

Managing natural hazards in the Hawke's Bay, New Zealand

Introduction

The region of Hawke's Bay lies on the East Coast of the North Island of New Zealand covering a land area of 1,416,336 hectares. It is arguably one of New Zealand's warmest regions, with surf and sun, vineyards and orchards and a range of outdoor adventures from windsurfing to trout fishing. In addition, the Hawke's Bay houses some of the most concentrated collections of Art Deco and Spanish Mission architecture anywhere in the world. Top that with views over the sparkling Pacific Ocean, fresh produce from the hinterland, friendly people, productive rural communities and an abundance of sparkling aquifer water and you know why 143,240 people (1996 census) have chosen to make Hawke's Bay their home.

Despite the many attractive reasons that Hawke's Bay is a great place to live, it is also a region that is often impacted by the forces of nature, whether it is in the form of earthquakes, flooding, drought, or volcanic eruptions (Johnston & Pearce 1999). Moreover there have been numerous significant events in the past, which have highlighted the community's vulnerability to these hazards. The following snapshot outlines Hawke's Bay's substantial history of natural hazard adversity.

Historic events

In 1863 a magnitude 7.0 earthquake occurred in Hawke's Bay (with the epicenter located near Waipawa), causing numerous landslides, liquefaction and surface faulting. Several years later in 1904 a magnitude 6.7 earthquake centered off Cape Turnagain, caused damage to chimneys, buildings and roads throughout southern Hawke's Bay from Masterton to north of Napier. Following this, a significant earthquake of 7.0 magnitude occurred in Central Hawke's Bay in 1921.

In 1931 parts of Hawke's Bay were devastated by a magnitude 7.8 earthquake, which caused the loss of 256 lives and destruction and major damage to property. Tsunami were also experienced as a result of this earthquake. Along with assistance from outside the region, the Hawke's Bay community showed its resilience at the time by rebuilding itself

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and is thus the reason why the region is now internationally renowned for its architecture.

In 1932 a magnitude 6.9 earthquake, centred near Wairoa, damaged buildings in Wairoa and Gisborne and caused landslides and the collapse of the Wairoa River bridge. Following this event, another large 7.6 magnitude earthquake struck Pahiatua in 1934.

In May 1960 a distantly generated tsunami originating off the coast of Chile caused damage when it reached New Zealand shores. The tsunami wave broke gas mains and a footbridge in Napier and damaged and moved pleasure boats and buildings.

Volcanic ashfalls from Mount Ruapehu in the central North Island affected the region in 1945, 1975, 1995 and 1996, and ash from Tongariro reached the region in 1896.

Flooding and storms, the most frequent natural hazard events in Hawke's Bay, have impacted the region continually since it has been inhabited. Flooding occurred in 1867, 1893, and 1897 where 356mm of rain fell in Napier over four days. During this latter event the Ngaruroro River broke its banks and flooded Hastings, while the Tutaekuri River broke its banks and joined with floodwaters from the Ngaruroro River to flood Clive and Napier. Floods also occurred in the following years of 1917, 1924, and 1936. The 1938 Esk Valley floods produced widespread flooding after three days of heavy rain throughout the region with exceptional falls in some areas—in 3 days 610 mm fell at Tutira and a staggering 1,000 mm at Puketitiri (with 390mm in one day).

Further flooding occurred in the years of 1941, 1948, 1953, 1974, and 1980 where rainfall at Whanawhana was recorded at 157mm in 48 hours and the Ngaruroro River breached the stopbank at Twyford resulting in serious flooding. The latest significant episode of flooding was during Cyclone Bola in 1988 where the highest rainfall for the three day period was recorded as 635 mm at Pukeorapa. The township of Wairoa was flooded and extensive landslides throughout the region severely impacted farming.

The range of geological and meteorological natural hazards present in Hawke's Bay continues to pose a significant threat to the region and as our society becomes ever more complex the potential economic and social costs of disasters increase every year.

Understanding its risk

There are five local authorities in the Hawke's Bay, which include one regional council (Hawke's Bay Regional Council), and four territorial local authorities (Napier City, and Hastings, Wairoa and Central Hawke's Bay Districts) (*figure 1*). Under the Resource Management Act 1991, both the regional council and territorial authorities have responsibility to manage natural hazards, controlling the use of land for the purpose of avoiding or mitigating (reducing) natural hazards (*figure 1*). Local Authorities in Hawke's Bay

Until 1990 the Hawke's Bay community simply lived with the prospect of experiencing natural hazards and had responded to and recovered from the impacts of some very significant events, but the concept of risk was not fully understood. Recognising that hazard identification and risk assessment are the cornerstones of mitigation, and with the enthusiasm of a few visionaries in the region, local authorities in Hawke's Bay were among the first in New Zealand to recognise the need to understand more about the region's natural hazards. They believed that once they understood more about the risk with which the community was living, they could minimise the economic and social disruption. Therefore a joint initiative instigated a program of identifying and

