EECA.

10.2 HOW IS ENERGY MANAGED IN TARANAKI?

(A) CENTRAL GOVERNMENT

Energy production, transmission, distribution and retail are undertaken by a range of private sector and state-owned enterprises working within commercial markets and a regulatory framework established by Central Government. Rights to Crown-owned minerals – oil, gas, minerals and coal – are managed under the Crown Mineral Act 1991, by the Crown Minerals Group within the Ministry of Economic Development. The Electricity Commission is a Crown entity established under the Electricity Act, to oversee New Zealand's electricity industry.

The Ministry of Economic Development develops and implements policy for the energy sector overall, and monitors market performance, including competition issues and gas and electricity prices. The Ministry also carries out energy supply and demand modelling which supports the development of energy and environmental policies and develops policy for the oil and alternative fuels markets.

The Energy Efficiency and Conservation Authority (EECA) was established under the Energy Efficiency and Conservation Act 2000 and is responsible for promoting energy efficiency throughout New Zealand across all sectors of the economy.

There are two national level strategies prepared by Central Government to guide energy development, transmission, distribution and use throughout New Zealand – the *New Zealand Energy Strategy to 2050*[14] and the *Energy Efficiency and Conservation Strategy*[15].

The *New Zealand Energy Strategy* aims to establish "a reliable and resilient system delivering New Zealand sustainable, low emissions energy services". Key features of the strategy are targets of 90% renewable energy generation by 2025, and that all new generation should be renewable except to the extent needed to ensure security of energy supply. Actions are proposed in the strategy to increase energy efficiency in the transport sector, encourage public transport and alternative fuels, use energy more efficiently and explore sustainable energy and innovation.

14 New Zealand Government, 2007. *New Zealand Energy Strategy to 2050. Powering Our Future.*
15 New Zealand Government, 2007. *New Zealand Energy Efficiency and Conservation strategy.*

The Government adopted a new *Energy Efficiency and Conservation Strategy* in an effort to boost energy efficiency and conservation and to promote the uptake of renewable electricity. A review of the earlier 2001 strategy had shown that its objective of improving energy efficiency across the economy had not been achieved. The strategy identifies targets and actions to improve energy efficiency and conservation throughout New Zealand. Targets and actions are set out for energywise homes (improving the performance of existing and new homes), energywise business (energy efficiency and renewable energy programmes in industry and commerce and in agriculture, horticulture, forestry and fishing), energywise transport (managing travel demand, reducing car and fuel use, improving transport efficiency, increasing the use of public transport and developing renewable fuels) and an efficient and renewable electricity system. Key targets under the strategy include 70,000 low-interest loans by 2015 for insulation, energy efficiency or clean heat in homes, up to 20,000 solar water heating systems by 2010, reducing vehicle kilometres travelled, encouraging use of public transport, halving per capita transport greenhouse gas emissions by 2040 and having 80% of vehicles capable of using 10% biofuel blends or electric powered by 2015.

The Government has also adopted a strategy to promote walking and cycling as alternative modes of transport[16].

(B) REGIONAL POLICIES AND PLANS

A recent amendment to the Resource Management Act 1991 requires Local Government to have particular regard to the benefits to be derived from the use and development of renewable energy. The *Proposed Regional Policy Statement for Taranaki* prepared by the Taranaki Regional Council identifies energy efficiency and development of renewable energy as issues for the region.

Regional plans prepared by the Taranaki Regional Council and district plans prepared by the New Plymouth, Stratford and South Taranaki district councils, provide for and regulate energy developments while ensuring that the environment effects of such developments are avoided, remedied or mitigated.

The *Regional Air Quality Plan for Taranaki* contains rules regulating discharges to air from petroleum exploration activities and from production stations. The *Regional Fresh Water Plan for Taranaki* allows and regulates the taking or diversion of water (for example for hydro-electric power generation) and for discharges of contaminants to land or water and use of riverbeds associated with energy industry exploration and development such as the laying of pipelines. The *Regional Coastal Plan for Taranaki* contains similar provisions in relation to the coastal marine area.

(C) DISTRICT PLANS

The *New Plymouth District Plan* contains objectives, policies and rules for activities such as building structures, earthworks and use of hazardous substances etc. Energy exploration, development and use are

Pohokura production station.

able to take place within the policy and rules framework set out in the district plan, which notes that the established activities of the petroleum exploration and production industry form part of the elements associated with the rural environment that have developed as a result of traditional rural practices.

The *Stratford District Plan* contains objectives, policies and methods covering issues such as amenity values, outstanding natural features and landscapes, rural and residential use, protected areas, mineral extraction and network utilities (among others) all of which may be of relevance to energy use and development. Rules in the plan permit certain underground pipeline operations for the distribution of natural gas, petroleum or geothermal energy, existing electricity lines and mineral prospecting and pre-drilling petroleum exploration activities in the rural zone. Other aspects of mineral exploration are dealt with as controlled or discretionary activities requiring resource consent. Solar heating devices are exempt from the height in relation to boundary requirements for buildings.

