

It should be noted that the recommended work will take place over several work streams of Council, and in some cases in conjunction with the external agencies such as the Auckland Regional Council, and the Regional Civil Defence & Emergency Management Group. The implications of the work are discussed below:

- *Undertake further gap analysis work with regard to the priority hazards to determine further areas of technical work for example effects of tsunami on bays and harbours.*

The gap analysis is to ensure that all technical information currently available is part of the consideration when finding solutions to reducing the impacts of emergency events on the community. It may be that further technical or scientific information has to be researched. This will be undertaken by the existing cross Council groups, and is also likely to involve the Auckland Regional Council, particularly in regard to coastal matters.

- *Redraft public education / information messages about hazards and risk, to focus on the highest priority hazards in Waitakere City.*

The local civil defence group would initiate this work; however, this would have to be undertaken in direct consultation with the Regional Civil Defence Emergency Management group and relevant agencies at a national level, to ensure consistency.

- *Include research on the consequences of hazards into the Long Term Council Community Plan (LTCCP), to get a representation of the consequences in number terms of a hazard on Waitakere City.*

This recommendation is consistent with the requirements of the Auckland Regional Policy Statement, regarding the development of new land, such that it should be free of hazards. This Council's forward planning is required to give effect to the Regional Policy statement. It is anticipated that this reduction work would be undertaken on a council wide basis.

- *Update council plans and business unit plans with the information that has emerged from the hazards prioritisation project.*

This is a cross Council project.

- *Develop and implement a strategy to work jointly with stakeholders to review and monitor risk activities, including land use planning.*

This cross Council piece of work will again give effect to regional policy, in terms of the strategic planning of new development areas to be free of hazard impacts, in addition to fulfilling an upcoming requirement of the Local authority Hazard Liaison Group of developing a Hazard Strategy for each Local Authority. The Hazard strategy would ensure cross Council contribution to hazard work, across the region.

- *Develop a plan for the long term recovery of Waitakere City communities after a significant emergency event.*

The Civil Defence Group and council already have a plan in place, and designated recovery managers, however, there is potential to make this more extensive. This would be a cross Council initiative in conjunction with regional and national agencies.

- *Undertake a city wide plan change to reflect new information that comes out of that recommended work.*

This work is dependant on the outcomes of the work, and potentially also encompasses work that may come out of the Proposed Plan Change to the Auckland Regional Policy Statement: CH11 Hazards, that is about to be notified for further submissions.

## 2. Information Consistency Project

This project is being coordinated by the Auckland Regional Council, as part of the work being undertaken by the Hazard liaison Group, to meet the requirements of Guideline One: Hazard Identification and information Management for Local Authorities. This work is seeking a consistency in the terminology used when refereeing to hazards, and that similar levels of information are stored and are accessible to the public throughout the region. All aspects of this work are being legally reviewed to ensure that the methods chosen do not compromise Council's liability.

### CONCLUSION

The Hazard Prioritisation project has identified the key hazards that have the potential to create a significant emergency event in the City. The report also recommends work to be undertaken to assist in understanding the range of hazards that impact on the City, and how to further reduce the impacts of an emergency event on the City. The recommendations will build on work that is currently being undertaken throughout the Council to ensure that the Council achieves a robust level of preparedness for a significant emergency event.

### RECOMMENDATION

That the Civil Defence Emergency Management Activity and the Local Authority Hazard Liaison Group report be received.

Report prepared by: Carolyn McAlley, Senior Planner: Policy Implementation.





## **Waitakere Hazards and Risks Prioritisation**

**Prepared for  
Waitakere City Council**

**By  
Kestrel Group Ltd**

**May 2006**

**A33**

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## Summary

SMG analysis was used as the basis for the prioritisation of hazards and risks that have the potential to affect Waitakere City.

An outcome of the analysis was a ranked list of hazards, with the hazards grouped into three shaded bands (high, moderate and low priority) in order to focus recommendations for work.

The high priority hazards include:

- Biological – Human epidemic,
- Tsunami – Near-field,
- Ex-tropical Cyclone,
- Volcanic Eruption – Local,
- Biological – Introduced pests and animal diseases.

Specific areas of work are recommended for the short and longer term for the high priority hazards.

# 1 Introduction

## 1.1 Background

Waitakere City Council engaged Kestrel Group Ltd (KGL) to assist with prioritising hazards and risks in their area in accordance with Target 5.1 and the associated Action set out in the Auckland Region Civil Defence Emergency Management (CDEM) Group Plan.

