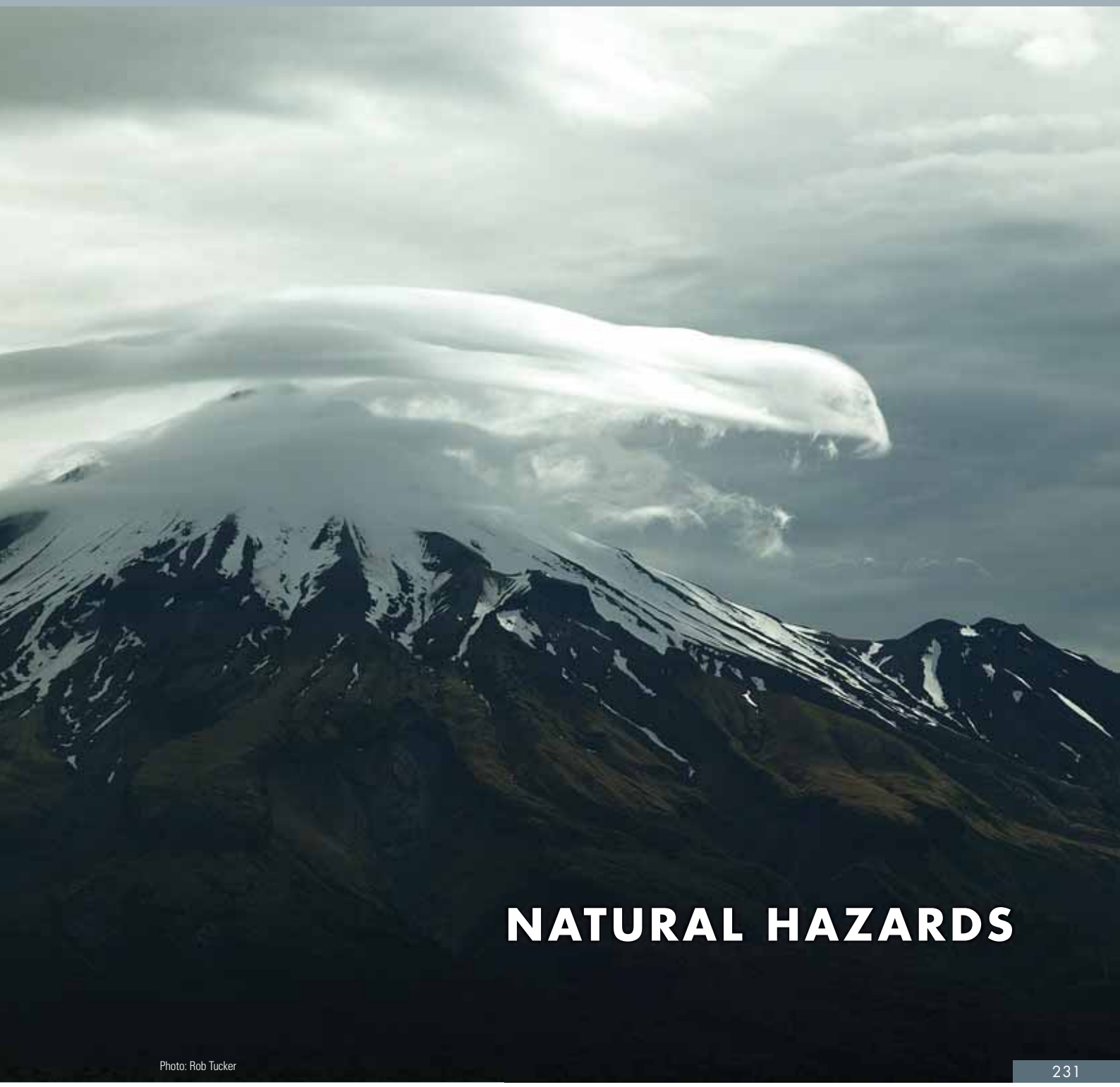
CHAPTER 8



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].

