



**Natural Hazards in Canterbury - Planning for
Reduction - Stage 2**

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CONTENTS

EXECUTIVE SUMMARY	iii
1.0 INTRODUCTION	1
2.0 METHODS.....	1
3.0 THE CANTERBURY REGION	2
4.0 NATURAL HAZARDS MANAGEMENT CONTEXT	4
4.1 Natural Hazards Management in New Zealand	4
4.2 Emergency Management in Canterbury.....	6
4.2.1 Canterbury CDEM online	9
5.3 ECan online links.....	11
6.0 DISTRICT PLANNING DOCUMENTS	12
6.1 Kaikoura	14
6.1.1 District Plan (proposed, as amended by Council decisions, November 2005) ..	14
6.1.2 LTCCP 2006-2016	16
6.1.3 Annual Plan (2007-8)	16
6.1.4 Website.....	17
6.2 Ashburton	17
6.2.1 District Plan (operative September 2001)	17
6.2.2 LTCCP 2006-2016	21
6.2.3 Annual Plan (2007-8)	21
6.2.4 Website.....	22
6.2.5 Future Ashburton.....	22
6.3 Timaru	23
6.3.1 District Plan (operative March 2005)	23
6.3.2 LTCCP (2006-16)	24
6.3.3 Annual Plan (2007-8)	25
6.3.4 Website.....	26
6.4 Mackenzie	26
6.4.1 District Plan (operative May 2004)	26
6.4.2 LTCCP (2006-16)	29
6.4.3 Annual Plan (2007-8)	29
6.4.4 Website.....	30
6.5 Waimate	30
6.5.1 District Plan (operative October 2001)	30
6.5.2 LTCCP (2006-16)	32
6.5.3 Annual Plan (2007-8)	32
6.5.4 Website.....	33
7.0 FLOODPLAIN MANAGEMENT STRATEGIES	33
7.1 Kaikoura	34
7.2 Ashburton River.....	35
7.3 Pareora and Waihao Rivers	35
8.0 CONCLUSIONS	37
9.0 RECOMMENDATIONS	40
10.0 ACKNOWLEDGEMENTS	40
11.0 REFERENCES	41

FIGURES

Figure 1	Canterbury region and districts: Location map	3
Figure 2	Hazard/risk reduction linkages between the RMA & CDEM Act (from Saunders et al. 2007).	5
Figure 3	Flooding zones on planning map from Ashburton District Plan.....	20
Figure 4	Flooding Area map from Mackenzie District Plan	28

TABLES

Table 1	Hazard analysis table from Canterbury CDEM Group Plan	7
Table 2	Progress on the Reduction projects, March 2008	8
Table 3	Natural hazards covered in the text of District Plans.....	13
Table 4	Natural hazards shown on planning maps.	13

EXECUTIVE SUMMARY

This report reviews the coverage of natural hazards in planning and related documents and the linkages between these documents. It analyses documents from the Canterbury Region and five districts within it (Kaikoura, Ashburton, Timaru, Mackenzie and Waimate). This is the second study of natural hazard planning in Canterbury - the first report (Forsyth 2006) covered the Canterbury Region generally, together with Hurunui, Waimakariri and Selwyn districts, and Christchurch City.

Documents consulted include: the Canterbury Civil Defence Emergency Management (CDEM) Group Plan, Canterbury Regional Policy Statement and regional plans, district plans, long term council community plans (LTCCPs), annual plans, council websites, growth and development strategies, and floodplain management strategies.

The inclusion of risk Reduction measures for natural hazards has been analysed in each document. This report specifically refers to hazards of a geological nature or those whose impact can be gauged from the geological record.

At the regional level, the ten-yearly review of the Regional Policy Statement, with a significant re-write of the Natural Hazards chapter, should result in better strategies for dealing with natural hazards at regional and district levels. The Canterbury CDEM Group has also reviewed parts of its plan, resulting in an updated Recovery section (Reduction has become a larger part of this process). The Hazards section is due to be revised in the near future.

At the district level, planning documents vary in their coverage of natural hazards. All District Plans studied cover natural hazards to some degree, give data and management strategies, and contain statements and rules about risk Reduction. LTCCPs generally have little natural hazard coverage, and Annual Plans tend to be very close to their LTCCPs. Most growth strategies, apart from the Greater Christchurch Urban Development Strategy, have minimal coverage of hazards and risk Reduction. Council websites generally have some coverage of natural hazards on their Civil Defence pages.

The Regional Coastal Environment Plan is being used by districts to a limited extent; in one case the hazard lines published by Environment Canterbury (ECan) are shown on planning maps and in another, rules for the coastal area are delegated to ECan. Two older District Plans pre-date the Regional Coastal Environment Plan, and one district in the study does not have a coastline.

Flood hazard is a major concern in all districts studied, and all have some coverage of this hazard on maps. Local floodplain management strategies vary in content and approach, from the old "catchment board" style of plan to modern formats integrating structural and non-structural measures. All the District Plans studied use setbacks from waterways, stopbanks and/or the coast, but none apply to active fault lines.

Methods of analysing hazard and risk are not stated and many plans require an expert to determine risks at particular sites. Sources of information on hazard planning maps are not given on the maps themselves; some plans give this information elsewhere and others not at all. However, many examples of good planning practice were noted during the study.

Keywords

Natural hazards, flooding, earthquake, landslip, land instability, erosion, sedimentation, tsunami, climate change, planning, strategy, development, civil defence, emergency management, CDEM, regional council, regional policy, district council, district plan, Canterbury, Kaikoura, Ashburton, Timaru, Mackenzie, Waimate.

1.0 INTRODUCTION

In 2005, GNS Science began a study on the effectiveness of planning for natural hazard risk Reduction in Canterbury, in collaboration with Environment Canterbury (ECan) staff, and this was subsequently published as a GNS science report (Forsyth 2006). The report covered the Canterbury Region, and analysed all available regional-level documents, but due to time constraints planning documents from only Hurunui, Waimakariri and Selwyn districts and Christchurch City were reviewed in detail.

In 2007, the Canterbury Civil Defence Emergency Management (CDEM) Group agreed that detailed coverage of the districts should be extended to cover the whole Canterbury region, with the exception of Waitaki District which lies partly in Otago and has opted to join the Otago CDEM Group. Stage 2 of the study, the present report, was prepared under contract to the Canterbury CDEM Group and ECan. The project aims and scope were stated as follows:

“2 Project aim

The aim of the project is to analyse and compare natural hazard coverage and mitigation strategies within planning documents from Kaikoura, Ashburton, Timaru, Mackenzie and Waimate districts.

3 Project scope

The project involves reviewing and analysing hazard risk reduction provisions within annual plans, long-term council community plans, district plans, and any other relevant plans and strategies from Kaikoura, Ashburton, Timaru, Mackenzie and Waimate districts. The project will analyse linkages between these plans and regional level planning documents including the Canterbury Regional Policy Statement, the Regional Coastal Environment Plan and the Canterbury CDEM Group Plan.”

In addition to the scope given above, some newer documents from the areas covered in Stage 1 were briefly surveyed.

The study was part-funded by the Canterbury CDEM Group and ECan, with the remainder funded by GNS Science under its Hazards and Society programme (Foundation for Research, Science and Technology contract CO5X0402).

2.0 METHODS

Documents were reviewed in hard copy where available, and otherwise viewed on council websites or in electronic form, during late 2007 and early 2008.

Documents and websites consulted were:

- ECan, Canterbury CDEM and district council websites
- Canterbury Regional Policy Statement (RPS) Review
- District Plans for Kaikoura, Ashburton, Timaru, Mackenzie and Waimate

- Long Term Council Community Plans (LTCCP) for these districts
- Annual Plans for these districts
- Growth and development strategies (Ashburton, Greater Christchurch)
- Catchment and floodplain management plans

Some notes and documents compiled for the earlier study on natural hazards in Canterbury (Forsyth 2006) were referred to during the present study.

When reviewing planning documents, questions included:

- Which natural hazards are covered?
- What details are given about them?
- What are the strategies for managing natural hazards?
- Do the aims/objectives/policies link into CDEM?
- Do aims/objectives/policies encourage CDEM philosophies (e.g. risk reduction measures)?
- Do growth strategies etc take into appropriate consideration the natural hazards of an area, and provide appropriate solutions?
- If strategies for risk reduction are present, are they acknowledged or funded in the LTCCP or Annual Plan?

When viewing council websites, initial questions included:

- How easy is it to find Civil Defence information?
- What Civil Defence information is given?
- Is there any other hazard-related information?

3.0 THE CANTERBURY REGION

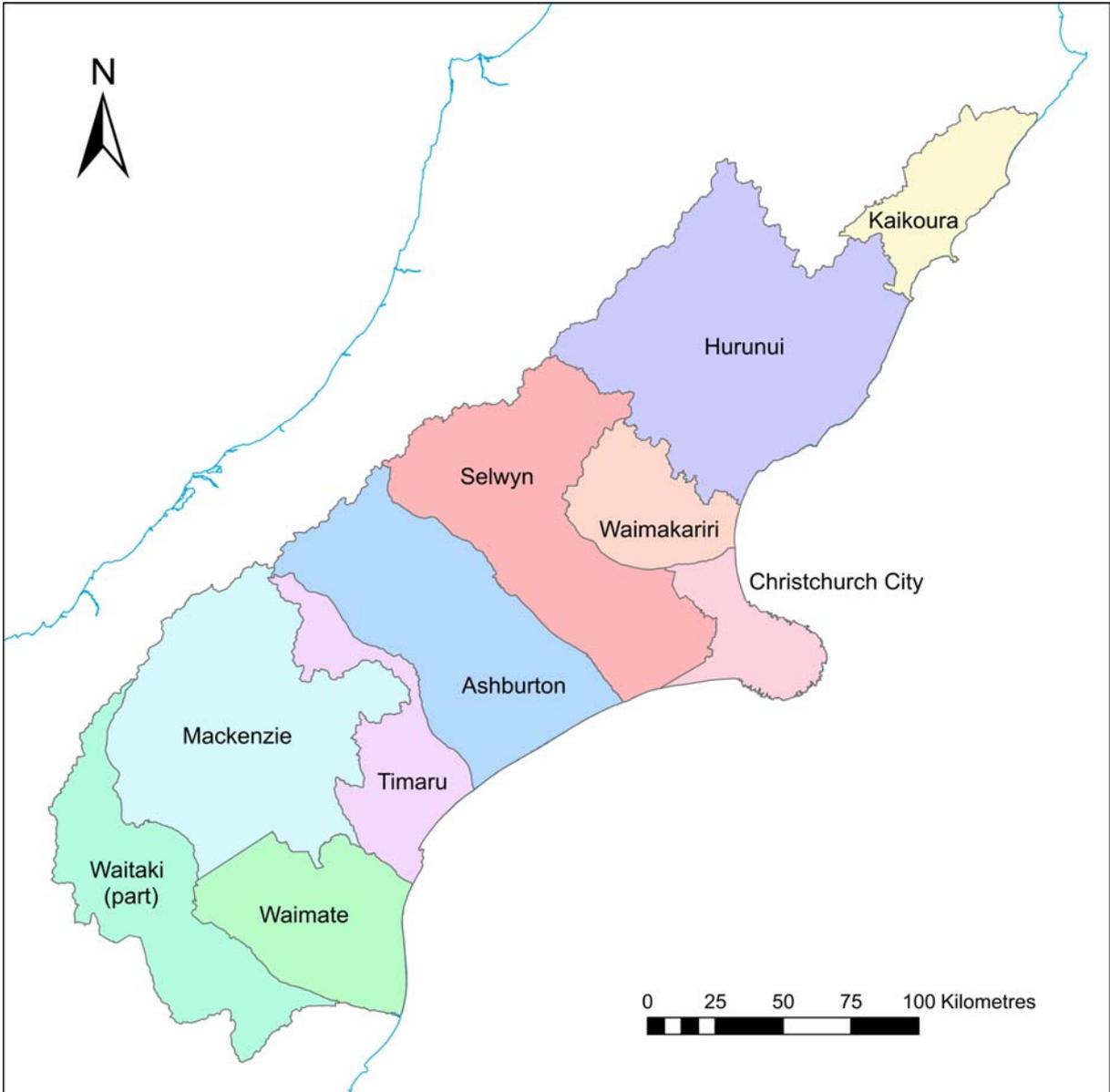
The Canterbury Region in the South Island of New Zealand (Fig. 1) comprises part of the mountainous Southern Alps, a belt of foothills and downlands, the alluvial Canterbury Plains and the volcanic hills of Banks Peninsula. The region makes up about 30% by area of the South Island, approximately 40 940 square kilometres. The population is about 521 850, over half the people in the South Island and about one-eighth of New Zealand's population (2006 census; Statistics New Zealand website, www.stats.govt.nz). Christchurch is the major city (population 348 435 in 2006).