Waitakere City is susceptible to a wide range of natural and non-natural hazards and risks. After consultation with the Policy and Planning, CDEM (including Rural Fire), and Strategy and Development sections of Council, along with EcoWater, a list of hazards was developed. The main focus is on those hazards which have the potential to create a significant emergency event in Waitakere City, and which would most likely require some degree of Council co-ordination to manage.

Hazards and their corresponding risks were then summarised, and prioritised in a two-stage process. This report details the prioritisation process and makes several recommendations for further work as a result.

## 1.2 Hazards Prioritisation Overview

The first stage of the prioritisation process involved a broad Likelihood and Consequences rating in accordance with the Australian/ New Zealand Risk Management Standard (AS/ NZS 4360:1999). This rating acted as an initial screening process to give an indication of the level of risk (Low, Medium, High or Extreme). The High and Extreme rated hazards and risks were then analysed in more detail in the second stage prioritisation process using the SMG model adapted by Ministry of Civil Defence & Emergency Management (MCDEM).

The SMG model suggests that 'seriousness' (consequences), 'manageability' and 'growth' should be the criteria used for prioritisation. The SMG model enables prioritisation of those hazards which represent the greatest risk, and can be effectively treated in the future by putting effort into managing the risks posed by these hazards, across each of the 4R's (reduction, readiness, response and recovery).

## 2 Hazards and Risks

### 2.1 Scope of Hazards and Risks

In order to assess and prioritise hazards, an understanding of the risks posed by these hazards and how they are currently being managed was required. A Hazards and Risks Summary was developed (available as a separate document) by compiling information from specific Waitakere City Council reports (e.g. Waitakere CDEM Local Plan, EcoWater plans) and other Auckland region hazard reports (e.g. Auckland Engineering Lifelines Project Final Report 1999, Auckland Regional Council technical publications). Council officers who have had experience with managing hazards in Waitakere City also contributed to the Hazards and Risks Summary.

For each hazard, a Maximum Credible Event (MCE) was described to assist in the SMG analysis.

Some hazards were not specifically included, as they would not require Waitakere City Council to play an active role in pre-event civil defence emergency management readiness and/ or post-event response activities.

These hazards include: climate change, storm surge, coastal erosion/ instability (occurring over time), urban fire, road/ rail accidents and space debris.

Climate change has the effect of exacerbating some hazards in the long-term, and the planning to reduce the effects of climate change should be undertaken in conjunction with the reduction and readiness planning of other hazards.

Storm surge, coastal erosion/ instability and urban fire are implicitly included under other hazards, but their areal impacts in isolation from other hazards such as an ex-tropical cyclone or earthquake are relatively limited, and will not have the potential to create a significant emergency event in Waitakere City. Road/ rail accidents were regarded similarly.

Extremely rare hazards such as space debris were also omitted from the analysis. The effects of a tsunami generated by a meteor impact would be severe on a global scale and would be beyond the ability of the Council to manage.

### 3 Levels of Risk

#### 3.1 Likelihood and Consequence Ratings

The qualitative risk analysis approach defined in Appendix E of AS/ NZS 4360:1999 was used as the basis of an initial hazard and risk analysis.

The parameters used for the Likelihood and Consequence ratings are summarised below in Table 1. The Likelihood parameters are taken straight from AS/ NZS 4360:1999. Consequence parameters are as developed by MCDEM and used by CDEM Groups in New Zealand (slight modifications by MCDEM are indicated in italics).

Table E3 of AS/ NZS 4360:1999 was used for the analysis, and is reproduced below in Table 2.

<b>Likelihood</b>	<p>A = <b>Almost certain</b> – is expected to occur</p> <p>B = <b>Likely</b> – will probably occur</p> <p>C = <b>Possible</b> – might occur at some stage</p> <p>D = <b>Unlikely</b> – could occur at some stage</p> <p>E = <b>Rare</b> – may occur only in exceptional circumstances</p>
<b>Consequence</b>	<p>1 = <b>Insignificant</b> – no injuries, little damage, low financial loss</p> <p>2 = <b>Minor</b> – <i>medical</i> treatment required, <i>possible deaths</i>, minor building and infrastructure damage, minimal <i>or moderate local</i> financial loss</p> <p>3 = <b>Moderate</b> – medical treatment required, possible deaths, moderate building and infrastructure damage, high financial loss</p> <p>4 = <b>Major</b> - Extensive injuries, <i>a number of</i> deaths, high level of building and infrastructure damage, major financial loss</p> <p>5 = <b>Catastrophic</b> – massive injuries and deaths, displaced people, wholesale building and infrastructure damage, huge financial loss</p>

Table 1: Likelihood and Consequence Ratings used in assessing the Level of Risk (source: AS/ NZS 4360:1999; words in italics are as modified by MCDEM).