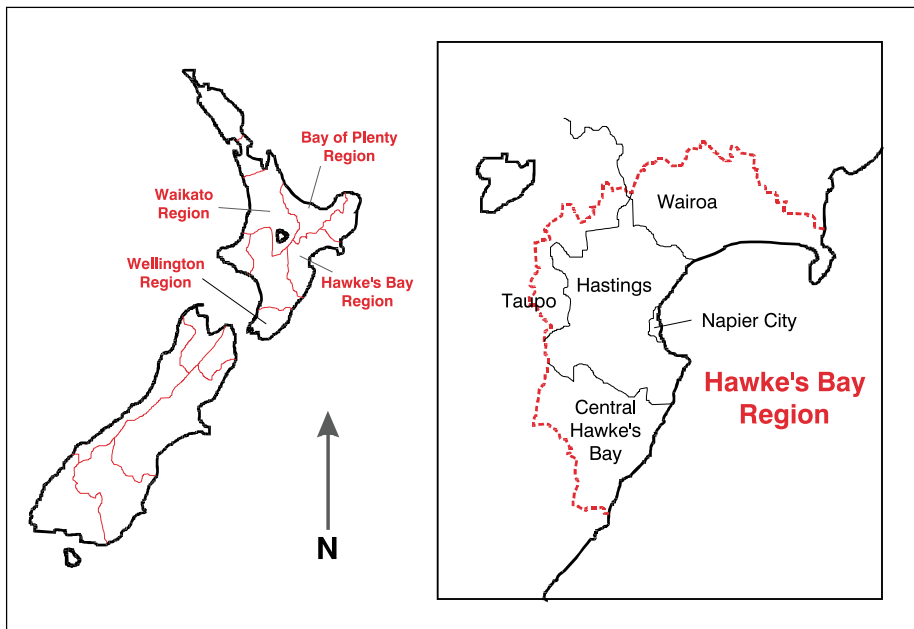


Figure 1: map of Hawke's Bay local authorities.

quantifying the more significant regional hazards, including earthquake, tsunami and volcanic hazards. This program (SNZ 600,000) was completed in 1998 (van Voorthuysen 1994), and local authorities have made a commitment to monitor and review its findings in the future.

Effective use of natural hazard information

The program produced a series of scientific natural hazard reports, which though extremely informative and revealing, were largely incomprehensible to the general community. As a consequence, the region still faced a two fold problem: how to better educate the general community about its risk and necessary mitigation; and how to effectively incorporate the natural hazard information into regional and territorial plans and policy statements to ensure implementation of essential natural hazards policy.

Community understanding

In 1999 the Hawke's Bay Regional Council produced one initiative — a publication entitled 'Natural Hazards in Hawke's Bay' (Johnston & Pearse 1999). The aim of this publication was to inform the Hawke's Bay community of their risk from natural hazards so that people, both individuals and organisations, could better prepare themselves, thus reducing any disruption that may result.

The publication presents information not only on the three more significant hazards: earthquakes, tsunami and volcanoes, but includes sections on flooding, landslides, coastal erosion and other meteorological hazards including high winds, snow, hail and drought. It discusses

general risk management principles and what individuals and organisations should do to prepare for the next disaster. It aims to present natural hazard information in an informative and interesting manner, and is full of glossy photographs and diagrams.

This publication has been provided free for use in Hawke's Bay schools, educational institutes and libraries, through sponsorship from the New Zealand Earthquake Commission. It is also available via the Hawke's Bay Regional Council's website (www.hbrc.govt.nz). The publication is now widely used by Civil Defence and Emergency Management staff in the region to educate individuals about hazards, and businesses and community organisations about

business continuance planning.

In 1998, the Hawke's Bay Regional Council assisted in establishing a group known as the Hawke's Bay Engineering Lifelines Steering Committee (Adey 2000). This group made up of regional infrastructural owners took on the challenge of risk assessment, essentially creating an inventory of existing structures in identified hazard areas to provide a basis for mitigation plans and priorities.

To further understand how the community may be affected by future hazard events several studies have been undertaken to assess the public's perceptions of hazards and their preparedness (Johnston *et al.* 1999, Ronan *et al.* 2001) (figure 2). This information can be used to evaluate the effectiveness of future mitigation and risk communication programs. It can also be used by emergency management professionals to assess community needs, develop strategies and plan the allocation and use of resources in preparing for future events.

Local Authority planning & policy

Planning in advance is one of the most effective means of avoiding or mitigating any adverse effects from natural hazards. A research project is currently underway to look at the different approaches of New Zealand local authorities when planning for natural hazards. The results will assist in defining which measures are successful with regard to natural hazard management in New Zealand and identifying the barriers to formulating and implementing hazard policies. The results from planning and policy research will have a direct application for regional and local authorities throughout New Zealand.