The regional authority is the Canterbury Regional Council, also known by its promotional name Environment Canterbury or ECan.

The region comprises the following territorial authority areas: Kaikoura District, Hurunui District, Waimakariri District, Christchurch City (including the former Banks Peninsula District), Selwyn District, Ashburton District, Timaru District, Waimate District, Mackenzie District, Waitaki District (part only).

For this report, several types of planning and supporting documents from Canterbury Regional Council and five district councils (Kaikoura, Ashburton, Timaru, Mackenzie and Waimate) have been studied. (Waitaki District lies partly in Otago and has joined the Otago CDEM Group, so was not considered in this study.)

Figure 1 Canterbury region and districts: Location map.



Each document has been examined for mention of natural hazards and particularly for the inclusion of measures to reduce the effects of natural hazards. The focus has been on hazards of a geological nature or those whose impact can be gauged from the geological record. Broadly these are:

- earthquakes
- coastal hazards including coastal erosion, storm surge and tsunami
- flooding
- erosion and sedimentation
- land instability including landslide and rock fall
- climate change
- volcanic eruption /ash fall

Flooding has been included, while other hazards of a meteorological nature such as wind, snowfall and drought, have not. This is because geological and geomorphological studies of river valleys can identify the extent of flood plains on geological (hundreds/thousands of years) time scales. This is useful as an adjunct to hydrological studies and historical records of flood extents. Wind, snowfall and similar events leave no such long-term marks on the ground, and cannot be interpreted by looking at the landscape.

4.0 NATURAL HAZARDS MANAGEMENT CONTEXT

4.1 Natural Hazards Management in New Zealand

The management of natural hazards in New Zealand is broadly established by two overarching pieces of legislation: the Resource Management Act 1991 (and later amendments) and the Civil Defence Emergency Management Act 2002 (Fig. 2). Both have national (central government), regional and local elements, and the best outcomes will be achieved when planning measures under both pieces of legislation are linked with each other and with community aspirations.

Internationally, and in New Zealand, Emergency Management philosophy emphasises the '4 R's' of Readiness, Response, Recovery and Reduction. In the National CDEM Plan, reduction is defined as:

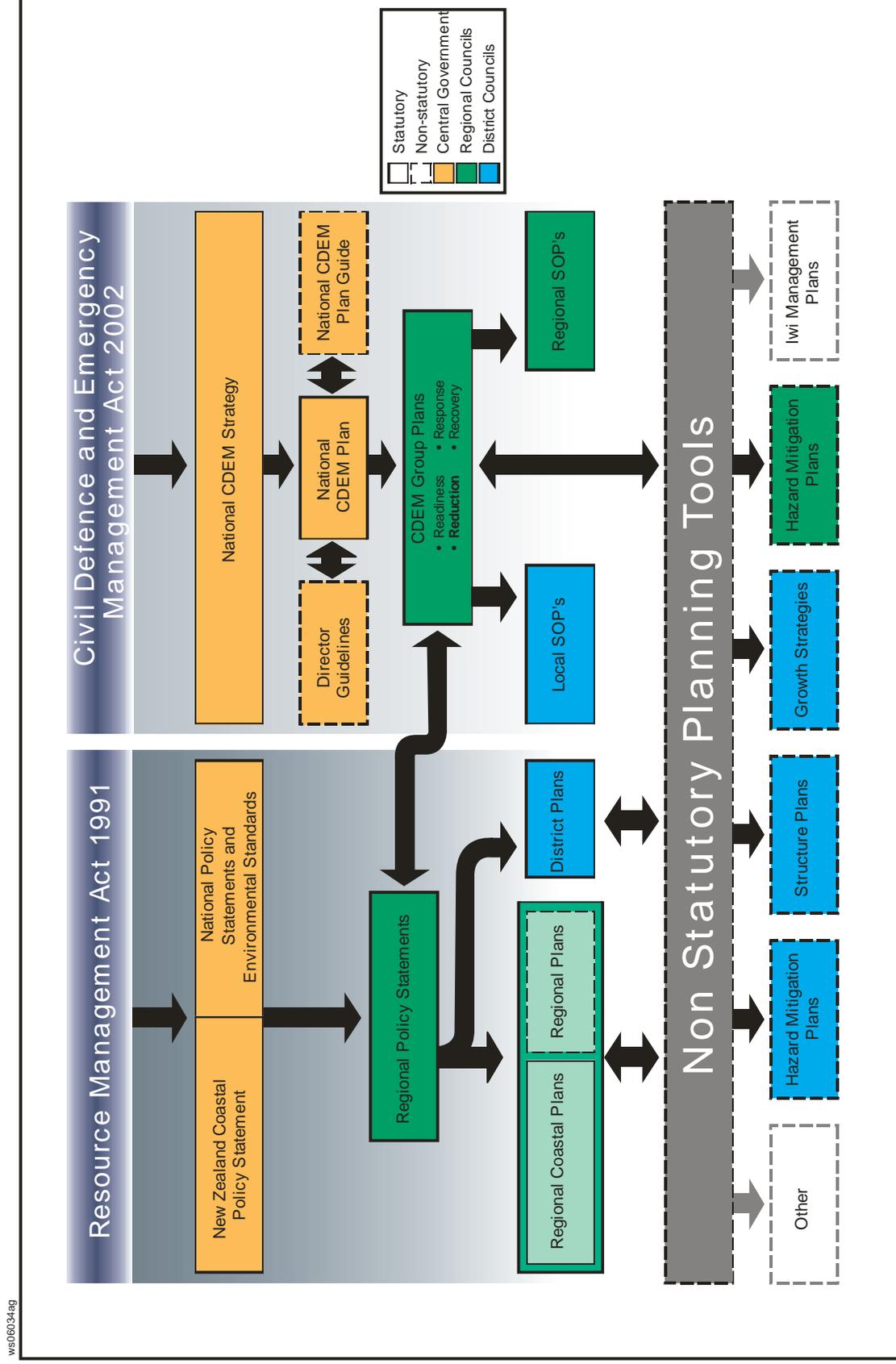
- "identifying and analysing long-term risks to human life and property from natural or non-natural hazards
- taking steps to eliminate these risks if practicable, and, if not,
- reducing the magnitude of their impact and the likelihood of their occurring."

The Civil Defence Emergency Management Act 2002 seeks to improve and promote:

- "the reduction of risks through partnerships with communities;
- the reduction of community disruption from avoidable hazards and risks;
- the reduction of fiscal risks from the costs of disruption"

www.civildefence.govt.nz.

Figure 2 Hazard/risk reduction linkages between the RMA & CDEM Act (from Saunders et al. 2007).



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This report focuses on the Reduction aspect of natural hazard management. Its purpose is to review the coverage of natural hazards in planning documents, and the linkages between CDEM documents and planning documents at regional and district/city level. By highlighting gaps, as well as good practice, it is hoped that the standard of planning for natural hazard risk Reduction can be improved.

The Readiness aspect of Civil Defence is well covered in the national-level websites of the Ministry of Civil Defence & Emergency Management (www.civildefence.govt.nz) and “Get Ready Get Thru” (www.getthru.govt.nz/). The latter actively promotes disaster preparation with a Household Emergency Checklist and Household Emergency Plan. “What's the Plan Stan”, a resource for teaching Civil Defence in schools, is also found here. Many council websites link to “Get Ready Get Thru” , which is extensively promoted on television, phone books, and other mass media.

4.2 Emergency Management in Canterbury

The foundation document for Emergency Management in the region is the Canterbury CDEM Group Plan (2005), which was reviewed in the previous study (Forsyth 2006; section 3). Several updates have been carried out or are proposed for parts of this plan (J. Mitchell, pers. comm., March 2008).

The CDEM Group Plan considers flooding, earthquakes, land instability and tsunami as the most significant hazards, with extreme meteorological events and rural fire also noted. Hazards are given in more detail, and ranked, in Appendix 2 of the CDEM Plan (Table 1).

The Hazards section of the Group Plan will be reviewed and updated by June 2009 as part of the five year review that is required by the CDEM Act 2002.

Section 2.4 of the CDEM Group Plan addresses risk Reduction, the main feature of this section being a table (2.4) prioritising the hazards in order to focus the Group's projects. Seven “Reduction” projects arise from these statements (Appendix 1 of the CDEM Plan, Work Programme). In March 2008, the Reduction projects were at various stages of completion (Table 2) (J. Mitchell, pers. comm., March 2008).