Likelihood	Consequence				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A (almost certain)	H	H	E	E	E
B (likely)	M	H	H	E	E
C (moderate)	L	M	H	E	E
D (unlikely)	L	L	M	H	E
E (rare)	L	L	M	H	H

**E:** extreme risk; immediate action required  
**H:** high risk; senior management attention needed  
**M:** moderate risk, management responsibility must be specified  
**L:** low risk; manage by routine procedures

Table 2: Qualitative Risks Analysis Matrix – Level of Risk (source: Table E3 of AS/ NZS 4360:1999).

### 3.2 Levels of Risk for Waitakere City

The outcomes of the analysis in terms of Level of Risk for hazards and risks affecting Waitakere City are shown below in Table 3.

	Hazard	Likelihood	Consequence	Level of Risk
<b>Natural</b>	Flooding	A	2	High
	Ex-Tropical Cyclone	B	3	High
	Tsunami – Far-field	B	2	High
	Tsunami – Near-field	D	4	High
	Earthquake	D	2	Low
	Land Instability	B	1	Medium
	Volcanic Eruption – Local	C	3	High
	Volcanic Eruption – Distant	B	2	High
	Fire – Rural	B	3	High
	Biological – Introduced pests and animal diseases	B	3	High
<b>Non-Natural</b>	Biological – Human epidemic	C	5	Extreme
	Lifeline Utility Failure – Water	C	2	Medium
	Lifeline Utility Failure – Electricity	C	2	Medium
	Lifeline Utility Failure – Communications and IT	C	2	Medium
	Hazardous Substances	C	2	Medium
	Dam Failure	D	2	Low
	Major Passenger Transport Crash	D	2	Low
	Criminal Acts	D	3	Medium

Table 3: Likelihood and Consequences ratings and Level of Risk for Waitakere City (based on AS/ NZS 4360:1999)

## 4 Hazard Prioritisation

### 4.1 The SMG Model

The initial hazard prioritisation model (referred to as SMUG) was defined in the MCDEM Director's Guideline on CDEM Group Plan preparation (DGL 2/02). A subsequent version developed in 2003 by MCDEM, which removed the 'U' or 'urgency' parameter, was used in this process (referred to subsequently as SMG analysis), as summarised below.

The SMG model was largely used to be consistent with the way regional hazards have been prioritised by the Auckland Region CDEM Group, although for this analysis a later version of the SMG model has been used. Timeframes and budget did not allow for a more quantitative analysis to be undertaken. Limitations of the SMG model are briefly discussed in section 5.2.

The definitions of 'S' or 'seriousness', 'M' or 'manageability' and 'G' or 'growth' that were used to prioritise hazards for Waitakere City Council are outlined in Table 4 below.

<b>Seriousness:</b>	The relative impact in terms of people and/ or dollars. The <i>human</i> consequences (potential number of lives lost and potential for injury), and the <i>economic, social, infrastructure and geographic</i> consequences of a hazard event are specifically considered while rating seriousness.
<b>Manageability:</b>	The relative ability to mitigate or reduce the hazard (through managing the hazard, or the community, or both). The manageability rating is a measure of how <i>difficult</i> a hazard is to address and a measure of the cross-sector management <i>effort</i> being applied to hazards across the 4R's.
<b>Growth:</b>	The rate at which the risk from the hazard will increase through either an <i>increase in the probability</i> of the extreme event occurring, an <i>increase in the exposure of the community</i> , or combination of the two.

Table 4: Definitions of Seriousness, Manageability and Growth used in the SMG Analysis.

### 4.2 Application of the SMG Model

The SMG method was applied to the available Hazards and Risks Summary information during a Council Stakeholders Workshop on 27 March 2006 and subsequently reviewed. Seven Council Officers from the Policy and Planning, CDEM (including Rural Fire), and Strategy and Development sections of Council, along with EcoWater attended the workshop. The outcomes were presented to and discussed with the Council Project Manager, before being summarised in this document.

