NATURAL DISASTER

REDUCTION

IN

NEW ZEALAND

PREPARED FOR THE ASIAN NATURAL DISASTER REDUCTION CONFERENCE, KOBE, JAPAN 17-18 DECEMBER 1995

INTRODUCTION

At the IDNDR Mid Term Review and World Conference on Natural Disaster Reduction at Yokohama n May 1994, New Zealand presented a national report which remains relevant to December 1995. Copies of that report are available to those attending the Asian Natural Disaster Conference. This new paper is based on the 1994 report but is shorter, and offers some updated material.

New Zealand has an area of 270,500 km^2 and a population of about 3.5 million. The country stretches from 48° South, across the band of the Roaring Forties, to latitude 34° South on the fringes of the region affected by cyclonic storms. A broken snow-topped ridge of collision for two tectonic plates, its islands are subject to frequent earthquakes and occasional volcanic eruption. Its eastern coasts look across 10,000 km of open ocean to South America from whose vicinity tectonic activity may at any time trigger fast travelling tsunamis. Avian or human visitors from overseas may introduce dangerous diseases.

New Zealanders are thus at risk from a number of natural threats. Some (e.g. meteoric impact) are shared by all people on the planet. Others are not. Events on a scale of the earthquakes at Hawkes Bay (1931) and in the Wellington region (1848, 1855) or the volcanic eruptions at Tarawera (1886) and Taupo (AD186), if they were to occur today, would cause great loss of life and material damage. Events such as these are more likely in New Zealand than in many other countries. Table 1 shows some events in New Zealand history which may be considered natural disasters:

Table 1 : Some New Zealand Natural Disasters 1840-1980

Date		Disaster
1846	May	Landslide at Te Rapa, Lake Taupo - 61 dead
1848	October	The Wairau earthquake and aftershocks - 3 dead
1855	January	Wairarapa earthquake which shook both islands -5 dead
1858	January	Floods in Hutt Valley - 9 dead
1863	July	Snowstorm and floods in Otago - about 100 dead
1878	September	Severe floods in the Clutha Valley with widespread destruction
1886	June	Eruption of Mt Tarawera 153 dead
1897	April	Tutaeduri flood - 10 dead
1918	November	Influenza epidemic - 6700 dead
1929	June	Earthquake at Murchison - 17 dead
1931	February	Earthquake in Hawke's Bay - 256 dead, 11,000 evacuated
1938	February	Flash flood destroyed a work camp at Kopuawhara - 21 dead
1953	December	Lahar swept away bridge and express train at Tangiwai - 151 dead
1968	April	Cyclone Giselle: Ferry Wahine sunk, over 50 dead
1968	May	Earthquake at Inangahua - 3 dead, 300 evacuated
1979	August	Abbotsford landslide destroyed or badly damaged 69 houses

Over this time it should be added that a number of shipwrecks besides the *Wahine* have occurred in which weather can be identified as the sole or overwhelming cause. Also, in the 1850's, major epidemics caused many Maori deaths but are not well recorded.

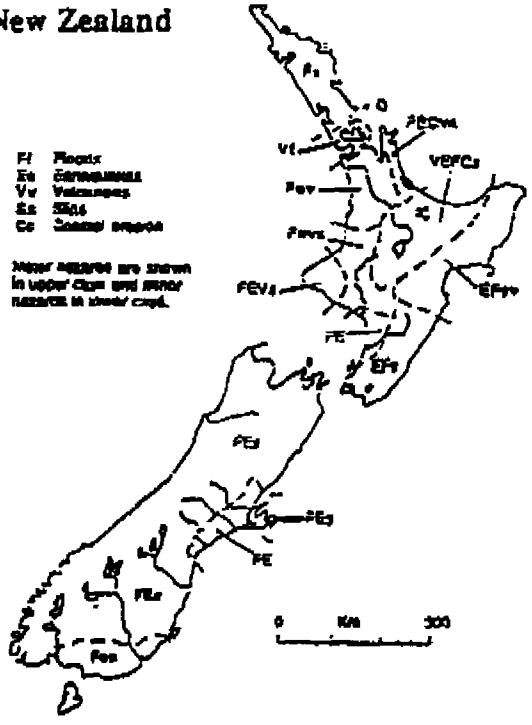
For the more recent period, it is possible to add comment on the cost of disasters:

Table 2 - New Zealand Natural Disasters, 1980-1993

Date	Type	Location	Affected Population	Losses
1981 April	Flood	Thames Valley	2250 +	$20m
1983 July	Flood	Golden Bay	150 +	$5m +
1984 January	Flood	Southland	8000	$110m
1985 February	Flood/Landslip	Thames Valley	200 (4 dead)	$10m +
1984 July	Flood	Poverty Bay	100	$3m +
1985 January	Flood	Nelson Bays	150	$1m
1986 March	Flood	Aorangi	1500 (1 dead)	$70m +
1986 August	Flood	Rangiora	320	N.A.
1987 March	Earthquake	Bay of Plenty	5000 +	$1100m
1987 March	Flood	Southland	700 +	N.A.
1988 March	Cyclone Bola	North Island	5000 + (5 dead)	$250m
1988 May	Flood	Greymouth	400 +	N.A.
1988 July	Flood	Palmerston North	1200	N.A.
1988 September	Flood/Landslip	Greymouth	350 + (1 dead)	$16m +
1990 March	Storm, flood	Taranaki, Wanganui	200	$12m +
1991 January	Flood	West Coast	130 +	$4m
1991 February	Flood	Catlins	128	$5m

In figure 1 below, we reproduce a map by John Macaulay, Honorary Director of the Geography Resource Centre, Christchurch showing the distribution of some significant hazards. It should be said that floods, earthquake and volcanic eruptions far exceed slips or coastal erosion in their importance.

Figure 1 - Some Natural Hazards in New Zealand



Thus we find that in New Zealand the most common hazard is flood, the potentially most dangerous is earthquake, and the most-underrated is volcanic eruption. No other natural hazard approaches the importance of these three. On average over the last 150 years less than three people a year have died by any of these causes. Annual flood

losses may amount to $200 million, and earthquake loses to $15 million (without counting the cost of protective works or insurance). This is in comparison with a GNP of about $NZ80 billion. The largest likely calamity could result in some 1600 deaths and losses of perhaps $46 billion.

Table 3 - Principal Natural Hazards in New Zealand

Type	Location	Exposed Population	Annual Deaths	Annual Costs
Floods	most inhabited areas	2.4 million	1.1	$200m
Volcanoes	Auckland & central North Island	2.0 million	2.5	n.a.
Earthquakes	central areas of New Zealand	1.8 million	1.9	$15m

MITIGATION ACTIVITIES

Legislation

The following New Zealand statutes have major implications in natural disaster reduction:

Health Act 1956
Water and Soil Conservation Act 1967
Local Government Act 1974
Fire Services Act 1975
Forest and Rural Fires Act 1977
Civil Defence Act 1983
Resource Management Act 1991
Building Act 1991
Health and Safety in Employment Act 1992
Earthquake Commission Act 1993
Biosecurity Act 1993
Maritime Transport Act 1994

Since the 1931 Hawkes Bay earthquake, New Zealand has steadily upgraded its building regulations. During the period 1960-1987 much of the central business districts in the major cities were reshaped with new high rise well-designed buildings, replacing older masonry structures. In the last few years doubts have developed about the pre-1971 standards, and as the economy allows, it can be expected that further upgrading will follow. The pattern of future changes will be affected by the Building Act 1991 which has moved from a building code system to a performance basis. It is hoped that this will result in innovative but no less effective methods of building construction and maintenance.

Most New Zealand housing is of timber framing and cladding. Corrugated iron has been the most popular roofing material. As a result the New Zealand population is well protected at home from earthquake effects except for the hazards of older chimneys and of ill-secured furniture.

New Zealand flood control works have traditionally included tree planting in at-risk headwaters, river clearance in lower reaches, and stop banks to protect valuable farmland and urban communities. Ongoing debate surrounds this policy, some arguing that the engineering works encourage a false sense of security and lead to higher losses when the stopbanks are overtopped by major flood events.

The Local Government Act 1974 places responsibility for land use zoning on territorial authorities, of which there are 74. Some have been more consciencious than others in

hazard mapping and in ensuring that land use is compatible with the hazards identified. Further emphasis to this has been given through the Resource Management Act 1991, which lays particular stress on protection of the environment for sustainable production.

During the past decade, New Zealand has substantially reformed both central and local government, with some emphasis on the environment and natural hazards. The Resource Management Act 1991 has given regional councils special responsibility to analyse natural hazards and to produce regional policy statements, which include sections on those hazards and on plans to deal with them. All 15 regional councils have now produced drafts at an advanced level, and these are open for comment by residents and by central government agencies.