Table 1 Hazard analysis table from Canterbury CDEM Group Plan

Hazard	Seriousness					Manageability										Total					
	Human	Economic	Social	Infrastructure	Geographic	Readiness		Response		Recovery		Reduction		Total Effs Manageability							
						D	E	D	E	D	E	D	E	D	E		D	E			
Earthquake Alpine fault*	5	4	4	4	2	40	3	1	20	3	1	1.5	3	1	2.0	2	2	6.0	5	1	10.8
Water Supply Failure/rural	5	1	3	3.5	2	25	3	1	20	2	1	1.0	2	1	1.0	2	1	1.0	2	1	9.6
*Water Supply Failure/Urban	5	3	3	4	4	3.5	2.5	1	1.5	2	1	1.0	2	1	1.0	2	2	6.0	4	2	9.4
*Waste Water Failure	6	3	3	4	2	3.4	3	1	2.0	2	1	1.0	2	1	1.0	2	2	6.0	4	2	9.4
Disruption of Fuel Supply	2	2	3	3	2	2.4	2	1	1.0	3	1	2.0	2	1	1.0	2	1	1.0	3	2	9.4
Human disease epidemic	6	3	4	2	1	3.0	2	1	1.0	3	2	1.0	3	1	2.0	2	2	6.0	4	2	9.0
Earthquake - local*	6	3	4	4	4	4.0	3	1	2.0	3	2	1.0	3	2	1.0	2	2	6.0	4	1	9.0
Tsunami	3	3	3	3	3	3.0	3	1	2.0	2	1	1.0	2	1	1.0	2	1	1.0	5	1	8.0
Flooding (including dam failure)	4	2	3	3	1	2.6	3	1	2.0	2	1	1.0	2	1	1.0	3	2	1.0	5	1	8.0
Electricity Failure	3	3	3	3	1	2.6	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.9	4	2	8.6
Telecommunications failure	3	2	3	3	2	2.6	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	4	2	8.6
Animal disease epidemic	1	4	3	1	2	2.2	2	1	1.0	2.5	1.5	1.0	2	1	1.0	2	2	0.9	3	2	8.2
Biological pests and new organisms	1	2	3	1	3	2.0	2	1	1.0	3	2	1.0	2	1	1.0	2	3	0.9	3	2	8.0
Drought	1	3	3.5	3	4	2.9	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	4	1	7.8
Extreme Temperature (hot/cold)	3	1	2	2	2	1.8	3	1	2.0	2	1	1.0	2	1	1.0	2	1	1.0	5	1	7.8
Computer/Information System Failure	1	2	3	1	1	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	4	2	7.8
Coastal erosion	1	2	1	3	3	2.6	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	4	1	7.0
Civil Unrest/Terrorism	3	3	3	3	2	2.8	2	1	1.0	2	2	0.0	2	1	1.0	2	2	0.0	2	2	6.8
Wildfire/rural/fore	3	1	3	3.5	3	2.7	2	1	1.0	2	2	0.0	2	1	1.0	1	1	0.0	2	2	6.7
High winds	3	2	3	3	1	2.4	2	1	1.0	2	1	1.0	2	1	1.0	1	1	0.0	3	1	6.4
Port Incident	3	2	2	2	2	2.2	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	3	1	6.2
Electrical storms	3	1	2	2	2	2.6	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.0	3	1	6.0
Land instability	2	1	2	2	2	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.0	3	1	5.8
Hail	2	1	2	2	1	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.0	3	1	5.8
Volcanic eruption - ash fall	1	2	2	2	2	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.0	3	1	5.8
Snow/Ice/sl	3	4	2	1	2	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	2	0.0	3	1	5.8
Marine Accident (at sea)	3	2	1	1	2	1.8	2	1	2.0	2	1	1.0	2	1	1.0	1	2	-1.0	3	1	5.8
Climate change	2	2	1	1	3	1.8	2	1	1.0	2	1	1.0	2	1	1.0	2	1	1.0	3	1	5.5
Urban fire	4	1	2	4	2.5	2.7	2	2	0.0	3	2	1.0	2	1	1.0	2	2	0.0	2	1	5.7
Hazardous Substances	3	1	2	3	3	2.5	1	2	0.0	2	1	1.0	2	1	1.0	2	2	0.0	2	1	5.6
Major Air Accident	5	1	2	2	1	2.2	2	2	1.0	3	2	1.0	2	2	0.0	2	3	-1.0	1	2	5.2
Heavy rainfall	2	2	2	2	2	2.0	2	1	1.0	2	1	1.0	2	2	0.0	2	2	0.0	2	1	5.0
Rail Accident	3	1	2	2	1	1.8	2	2	0.0	2	2	0.0	1	1	0.0	2	1	1.0	1	2	4.8
Major Road Accident	4	1	1	2	1	1.8	3	2	1.0	2	2	0.0	2	1	1.0	2	2	0.0	2	1	4.8
Space Debris	3	1	1	1	1	1.4	2	1	1.0	2	2	0.0	2	1	1.0	1	1	0.0	2	1	4.4
Meteorite	3	1	2	2	1	1.8	1	1	1.0	2	1	1.0	2	2	0.0	1	1	0.0	1	1	3.8
									1.15			0.90			0.36						0.31

Seriousness is estimated on a scale from 1 (little impact) to 5 (catastrophic impact).
 Manageability is estimated on a scale of 1 (little), 2 (moderate), 3 (extreme), in relation to the Difficulty of providing for the respective factor and current Effort expended.
 Top 10 Hazards: Road/Glass 1.75, Response 1.15, Recovery 1.20, Reduction 0.40
 Top 20 Hazards: Road/Glass 1.43, Response 0.98, Recovery 1.10, Reduction 0.45

Table 2 Progress on the Reduction projects, March 2008

PROJECT	PROGRESS
Red04/01 - Review of organisational and regulatory hazard reduction measures	Ongoing with project partner GNS Science [this report and Forsyth (2006) form part of the Red04/01 project].
Red04/02 - Community-based hazard reduction programme (Public Education)	Ongoing with GNS Science; Social Resilience Project in conjunction with an Auckland-focused study
Red04/03 - Meteorological hazard project.	Funding discontinued by the Group Joint Committee in 2006
Red04/04 - Fuel Supply Hazard Project	Phase 1 (Storage) completed. Phase 2 (Distribution) now underway.
Red04/05 - Update of Consequences section of Summary Hazard Register	Has focused on specific hazards, firstly tsunami (after the Indian Ocean tsunami), then Human Influenza Pandemic. Operational plans have been revised or developed as a result. No need has been identified to amend the consequence component of the Group Plan. An update of the whole Summary Hazard Register is also planned for the 2008-9 year.
Red04/06 - Review of CDEM partner emergency-related insurance arrangements	Project completed in 2005. Enhanced arrangements made at CDEM Group level.
Red04/07 - Canterbury Lifelines Utilities Disaster Resilience Statement	Project has proven to be more difficult than originally envisaged and has been set aside for the time being.

Section 9 of the Group Plan, dealing with Recovery, has recently been updated and was adopted by the CEG¹ in February 2008. The new version has significantly more references to risk Reduction than the former version, and places this concept firmly within the framework of Recovery. The Definition section (9.1.1) states that CDEM Recovery encompasses “Reducing future exposure to hazards and their associated risks” , while Section 9.2, The Principles of Recovery, re-states that:

“Recovery should not just aim at recreating the past, but creating the future. Opportunities to reduce vulnerability to future hazard events will be sought and implemented during Recovery.”

Reduction also becomes one of the priorities to be followed in the recovery phase:

“Natural Environment Recovery: Repair of damage to the natural environment, including *strategies to remove or reduce the risk of future damage.*

Built Environment Recovery: Restoration of critical infrastructure... Recovery of these physical items must be based on long term strategies adopting mitigation measures that prevent or *reduce* the likelihood and consequences of future emergencies. Thus they link back to *Reduction planning.*” (section 9.3, italics added).

¹ Canterbury Civil Defence Emergency Management Co-ordinating Executive Group

Thus the opportunity of revising the Recovery section has resulted in raising the profile of Reduction within the Recovery phase.

The Group Recovery Plan is a separate document from the CDEM Group Plan, and was at a draft stage at the time of writing (March 2008). It contains several of the statements about Reduction that occur in Section 9 of the Group Plan, placing Reduction among the priorities during the Recovery phase and afterwards. It should ensure that Reduction of future risks is on the agenda amid the many demands made on communities recovering from a disaster.

4.2.1 Canterbury CDEM online

The Canterbury CDEM Group website www.cdemcanterbury.govt.nz/ continues to give access to a variety of useful public information, such as community-based volunteer training, family survival plan and disaster survival kit. Most council websites surveyed link to this site, many from the home page.

New content since the previous (2006) report includes a link to locally produced brochures about tsunami preparation (by Environment Canterbury and Christchurch City), a six-day “Disaster Week” programme to build emergency preparedness, information on pandemic planning, and an article entitled “Are we ready for an earthquake centred on the alpine fault?” [sic].

The local CDEM arrangements for each district are also available online at www.cdemcanterbury.govt.nz/information-for-emergency-managers.htm. These contain a wealth of information about the hazardscape of each district, many with informative maps. Much of this useful material does not appear on the council websites, but it could be more widely circulated, which would enhance public awareness.

The Canterbury CDEM Group website continues to give readers the impression of a proactive, engaged and relevant organisation.

5.1 Canterbury Regional Policy Statement Review

(via website www.ecan.govt.nz/ on 14 November 2007)

As noted previously (Forsyth 2006, section 4.1), the Canterbury Regional Policy Statement (CRPS) of 1998 addressed natural hazards in a generalised way and did not satisfactorily allocate responsibility for hazard management. This resulted in ongoing debate about the overlap of responsibility for hazards between district and regional councils. It is pleasing to note that the 10-year review of the Regional Policy Statement, now under way, will include a significant re-write of the Natural Hazards chapter.

A background paper, the CRPS Scoping Report Oct 2006, summarises ECan thoughts:

“The current CRPS Chapter 16: Natural Hazards does not provide the necessary clarity of functions and overall

policy guidance to effectively manage the risks from natural hazards. ...

The importance of this issue to the region and the deficiencies in the CRPS suggest a significant re-write of this chapter is required. This could commence at any time but will need considerable input from territorial authorities. The changes to be considered include:

- More precise policies to guide risk management, including, if possible, guidance on what constitutes acceptable levels of risk
- A clear delineation of the responsibilities between territorial authorities and Environment Canterbury
- The inclusion of a section on climate change
- Guidance on the balance between risk reduction measures and any adverse effects from these measures. “

Another undated, anonymous background paper (accessed on the ECan website, 14 Nov 2007) includes further details of the current deficiencies in the CRPS Natural Hazards chapter, and reviews ways of dealing with the issues from other regions.

The new Natural Hazards chapter of the Regional Policy Statement is currently being developed with input from territorial authority resource planners (H. Grant, pers. comm., May 2008). This will help to overcome any “disconnect” between district-level and regional-level knowledge of natural hazards. Furthermore, future district plans are required to give effect to the RPS, so planning for known hazards should become more unified. Improved protocols for the divisions of responsibility between districts and regions should also result from the 10-yearly review.

These ongoing discussions between ECan and territorial authority planners, and the RPS review, represent a considerable step forward in policy planning around natural hazards. They should result in much more workable strategies and methods for dealing with natural hazards at both regional and district levels.

5.2 Greater Christchurch Urban Development Strategy (2007)

The Urban Development Strategy (UDS) is a high-level discussion of options for managing ongoing growth around Christchurch and the neighbouring districts (Selwyn to the south and west and Waimakariri to the north). It is available at www.greaterchristchurch.org.nz. Since the earlier study (Forsyth 2006, section 4.6), the strategy has been signed and formally launched (June 2007). Although it does not fall within the area of the present study, it is relevant to review whether natural hazards are adequately addressed.