### 4.3 Method for Rating Seriousness

**Seriousness:** the relative impact in terms of people and/or dollars.

When rating seriousness, the *human* consequences (the potential number of lives lost and potential for injury) and the *economic, social, infrastructure* and *geographic* consequences of a hazard event were specifically considered.

For each of the high and extreme rated hazards listed in Table 3 above, a seriousness score of 1-5 was assigned to each of the five elements above. These were averaged to attain a total seriousness score. The elements used in this part of the analysis are listed in below, with a description assigned to the levels 1-5. The human and economic consequences are specific to Waitakere City.

#### Human Consequences

Deaths, injuries and psychological distress. Based on an estimated population of 191,900 for Waitakere City (2005 Statistics NZ).		
Level	Description	Details
1	Insignificant	No deaths; 0-960 people affected; 0.5% of affected community injured/displaced
2	Minor	No deaths; <1,900 people affected; 0.5-1% of affected community injured/displaced
3	Moderate	0-15 deaths; <4,800 people affected; 1-2.5% of affected community injured/ displaced
4	Major	0-75 deaths; <9,600 people affected; 2.5-5% of affected community injured/displaced
5	Catastrophic	0-75 deaths; >9,600 people affected; >5% of affected community

#### Economic Consequences

Direct costs, business loss and interruption, and general effects on economic activity. Based on estimated number of households of 55,656 and estimated median household income of \$46,426, which totals \$2.5 billion (2001 Census figures).		
Level	Description	Details
1	Insignificant	Costs <0.5% of total (<\$12.5M)
2	Minor	Costs between 0.5% and 2% of total (<\$52M)
3	Moderate	Costs between 2% and 5% of total (<\$129M)
4	Major	Costs between 5% and 10% of total (<\$258M)
5	Catastrophic	Costs >10% of total (>\$258M)

### Social Consequences

Disruption to normal social function (i.e. inability to carry out routine activities) and impacts upon community networks and facilities.

Level	Description	Details
1	Insignificant	Few or no effects
2	Minor	Noticeable disruption, with short-term loss of ability to carry out routine activities (hours to a few days)
3	Moderate	Several social services impacted to varying degrees for an extended period of time (weeks), but disruption is temporary
4	Major	Most social services are severely impacted for a long-term period (months to years), with permanent closures to services/businesses
5	Catastrophic	Normal social function is permanently disrupted, with loss of services and businesses resulting in demographic and other changes. Other social services take months to years to recover

### Infrastructure Consequences

Infrastructure statement of relative damage/ loss across all categories of built infrastructure

Level	Description	Details
1	Insignificant	Few or no effects
2	Minor	Light damage to buildings and structures; services remain on-line, but unavailable for a period or hours
3	Moderate	Variable damage to buildings and structures; services off-line for several hours to days
4	Major	Heavy damage to buildings and structures; services off-line up to several months
5	Catastrophic	Extensive damage to buildings and structures; many remaining buildings and structures are unrecoverable; all essential services off-line, and some cannot be recovered

## Geographic Consequences

Physical effects on the land and environment		
Level	Description	Details
1	Insignificant	Few or no effects
2	Minor	Short-term localised effects requiring clean-up or restoration
3	Moderate	Damage to multiple ecosystems, temporary or localised landform changes
4	Major	Loss of a significant ecosystem, or damage to multiple systems and ecological effects. Regionally significant and permanent landform changes requiring modified land use
5	Catastrophic	Permanent loss of multiple ecosystems and irreversible ecological effects, multiple regionally significant landform changes requiring modified land use

### 4.4 Method for Rating Manageability

**Manageability:** the relative ability to mitigate or reduce the hazard (through managing the hazard, or the community, or both).

The manageability rating is a measure of how *difficult* a hazard is to address and a measure of the extra management *effort* needed to be applied to hazards generally across the 4R's = reduction, readiness, response and recovery.

The level of *difficulty* and management *effort* for each of the high and extreme rated hazards listed in Table 3 above was scored from 1-3 (low, medium and high, which corresponds to the level of difficulty and the effort being applied across the 4R's), and the difference between the two taken for each.

For example, if a hazard has the potential to be mitigated and the risk significantly reduced by putting more emphasis on simple reduction initiatives in the future, it would receive a low score (e.g. it is not *difficult* to address and the extra *effort* required is low).

The level of *difficulty* in some cases may be inversely proportional to management *effort*, particularly where a hazard appears too hard to address and therefore little effort is being applied across the 4R's. On the other hand, a lot of *effort* may be expended on a relatively easily managed hazard.