The *South Taranaki District Plan* has objectives, policies and methods on a range of issues including the coastal environment, environmental quality, infrastructure, natural hazards, landscape, and historical and cultural heritage among others. Rules in the rural zone permit petroleum

16 Ministry of Transport, 2005. *Getting There - On Foot, By Cycle.*

prospecting, including seismic exploration while petroleum exploration and production testing require resource consent as controlled activities. Energy generation activities associated with the manufacturing, processing and/or treatment process are permitted activities in rural and industrial zones.

All district plans contain provisions that ensure access to natural light and sunlight and avoid shading of neighbouring properties in the built environment.

(D) BUILDING ACT

In addition, under the Building Act 2004 and in granting building consents, district councils must ensure that all building work complies with the *Building Code*. This requires among other things that buildings are constructed to provide adequately controlled interior temperature, adequate natural light and facilitate the efficient use of energy.

(E) TRANSPORT

The *Regional Land Transport Strategy* prepared by the Taranaki Regional Council contains policies and actions to reduce vehicle traffic demand, fuel consumption and greenhouse gas emissions through the increased use of alternative modes of transport such as rail, public passenger transport and walking and cycling. The strategy also recognises the need to integrate land use with land transport to minimise the total demand for travel. The Council's *Regional Passenger Transport Plan* which forms part of the strategy sets out a programme for providing and supporting public passenger transport in Taranaki. The plan recognises the benefits of public transport in reducing private vehicle use and use of fuel energy.

In 2006-07, over 320,000 trips were made on urban bus services in New Plymouth[17]. In July 2007 the council introduced once-a-week bus services between Waverley and Hāwera, Opunake and Hāwera, and Opunake and New Plymouth. A once-a-week service between Inglewood and New Plymouth was introduced in November 2007.

The Taranaki Regional Council has also adopted a *Regional Walkways and Cycleways Strategy for Taranaki* to promote walking and cycling throughout the region. One of the key benefits of walking and cycling noted in the strategy is reduced consumption of fossil fuels and reduced emissions of greenhouse gases. The strategy records a number of initiatives already under way in Taranaki to promote walking and cycling.

Passengers board a City Link bus, New Plymouth.

(F) ENERGY EFFICIENCY

The Council employs a Regional Waste Minimisation Officer (partly funded by the district councils) to promote waste minimisation and energy efficiency throughout the region. Over 50 organisations have been visited between early 2007 and mid 2008 – mainly restaurants and cafes, hotels and service clubs, a major shopping centre, offices and marae. A walk-through assessment is made of current energy practices and the potential for improving energy efficiency identified (see case study on Furlong Motor Inn).

The four local authorities in Taranaki all apply in-house energy efficiency programmes. The Taranaki Regional Council is a member of the Communities for Climate Protection (New Zealand) which has seen the Council develop an action plan to increase energy efficiency within its own operations.

(G) SUMMARY OF PROGRESS

Progress in implementing regional objectives and policies on energy is summarised in Table 10.6.

Mountain biking.

New Plymouth coastal walkway.

17 Taranaki Regional Council, 2007. *Annual report: Regional land transport planning and passenger transport. 2006-07.*

Table 10.6 Summary of progress: implementing regional objectives and policies on energy.

Issue	What do we want to achieve?	What are we doing about it?	Where are we at?
Sustainability managing energy	• Efficiency in the use, production and transmission of energy • Promotion of renewable sources of energy • Enabling of people and communities to use and develop energy to meet their needs	• Implementing regional plans and district plans and process resource consents to regulate and allow energy production, transmission and use, including renewable energy. • Implementing the *Building Code* to facilitate the efficient use of energy in buildings. • Promoting alternative modes of transport to private vehicles, urban design and travel demand management that reduce consumption of fossil fuels. • Advocating actions at Central Government level to ensure reliable and affordable energy supplies, research into energy efficiency and renewable energy technologies and strategies to enable New Zealand to continue to meet its energy needs.	• All regional and district plans in the region are operative. Resource consents for energy developments or projects are monitored. • *The Building Code* is implemented. • Alternative modes of transport and travel demand management are promoted. • Central Government has adopted an *Energy Strategy to 2050* and an *Energy Efficiency and Conservation Strategy.*

10.3 HOW DO WE COMPARE?

Energy production and transmission are managed at a national level. Taranaki is New Zealand's only producing oil and gas region and is the hub for the processing and distribution of natural gas to industrial, commercial and residential consumers throughout the North Island.

However, regional differences occur in energy use. Table 10.7 shows the way in which energy is used in each region and what percentage of that energy is used by the agriculture, commerce, household, industry and transport and storage sectors.

Regional differences in energy end use reflect the overall make up of the economy in each region, the dominance (or otherwise) of particular industries, climate and population size (which will influence household energy use) and location and distance from main centres and markets (which will influence transport energy use). For example, industrial energy use in Southland accounts for 68.6% of all energy use in Southland, the highest proportion by far of all regions, and is likely to be the result of one large energy user (the Tiwai Point aluminium smelter) in that region. This reduces the relative proportions of energy use in other sectors even though in absolute terms, and on a per capita basis, the energy used in other sectors may be similar to other regions.