Further changes in risk management, including mitigation measures, are flowing from the Earthquake Commission Act 1993 which is removing from the Government liability for insurance of the commercial sector. The Government continues as guarantor of earthquake insurance for all dwellings with fire insurance. In New Zealand as overseas the role of insurance and its availability is passing through a challenging period.

General Hazard Studies

Hazard analysis in New Zealand was given a boost in 1984 with the publication of **Natural Hazards in New Zealand**, compiled by Ian Speden and M.J. Crozier for the NZ National Commission for UNESCO, and has been encouraged by the more recent **Natural Hazards 90: Natural Hazard Assessment in New Zealand**, edited by Crozier.

In June 1994 the Canterbury Regional Council published **Natural Hazards in Canterbury**, an update of earlier work. Other regional councils are doing similar studies and have especially analysed flood hazards, for which some hold half a century of records. The Resource Management Act 1991 requires all regional councils to prepare "regional policy statements" which include an appraisal of natural hazards. These are making good progress, with a process of public consultation. It is likely that all will be completed by the end of 1994.

The urban area thought to have the highest earthquake threat in New Zealand is the capital, Wellington, with a population of about 300,000. The Centre for Advanced Engineering (CAE) at Canterbury University undertook a "lifelines" project, examining the vulnerability of electricity, gas and water supplies, telecommunications and other key services. A substantial report **Lifelines in Earthquakes: Wellington Case Study** (August 1991) resulted. Since it appeared work has begun on reducing vulnerability of the city's lifelines, including telecommunications. CAE has gone on to a comparable study for Christchurch, and the methodology has important overseas applications.

In March 1995 the Earthquake Commission hosted a highly successful conference "Wellington After the Quake: The Challenge of Rebuilding Cities". This meeting took place only 10 weeks after the Great Hanshin Earthquake in Japan, but it was possible for a number of presenters to offer reflections from that event and to relate them to the problems facing Wellington, a city of somewhat similar geography to Kobe, though much smaller.

The indepth discussion of recovery issues which took place can be seen to illustrate the continuum of comprehensive emergency management which links recovery to mitigation, and may have helpful lessons for other cities here and abroad.

The nature of hazards in New Zealand makes regional analysis rather than a national approach the more fruitful, since it can be closely related to mitigation and planning with involvement of people and institutions which will most benefit from such measures. However, New Zealand also has national groups involved in risk assessment

including the Institute of Geological and Nuclear Sciences, MetService (both these are on the IDNDR Committee), and the National Institute for Water and Atmospheric Research. In addition there are seven universities in New Zealand in which a good deal of important research is carried out.

DISASTER PREPAREDNESS

New Zealand has excellent emergency services - police, fire brigades and ambulance services. In addition it has a well developed civil defence system. Civil defence in New Zealand is understood to be an all hazard approach to natural and technological threats in a changing environment. It is the responsibility of territorial authorities and regional councils. Together they employ some 100 people in civil defence work, full or part-time, and spend about $7 million a year. They are supported by the Ministry of Civil Defence. It is a small agency with 35 staff and a vote of something like $6 million (including $1 million of support to local and regional work).

The Civil Defence Act 1983 requires all communities to be covered by plans for response to natural disasters. These are reviewed triennially and are currently up-to-date. Many local civil defence organisations have annual exercises, while national exercises are held about every four years. To support standards of local and regional readiness, the Minister of Civil Defence operates a National Civil Defence School. This opened in 1983 and in its first 12 years has held 200 events with over 11,000 participants.

Departments of state and organisations are also required to prepare plans to continue operating during and after a civil defence emergency. ("Organisations" are defined to include school boards of trustees and other specified agencies.) The precise nature of the planning process here will vary but plans should be prepared with the full knowledge of the department or organisation's management structure, key functions and resources, and provide for linkages with civil defence management structures at appropriate level.

Industry and private organisations are not specifically directed by the Civil Defence Act to prepare plans, but they should do so, both in their own and in the community's interests. Many firms are showing marked interest.