#### 4.5 Method for Rating Growth

**Growth:** the rate at which the risk from the hazard will increase through either an *increase in the probability* of the extreme event occurring, *an increase in the exposure of the community*, or combination of the two.

Each of the high and extreme rated hazards listed in Table 3 above were assigned a score of 1-3 based on the descriptions in Table 5 below.

Increase in Probability	Changing Community Exposure	Rating
Low	Low	1
Low	Medium	1
Medium	Low	1
Medium	Medium	2
Low	High	2
Medium	High	2
High	Low	2
High	Medium	3
High	High	3

Table 5: Growth ratings used in the SMG analysis.

## 5 Results

### 5.1 Overall Scores

Table 6 below summarises in priority order the ratings assigned to each of the SMG criteria of Seriousness, Manageability and Growth for High and Extreme hazards from the initial screening process.

Hazard	Seriousness	Manageability	Growth	Total Score
Biological – Human epidemic	4.0	0	2	6.0
Tsunami – Near-field	3.8	1	1	5.8
Ex-Tropical Cyclone	3.6	0	2	5.6
Volcanic Eruption - Local	3.6	0	2	5.6
Biological – Introduced pests and animal diseases	2.4	1	2	5.4
Tsunami – Far-field	2.4	0	1	3.4
Fire – Rural	3.0	-2	2	3.0
Volcanic Eruption – Distant	2.0	-1	1	2.0
Flooding	2.2	-2	1	1.2

Table 6: Summary of the component ratings and overall scores.

The table above provides a ranked list of hazards. However, due to some uncertainties in the information used in the analysis, it is considered more appropriate to group the hazards into three shaded bands and treat the priorities the same within each band.

The following arbitrary cut-off levels reflect the bands:

High Priority:	Total Score $\geq$ 5
Moderate Priority:	$3.0 \leq$ Total Score $<$ 5.0
Low Priority:	Total Score $<$ 3.0

## 5.2 Difficulties with Prioritising Hazards

There are several difficulties associated with assigning ratings to each of the above criteria:

- The 'seriousness' rating assigned to a given hazard depends upon the magnitude of the hazard event under consideration. Maximum Credible Events (refer to the Hazards and Risks Summary) were used wherever possible,
- There is a lack of quantitative data that can be utilised to compare hazards against each other.

Due to a lack of quantitative data, many of the hazard consequences or risks described above are qualitative, which makes prioritisation slightly more difficult.

Moreover, the SMG model as described above assumes that each of the criteria is of equal value and combines scores through simple addition and averaging, potentially resulting in different priorities every time the process is undertaken. In addition, the model often results in closely grouped scores, making it difficult to separate priority hazards apart.

However, the SMG model is still a useful tool to assist with prioritising hazards and risks, as it brings people together to systematically work through hazards and risks, and assign priorities while applying an initial degree of objectivity. The SMG model is also an improvement over the way hazards and risks were previously considered by the CDEM sector. MCDEM is undertaking a review of the model and it is likely that a revised model will be recommended for use in the future (i.e. for CDEM Groups to use).

Overall, the results are reasonable in that the highest priorities represent the hazards that are the most serious and have the most potential to impact Waitakere City.

## 6 Recommendations

### 6.1 Recommendations for Further Work

The priorities (as represented by three shaded bands) are reasonable in that the highest priorities represent the hazards that are the most serious and have the most potential to impact Waitakere City, and in which there is still some amount of work that can be undertaken to manage these hazards generally across reduction, readiness, response and recovery. The highest priority hazards also have a high residual risk (the level of risk remaining even after risk treatment measures have been implemented), and which would have the potential to create a significant emergency event in Waitakere City, requiring some degree of "whole-of-Council" co-ordination to manage.

In practice, this means that Waitakere City Council could focus on the following recommendations for work for the highest priority hazards:

- Biological – Human epidemic,
- Tsunami – Near-field,
- Ex-tropical Cyclone,
- Volcanic Eruption – Local,
- Biological – Introduced pests and animal diseases.