Taranaki's energy use of 15.36 PJ is 3.2% of New Zealand's total energy use and is above Taranaki's share of the national population at 2.8%. Taranaki's energy use in agriculture as a proportion of total energy use in the region (14.9%) is twice the national average and is sixth highest of all 16 regions reflecting the level of activity of this sector in the region. However, the highest absolute energy use in agriculture is found in the Waikato region (at 6.64 PJ or 14% of the region's total energy use) and is almost three times that used in Taranaki. The Marlborough region has the highest proportional consumption in agriculture of all regions at 23% of total energy used in the region.

Taranaki has a relatively high proportion of energy use in industry at 38.3%, the third highest proportion in New Zealand after Southland and Bay of Plenty, reflecting the presence of the oil and gas, petrochemical processing and supporting engineering industries.

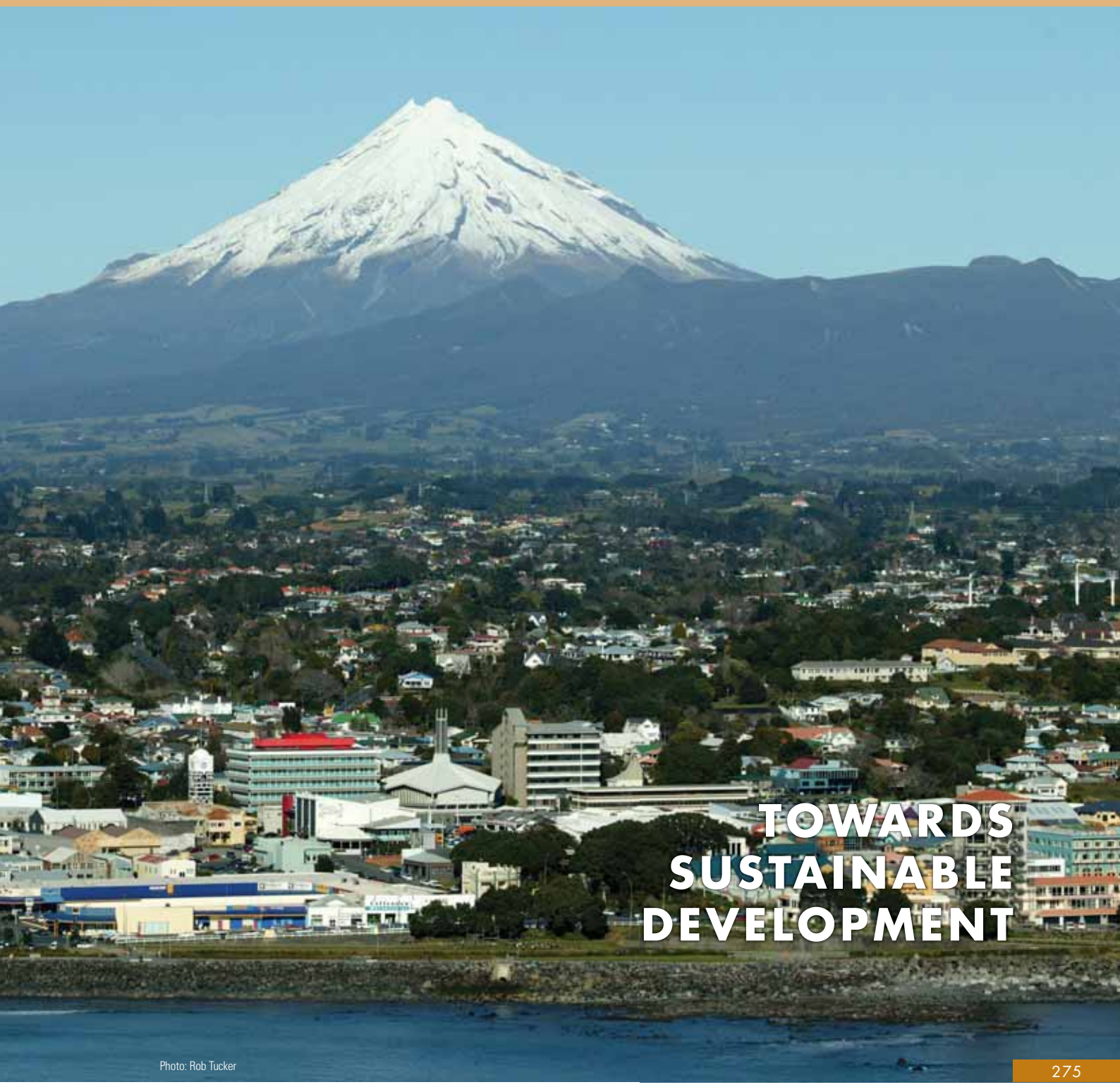
Pohokura offshore well-head platform.

Table 10.7 Energy used by region in different sectors of the economy.