The Strategy itself mentions a variety of natural hazards. Section 3.5, Overview of Growth Issues, states that:

“Flooding, earthquake risk and liquefaction, tsunamis, shoreline recession, storm surges and coastal inundation all pose varying degrees of risk to the area and will constrain further growth... Climate change risks are more likely to result in coastal inundation from increasing storm surges especially for those areas at, or below, sea level.”

In Section 6.15, Natural Hazards and Climate Change, there is another list of natural hazards

that development must consider:

“The location and form of any development must take account of present and future natural hazards to avoid and minimise risks to health, property and the environment. Geological processes and climate change must be considered when taking a long-term view of urban development. ... It is vital that planning and development processes ensure resilience for the community. The most serious natural hazards associated with the study area in order of priority, based on likelihood and impact, are: fire, earthquake, drought, flooding, sea level rise, tsunami, strong winds and landslides.”

The “precautionary principle” is invoked, and the strategy of risk avoidance is spelled out in Section 3.6 (Growth Management Assumptions):

“A risk avoidance approach is taken in selecting new areas for residential and commercial development on land affected by slippage and instability, earthquakes and liquefaction, flooding and rising sea levels.”

Roles are identified for ECan (both as lead and support agency), the Christchurch, Selwyn and Waimakariri councils, the Canterbury CDEM Group, and the UDS Implementation Committee (although the latter will not actually carry out actions, which will fall instead to ECan and the territorial authorities).

The strategy is now moving into the implementation phase, with regional and district councils cooperating to align their plans and policies around infrastructure and future growth. The strategy has set a useful broad context of planning for natural hazard avoidance and risk reduction. The forthcoming urban design strategies, development plans and catchment management plans will presumably include details of natural hazards and the constraints they impose, along with detailed methods of minimising or avoiding these hazards.

5.3 ECan online links

The ECan homepage (www.ecan.govt.nz/home/) leads directly via a “hot link” to the Canterbury CDEM Group website. The rest of the ECan website was also scanned for material relating to hazards. The hazard coverage is still under development (H. Grant, pers. comm., Jan. 2008).

“Dramatic dynamic dunes” is an environmental education module (also accessible through “Our Environment/Coast”) featuring images and issues from Pegasus Bay. The material is written at a level appropriate for schools. Much of the information concerns ecosystems, but there is some coverage of the role of dunes in protecting the land behind from coastal hazards (erosion and saltwater inundation). On a related subject, the ECan home page also links to a draft Northern Pegasus Bay Coastal Management Plan, for which community feedback is currently sought (January 2008). This management plan has no mention of hazards as such. Both sets of information about the coastal dunes of Pegasus Bay emphasise ecological and recreational values rather than hazard issues, but there is some hazard information embedded in the educational material.

The main part of the ECan website dealing with natural hazards is under Plans and Reports/Natural Hazards. On this web page are found several floodplain management strategies (see section 7), and the Earthquake Hazard and Risk Assessment Study (2005). This web page content does not accurately reflect the large collection of natural hazard data held by ECan, and a comprehensive list of these documents is being compiled. Including this

bibliography on the website would enhance public awareness of all natural hazards.

A link in the ECan website to GIS mapping formerly included fault lines (Forsyth 2006). These data have been temporarily withdrawn while the database is updated with new information. The display of such information, while not without its technical problems, is considered to be useful in raising public awareness.

6.0 DISTRICT PLANNING DOCUMENTS

The main planning document for each district is the District Plan, which includes the Planning Maps. District Plans take several (or many) years to prepare and become operative. A review must then occur no later than ten years after the plan becomes operative. Plan variations may occur but this too may be a lengthy process. District Plans contain council rules for land use and development.

Complementary to the District Plan is the Long Term Council Community Plan (LTCCP), which expresses the vision and future directions of the community, along with proposed expenditure and large projects. These plans forecast ten years in advance but must be reviewed every three years. All those consulted for this study cover the period 2006-2016. Annual Plans are generally derived from the LTCCP but can vary from it if required by more recent events. Between them these three documents contain philosophies, visions, policies, rules and explanations for the management of the district and the activities of the community.

Council websites are not in themselves planning documents, but may be the first point of contact with councils. Many contain links to the planning documents, together with news, local interest or educational material. The reason for including council websites in this study is to examine their civil defence/emergency management content and whether there is any focus on risk Reduction as well as the more usual Readiness and Response activities. Any other hazard-related content was also noted.

Because each planning document is unique to its district, contents and philosophies differ although many similarities also emerge. Hazards identified as significant to the district vary (Tables 3 and 4), but the most important is always flooding, as noted elsewhere in New Zealand (Forsyth & Becker 2005; Forsyth 2006). It is notable that no active faults are shown, nor are setbacks established from them, even in districts where earthquakes are considered to be a significant hazard.

Table 3 Natural hazards covered in the text of District Plans. (* : plan includes the generic list of natural hazards from the Resource Management Act)

District	Identified as major hazards	Also mentioned
Kaikoura	flooding, coastal erosion/inundation from the sea/tsunamis, earthquakes	land instability, over-exposure to the sun * in “definitions” section
Ashburton	flooding, coastal erosion/inundation from the sea, earthquakes, severe climatic extremes (drought, snowfall, wind),	
Timaru	river flooding, coastal erosion and flooding, subsidence	drought, earthquakes, wind; also *
Mackenzie	flooding (incl erosion, deposition, avulsion), shallow slumps/earth flows, slumping/slipping, active alluvial fans, rockfall, earthquake, drought, fire, wind	
Waimate	flooding, severe climatic extremes (incl drought, snowfall, wind), coastal erosion/inundation from the sea, earthquakes	tsunami; also * in “definitions” section

Table 4 Natural hazards shown on planning maps.

District	Hazards shown on main maps	Hazards shown on one map	Hazards shown on specific maps
Kaikoura			Flooding, ponding
Ashburton	Flooding (apart from Rural C Zone)		
Timaru	Stopbanks, 100-year coastal erosion line, coastal inundation line		
Mackenzie	Lakeside inundation	Flooding - Kimbell	Flooding
Waimate		50-year erosion line – Waitaki Mouth	Flooding, stopbanks

6.1 Kaikoura

6.1.1 District Plan (proposed, as amended by Council decisions, November 2005)

The main coverage of natural hazards is in Section 8. The principal hazards mentioned are flooding, coastal erosion/ inundation from the sea/tsunamis and earthquakes. Land instability and over-exposure to the sun are also dealt with as separate issues. Mentioned but not further dealt with in the Natural Hazards section are snow, wind, drought, fire, erosion, sedimentation, and volcanic/geothermal activity.

The structure of the Natural Hazards section is very clear, with Issues leading in turn to Objectives, Policies and finally Implementation Methods and Rules. A General section is followed by specific measures relating to Flooding, Coastal Hazards, Land Instability and, finally, Over-exposure to the Sun (Kaikoura is the only Canterbury district which recognises this as a natural hazard).

General policies and methods include increasing community awareness, a GIS-based natural hazards register, liaising with the Regional Council on Civil Defence education and response procedures, protecting protection works from the activities of people, considering natural hazard issues in the resource consent process, and avoiding unnecessary duplication of provisions between the District and the Regional councils. This last recurs throughout the document, particularly in relation to coastal hazards; overall the intention is not to require applicants to gain permission from both ECan and Kaikoura District Council for their activities.

Further policies, methods and rules relate to specific hazards. For Flooding, these include:

- identify areas at risk
- avoid and discourage residential development on land prone to high and moderate flood risk or where the probability of flooding is greater than 0.2% AEP², defined as a 10% chance in any 50 year period that a site will be inundated by flood waters
- raised floor levels (not specified), floor heights (based on a 0.2% probability of flooding in any one year, 8.8.2) and setbacks from stopbanks (100 m, 8.8.1).³

Specific measures relating to coastal hazards are softer, such as supporting and cooperating with Regional Council provisions and the NZ Coastal Policy Statement, and providing information to land owners. Measures relating to Land Instability suggest identifying areas of unstable land and taking land stability into account when considering subdivision applications. Although Earthquakes are considered a significant natural hazard in the district, and there is a good list of major faults potentially capable of generating earthquakes, there are no specific provisions for reducing risk (such as applying setbacks from fault lines).

² Annual Exceedance Probability, a standard engineering term referring to the probability of this hazard occurring in any one year

³ The Definitions section of the plan contains useful definitions for the centre line of conventional and modified stopbanks.

Several noteworthy statements are made in Section 8. The flooding event of December 1993 suggests that reliance on flood protection works alone is not the most effective long term solution to minimise potential damage (8.1.a). The plan recognises that coastal systems are dynamic and therefore some features may migrate inland, and that sea level rise needs to be monitored and taken into consideration, possibly leading to changes to the District Plan in the future (8.4.2.3 & 4). Utility lifelines are to be discouraged from locating in the highest risk areas (8.3.2.6). These are all useful statements. There is also the statement that some risk of flood damage may be accepted if there is a benefit from doing so (8.3.3 Explanation):

“If risk to life can be minimised and the economic benefit in periods between flood losses outweighs the risk of occasional damage, certain kinds of development might still be justified provided that the developers/occupiers are aware of the risk”.

Section 13 – Subdivision covers many of the same natural hazard issues as Section 8, within an overall objective of avoiding subdivision in hazardous locations unless the risk can be remedied, mitigated or avoided without adverse environmental effects. A new policy recognises the role of esplanade reserves and strips in mitigating natural hazards, and this is re-stated in 13.12.9.Schedule 1(i). Setback rules of 10 m from river beds or wetland edges are stated in Section 18 (Residential) and Section 20 (Business), and Section 22 (Rural) clarifies that the margins of water bodies have values including protection against natural hazards (22.1.3). Setbacks of 50 m from the Coastal Marine Area (in Residential and Settlement zones) and 100 m (in Rural zones) are also applied in Section 13. Finally, Section 25 Assessment Matters guides applicants and decision makers when assessing environmental effects – most of the first 21 questions (25.2.1.a-u) relate to assessing natural hazards.

Planning maps were viewed on the website (www.kaikoura.govt.nz/ on 29 January 2008). Flood hazard is shown on a separate series of maps (Part 4) with cadastral base. The black-and-white maps are not very clear but should be clearer when eventually printed as part of the final District Plan. A total of seven types of flooding and ponding areas are shown, divided into highest, moderate and lowest risk. Stopbanks are referred to in the Rules (e.g. 8.8.1.a) but they do not appear to be shown on the maps, although it is hard to tell on these web-based versions.

The source of the flooding information is not given on the maps. According to the preamble/cautionary note at the start of the maps, the source is “a subjective geomorphic interpretation ... based on detailed field mapping and local knowledge”, and according to Section 8.1.a of the main plan, it is “a geomorphological study undertaken by [Canterbury] Regional Council and incorporat[ing] historical flood data”.