The following specific areas of work are recommended for the short term:

1. Undertake an information gap analysis for the high priority hazards and determine areas for further technical and scientific studies, for example, for the specific response (local wave amplification effects) to tsunami in some bays and harbours.
2. Re-draft public education/ information messages about hazards and risks, to focus on the highest priority hazards in Waitakere City. Certain risk reduction message could be included, for example, in the event of an ex-tropical cyclone, for which there is warning, messages about fastening down roofs to protect them from high winds can help reduce risk/ damage. In the event of a volcanic eruption from the Auckland Volcanic Field, messages about the irritant/ health effects of ash and ash clean-up messages would be useful. A number of messages can be drafted in advance.
3. Include research on the consequences of hazards into the Long Term Council Community Plan (LTCCP). Semi-quantitative research on the consequences of hazards could be carried-out in conjunction with the Auckland Regional Council. The use of hazards data (this type of data includes data in GIS such as the 100-year floodplain), and population, building and lifeline utility data (this type of data includes census and valuation data), is combined and scientifically related to get a representation of the consequences in "number terms" of a hazard event on Waitakere City. Up-front technical and scientific studies will provide the

necessary subsequent hazards data, which is largely absent from Council databases.

4. Replace information in existing Council plans (i.e. those that do not require notification, including the CDEM Local Plan) with the information available in the Hazards and Risks Summary. In some cases this information may be more specific to Waitakere City than information currently in these plans.
5. Include risk management of the highest priority hazards as part of individual Council business unit plans, including business continuity planning and/ or staffing considerations. Individual Council business units should continue to commit resources to treat their own priorities (e.g. EcoWater continues to manage flooding to the extent that it current does, and Waitakere CDEM continues to implement measures to treat rural fires), but should consider the impacts of significant emergency events.

The following specific areas of work are recommended for the longer term:

1. Develop and implement a strategy to work jointly with stakeholders to identify, review and monitor risk treatment activities, including land-use planning, building consents and resource consents, in particular for activities in low-lying coastal areas (for inundation from tsunami or ex-tropical cyclone events).
2. Plan for the long-term recovery of Waitakere City's communities after a significant emergency event, initially considering the highest priority hazards, in particular the likely physical, economic and social impacts of these hazards. Integrate recovery planning with the Auckland Region Civil Defence Emergency Management Group's recovery planning, and review the Local Recovery Plan to ensure its robustness.
3. Undertake a Waitakere City District Plan change (i.e. notified plan change) to reflect new information that comes out of recommended work, which can enhance the District Plan. Brief the Auckland Local Authority Hazards Liaison Group of new information and any plan change.

## 6.2 Other Considerations

In addition to the above, it may be necessary to carry out similar work for lower priority hazards (if not already done), in particular flooding, as it is the most commonly occurring natural hazard in Waitakere City, and one that is frequently "seen" in the hazard scape. That is to say that even though flooding is being managed well in Waitakere City (a lot of *effort* may be expended on a relatively easily managed hazard) the growth of Waitakere City, and its topography and exposure to ex-tropical cyclones justifies its inclusion in similar recommended work, which also includes:

- Review the consents process used during land development to include the provision of Integrated Catchment Management Plans (ICMPs) or Catchment Management Plans (CMPs), where they do not currently exist, and further flood modelling/ survey work, to identify overland flow paths, flood levels and flood remedial options for properties (i.e. building design works will need to be outside overland flow paths and with a minimum floor level requirement). In the process developers will bear the cost of plan and flood modelling/ survey work, and will protect Waitakere City Council from any litigation.

**Assessment of Auckland Civil  
Defence and Emergency  
Management Group warning system  
options**

G. S. Leonard  
D. M. Johnston  
W. Saunders  
D. Paton

**GNS Science Report 2006/002  
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*ASI*



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## ABSTRACT

This report recommends priority options for public notification of warnings for the short (1 year), medium (1 to 5 years) and long (5 to 10+ years) term for the Auckland CDEM Group, based on a review of 26 options under the broad headings of 'natural warnings', 'via institutional staff to those in their care', 'via community/organisation networks to the public', 'via third-party hardware and/or staff' and 'via dedicated hardware'.

Early warning public notification is discussed in the context of an effective warning system, as part of the underlying goal of improving community resilience. Effective warning systems include, as well as early warning and public notification: response planning; discussion and communication; education, training, maps and signs; exercises; underpinning hazard research; and effectiveness evaluation. In parallel to this report there is also a long-term community resilience project underway for the Auckland region.

Technology currently allows, in theory, for the vast majority of people to receive a detailed warning message within seconds of the notification system being activated. The major limiting factors are cost, technology-implementation lead-time, ongoing maintenance costs, ongoing effort through testing and exercising of the system, and most importantly the development of a resilient community with the capability and motivation to make the correct decisions based on the warning message received. The partial, and/or un-maintained/un-exercised implementation of a new hardware-based system may have a negative impact on overall community resilience, especially due to reduction in other mitigation measures because of reliance on the warning system to 'save us'.

