

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.

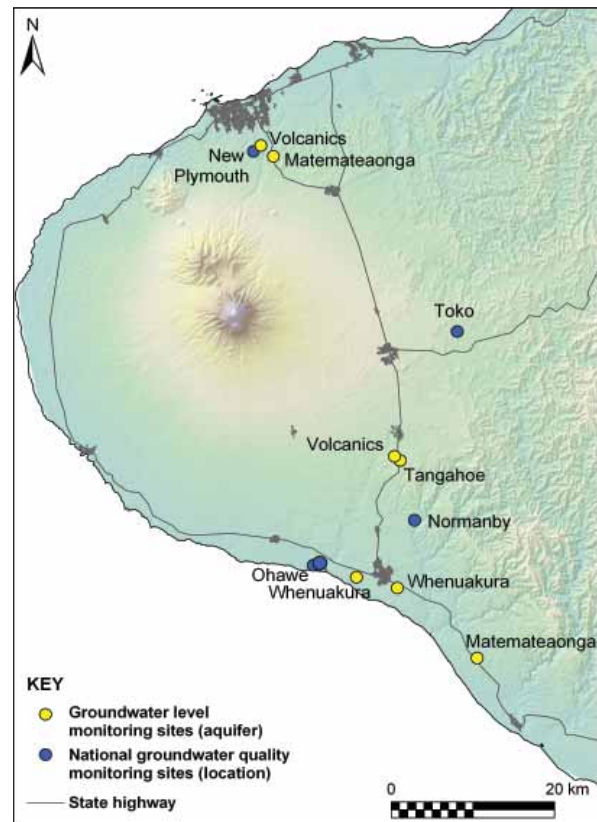


Figure 4.31: Location of groundwater level and groundwater quality monitoring sites.

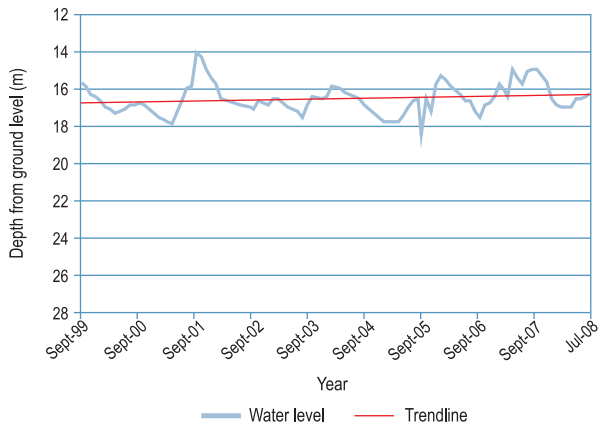


Figure 4.32: Example of water levels in a shallow aquifer, Taranaki Volcanics aquifer at Eltham.

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 m³ 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 m³ a day.

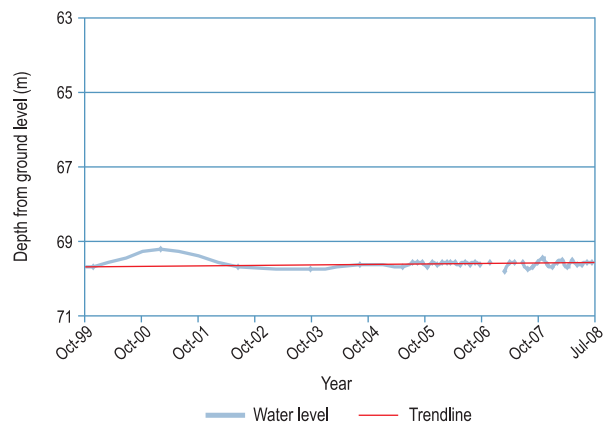


Figure 4.33: Example of water levels in a deep aquifer, Matemateāonga aquifer, in New Plymouth.

There are currently 81 resource consents to abstract groundwater in the Taranaki region. The total consented allocation of groundwater is 44,022 m³ day, up from 22,299 m³ per day reported in 2003⁵⁹. 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 m³ 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