Coastal hazard or inundation lines are not shown on the planning maps. The intention is clearly that those of ECan are used, as referred to in 8.8.4, and rules relating to those areas are not duplicated in the District Plan provisions. Neither are major active fault lines shown on the planning maps; perhaps it is expected that ECan data are used instead.

Overall, Kaikoura’s District Plan contains many useful statements, policies and rules relating to natural hazards. However hazards coverage within rules and planning maps is uneven, dealing almost entirely with flooding and not with some of the other significant hazards in the

district (for example, earthquakes, tsunami, coastal erosion and inundation, rockfall onto highways and railways). The preponderance of flood-related coverage is probably because a detailed Kaikoura Floodplain Management Strategy exists (see section 7.1, below). The approach to developing in flood risk areas – it may be acceptable if owners are aware of the risk – is similar to that currently used by Queenstown-Lakes District (Forsyth et al. 2004). Kaikoura's District Plan is also unique in this study in its statements about avoiding unnecessary duplication of provisions between the District and the Regional councils. These recur throughout the document, particularly in relation to coastal hazards.

The document's status as "proposed" may account for its unfinished nature in places. For example, on p 69, an amended paragraph in Explanation and Reasons reads: "The District Council and the Regional Council both have functions for avoiding and mitigating natural hazards in the District. This requires that appropriate emergency response procedures are put in place to minimise the consequences of hazard events". The second sentence does not follow logically from the first. Similarly in Policy 8.2.2.3 (p 68) : "To mitigate and where possible, avoid natural hazards in consultation with the Regional Council, by ensuring that emergency response procedures are put in place." This mixes mitigation, avoidance and response in one policy which is of dubious usefulness.

6.1.2 LTCCP 2006-2016

This plan outlines Council's key priorities and issues (p 56), including "Safety and Wellbeing". This section states:

"Kaikoura lies in a location subject to flooding, earthquakes, vegetation fires and possible tsunami ... it is important that we continue to have sufficient volunteers and resources available to respond to any callouts and emergencies ... Council is proactive in working with voluntary organisations and Central Government agencies to ensure emergency facilities are based in the appropriate locations."

Co-operation with the regional CDEM Group is also mentioned.

Civil Defence operating expenses (budget for 2007 \$38 000, rising to \$44 000 in 2016) are given under the "Safety and Wellbeing" heading. No capital expenditure is identified for Civil Defence. The Council holds several insurance policies against disasters (for infrastructure reinstatement and costs associated with business interruption and recovery; p161-162).

Another of the key priorities is "District Development" – "Managing ... growth to minimise the impact on the environment will be the key issue for the community." The operation of the District Plan, and a proposed Structure Plan, occur under this heading, but the section does not mention hazards.

Overall, the LTCCP does not appear to regard natural hazard issues as significant in future planning. Natural hazards are mentioned only in passing, in the context of Civil Defence responses. Thus the LTCCP has much less focus on natural hazards than the District Plan.

6.1.3 Annual Plan (2007-8)

(via website www.kaikoura.govt.nz/ accessed 30 January 2008)

The “Safety and Wellbeing” section contains the sub-activity Civil Defence. This states that “Council will be participating in a number of regional Civil Defence exercises this year, including one which may be run over a 24 hour period, to put our resources to the test.” The rest of this section conforms closely to the LTCCP. Civil Defence is linked with rural fire services, environmental health, road accidents, crime and family violence.

Under “District Development” the sub-activity of District Planning is very similar to that in the LTCCP. Council intends the District Plan to become fully operative during this financial year, which at the time of writing is still possible, and work will continue on several potential plan changes.

The Annual Plan closely reflects the approaches to natural hazards found in the LTCCP.

6.1.4 Website

(www.kaikoura.govt.nz/ viewed 30 January 2008)

The Council’s home page has a hot link to Civil Defence under “Special features”.

In an emergency, this it is intended to update the page as often as possible to give information on response to, and recovery from, a Civil Defence emergency. (This system may be vulnerable if the power or phone lines are cut.)

The Civil Defence home page has a description of the official warning system for the town (using the fire siren). “How prepared are you?” has a link to the MCDEM website but not the Canterbury CDEM website. “Do you know where to go for help?” contains a list of sector posts, encouragement to become a volunteer, and a link to the Council’s Emergency Management Officer. A third page links to information about pandemic planning, and only from here is there a link to Canterbury CDEM.

No other information related to natural hazards was found on the website.

6.2 Ashburton

6.2.1 District Plan (operative September 2001)

The main coverage of natural hazards is in Section 3.4. The main hazards mentioned are flooding, coastal erosion and inundation from the sea; drought, fire, snow, wind and earthquakes are also mentioned. The overarching principles are avoidance and mitigation of hazards, by way of protection (e.g., stopbanks, breakwaters) and guiding communities away from areas exposed to hazards. In a useful statement (Section 3.4.2), the plan acknowledges that protective works may fail and give rise to greater levels of flooding risk (likelihood and/or intensity of flooding).

The Objectives (3.4.3.1) are:

- minimal loss of life, damage to assets or infrastructure, or disruption to the community...from natural hazards
- avoidance, remedying or mitigation of adverse effects on the natural character of the environment...from natural hazard mitigation activities.

From these Objectives flow general Policies of increasing community awareness, adopting protection measures, appropriate building construction, identifying natural hazards within the resource consent process, discouraging subdivision within flood risk or coastal areas, ensuring activities do not cause adverse effects from natural hazards, and considering how protection works affect the environment.

Specific Policies relating to flooding and coastal erosion/inundation are listed. These can be summarised as discouraging development and inappropriate land uses in high-risk areas, designing structures appropriately in low-risk areas, and having regard to the effects of protection works on natural features. In addition, flood protection works for Ashburton township will be improved to protect against a 1 in 200 year flood.

Implementation Methods are also grouped into general and specific. General Methods include:

- inform community
- develop a GIS-based hazards register
- liaise with ECan on monitoring, flood management measures, emergency response and effects of protection works on natural character
- consider natural hazards in building, subdivision and resource consent processes
- identify areas at risk on planning maps.

Specific Methods for avoiding or mitigating flooding and coastal erosion are:

- rules to control activities in identified risk areas - these occur in the Zones section of the plan, see below
- discourage damaging coastal activities
- co-operate with ECan on protection works.

In explanation, the plan notes that costs to the community may be reduced by preventing or mitigating adverse effects rather than responding in a reactive manner (a statement about risk Reduction). In regard to river flooding, the plan acknowledges that in spite of various types of protection works, controls on building and subdivision in specific areas are still required. The source of flooding data on the planning maps is given as South Canterbury Catchment Board and ECan staff, but additional ECan studies may result in District Plan changes in future. In the meantime, proposed developments will need site-specific assessments of potential flooding hazard. In regard to coastal erosion/inundation, the source of information is "previous erosion trends plotted from maps" and a time frame of 200 years is mentioned. Limiting development, discouraging inappropriate activities on the coastal margin, and providing information to adjacent landowners, are intended to reduce the need for coastal protection works, but existing protection works may still need to be maintained.

Section 3.8, Subdivision, uses Section 106 of the Resource Management Act to require that

subdivision must be avoided in localities where there are significant natural hazards (flooding, subsidence or slippage) unless these can be mitigated without consequent adverse effects on the environment. Section 6.6.2.2 Controlled Subdivision Activities gives the list of natural hazards (erosion, flooding and inundation, landslip, rockfall, alluvion, avulsion, subsidence, etc.) from the Resource Management Act over which the Council may exercise discretion.

Section 3.14, Monitoring, Review and Enforcement, provides a very good framework for liaising with, supporting and assisting ECan and scientific organisations to monitor and collect relevant data including coastal erosion rates and flooding risks.

Section 4.2, Residential And Rural Residential Area Issues, deals with the significant flood hazard in parts of Ashburton - an estimated 1% chance in any one year of being flooded by the Ashburton River. The Council intends to provide additional flood protection works for parts of the town, enabling it to expand, which is clarified further in the Future Ashburton Development Plan (see section 6.2.5, below). The location of new residential areas needs to minimise any additional potential damage to assets.

Rules for the Zones (section 7) restrict development in flood risk areas and near stopbanks and the coastline. Flood risk rules are established only for Rural Zone A and B; homes may not be built, extended or relocated in the areas shown on the Planning Maps as "Flooding - High Risk", and building/relocating homes in "Flooding - Low Risk" areas is a Controlled Activity in respect of the location and floor levels of the building (7.6.5.1.7).

Stopbank and coastal setbacks apply more widely to rural and residential land, for example:

"a) All buildings shall be set back a minimum distance of 100m from the centre line of any stopbank shown on the plan included in Appendix 11.

b) Where there is no stopbank, all buildings shall be set back a minimum distance of 4m from the bank of any waterway, measured at its annual fullest flow." (7.2.5.1.13).

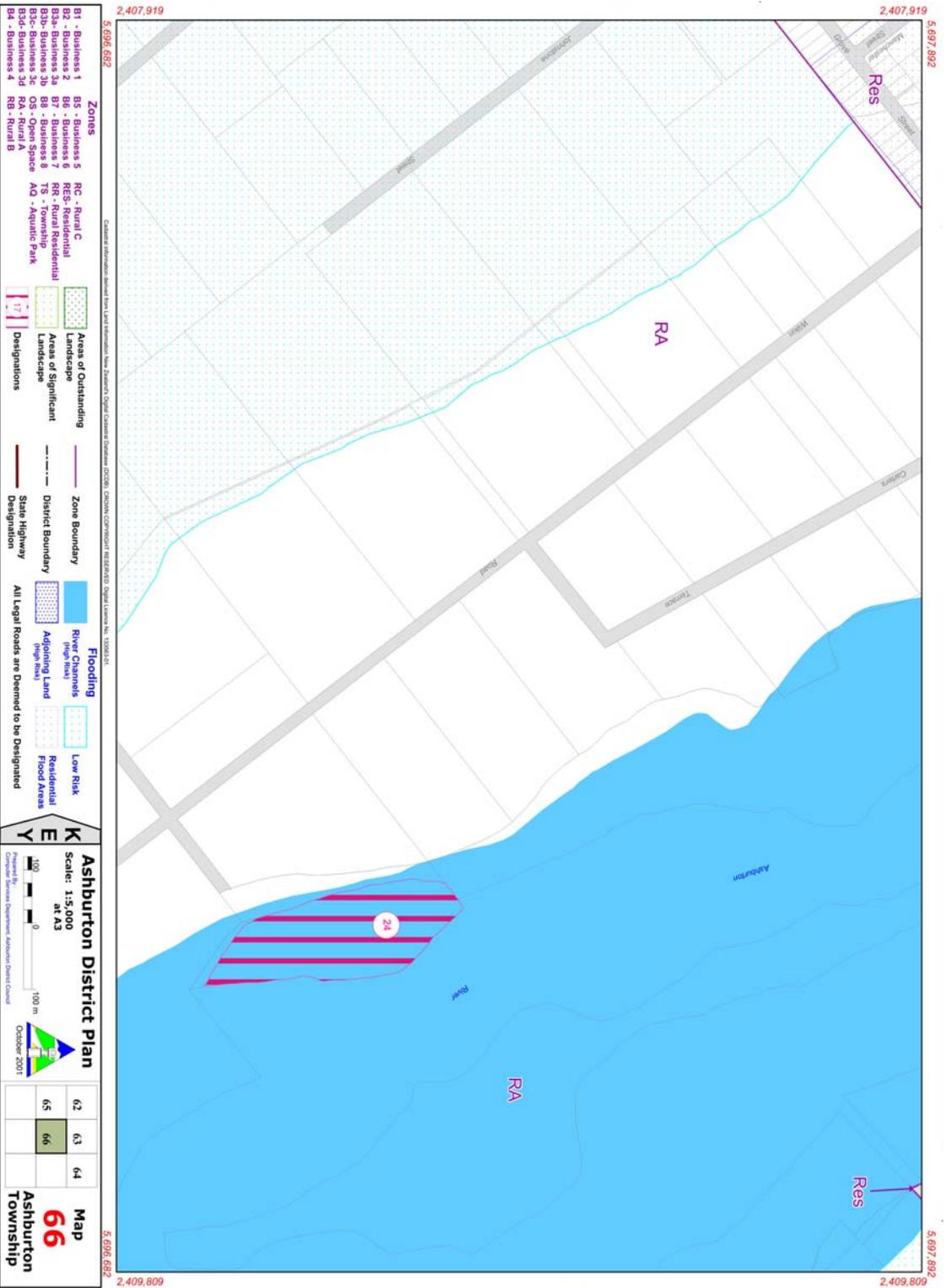
It would be interesting to know how difficult (b) is to administer, and whether this small setback is actually enough to avoid flood damage. Appendix 11 has a map of the stopbanks and useful definitions of the centre line of conventional and modified stopbanks.