Region	Energy used (PJ)	% energy used by sector				
		Agriculture	Commerce	Household	Industry	Transport & storage
Auckland	149.45	2.5	12.5	32.4	37.0	15.6
Bay of Plenty	35.36	7.4	8.4	29.0	42.6	12.6
Canterbury	57.87	5.8	11.6	35.3	29.3	18.0
Gisborne	4.77	14.7	9.4	38.8	21.2	15.9
Hawke's Bay	16.34	10.2	9.7	37.3	28.0	14.8
Manawatu-Wanganui	25.03	7.2	15.6	37.2	24.8	15.0
Marlborough	5.71	23.3	10.0	29.9	24.2	12.6
Nelson	8.28	18.4	8.0	21.5	17.6	34.5
Northland	15.69	16.1	9.1	37.2	24.5	13.0
Otago	22.01	8.0	13.0	36.0	27.0	15.9
Southland	30.02	6.3	3.7	13.0	68.6	8.4
Taranaki	**15.36**	**14.9**	**7.2**	**28.0**	**38.3**	**11.5**
Tasman	5.18	20.8	6.4	34.7	28.0	10.0
Waikato	47.47	14.0	9.1	32.0	30.1	14.9
Wellington	43.32	2.6	16.9	41.3	25.6	13.6
West Coast	5.18	24.5	9.3	25.7	22.8	17.6
New Zealand	**487.07**	**7.2**	**11.2**	**32.4**	**34.1**	**15.0**

Note: Household includes household transport. Data sourced from the Energy End Use Database, EECA.

CHAPTER 11



TOWARDS SUSTAINABLE DEVELOPMENT

Photo: Rob Tucker

WORKING WITH PEOPLE, CARING FOR THE ENVIRONMENT

The purpose of this document is to report to the community on the state of the environment in the Taranaki region and to record changes since the Council's last state of the environment report in 2003[1].

The majority of the environmental indicators reported on here demonstrate that environmental quality and overall sustainability in the Taranaki region remain high. Significant progress has been made on a number of issues since the last report. Some issues continue to require priority attention and strategic action from the Council into the foreseeable future, but these are considered to be manageable with continued targeting of appropriate resources to the task.

Over 92% of the region's land and soil resources are sustainably managed, with 87.4% of the hill country now used sustainably with no significant soil erosion problems. The Council continues to make good progress in promoting, in partnership with landowners, sustainable land management in the hill country. At the time of the last report, the Council had prepared farm plans covering 28% of the privately-owned hillcountry land. That figure now stands at 58%.

The *Regional Soil Plan*, made operative in 2001, addresses soil erosion issues in Taranaki with the sustainable land management programme supporting hillcountry farmers to farm in a sustainable way. The Council will continue to monitor soil erosion in Taranaki.

Taranaki is fortunate in having soils that have very low to moderate vulnerability to soil compaction, so problems of soil compaction only occur under wet winter conditions and are generally reversible with appropriate pasture and stock management. The *Regional Soil Plan*, includes policies and methods to address soil health issues in Taranaki. Actions include working directly with landowners on sustainability issues.

The Council's database shows there are few confirmed contaminated sites in Taranaki. The Council has investigated 757 sites in order of priority and 16 sites have been remediated or are currently managed so that any levels of contamination no longer pose an unacceptable environmental risk. Hazardous substances are managed under the Hazardous Substances and New Organisms Act 1996, and discharges under the Resource Management Act 1991. Council inspects industries and businesses to assess compliance with regulations under these acts.

About 20% of the region is set aside as public conservation land and managed by the Department of Conservation to safeguard biodiversity values. Programmes are targeted by a range of agencies and community groups at maintaining or enhancing the biodiversity of the region. These include protecting areas of indigenous vegetation remaining on private land through QEII covenants; undertaking predator control programmes, aimed at protecting threatened fauna; planting both native and exotic flowering and fruiting trees in the city to attract birds; weeding coastal cliffs to protect threatened plants; maintaining low possum levels through the Council's self-help possum control programme on the ring plain and by the Department of Conservation programmes in conservation areas; and restoring areas of riparian or wetland vegetation.

Council staff discuss possum control with a farmer.

Taranaki is also fortunate to have rivers and streams that are short and fast so water quality is better than might be predicted given the highly intensive land uses of the region.

The quality of Taranaki's fresh water has been monitored by the Council through a state of the environment monitoring programme. This has shown that measures of ecological health, such as the communities of invertebrates living in streams, are good to excellent in the upper catchments where there is more stream bank vegetation cover but only fair further down the catchment where land use is more intense. Over the past 12 years, ecological health has demonstrably improved, including a number of sites in the middle and lower reaches of catchments, and has not demonstrably deteriorated at any sites. The region's fresh water usually meets the bacteriological guidelines for swimming, although at certain times of the summer (immediately after a flood event) or in certain catchments (such as the small intensively farmed catchments) water quality may not meet national guidelines. Measures of levels of organic pollution (BOD), bacteriological pollution (faecal coliforms and enterococci) and toxicity (ammonia) are now stable regionally, after past improvements. The region's water quality comfortably meets guidelines for dissolved oxygen and clarity. Taranaki rivers are naturally high in phosphorus and so do not meet national guidelines, furthermore levels of phosphorus are generally deteriorating. Nitrogen levels meet guidelines in the upper reaches of catchments, but not further down, where impacts of agriculture are more intense.