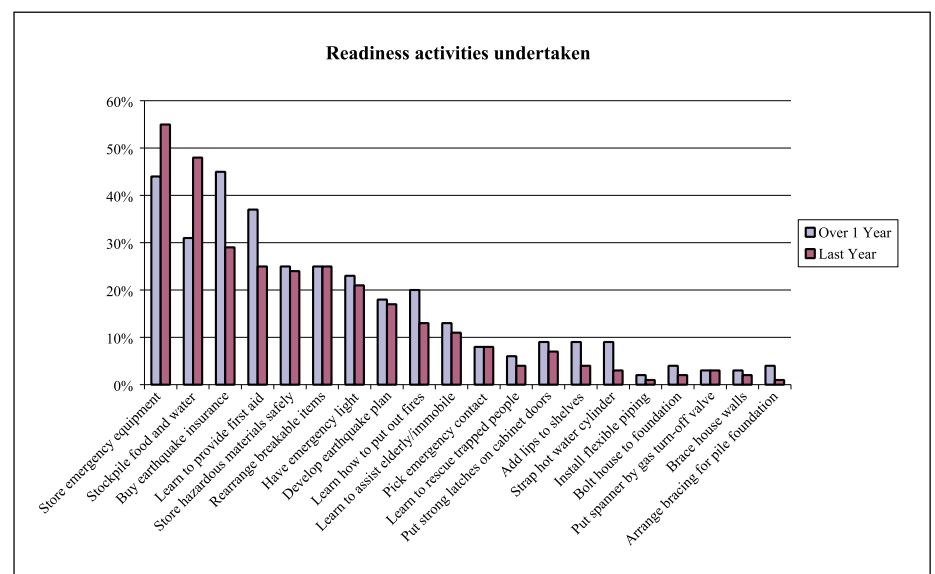


Figure 2: Readiness activities undertaken in the last year and over 1 year ago. Data from a 1999 survey of earthquake preparedness in the Hawke's Bay (Ronan *et al.* 2001)

For the project, an initial study was conducted, which involved analysing how twenty-four regional and district councils located in the Hawke's Bay, Bay of Plenty and Waikato regions address earthquake hazards (Becker and Johnston 2000). Future work will expand on the earthquake study and will involve looking at how authorities plan for a wider range of natural hazards. Hawke's Bay will be the first region to be involved in this wider research which will involve studying local plans and policy statements to look at their hazard content and interviewing staff at local and regional councils to collect information on the other influences of hazard policy adoption. From this, it will be possible to identify barriers to the effective implementation of natural hazard policy and compile a set of 'best practice' guidelines for natural hazards.

Continuing research

Despite the improvements in our knowledge of natural hazards and their risk, much is still to be learnt. An integral part of Hawke's Bay's hazard management strategy is sound research. The regional council and local authorities are working in partnership with Crown Research Institutes, universities and other research providers to continue research into the wide range of hazards, their effects and management. This includes support not only for physical sciences but also the social sciences.

One of the keys to improving future risk assessments is exploiting the power of Geographic Information Systems (GIS) by integrating data on the natural, built and social environments to generate new information based on the interaction between a multitude of layers. This work has already commenced with the Hawke's Bay Engineering Lifelines study and is a natural progression for the region, following on from the past decade's hazards identification work. Further project work of this sort will allow the councils to explore in more detail consequences of events and evaluate the impact of mitigation measures and policy changes.

Summary

For hazard management strategies to be effective the hazards must be well understood. Prior analysis of the hazards and their potential impacts will provide the vital information needed for planning to minimise the unexpected. The regional council and local authorities are working together to develop an integrated approach to managing natural hazards in Hawke's Bay, linking sound research, sensible planning and community education.

References

Adey M. 2000, 'Hawke's Bay Engineering Lifelines: A perspective from the chairman of the steering committee', *Proceedings of the Natural Hazards Management Conference, Napier, 16-17 August 2000*, Institute of Geological and Nuclear Sciences information series 48, pp. 1-2.

Becker J. & Johnston D. 2000, 'District plans and regional policy statements: How do they address earthquake hazards', *Planning Quarterly*, September, pp. 22-23.

Johnston D.M. & Pearse L.J. 1999, *Natural hazards in Hawke's Bay*, Hawke's Bay Regional Council Technical Report AM99/03.

Johnston D.M., Bebbington M.S., Lai C. D., Houghton B.F. & Paton D. 1999,

'Volcanic hazard perceptions: Comparative shifts in knowledge and risk', *Disaster Prevention and Management* No. 8, pp. 118-126.

Ronan K.R., Johnston D.M. & Paton D. 2001, *Communities' understanding of earthquake risk in Hawke's Bay and Manawatu-Wanganui regions, New Zealand*, Conference technical paper, New Zealand Society for Earthquake Engineering Technical Conference, 23-25 March, Wairakei.

van Voorthuysen R. 1994, Natural hazard investigations in Hawke's Bay, *Proceedings of the Natural Hazards Management Workshop, Wellington, 8-9 November 1994*, Institute of Geological and Nuclear Sciences information series 31, pp. 75-78.



Figure 3: Houses in danger (between Haumoana and Te Awanga) 1974.

From 'Natural Hazards in Hawke's Bay', photo-Hawke's Bay Herald Tribune



Figure 4: The Hawke's Bay Regional Council repairs the Ngaruroro stopbank with dandbags during Cyclone Bola in 1988. This photo also shows how stopbank schemes protect horticultural land in Hawke's Bay.

From 'Natural Hazards in Hawke's Bay', photo-Hawke's Bay Regional Council.