To avoid coastal hazards, in general homes may not be built, extended or relocated between 50 and 100m of the line of permanent vegetation along the coast, and no buildings may be constructed or relocated within 50m of the line of permanent vegetation along the coast (e.g. section 7.6.5.1.8). The rules are similar for the coastal settlements at Rangitata River Mouth and Hakatere. The interesting feature of these provision is the use of "the line of permanent vegetation along the coast" as the marker for setbacks. Note that Ashburton's District Plan pre-dates the Regional Coastal Environment Plan with its two coastal erosion hazard zones.

The Planning Maps show flooding zones, particularly in Ashburton township and along the Ashburton River, but not in Rural C (high country) areas.

The source of flooding information (South Canterbury Catchment Board/ECan) is given in the text of the plan rather than on the maps. Coastal hazard zones and active faults/ earthquake hazard are not shown.

Figure 3 Flooding zones on planning map from Ashburton District Plan.



Overall, in the Ashburton District Plan, flooding and coastal erosion/inundation have plenty of coverage, giving reasons. The role and limitations of protection works are covered well, and setbacks are used in the rules. There is no coverage of earthquake hazards. There are strong statements about discouraging inappropriate land uses and activities, especially in relation to coastal cliff tops. A good framework is in place for the Hazard Register, and for liaison with ECan and scientific organisations in monitoring and relevant data collection.

6.2.2 LTCCP 2006-2016

Key Issues for the District (p9 ff) include reference to ongoing district planning matters – the recent District Development Plan 2005, and a proposed review of the District Plan, which may include changes arising from the Development Plan. None of the Key Issues relate to natural hazards as such, but the planning documents referred to do have a hazard management dimension.

The Community Outcomes have only a minor relationship to hazard matters. Outcome 5, entitled “Healthy, active people enjoying a good quality of life in a caring and safe community”, includes planning for and responding to emergencies. Emergency preparedness and the regional CDEM Group are mentioned in passing.

The Council activity “Essential Services” covers Emergency Management which in turn includes Civil Defence. The wording is about Readiness and Response, not Reduction. Although Civil Defence is funded differently from Rural Fire Protection (p 46), both are grouped in the budget (p 48) so Civil Defence spending cannot be identified. Where Emergency Management is dealt with in more detail (p 95ff), the statutory framework for Civil Defence arrangements, and the Canterbury CDEM Group, are covered briefly. The paragraph “Assumptions for the future” states that the Emergency Management budget has been prepared assuming that no major Civil Defence emergency occurs in the district. No capital expenditure is planned for Civil Defence.

The Council activity “District Planning” covers the operation of the District Plan and planning for future growth. There is no mention of hazards limiting growth, or of reducing the risks from natural hazards. The LTCCP has much less hazard focus than the District Plan.

6.2.3 Annual Plan (2007-8)

The Annual Plan groups Civil Defence with Rural Fire Protection as Emergency Management under “Essential Services”, and they are not separated in the budget (\$300 591, similar to the LTCCP forecast). Service targets include filling sector positions and training volunteers, and maintaining local information in the regional CDEM plan.

“Environmental Services” includes planning and land information. One of the service targets (p 55) is Quality of Information, stipulating periodic auditing of accuracy and completeness of information provided on LIMs. Perhaps in view of the website disclaimer (see 5.2.4, below) on the completeness of hazard information on LIMs, this should be upgraded somewhat. A

possible target could be to include hazard information (from the hazard register established in the District Plan) on all LIMs.

The Annual Plan has a similarly small hazard focus to the LTCCP.

6.2.4 Website

(www.ashburtondc.govt.nz/ viewed 14 November 2007)

The website allows access to a Land Information Memorandum (LIM) application form. The preamble to this includes an interesting disclaimer:

“Council can, on request, supply all the details it holds on any piece of land within the district. The information is contained in a Land Information Memorandum (LIM) and can include rates, building/resource consent records, health licences, complaints, water supply information, land features and the like. ... *The report might not be able to identify potential erosion, slippage or the presence of hazardous contaminants*, but it will be able to point out conditions of the property and any certificates issued under the Building Act.” [italics added]

With this statement, Council has obviously felt the need to guard against potential claims that it did not predict a land-based natural hazard. But if indeed there is a hazards register for Ashburton, the information should be on any LIM. The statement suggests a possible lack of connection between the hazards register (mandated in the District Plan and the RMA) and the LIM process.

Council's home page has no reference to Civil Defence. Emergency management information is accessed via Services; the Civil Defence page then has good links to Canterbury CDEM, MCDEM and GNS Science. The Civil Defence section also includes a Be Prepared page (links to Get Ready Get Thru and household emergency checklist), a page giving the national and local Civil Defence framework of legislation and plans, and a page of local information, district headquarters and sector posts (with map). Finally there is a useful page about local hazards, with the most detail on Flooding, including some local knowledge. Earthquake, tsunami, wind storm, fire, snow and technological emergencies (air crash, chemical spillage etc) are also mentioned.

6.2.5 Future Ashburton

The Future Ashburton Development Plan (also referred to as Ashburton District Development Plan) was viewed on the Council's website on 1 September 2008. It is not very easy to find, requiring the reader to navigate through Services and then District Planning. The plan was prepared for the Council by Boffa Miskell and adopted in June 2005.

The purpose of the plan is to present a basis for district development in the next 20 years. The results from this study are intended to lead to structure plans and ultimately to District Plan changes (e.g. new land zonings) as required. In terms of natural hazards, the study recognises flood risk, and land use in flood-prone areas, as issues for the townships of Ashburton, Tinwald and Hinds.

Design principles mentioned include the use of green ways and green belts. At various points

in the study these are seen as having different functions: management of stormwater and overflow/flood hazard mitigation; recreation and public open spaces; and barriers to prevent urban creep and define urban zones from rural zones. They are specifically mentioned as contributing to stormwater management in Ashburton, Rakaia and Methven townships.

However, examining the location and extent of the proposed green belts shows that mitigation of flood hazard would actually be negligible. In Ashburton township, the proposed encircling green belt takes little account of the river channels which cut the town from northwest to southeast. Even more obviously, green belts can have little flood mitigation function in Methven (which does not have an identified flood risk) and Rakaia (where the proposed green belt is on the side of town furthest from the river and remote from any identified flood zones).

The idea that riverside green ways can have hazard mitigation functions as well as recreational and amenity functions is well established, but the green belt proposals in this study would have little effect in a hazard context. It is to be hoped that future development plans will address the management of flood hazard in the townships of Ashburton District in a more effective manner.

6.3 Timaru

6.3.1 District Plan (operative March 2005)

The main coverage of natural hazards is in Part B Section 4. The chief hazards mentioned are river flooding, coastal erosion/flooding, and filled sites – not normally a natural hazard but a later section refers to “naturally induced threat of subsidence”. Also mentioned but not further dealt with in the Natural Hazards section are drought, earthquakes and wind, and the “definition” list from the Resource Management Act. Some hazards are noted as being addressed through the Building Act.

The format gives Issues 1-3 (river flooding, coastal erosion and flooding, and filled sites) with explanations and some data on coastal erosion rates. These are followed by six Objectives, each flowing on to Policies which in turn flow on to Methods. The Objectives/Policies follow the order Avoid, Mitigate, Identify, and Minimise (the latter includes minimising both hazards and costs). Finally, Monitoring and Anticipated Environmental Outcomes are covered.

Objective 1, “Avoid further non essential development or redevelopment in the most hazard prone locations in the District”, is a strong statement about risk Reduction, and is further amplified in the “Principal Reason” section:

“...The costs of development in hazard prone areas are borne by the whole community... The community as a whole is better served by avoiding all but essential development in the most vulnerable areas.”

Policies and Methods specific to flooding include:

- residential construction to have no more than a 0.5% chance in any one year of a flood reaching the floor level (equivalent to 200 year flood event). Floor level is

defined in the Definitions section.

- residential and intensive development within 100 m of stopbank centreline, or on site subject to 2.0% chance of flooding, to be discretionary (report from Regional Council required)
- encouraging relocation of households away from the most hazard prone locations (but without making direct financial contributions).

Undertaking new research into natural hazards, the use of LIMs and PIMs, and the Council's Hazards Register are also mentioned.

General Rules in Part D6 require resource consent applications, for land use or subdivision, to identify and assess natural hazards and options for avoiding and mitigating them. Rule 6.16, in the main reference to natural hazards, gives floor heights and stopbank setbacks, and prohibits residential activities on the river side of stopbanks and in the coastal inundation area.

The Planning Maps show stopbanks, a 100-year coastal erosion line, and a coastal inundation line, but not river flooding areas. The text of the plan implies (p. B52) that the coastal erosion line comes from ECan, but this is not stated on the map legend. If so, it is the more conservative of the two coastal erosion lines shown in the Regional Coastal Environment Plan (2005). The source of the coastal inundation line is likewise not stated on the map legend, but the plan (p. B54) notes that "Areas subject to coastal inundation have been identified by Canterbury Regional Council".

Generally on the seaward side of the coastal inundation line, but not entirely defined by it, the land is zoned R3 (coastal environment retaining high degree of natural character). This zone has clearly been established to preserve natural character, rather than to avoid natural hazard, but the effect may be similar as residential activities are non-complying in this zone as well as being prohibited on the seaward side of the coastal inundation line.