The *Regional Fresh Water Plan*, made operative in 2001, contains policies, methods and rules to maintain and enhance water

1 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region – 2003.*

quality in Taranaki. Council officers regularly monitor for compliance with the plan and resource consents, undertaking enforcement action where necessary. Management highlights over the past five years include a decline in the number of point source discharges to surface wastewater from 1,612 in 2003 to 1,413 in 2008, significant investments made by agriculture, industry and the community in waste water treatment and disposal systems, and the high rate of compliance with consent conditions with rates averaging 96% over the past five years.

There has been a significant growth in the Council's riparian management programme – 2,009 riparian plans have now been prepared (treble the number of plans that had been prepared by 2003) covering a total of 10,818 km of stream bank, and 1.3 million riparian plants have been provided at low cost to riparian plan holders since 1997. However, implementing riparian plans by landowners has been slow with only an additional 504 km of stream bank having been fenced, and 426 km of stream bank planted. Taking into account existing fencing, however, it does mean that 60% of Taranaki's stream bank on the ring plain is fenced, and 43% is vegetated.

Taranaki is well-endowed with water with over 530 named rivers and streams. The equivalent of 194 Olympic-sized swimming pools of water per day is allocated for abstraction from Taranaki rivers and streams. Most of this is used for municipal and rural water supply schemes but interest in pasture irrigation is increasing, particularly in the coastal and southern areas of the region. More than 20% of the average low flow is allocated for use in nine rivers, but flows at which abstraction must cease are set to safeguard ecological values.

The *Regional Fresh Water Plan* contains provisions to manage water use to protect aquatic life and other values. The Council consults with the community and affected parties on this. Measures are required to mitigate or reduce the environmental effects of water use and these are closely monitored by the Council.

Groundwater quality and quantity in Taranaki is generally very good. Relatively low levels of groundwater use mean that the system is not over-allocated or stressed, although groundwater abstraction is increasing. Of the 68 groundwater wells monitored, 94% had nitrate levels that met national drinking water standards. Nitrate levels have been found above the guidelines in a few wells tapping into shallow aquifers in South Taranaki, but overall groundwater quality in terms of nitrate levels is generally improving.

Over the past five years regionally significant wetlands have on the whole been adequately protected through formal mechanisms and proactive protection works such as fencing and planting. However, small wetlands and streams are under threat from land development. Of 108 structures that have the potential to impede fish passage, 49 provide adequate fish passage, two have been removed and the others need remedial work. Since 2001 fish passage has been improved over 12 structures.

Freshwater biodiversity is managed through provisions in the *Regional Fresh Water Plan* for land drainage, protection of regionally significant wetlands and provision of fish passage past structures.

Working with tangata whenua is an essential part of managing our environment.

Taranaki is also fortunate to have an exposed coastline which ensures excellent bathing water quality. Forty-three consents are held for discharges to the coast, but of these there are now only six major community or industrial treated wastewater discharges direct to coastal waters, and significant improvements continue to be made in terms of waste treatment and disposal systems. Now, the greater influences on coastal water quality are the rivers and streams discharging to the sea, carrying with them the cumulative effects of land use within their catchments. This is most noticeable from catchments draining the more erodible hillcountry rivers.

Taranaki has an active, high-energy coastline with natural erosion occurring at numerous points. Since the *Regional Coastal Plan* became operative, 238 coastal permits have been issued, reviewed or varied for activities in the coastal marine area and 96 new consents have been granted since 2003. Most coastal permits are for coastal protection works and stormwater structures with an estimated 11.6 km of seawall built to protect the region from coastal erosion (about 2 km of this has been over the past five years).

The *Regional Coastal Plan*, contains policies and methods to protect the high water quality and natural character of the Taranaki coast. Again, the Council works with resource users, affected parties and the wider community to help achieve this.

Coastal biodiversity is monitored by the Taranaki Regional Council (estuaries and rocky shore communities), the Department of Conservation (marine protected areas and threatened marine mammals), the Ministry of Fisheries (fish stocks) and the Ornithological Society (birds). These programmes have found that ecological conditions in both the Tongaporutu and Waitōtara estuaries, and along rocky shore reefs, are generally stable and more than 70 different species of birds use the monitored estuaries (which include two Waikato region estuaries). The legally protected subtidal habitats around the Sugar Loaf (Ngā Motu) Islands provide shelter for a greater diversity, and higher numbers, of fish and other organisms than neighbouring areas of reef. Extensive reef ledges in North Taranaki, now protected under a marine reserve, support a highly diverse collection of rare and exotic sponges.

Coastal and marine biodiversity is managed by a number of agencies operating under various pieces of legislation. Coastal biodiversity

protection has been enhanced recently with the establishement of two new marine reserves. It is safeguarded through the *Regional Coastal Plan*, the fisheries quota management system, and through the setting aside of marine reserves or marine protected areas.

In the previous state of the environment report it was noted that on the basis of national guidelines, air quality in Taranaki is rated as excellent. Given that there are no significant widespread pressures on air quality, levels of monitoring of general air quality have been reduced, although the Council still carries out comprehensive monitoring of consented activities. Consent conditions are generally more stringent, reflecting better control options and heightened community expectations, and so major air discharge permit holders continue to make significant investments in emission controls and production technology.