In the table below estimated expenditures for various categories of disaster mitigation or preparedness are provided:

Table 4 - Estimated Disaster Reduction Expenditure 1994-95

	$million
Accident Prevention Services	32
Ambulance	30
Civil Defence	11
Fire Services	137
Flood Prevention	49
Maritime Safety	3
Natural Hazard Research	32
Occupational Safety	21
Police	71
Road Safety	130
Pest Control	57
Soil Conservation	7

It is to be understood that natural hazard research in New Zealand is ongoing and was well established before the Decade began. Naturally, it will continue beyond the end of

the Decade, but IDNDR has offered an additional focus for such efforts.

This year a Review has been held of emergency services, the relationships between them and at local, regional and national levels. A consultative process is now in train to apply the conclusions of the Review.

PUBLIC EDUCATION AND INFORMATION

General Education Work

In the period 1989-95 it is estimated that central and local government together spent $3.3 million directly on public education concerning natural disasters. As part of the work of the Decade, a Public Education Advisory Committee was formed in 1992 to develop more effective education strategies. Civil defence organisations each year distribute about 200,000 leaflets, besides posters, videos and other activities.

Amongst non-Government efforts in public education is that of the Council for International Development. The Council is composed of 35 NGO's dealing with overseas development. It has established committees on development education and disaster response.

Homes and Workplaces

Household emergency preparedness messages have generally attempted to encourage families to be ready to face three days without outside help (storing water, food and so on, and maintaining first aid kits, battery, radios and light and heat sources). For the workplace, emphasis has been placed on personal safety and corporate survival.

Schools and Early Childhood Centres

In 1993 the international theme for IDNDR Day of "Stop Disaster in Schools" was particularly relevant to New Zealand audiences. In the week in which the day fell, it is believed that 500 (of 2800) schools and 150,000 pupils undertook some activity related to the theme. Education reforms have placed new responsibilities on Boards of Trustees and Principals who were sent in August 1992 new Emergency Guidelines to assist them in promoting school safety. In July 1995 a comparable document for early childhood centres was published, 6,000 copies being distributed.

Natural hazards are treated in the school curriculum, especially as part of social studies and geography. About one-third of pupils aged 15 sit a geography paper which includes a natural disasters section. The particular hazards chosen by teachers for study are influenced mostly by regional relevance, although availability of quality study materials is also important. A report on this aspect of natural disaster education "Teaching About Hazards and Disasters in the New Zealand Geography and Social Studies Curriculum" by John Macaulay, appeared recently in the book **Learning to Live Safely in the Australian Environment**, which is an Australian contribution to IDNDR. Further steps are being taken to include disaster reduction matters in the social studies and health curriculum statements.

Tertiary Studies

In 1991 Massey University at Palmerston North, which is the principal New Zealand university for extra mural studies, introduced a new Diploma in Civil Defence, which is seen in part as a contribution to the Decade. It comprises six papers, chosen from a wide range of topics in planning and emergency management. In 1991, 33 people enrolled, in 1992 there were 26 enrolments, 21 in 1993, 16 in 1994 and 15 in 1995.

At Victoria University of Wellington, the Department of Politics offers an honours course on "International Co-operation in Disasters and Development", which has an annual enrolment of 15-20 students. Part of that course focuses on IDNDR.

WARNINGS

Meteorological Events

MetService issues Special Weather Bulletins, alerting regional councils, the Ministry of Civil Defence and others to impending meteorological events of a more strenuous kind. The Bulletins are issued when the following conditions are expected over a wide area:

- Severe gales, defined as sustained wind speeds over land of more than 47 knots or 87 km/hr.

- Heavy rainfall, defined as more than 50mm of rain in 6 hours or more than 100mm in 24 hours.

- Heavy snow to low levels, defined as more than 10cm of snow in 6 hours or 25cm in 24 hours. Warnings are only provided where it is expected to fall to low levels - less than 500m in the South Island and less than 1000m in the North Island.

MetService disseminate these Bulletins by faxing (automatically, by computer) directly to authorities such as regional councils and civil defence, as well as directly to media outlets. They are also sent to Teletext. Marine gale warnings are disseminated via HF radio, VHF radio, and by Inmarsat.

MetService are gradually moving towards a situation where they may be able to provide shorter-term warnings of smaller scale events such as severe thunderstorms and hailstorms. Should funding be available for such an enhancement to the warning system more rapid dissemination and targetting would need to be considered as such warnings have lead times of a few minutes to an hour or so and apply to very localised areas.

MetService in Wellington receives Special Weather Bulletins from the Tropical Cyclone Warnings Centre in Nadi, Fiji, and relays them to Radio New Zealand International who broadcast them on short wave to the Pacific Islands.