Overall, the plain language and clear linkages between the Issues, Objectives, Policies and Methods are commendable. Explanations and reasons are clearly stated, and these sections contain some factual data as well as noting where policies are consistent with higher level (regional and national) Policies and Acts. The prominent position of "avoidance" strategies ensures that natural hazard risk Reduction is firmly on the agenda. Although river and coastal hazards are reasonably well covered, earthquake hazard is not, nor are sites with "naturally induced threat of subsidence", whatever that is intended to mean. The Planning Maps show coastal hazard lines well, but not the sources of these lines, and river flooding hazard zones are not shown.

6.3.2 LTCCP (2006-16)

Timaru's LTCCP was viewed on the Council website on 15 November 2007. The plan is due for its next review in 2009.

The Key Challenges listed do not contain any coverage of hazards. The Community

Outcomes, developed through consultation in 2005, do not specifically mention hazards either.

Civil Defence comes under the Community Outcome “Vibrant, safe and caring communities”. Linkages with the Canterbury CDEM group and neighbouring councils are mentioned. No monitoring indicators are given for Civil Defence and no other hazard-related factors are mentioned.

In Section 3 (Groups of Activities), the Planning and Regulatory Services section shows the Civil Defence budget as varying from \$183 900 to 193 700 with no clear increase or decrease. A page showing details of Civil Defence activities has some mention of risk Reduction:

“Promotes a safer, more resilient and caring community through:

...Enabling communities to prepare for and **reduce** the potential impact of disaster and rural fire...”

“Readiness and **reduction** advice is provided through the TDC Civil Defence unit and through partnerships with other organisations” (bold and italics added).

The deliverables and performance indicators, however, refer only to the Readiness and Response functions of Civil Defence. In conclusion, Timaru’s LTCCP contains little about natural hazards and risk reduction, but more than most other LTCCPs in this study.

6.3.3 Annual Plan (2007-8)

The Annual Plan was viewed on the Council website (www.timaru.govt.nz/) on 15 November 2007. The plan is based on year 2 of the LTCCP.

None of the major projects are hazard-related, but in “Variances”, the snow event of winter 2006 is noted as having had an impact on the disaster relief fund. (The 2005/6 Annual Report carries more details of the event under the heading “The Day the Snow Fell”.)

Civil Defence and Rural Fire come under the Planning and Regulatory Group. The Civil Defence budget of \$201 000 is higher than that given in the LTCCP for the same year (\$190 400), and this budget is separate from that for Rural Fire. Civil Defence and Rural Fire spending appears to be mainly related to training, education and event response, although capital expenditure for Civil Defence includes communications equipment and signage.

No other hazard-related spending is apparently identified in the Annual Plan. Some may be hidden within planning functions, but if so this is not explicit.

Overall, the Annual Plan is well displayed and illustrated, with clear information. Civil Defence, which is separated from Rural Fire, is the only specified hazard-related activity, and no strategies for reducing risks from natural hazards are identified. The hazards focus of the Annual Plan is similar to that of the LTCCP.

6.3.4 Website

(www.timaru.govt.nz/ viewed 3 March 2008)

The home page links directly to the national “Get Ready Get Thru” website. The Council’s Civil Defence page is opened via a heading in the side bar, and this page links in turn to many other sites such as ECan, Canterbury CDEM, MCDEM, MetService, GNS, NIWA and EQC.

An impressive range of further information is accessed from the Civil Defence home page, including Civil Defence history, the 4 R’s, volunteering and specific hazards (earthquake, flooding, storms, tsunami and “manmade/technological hazards”). Each hazard has a short description written at a very good level for school projects, and there are appropriate links (for example, earthquakes link to GNS and flooding to ECan). There is also a very humorous quiz based on the content of the Civil Defence pages, which is highly recommended, even for adults.

Overall, the comprehensive links from the Civil Defence home page are impressive, while the fun quiz and appropriate-level information add greatly to the site’s usefulness for schools. The Timaru Civil Defence home page was one of the best seen in this study, although unlike some others, it does not have a map of sector posts and lists of wardens.

6.4 Mackenzie

6.4.1 District Plan (operative May 2004)

The general coverage of natural hazards is in Section 17. Hazards are also dealt with in the Zone sections, as Issues, Objectives, Policies and Rules within the Business, Residential and Rural zones.

The known and anticipated hazards given in Section 17 are flooding (including erosion, deposition and avulsion), shallow slumps and earth flows, slumping or slipping, active alluvial fans (including flooding, deposition, erosion, debris flows and avulsion), rockfall, earthquake, drought, fire and wind. Locations are listed for the first five (as far as “rockfall”), but not shown on maps.

The format of this section gives a single Issue – “Adverse effects of natural hazards” - and a single Objective – “Avoid loss of life, and minimise cost of damage and disruption to the community, or other parts of the environment from natural hazards”. Nine Policies follow, covering the more general topics of community awareness, hazards register, monitoring, emergency response, appropriate building construction, resource consent processes, discouraging subdivision within flood risk areas, and differentiating between higher and lower flood risk and between residential and other buildings for flood mitigation.

From the Policies flow six Implementation Methods, including informing the community, collecting information, monitoring, and rules to control development in flood risk areas. Partners such as DOC and Canterbury Regional Council are given for some of the policies

and methods. The Explanation section (apparently derived from that of Ashburton) emphasises the preparedness of the community, and mitigating hazards through knowledge of them. Education, monitoring, collation of hazard information and the hazards register are seen as way to achieve this. These constitute strong statements about community awareness, and a risk Reduction philosophy is implied though not actually stated.

In a separate section about river flooding, the plan acknowledges that in spite of various types of protection works, controls on building and subdivision in specific areas are still required. The source of flooding data on the planning maps is given as South Canterbury Catchment Board and ECan staff, but the maps are described as broad assessments, and site specific information will be required for any development.

In the Zone sections, specific hazards are described within the Business, Residential and Rural zones, such as an active alluvial fan at Glentanner and flooding hazard at Kimbell (where a special hazard area has been identified). Specific rules are applied to these places, for example, at Glentanner site stability and flood hazard are matters subject to Council control, and applicants must demonstrate protection from a 100-year flood event and provide a report from a registered engineer or other suitably qualified person.

Residential Zone Rules to avoid flood risk prohibit residential buildings in high flood risk areas, while in areas of low flood risk, residential buildings require floor heights 150 mm above flood waters of 0.2% annual probability (500 year return period flood) and other buildings must have floors 150 mm above flood waters of 0.5% annual probability (200 year return period flood) (Rule 3.1.1.e, Residential Zone). This rule also notes that suitably qualified experts need to determine these flood levels.⁴ No residential buildings are allowed in the Kimbell Hazard Area where “flood erosion risk” has been identified (3.1.1.k, 7.1.1.r).

Rural Zone Rules give the same floor height restrictions (3.1.1.j) and building setbacks of 20 m from banks of waterways, 50 m from wetlands and 100 m from lakes (3.1.1.f) noting that: “flooding is a natural hazard which can be most effectively avoided or mitigated by directing buildings away from hazard areas”.

Objective 7 in the Rural Zone section makes a commendably strong statement about risk Reduction: “Avoidance of loss and damage to life and property is generally preferable to restoration and compensation for loss where this is possible”.

Section 12 – Subdivision states a general philosophy of avoidance of natural hazards unless they can be mitigated (Objective 5) and a policy of requiring esplanade provision to mitigate hazards.

The Planning Maps in general do not show hazards or hazard zones, although lakeside protection areas have an implication of hazard (inundation). A specific flood risk area is identified at the township of Kimbell (map 53) and is subject to specific rules (see above). However, a series of Flooding Area maps is additional to – it is stated that it does not form

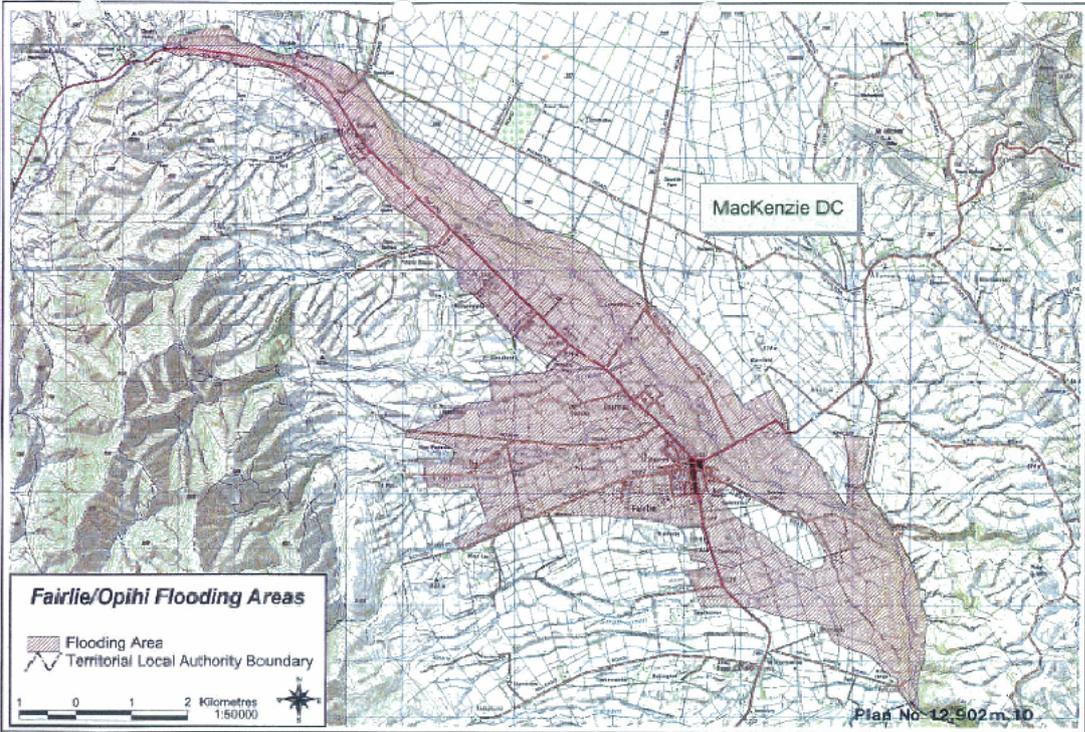
⁴ Flood Risk and Floor Height are given useful definitions in Section 3 of the Plan, for example, “High Flood Risk: means areas where the product of water depth (metres) multiplied by velocity (metres per second) equals or exceeds 1 in areas subject to inundation during an event of 0.2% Annual Exceedence Probability”.

part of – the District Plan. The maps cover the major floodplains of the district – the Pareora, Te Ngawai, Opuha and Opuhi rivers together with the surroundings of Lake Opuha and Twizel.

The map scale is given as 1:50 000 (actually 1:75 000 as presented in the plan) and in one case 1:75 000 (actually 1:100 000). The source of the data is not stated on the maps but is given in the text of the plan (see above). A note on facing pages for each map states that the flooding areas shown are based on known flood events and are indicative only; flood assessment for individual properties is needed.