The *Regional Air Quality Plan*, made operative in 1997, contains policies, methods and controls to maintain and enhance air quality in Taranaki and is in the process of being formally reviewed, in consultation with the community.

The Government and other members of the international community are addressing climate change through a range of initiatives, including actions to implement the Kyoto Protocol. Initiatives at the regional level include management of point source emissions through the *Regional Air Quality Plan*, and advocacy for sustainable land management which may lead to increased numbers of trees which will mitigate greenhouse gas emissions.

Issues in this report concerning natural features and landscapes, and amenity and heritage values, are largely the domain of the district councils. This report shows such features to be of a high quality in Taranaki and recognised and provided for in both district and regional plans.

Taranaki is subject to a range of natural hazards, the most significant of which are flooding, volcanic activity, earthquakes, high winds and land instability. The Council operates an extensive water level monitoring and flood warning system, as well as wind and rainfall recorders. In addition, eight seismometers (instruments used to measure earthquakes) are located around Mount Taranaki to monitor potential volcanic activity. Over the past five years monitoring has shown no volcanic activity, four significant flood events and a number of minor events. Each year in Taranaki, on average, 200-300 minor earthquakes were recorded. The swarm of tornadoes that hit Taranaki in July 2007 triggered a declaration of a state of emergency. The emergency response systems functioned well and the Taranaki community rallied around to help.

Both regional and district plans identify natural hazards and contain controls to reduce hazard risks. Significant hazards and risks to be managed by the Taranaki Civil Defence Emergency Management Group are identified in the *Taranaki Civil Defence Emergency Management Plan*. A volcanic strategy has also been prepared and updated. The Taranaki Regional Council has prepared and updated a flood event standard operating procedure. Community awareness and education of natural hazards and responses are carried out.

Riparian planting. Taranaki Regional Council Chairman David MacLeod, Fonterra Shareholders Chairman Blue Read and Shareholders Council member Shona Glentworth.

In our increasingly consumer-driven society, with its throwaway philosophy, the management of waste is a major issue, with the challenge being to find new uses for materials no longer required (i.e. recycling) or to find ways of cutting down on the quantity of materials that end up being discarded (i.e. minimising the amount of waste generated). There is also a need to ensure that large volumes of waste can be safely disposed of. The whole Taranaki region is now serviced by just one well managed landfill, at Colson Road in New Plymouth, but the quantity of waste discharged to the landfill has increased by 20%. Increasingly wastes are discharged to cleanfills, which have increased in number from 13 (in 2003) to 23, and council kerbside recycling collections have expanded in the region with a kerbside green waste collection now being offered in South Taranaki. Since 1991 the Council has collected and disposed of more than 40 tonnes of redundant, unknown or hazardous wastes.

The *Regional Waste Strategy* has been prepared and adopted by all four councils in the region. The Strategy provides specific waste minimisation and management goals for local authorities, industry and the community on matters relating to waste minimisation, hazardous wastes and waste disposal.

Finally, in relation to energy, Taranaki produces energy from both non-renewable fossil fuels (oil, gas, coal) and from renewable sources such as water (hydroelectricity), wind, solar or biomass. Taranaki uses 3.2% of the total energy consumed in New Zealand with industry using 38% of all energy consumed in Taranaki and with households consuming the next greatest proportion (28%). 477 resource consents have been issued by the Council relating to petroleum exploration activities over the past five years and 48 relate to production stations. Four hydroelectric power generation

schemes in Taranaki can produce up to 47 megawatts. Taranaki has currently no wind farms, although one is proposed in South Taranaki.

Energy production and use are primarily managed by Central Government (e.g. the Ministry of Economic Development). Two national-level strategies guide energy development, transmission and use: *The New Zealand Energy Strategy to 2050* and the *Energy Efficiency and Conservation Strategy*. At the local level, energy, and effects associated with the production of energy, are managed under the *Proposed Regional Policy Statement*, and regional and district plans.

Many of the programmes described in this report have relied on a combination of methods. The Council has continued to implement its suite of regional plans prepared in the late 1990s. These contain formal policies and rules to manage the adverse environmental effects of activities. Resource consents issued in accordance with the plans are monitored and enforced. This is a necessary part of effective environmental management and the Council places considerable emphasis on compliance with the conditions of resource consents to ensure that acceptable environmental standards are maintained in the use and development of our natural and physical resources.

The overall approach of the Council to all of its environmental work, however, is encapsulated in its slogan "working with people, caring for our environment". The Council has continued to give effect to this slogan and to strengthen it further in the past five years by getting alongside farmers, landowners, industries and individuals and taking practical actions to protect and improve the environment. This can be seen not only in the sort of actions taken to continuously improve environmental performance through the resource consent process, but also in the efforts of the Council and the community in the very significant voluntary programmes run by the Council such as its riparian and sustainable land management programmes. The Council is set to expand its voluntary programmes further in the area of biodiversity protection and enhancement following a review of biodiversity policy and adoption of a *Biodiversity Operational Strategy* in 2008.