Tsunamis

New Zealand participates in the Pacific Tsunami Warning System and has three tide gauges associated with that project. Warnings of tsunamis are promulgated from the Ministry of Civil Defence to regional councils and territorial authorities.

Volcanoes

Warning protocols for the volcanic fields are being developed in conjunction with the seismic networks in place on them. The warning system for the Whakapapa Skifield on Mt Ruapehu was tested in an exercise in July 1995 to ensure that visitors, including tourists from overseas, could be alerted and moved to safety in the event of a warning. This proved a very timely exercise, for in September 1995 the volcano increased its activity and a lahar closely approached one of the chair lift routes. Ski operators and others, led by the Department of Conservation took appropriate measures while civil defence and scientific advisors closely monitored the event. No injuries have been suffered up to the time of writing (in December, when tramping rather than skiing is the principal recreational attraction of the mountain).

INTERNATIONAL CO-OPERATION

Assistance to Other Countries

New Zealand seeks to assist in effective disaster relief overseas, especially when the disaster affects those countries in our immediate region, the South West Pacific.

The Ministry of Foreign Affairs and Trade (MFAT) co-ordinates all aspects of New Zealand's response to a disaster. If needed, MFAT convenes an Emergency Task Force involving other concerned government departments as well s representatives from NGOs and Wellington-based representatives from the Pacific Island country affected. In particular it works closely with the Royal New Zealand Air Force and other defence forces in damage assessment and, where necessary, in the transport of immediate relief supplies to disaster areas.

Disaster relief activities are coordinated under an informal arrangement linking France, Australia and New Zealand (FRANZ). This ensures that the resources of the three countries are used to best effect in responding to calls for assistance from countries in the region in the wake of natural disasters, particularly tropical cyclones. The three countries pool transport and other resources, and coordinate their assistance to ensure that the most immediately needed and appropriate relief materials are sent. These arrangements were promptly put to the test in the aftermath of hurricanes Kina and Nina, which struck Fiji and Solomon Islands respectively in early January 1993.

New Zealand's Official Development Assistance Programme places emphasis on reducing the impact of natural disasters. The New Zealand Government recognises that disaster preparedness is a high priority among the development needs of the South Pacific region and is ready to offer what it can in terms of advice and training in response to requests for assistance.

The New Zealand Defence Forces have a long tradition of assisting our Pacific neighbours recover from natural disasters. Ships and crews of the Royal New Zealand Navy, soldiers and equipment from the Army, and personnel and aircraft of the Royal New Zealand Air Force are sent from their New Zealand bases to give immediate aid. Long term rehabilitation projects are often carried out by Army engineers as countries struggle to rebuild schools and other amenities.

New Zealand is a member of WMO. Its representation and operational activities with other members of WMO is through MetService. Under a contract with the Ministry of Transport, MetService provides technical and administrative support to a number of countries in the South West Pacific to assist in their operational activities for gathering weather and climate data. The observations are of vital importance in monitoring and forecasting the movement of tropical cyclones.

The meteorological services of New Zealand, Fiji, and Australia (based in Wellington, Nadi and Brisbane respectively) are together responsible for monitoring tropical cyclones in the South Pacific. Special Weather Bulletins are issued by one or more of these services when a cyclone or other hazardous weather conditions threaten an island group.

The Fiji Meteorological Service operates the Tropical Cyclone Warning Centre for the South West Pacific in Nadi. Under the Tropical Cyclone Operational Plan, should the Nadi centre cease functioning (e.g. from the impacts of a tropical cyclone on Fiji), then MetService in Wellington will temporarily take over the warnings function.

The Radio New Zealand International (RNZI) Charter includes a commitment to broadcast warnings, instructions and advice in disaster situations. RNZI transmits to all the countries of the South West Pacific region and beyond. RNZI's ability to reach a

large section of the region is enhanced by broadcasting both in English and the major languages of the Pacific Island countries, although warnings are normally broadcast in English. The station broadcasts approximately 17 hours per day, six days a week, as well as a reduced number of hours on Sundays and makes regular use of 14 different languages.

In addition to these official initiatives, the PEACESAT satellite terminal, based at Wellington Polytechnic, has links with terminals in the North and South Pacific, and provides a useful backup facility to government and NGO with the exchange of information during and after natural disasters.

New Zealand non-government organisations, such as the Red Cross, have also played a part in organising relief after disasters in the South West Pacific, as well as at home..