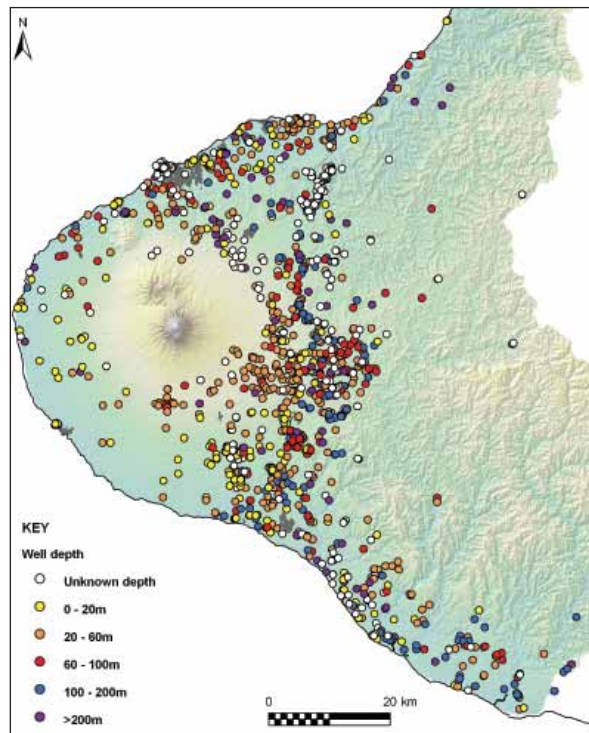


Figure 4.34: Location of groundwater bores.

59 Taranaki Regional Council, 2003. *Taranaki – Our Place, Our Future. Report on the State of the Environment of the Taranaki Region – 2003*.

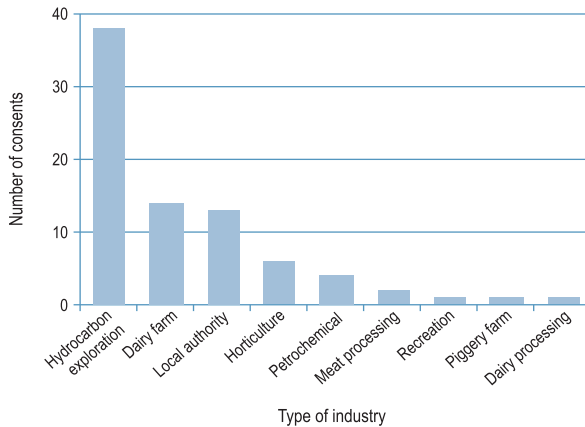


Figure 4.35: Groundwater allocation by use category.

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

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



Ground water monitoring.

and 35% of the average annual recharge for other types of aquifers⁶⁰. 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.

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 Taranaki groundwater.

Groundwater quality from the region's three major freshwater aquifers has been monitored on a quarterly frequency since 1994 at five sites⁶¹ (Figure 4.31). Health-related maximum allowable values and aesthetic

guideline values related to taste, odour or colour have been developed⁶². 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 groundwater⁶³. 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 reducing 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 Taranaki⁶⁴ 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.

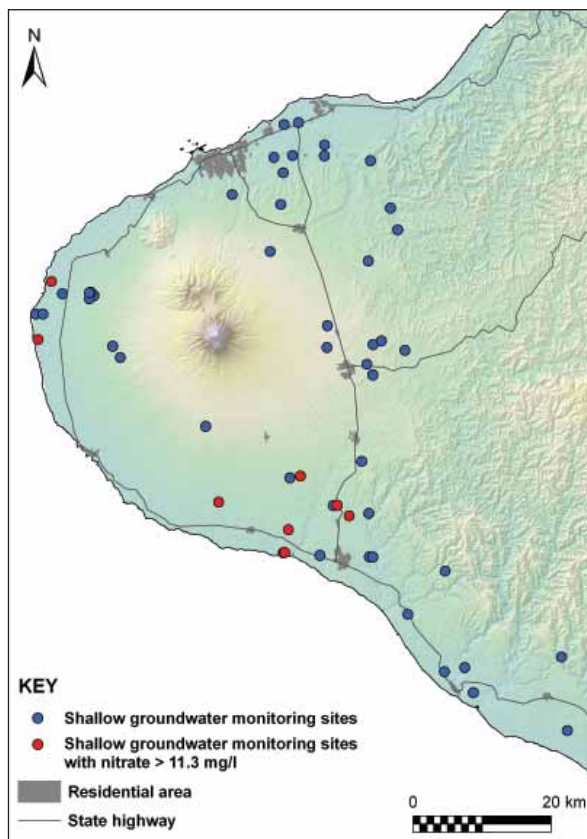


Figure 4.36 Results of nitrate sampling.

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 residues⁶⁵. 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 trends⁶⁶. 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 m³ per day without a resource consent, provided certain conditions safeguarding the environment are met. This



Council staff meeting with drillers.

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



Bore drilling.

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 2006⁶⁷. 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 Environment⁶⁸. 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.	<ul style="list-style-type: none"> • Sustainable use, development and protection of groundwater. • Maintain and enhance groundwater quality. 	<ul style="list-style-type: none"> • Implementing the <i>Regional Fresh Water Plan</i>. • Controlling groundwater abstraction and drilling. • Controlling discharges to land. • Monitoring groundwater levels and quality. • Providing information and advice on groundwater resources and drilling. 	<ul style="list-style-type: none"> • <i>Regional Fresh Water Plan</i> 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 4.27: 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.

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