The ability to successfully develop effective programmes that involve partnerships, facilitation and advice, instead of a major reliance on rules to force change, has been due to a continuation of positive shifts in environmental awareness and responsibility over the past decade or more, and which was noted in the Council's 2003 *State of the Environment Report*.

SUSTAINABLE DEVELOPMENT: THE PATH TO A SUSTAINABLE FUTURE

Another way of looking at our level of sustainability is to examine the ecological footprint of the region which is the total amount of productive land required to support a given population. Using this definition, Taranaki was included among the best performing regions, and was below the New Zealand average, in a recent study on the ecological footprint of regions throughout the country. This suggests that the region's population is living within the carrying capacity of the land and not in an ecological deficit situation[2].

Sustainable development means looking after the environment for future generations.

The combined effect of all the actions noted in the preceding sections of this report represents a significant step along the path to sustainable development, which meets the needs of the present without compromising the ability of future generations to meet their own needs[3].

The New Zealand Government has endorsed the concept of sustainable development for New Zealand as the foundation for enhancing the well-being of people and the environment[4]. Sustainable development involves looking after people, taking a long-term view so that each generation plans for the next generation and takes into account social, cultural, economic and environmental dimensions. In short, sustainable development is best understood as a balanced, integrated approach to development that ensures we look after people and the environment now and in the long term.

The international community has agreed that governments cannot achieve sustainable development on their own. Any progress depends on the efforts of primary producers and industry, Local Government, communities and other sectors of society – each has its strengths and particular contributions to make. Local Government is seen as playing a pivotal role in educating, mobilising and responding to the public to promote sustainable development because it is the level of governance closest to people. This is reflected in New Zealand's own Local Government Act 2002 which has an expectation that local authorities will play a broad role in promoting the social, economic, environmental and cultural well-beings of their communities by taking a sustainable development approach[5].

Local authorities are required to include in their long term council community plans an outline of how they will work with other local and regional organisations, Māori, Central Government, non-Government organisations and the private sector, to further the community outcomes desired for the future of the region or district.

This reflects international approaches where practical actions based on participation and commitment from all parties at the local level are essential for building sustainable economies and communities. It also recognises that working in partnership with people is more conducive

2 McDonald G, & Patterson M, 2003. *Ecological Footprints of New Zealand and its Regions*. Ministry for the Environment, Environmental Reporting Technical Paper.
3 World Commission on Environment and Development, 1987. *Our Common Future*. The Commission's definition of sustainable development is widely used internationally.
4 New Zealand Government, 2002. *The Government's Approach to Sustainable Development*.
5 Local Government Act 2002 Section 3

Table 11.1: Community investment in the environment in Taranaki 2002-2007[6].

Taranaki Region ($ Million)	Capital Cost		Annual Operating Cost	
	1997-2002	2002-2007	1997-2002	2002-2007
Surface Water				
Community	$16.1	$83.4	$10.0	$21.7
Agriculture	$5.1	$7.2	$0.9	$1.5
Industry	$26.7	$16.3	$1.7	$1.3
Sub-Total Surface Water	**$47.9**	**$106.8**	**$ 12.7**	**$24.5**
Air				
Community	-	$0.0	-	$0.0
Agriculture	-	-	-	-
Industry	$18.2	$48.7	$1.6	$0.8
Sub-Total Air	**$18.2**	**$48.7**	**$1.6**	**$0.8**
Land				
Community	$7.9	$4.7	$4.2	$8.7
Agriculture	-	$12.3	-	-
Industry	$14.0	$32.0	$1.5	$1.5
Sub-Total Land	**$21.9**	**$49.1**	**$5.7**	**$10.2**
Energy				
Community	-	-	-	-
Agriculture	-	-	-	-
Industry	-	$7.1	-	$0.8
Sub-total Energy	**$0.0**	**$7.1**	**$0.0**	**$0.8**
Environment Services				
Community	-	-	$5.9	$4.2
Agriculture	-	-	-	-
Industry	$3.2	$4.9	$3.0	$1.3
Sub-Total Environment Services	**$3.2**	**$4.9**	**$8.9**	**$5.5**
Total Community	$24.0	$88.0	$20.1	$34.6
Total Agriculture	$5.1	$19.5	$0.9	$1.5
Total Industry	$62.0	$109.1	$7.8	$5.7
Total	**$91.1**	**$216.7**	**$28.8**	**$41.8**

6 Business & Economic Research Ltd has indicated that the investments figures provided are conservative.

to building co-operation and commitment than working in isolation. This is why many of the policies and programmes described in this report represent a step along the path to sustainable development in Taranaki. They represent an attitude of 'doing' – of taking action on practical initiatives for the environment. This is a significant shift in approach from the 1970s when increasing levels of regulation were applied to address the pressures being placed on the region's natural resources. The Council still applies rules and regulations as these provide certainty and clarity for everyone as to the environmental standards required. However, with increasing understanding and goodwill, the Taranaki community has continued to embrace environmental stewardship. Successive councils have taken up the challenge to work with the community to achieve outcomes that are sustainable in the long term.

Taranaki's generally high-quality environment has been maintained, and in many instances enhanced, through these efforts, despite continuing economic development and intensification of resource use. Again, this has not been achieved by accident or by good luck but by the combined efforts of industry and agriculture and the community at large.