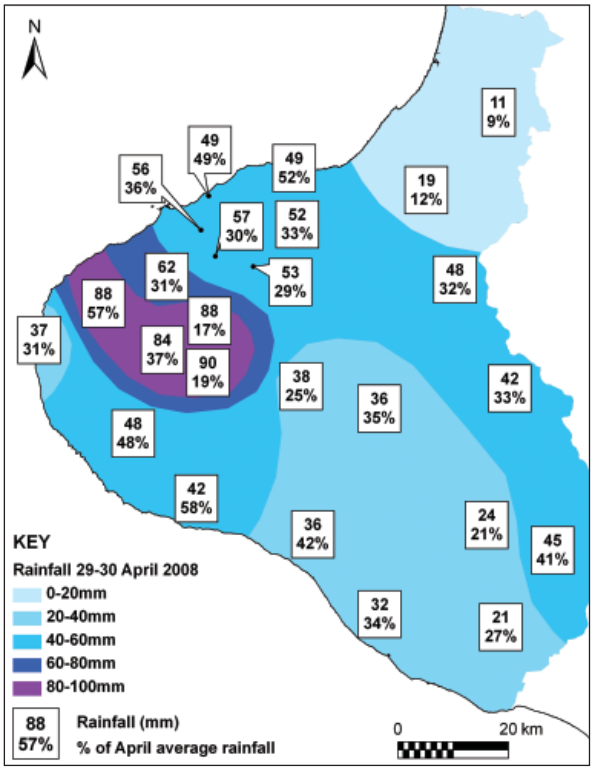


Figure 8.1: Rainfall event of April 2008.

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.

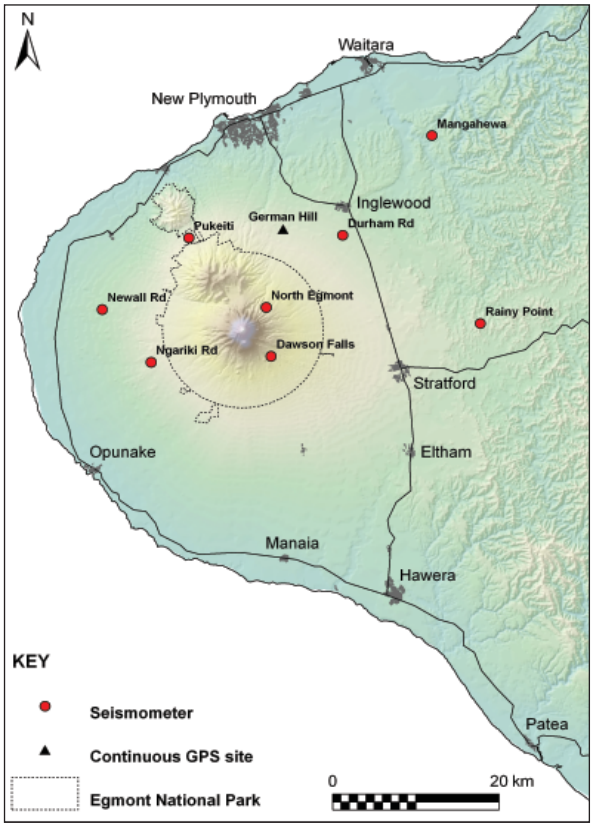


Figure 8.2: Location of earthquake monitoring sites.

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.

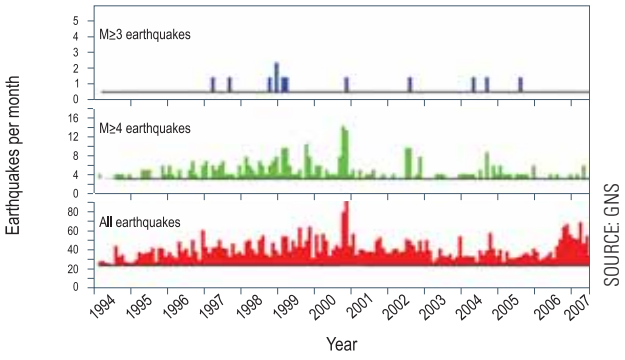


Figure 8.3: The number of earthquakes recorded in Taranaki from January 1994 to June 2007. All detected earthquakes are shown in the lower graph, those of magnitude 3 and above (centre) and those of magnitude 4 and above (top).

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.