The Council for International Development plays an increasing role in co-ordinating the activities of its member agencies and others in responding to overseas disasters. It is currently establishing a national NGO relief liaison committee.

International Assistance Required

Recent disasters have all been within the capacity of New Zealand response agencies. A scenario which could require significant overseas help would be a major earthquake in Wellington or Christchurch, or a major volcanic eruption. Engineering, loss adjustor and scientific analysis help is likely to be needed. It is likely that after a major earthquake, transport and medical help would also be needed.

The New Zealand National IDNDR Committee has noted the great benefits which have been derived from invitations to attend briefings after disasters, and to visit disaster scenes, especially earthquake and wildfire sites. In many cases an offer of help may result in an important occasion of learning, so that giving becomes getting. The Committee acknowledges in particular the co-operation of authorities in Armenia, the United States of America and Australia to New Zealand experts and observers.

In May 1995 New Zealand accepted the invitation from the Government of Papua New Guinea to send a team to Rabaul, to study the contingency planning emergency management associated with the eruption of September 1994. This was a very helpful visit for New Zealand, and proved particularly timely. The visit report was published in September, and two weeks later Mt Ruapehu, New Zealand's largest volcano, began an eruptive episode.

The Chartered Institute of Transport held a conference in Christchurch in October 1995 on the subject "Transport and Aid - We can do it Better". Over 100 people from around the world attended. The conference considered issues for donor and recipient countries as well as matters relating to the physical movement of people and supplies.

ANNEXE A: Further Reading

Civil Defence Review Panel Report, by B McLay et al, 1992

Contingency Planning for and Emergency Management of the 1994 Rabaul Volcanic Eruption, Papua New Guinea, by E T Finnimore et al, MOCD, 1995

Creating Flood Disasters?, by Neil J Ericksen, NWASCA, 1986

The Earthquake Business Plan: A Planning Guide for Commercial Organisations, by Keith Westwater, MOCD 1990

The Earthquake Business Plan: A Planning Guide for Corporate Organisations, by Keith Westwater, MOCD 1990

The Earthquake Business Plan: A Planning Guide for Small Businesses, by Keith Westwater, MOCD 1990

The Earthquake Business Plan: Saving your Goods and Chattels, by Keith Westwater, MOCD 1991

Emergency Procedures: Guidelines for Early Childhood Services, MOCD, 1995

Emergency Procedures: Guidelines for Schools, MOCD and Ministry of Education, 1992

Learning to Live Safely in the Australian Environment, edited by John Lidstone and Peter Wilson, Queensland University of Technology, 1993

Forging the Links: New Zealand's National Report to the United Nations Conference on Environment and Development, Ministry for the Environment, 1991

Lifelines in Earthquakes, Centre for Advanced Engineering (CAE), University of Canterbury, 1991

Natural Hazards in Canterbury, Report 94 (19) by Dr I F Owens et al, Canterbury Regional Council, 1994

Natural Hazards in New Zealand, edited by Ian Speden and M J Crozier, NZ National Commission for UNESCO, 1984

Natural Hazards 90: Natural Hazard Assessment in NZ, edited by M J Crozier

Regional Policy Statement Working Paper: Natural Hazards, Taranaki Regional Council, 1992

Report No.22: Final Report on Emergencies, [NZ] Law Commission, 1991

Report of the Emergency Services Review Task Force, by Sir Somerford Teagle et al, 1995

Review of the Earthquakes and War Damage Commission, by David Dowrick et al, Marsh & McLennan, 1991

Risk Assessment of Industrial and Natural Hazards, CAE, 1992

Volcanic Hazards at Egmont Volcano, by V E Neall and B V Alloway, MOCD, 1991

Volcanic Hazards at Okataina Centre, by I A Nairn, MOCD 1991

Volcanic Hazards at White Island, by I A Nairn, B F Houghton and J W Cole, MOCD, 1991

Volcanic Hazards in the Kermadec Islands, by J H Latter et al, MOCD, 1992

Volcanic Hazards at the Auckland Volcanic Field, by Ian E M Smith and Sharon R Allen, MOCD, 1993

Volcanic Hazards at Mayor Island, by B F Houghton et al, MOCD, 1995

Wellington After the Quake, EQC and CAE, 1995

Wellington Earthquakes Lifelines Group 1993 Report

Wellington Earthquake Lifelines Group 1995 Report, WRC, 1995