In the short term (1 year), development of existing available warning systems should allow for the notification of a substantial proportion of both rural diffuse-populations and urban areas for most if not all hazards (hazards with seconds to minutes of lead time may not have full, or in the shortest-time frame cases any, public notification via these systems). These are broadly (a) notification through existing organisations and groups that maintain their own communication networks (e.g. Surf Lifesaving, Rural Fire, etc.), (b) notification via existing third party hardware and staff (e.g. Radio and TV stations; Police and Fire mobile PA loud-hailers, and/or door-to-door notification). The biggest cost is the effort of start-up detailed planning of the method, notification priorities, message content etc., and effort in ongoing and regular exercising, evaluation and improvement of these arrangements. The awareness and motivation required to respond to natural warnings can also begin to be fostered in the short term.

In the medium term (1 to 5 years) detailed feasibility analysis of new technologies should be carried out to determine if the cost-benefit is acceptable. Effective response to such systems would require a more resilient community with greater awareness of hazards, warning systems, potential warning messages and appropriate response to them; without this, panic and other inappropriate decisions based on receipt of a warning message may result in a worse response than would occur without implementation of any new technologies. Bimodal population density means group notification may not be the most efficient, or even possible, for rural diffuse-population areas, whereas individual notification may not be as fast or

practical for high-density urban areas. The best available new technologies to directly reach the large majority of the rural diffuse population relatively quickly are cell-broadcast (or similar mobile communications technology) and/or tone-alert radio; these two and/or fixed PA loud-speakers should be analysed in detail for urban areas. All are cost-limiting, but the cell broadcasting appears to have the potential to be the cheaper and more cost-effective in the medium term.

We recommend a national working group between CDEM Group representatives, MCDEM, communication providers and warning supply agencies to brainstorm this option and other new mobile communications technologies possibly on the horizon.

The time-lag between initiation of notification and receipt by all available end-users is the critical success factor for a major new all-hazard technology-based system. It needs to accommodate as best as possible short time-frame hazards such as earthquake (seconds, possibly never feasible), dam failure, tornado, local or regional source tsunami (minutes; seconds for notification is better). This time-lag criticality also means that the time taken to initiate an early warning prior to notification, and for people to respond, should also be a focus of effort by the CDEM Group. It is unclear whether mobile communications technologies such as cell broadcast can, with full automation of the system, notify all end-users in seconds, but minutes is certainly feasible. Technological advances in the next few years may well improve this. Development of a major dedicated hardware system such as tone-alert radio or fixed PA loudspeakers may take years, and then in short order be superseded by cheaper and faster mobile communications as the optimum system.

In the longer term (5 to 10+ years) the target should be the development of wider community resilience. Improved resilience reduces the impacts of natural hazards through several community-driven means including, but not limited to, the ability and motivation to receive, understand and make decisions based on early warning messages. Such changes to the awareness and motivation of the community take place over decades rather than years.

## KEYWORDS

Auckland, effective early warning system, public notification, all hazards, civil defence, emergency management, community resilience, new technology

## **1.0 INTRODUCTION**

The Auckland Civil Defence and Emergency Management Group (CDEMG) is investigating the provision of a system to disseminate warnings to the public of the Auckland region. This report discusses and makes recommendations for such a system. This requirement is set out in the Ministry of Civil Defence and Emergency Management (MCDEM) National Plan and the draft National Plan. In addition, the Auckland CDEM Group Plan sets out as a target that the CDEMG will, 'determine how the national warning system can be initiated on a regional basis by December 2005'.

The Auckland CDEMG have explored the option of using the fixed line telecommunications network to disseminate automatic warnings and have identified a number of limitations. The CDEMG committee resolved that priority be given to further investigate the use of telecommunications and electronic technology for the provision of early warning and other assistance for CD Emergencies. This project seeks to meet the objectives resolved in that meeting and explore wider options for warning dissemination.

Warning systems will be utilised for a range of different scenarios including those with relatively short warning times (e.g. tsunami, volcanic eruption, flooding) and those with longer warning periods (e.g. cyclone, drought, epidemic). The amount of warning time and immediacy of response will determine which warning systems are appropriate. It may be necessary to utilise different mechanisms for disseminating warnings with different timeframes. For some hazards, warning systems will not be useful, such as earthquake.