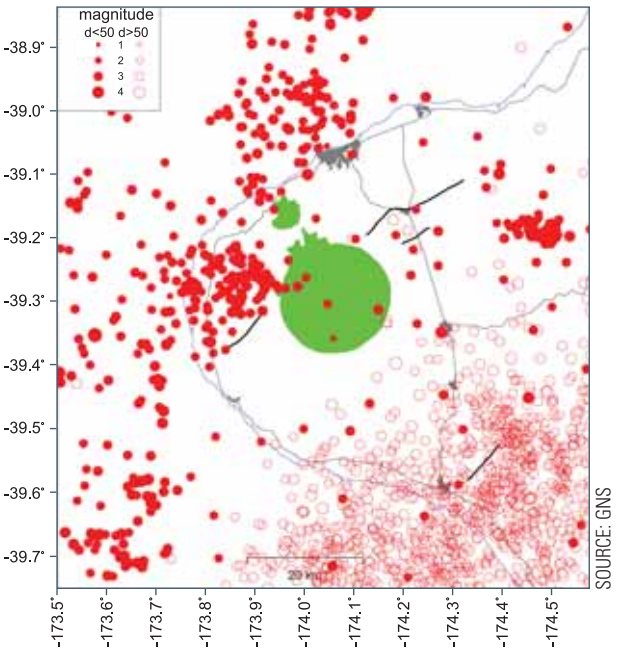


Figure 8.4: Earthquakes of magnitude 2.7 and larger in Taranaki between January 1994 to June 2007. Closed circles indicate earthquakes less than 50 km deep and open circles are those more than 50 km deep. The larger the circle the greater the magnitude.

(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."

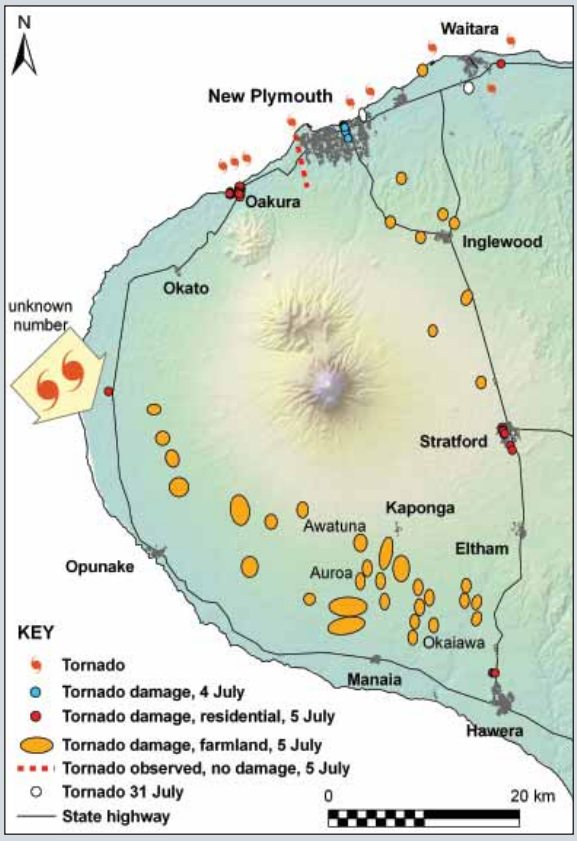


Figure 8.5 Location and path of tornadoes across the Taranaki region.

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.

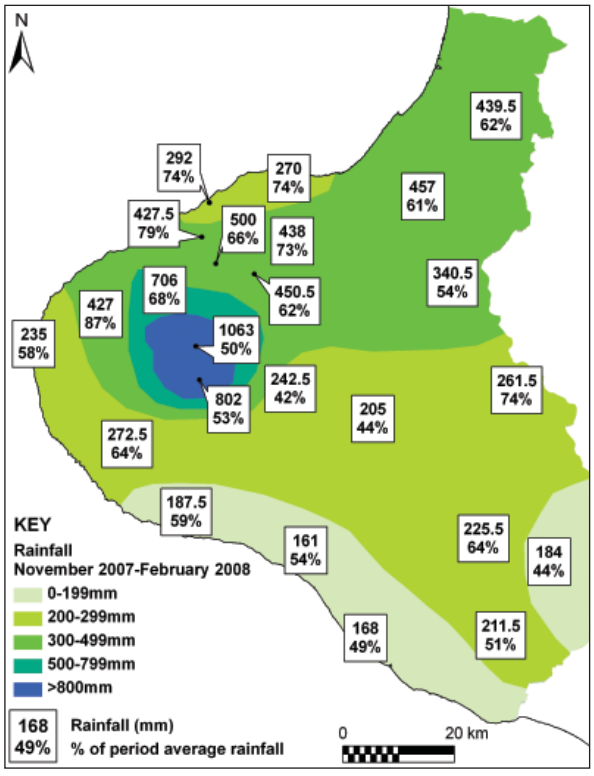


Figure 8.6: Map of rainfall between Nov 07 – Feb 2008 .

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.