The *2003 State of the Environment Report* included an independent economic analysis of the level of spending by the Taranaki community on environmental protection and enhancement over the previous five years and earlier. The Council commissioned a repeat of that work to provide up-to-date information on the level of investment being made on the environment in Taranaki in the past five years. The results have shown capital investment by the Taranaki community in excess of $216 million in the period 2002-2007 compared with $91 million in the preceding five-year period. Annual operating costs are of the order of $41.8 million ($28.8 million in the proceeding four-year period). Total spending on the environment by the Taranaki community has been conservatively estimated at $85.1 million per annum[7] (Table 11.1). This is an increase of $28 million per annum from the $57.1 million per annum reported in our 2003 report.


Rob Tucker

Opening a new farm dairy on a PKW farm.

A QUESTION OF BALANCE

How can we maintain and expand agricultural production while at the same time protect and enhance environmental quality?

That is one of Taranaki's big sustainability questions. And for the Parininihi Ki Waitōtara Incorporation (PKW), the answer in today's modern business world lies in traditional and timeless kaitiakitanga.

This is more than just words. PKW's practical brand of kaitiakitanga is backed with serious money.

For example, its subsidiary PKW Farms Ltd spent $120,000 on a 22 m centre-pier bridge on one of its Taranaki dairy farms, as part of wider efforts under its land management plan to protect waterways. So committed is PKW to these efforts that it is considering a Memorandum of Understanding with the Taranaki Regional Council agreeing to meet the *Dairy and Clean Stream Accord's* regional targets for riparian protection early.

Formed in 1976, PKW looks after the interests of the 8,000 owners of some 20,000 ha of West Coast lease land between Parininihi in the north and Waitōtara in the south. About 2,400 ha of this is dairy land, operated as 13 farms with 50:50 sharemilkers milking about 7,000 cows.

Besides riparian fencing and planting, and replacing fords with bridges, PKW Farms Ltd is fencing native bush remnants and encouraging regeneration – so successfully at one site that a former farmhouse has been transformed into a tourist lodge and corporate retreat.

It is replacing substandard effluent ponds with spray irrigation systems that allow aerobic, ultra-violet sterilisation of the effluent, with no surface run-off into creeks.

PKW is also installing road underpasses, at about $60,000 each, to keep the solid waste off public roads and prevent disease transfer by vehicles.

All this environmental care and stewardship that is the essence of kaitiaki duties has taken place against a backdrop of increased milk production. PKW Farms Ltd and its sharemilkers are producing at well above the region's average, with the farms expected to overwinter 7,000 cows, and produce 2.3 million kgs of milk solids, an average of about 1,077 kgs/ms per hectare.

"PKW is committed to be a leader in the field of on-farm environmental protection and restoration,' said the Chairman, Spencer Carr. "The continuation of the land management plan will see PKW become a state-of-the-art on-farm dairy producer, with a scale that will make it potentially significant in the international market.

"This scale and commitment to leading technology and environmental management means that PKW Farms Ltd can create a base for enlightened processing and innovation in the range of dairy products, from foods to health and sport supplements and medical remedies."

7 Wu, J. Sanderson, K. 2008. *Community Investment in Environmental Improvements in Taranaki.* Prepared by Business and Economic Research Limited for the Taranaki Regional Council.

Environmental monitoring by schools increases environmental awareness and understanding.

These levels of investment represent a significant commitment by the Taranaki community to the maintenance of the high-quality environment that we all enjoy. Much of what has been achieved is the result of proactive initiatives supported and encouraged by the Council and the wider community.

Harnessing the commitment of all sectors to a sustainable future is the way forward. The Council will continue to work within and alongside the people of Taranaki to this end.

WHERE TO FROM HERE?

This report is the third state of the environment report to be prepared by the Council. It builds on the findings of the *2003 State of Environment Report* and the *1996 State of the Environment Report*. It makes extensive use of information gathered from specified state of the environment monitoring programmes established in 1995 and earlier, and from monitoring programmes undertaken by other agencies and community groups. State of the environment monitoring is a core function of the Council. Accurate trend analysis and early warnings of issues require a long-term, focused and scientifically-designed monitoring programme. The Council has committed resources to have an appropriate programme in place into the long term as evidenced in its *Long Term Council Community Plan*.

The Council will continue to report on the state of the environment, through various media such as annual reports, reports on special investigations and research, or on particular aspects of the environment and through the Council's *Recount* newsletter and via the Council's website[8].

If readers require further information about any of these issues or information presented in this report, staff of the Taranaki Regional Council are happy to assist.

The Taranaki Regional Council welcomes and encourages feedback on the issues discussed in this report – phone 06 765 7127, email: info@trc.govt.nz or visit the Taranaki Regional Council at 47 Cloten Road, Stratford.

8 www.trc.govt.nz

Taranaki Regional Council
Working with people, caring for our environment

Private Bag 713
47 Cloten Road
Stratford
New Zealand
www.trc.govt.nz
Phone 06 765 7127
Fax 06 765 5097
Email info@trc.govt.nz

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