### **1.1 Project objectives**

The objectives of this project are to develop a number of recommended options for the dissemination of CDEM warnings to potentially affected businesses and communities in the Auckland Region, so that an informed selection can be made of system(s) for implementation.

Recommended options should meet the following requirements:

- be based on examples of best practice from elsewhere in New Zealand and overseas
- be easy to understand/interpret
- be suitable to the Auckland hazard context
- could be applied consistently throughout New Zealand
- could be targeted to specific geographic audiences
- are cost effective
- can be implemented quickly and easily
- address social behaviour models.

## 1.2 Project tasks

In order to meet the project objectives, several tasks have been undertaken. This project:

- Assesses New Zealand and overseas examples of best practice effective warning systems, with a focus on public notification arrangements (Section 4, Appendix 3).
- Reviews systems in use in countries that are considered to have a "like New Zealand" hazard profile and social values (Appendix 2);
- Assesses which public notification systems meet the requirements listed under 'Project objectives' above (Sections 3 and 4), with comment on how these best fit within an effective warning system (Section 2);
- Recommends a number of options for delivery of public warnings ('public notification') in Auckland (Section 5);

In addition, the authors will participate in the presentation of the results of this project to CEG and the CDEMG at a future date.

## 1.3 Research and external input

A list of system and hazard-specific references (including internet references) can be found in the 'Reference' section at the back of this report. In addition, a list of people, agencies, and suppliers who were contacted during the course of this project can also be found as part of the reference section.

## 1.4 Context

This section lays out the national and regional CDEM context within which the current review sits.

### 1.4.1 Legislation, plans and existing early warning systems

Many warnings are generated or supplied by the MCDEM via the national warning system. Under the National CDEM Plan<sup>1</sup>, MCDEM is responsible for issuing warnings of national significance to CDEM Groups, local authorities, police, certain government departments, lifeline utilities, and certain broadcasters. CDEM Groups are responsible for disseminating national warnings to local communities and maintaining local warning systems. The National Plan does not include local actions and procedures required to disseminate or respond to warnings – that is the responsibility of each CDEM Group. Appendix 1 outlines sections 60-62 of the National Plan, which describes the objective and scope of general warnings, and the national warning system.

The Auckland Region CDEM Group Plan acknowledges that currently no warning system exists that can be initiated for regional events. The objective is therefore to develop an integrated system for the region that can provide warnings to the public of impending events

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<sup>1</sup> The National Civil Defence Management Plan comes into effect on 1 July 2006.

and other emergency conditions. The recommendations of this report will contribute to the development of this system. Following consultation with the media (a key partner in warning systems), an integrated regional warning system will be introduced that is consistent with the national system.

The CDEM Group Plan includes a table 'Event Types and Status' (Section 3 - Operational Arrangements, Table 3.2) which outlines event levels, status/procedures, and the role of the EOC and Controller. However, although it describes the five levels of events (Level 1 being a small local incident where no declaration is required, to Level 5 being an imminent or State of National Emergency), it does not provide guidance on how or when public notification should occur within these levels. Any new notification system should be included in this table.

While there is no physical warning system currently in place, a framework for a public warning system does already exist. The purpose of the proposed public warning system is for warnings to be issued to the public concerning physical safety from a hazard or emerging threat, prior to and during a civil defence emergency. The general public can be currently alerted via radio and television to an impending emergency. Any new warning system that is used for this purpose will be introduced in public education activities to ensure that the level of community understanding on how to access emergency information is established. Warnings will be issued in accordance with SOP G202: Regional Warning System. Specific warning systems will also be developed for hazards through Contingency Plans.

Where no Contingency Plan exists, the following warning levels are established to assist readiness:

**Advisory** – The status quo. No response required, information received from monitoring and surveillance agencies (e.g. Institute of Geological and Nuclear Sciences (GNS Science));

**Alert** – A preparatory phase recognising that limited information may be available for an emerging threat. Liaison with emergency services is initiated. Notification from the CDEM Office to:

- Group Controller and Local Controllers
- CDEM Group
- Local Authorities
- MCDEM
- Emergency Services

**Standby** – Threat imminent and key personnel put on standby. Liaison with emergency services is increased and the Public Information and Media Management Plan is activated. Standby warnings will be issued to those agencies detailed in SOP G202 (yet to be completed)

**Full Activation** – Event occurred or inevitable.

Any warning system must be incorporated into the warning levels, to aid decision making as to when public notification is required.