Overall, most relevant hazards are identified and described, although there is no coverage of earthquakes/seismic risk. General policies for education and community awareness are stated in the Natural Hazards section. The rules for flood hazard avoidance, building setbacks, and so on are found within the Zone sections, which also contain some strong statements about risk Reduction without actually using that term. The linkages between Issues, Objectives, Policies and Rules is clear, and the definitions of flood risk are technical and clear. The Planning Maps only show flooding hazard, and that only in certain parts of the district. The Mackenzie District Plan clearly draws on that of Ashburton, with very similar wording in several sections of the natural hazard coverage.

Figure 4 Flooding Area map from Mackenzie District Plan



6.4.2 LTCCP (2006-16)

The Community Outcomes as written (“Attractive and highly valued natural environment”, etc.) do not provide much context for natural hazard management, nor do any of the Issues mention natural hazards. In the Activities section, Civil Defence comes under Regulatory Services while Stormwater has its own heading.

The Stormwater section (Vol 1 p 43) is cast in the context of the RMA and avoidance/mitigation of natural hazards, with a clear implication of risk Reduction. The section mixes maintenance of drainage ditches to help prevent surface flooding, with protecting health and treating stormwater as potentially contaminated. Levels of service are written around protection from flooding events, with secondary service targets relating to 1 in 2 year, 1 in 5 year, and 1 in 10 year events (the service standard for 1 in 5 year events, “no flooding of above ground level floors of non-inhabited parts of buildings” is rather unclear). Ponding and surface flooding problems in the townships are identified, with the worst issues at Fairlie and the fewest at the planned town of Twizel. Capital expenditure for flood hazard protection is proposed in the Western Catchment near Fairlie (p 47).

Civil Defence (in Regulatory Services) is strangely linked with the community outcomes, for example with the “Natural Environment” outcome via “maintaining a high ready response system for rural fire and civil defence will assist in promoting the highly natural environment that we all enjoy...”, and also with the “Fit and Healthy Community” outcome. Civil Defence personnel include volunteers and a part-time employed officer, plus the network of the Canterbury CDEM organisation. The Civil Defence target is to carry out two training sessions per year. No capital expenditure is identified for Civil Defence, although \$21 000 for rural fire is wrongly entered under Civil Defence on p. 82 (the correct figures are in the Annual Plan). A possible avian flu pandemic is identified as a future Civil Defence concern.

Overall, the community outcomes provide little hazard management context and the result is the force-fitting of miscellaneous council activities together (such as Civil Defence, dog nuisance and food safety). The statements about hazard avoidance in the District Plan do not carry over into the LTCCP - they may be implicit in implementing the District Plan and the Building Act, but this is not explicit in the LTCCP. On the other hand, there is some coverage of natural hazard risk Reduction in the Stormwater section, with associated capital expenditure.

6.4.3 Annual Plan (2007-8)

The Annual Plan includes some amendments to the LTCCP, but none related to hazard management, nor do any of the Significant Forecasting Assumptions relate to hazards. The Stormwater section contains material from the same section in the LTCCP, and includes planned expenditure on flood protection at Fairlie (\$156 000). The Civil Defence coverage is likewise identical to that in the LTCCP apart from a correction in the financial tables (p 51, 52).

The Annual Plan contains little about hazards that is not in the LTCCP. Flooding hazard at Fairlie and a potential flu pandemic are the named causes of concern, but overall there is apparently very little focus on natural hazards.

6.4.4 Website

(www.mackenzie.govt.nz/ viewed 5 March 2008)

The council home page links directly to the national “Get Ready Get Thru” website and the Canterbury CDEM Group site. There is also a dedicated part of the home page for Civil Defence messages. The Civil Defence page includes “What to do in the Event of an Emergency”, Council contacts, and a few details about the local Civil Defence setup. Council maintains a part-time Civil Defence Officer who coordinates a network of volunteers and Council staff. Training for Council staff in Civil Defence procedures is mentioned, along with involvement in the Canterbury CDEM Group. There is no information about specific hazards in the district. Mackenzie’s Civil Defence home page was the most basic seen in this study.

6.5 Waimate

6.5.1 District Plan (operative October 2001)

The plan has no natural hazards section. Section 3 - Definitions contains the generic list of hazards from the Resource Management Act. The main coverage of natural hazards is under the Zones (Rural, Residential and Business) and in Section 10 – Subdivision.

Natural hazard Issues are stated similarly for each zone, with a general list of hazards (flooding, severe climatic extremes (drought floods, snowfall, wind), coastal erosion and inundation from the sea, and earthquakes). Also mentioned in the introduction to the issue is tsunamis. The concept of risk is addressed, firstly the nature of the hazard (infrequent and widespread or frequent but localised) and secondly vulnerability to the hazard as a result of development. In the Rural and Residential zones, some detail (the same for both zones) is then given about the locations of floodplains and the locations and rates of coastal erosion. This information is omitted from the Business Zone because it is less applicable. The relevant Objectives and Policies, which do not follow on directly, are then listed.

Each zone contains as one of its Objectives:

“Avoid loss of life, and avoid or mitigate damage to assets and infrastructure, or disruption to the community of the District, from natural hazards”.

Various policies then follow, which are slightly different in each zone. For the Rural Zone these are:

- control buildings near waterways and stopbanks to limit flood damage
- encourage relocation away from coastal and riverbank erosion areas
- provide advice and information about natural hazards
- avoid adverse effects of natural hazard mitigation measures.

The second, third and fourth also occur in the Residential Zone, while the Business Zone has only the third policy.

Methods of Implementation include non-regulatory (including a hazards register) and legislative (the implementation of various Acts, namely Building; Resource Management; Civil Defence Emergency Management; and Local Government Official Information and Meetings Acts). Finally there are the Rules, set out separately. Those most relevant to natural hazards occur mainly in the Rural Zone and include:

- no building in areas identified as high flood risk
- buildings in areas identified as low flood risk controlled for siting and floor height⁵
- building setback from open watercourses is 7 m, except for larger named rivers, streams and drains where it is 100 m
- buildings to be landward of the 50-year erosion line at Waitaki Mouth

The relevant lines and areas are those on the planning maps, but there is a requirement for a suitably qualified person to determine flood risk at any particular site.

In Section 10 – Subdivision, natural hazard issues are worded differently, and generally have the effect of avoiding hazard areas when subdividing, and mitigating hazards without creating further adverse impacts. Subdivision is a controlled activity in respect of hazards, and the use of a hazard register is mentioned.

The Planning Maps generally do not show natural hazards apart from Map 24 which shows a “50 year erosion line” at Waitaki Mouth, for which the source is not given (Waimate’s District Plan significantly pre-dates the Regional Coastal Environment Plan of 2005). A separate series of Flood Risk maps is dated October 2001. Areas of flooding risk (not differentiated into higher and lower risk) and stopbanks are shown on 1:100 000 cadastral map bases. One larger scale map of Waimate (1:75 000) covers the township area. The source of flooding information is not given anywhere in the plan. A comparison of the Waihao River part of Flood Risk Map F, with the Waihao River Floodplain (estimated 500 year return period flood) in the Waihao River Floodplain Management Strategy (see section 7.3, below) suggests that the two maps are very similar; therefore Flood Risk Map F probably shows the area affected by an estimated 500 year flood event.

Overall, the linkages between Issues, Objectives, Policies and Rules is much less clear than in the (mainly more recent) plans where these follow each other directly. There is no single section with general statements or details about hazards; rather, these are distributed throughout the various zones. Some useful rules on setbacks from waterways are included. The issue of flooding risk is dealt with in less detail than in some other plans; higher and lower risk are not shown on maps. Earthquake risk is not covered. The Planning Maps mainly show flooding hazard, together with one coastal erosion line.

⁵ Floor height and high/low flood risk are defined in the Definitions section

6.5.2 LTCCP (2006-16)

According to the Mayor's message at the beginning of the document (Volume 1), Waimate has only recently set up its Civil Defence plan. Civil Defence fits into the the "Security and Safety" community outcome, along with police and roading (vol. 2). Civil Defence tasks include maintaining emergency networks, equipment, training, and exercises. Further tasks that are not often seen within the Civil Defence role are to maintain a register of hazard sites (updated within 10 working days of identification); to review Civil Defence hazards in the district annually by reviewing historic data and surveying residents; and to produce a disaster recovery plan for core Council functions. (The register of hazard sites, noted in vol. 2 as a Civil Defence responsibility, reappears in vol. 3 under the Building Control activity). Volume 3 includes several projects related to Civil Defence operating procedures, equipment (radios and generators, budgeted at \$5000 rising to \$6000 per year through the period of the plan) and assisting the Ministry of Civil Defence with a Lifelines pilot study for the district (although possibly this refers, rather, to the Canterbury CDEM Group). Civil Defence is budgeted separately from Rural Fire, and was planned to rise from \$48 000 at the start of the plan to \$154 000 by 2016 (but see section 6.5.3, below).

The "District Planning" outcome does not mention hazards. Overall the LTCCP does not have a large focus on hazards, although the list of Civil Defence tasks is very comprehensive and includes council's hazards register and disaster recovery plan.

6.5.3 Annual Plan (2007-8)

The Annual Plan opens with a precis of submissions received, of which six expressed concerns about Civil Defence. Some agreed with proposed cuts to the Civil Defence budget, others were unhappy about cuts to services, and in some cases the summary does not make the submitter's stance clear. The messages from the Mayor and CEO both mention reduction of the Civil Defence budget, after the organisational build-up over the previous two years.

Civil Defence comes under the Community Safety activity, and is covered on pages 65-66. The financial performance table shows a significant over-expenditure of \$142 000 in 2006. This spending relates to response costs to the June 2006 snow event and the unplanned expansion of the emergency management part-time position to full-time (J. Keenan, pers. comm., March 2008). For the 2008 financial year, Council cut rates support by \$53 000 "due to a dollar value cut proposed by Councillors". This is listed as a material variance from the LTCCP. Despite this, council will try to "maintain its agreed levels of service and monitor actual costs against budget".

Council's hazards register again appears under the Building Control activity, and again no hazard matters are mentioned under the District Planning activity.

The Annual Plan closely follows the LTCCP, except for the material variance (reduction) in Civil Defence funding. Civil Defence arrangements for Waimate are clearly readjusting after the previous two-year period, in which the Civil Defence organisation was set up, significant overspending occurred and a large snowfall event affected the district.

6.5.4 Website

(www.waimatedc.govt.nz/ viewed on 8 January 2008)

The council's home page has no links directly to Civil Defence; rather, this is reached via the Council tab or the search function.

The Civil Defence page links to the Canterbury CDEM Group website and also names the Council Civil Defence contact person. Personal preparedness information (survival kit etc.) is available, along with "What to do in the Event of an Emergency" and background information on Civil Defence that largely deals with the legislative framework. A forthcoming Pandemic Survival Roadshow is advertised. Probably the most useful content is the sector post map and list of wardens, which was recently updated.

An interesting feature, not seen elsewhere in this study, is the application of text messaging:

"Civil Defence Info via Text Messaging

Waimate is the third council in the country to use the OPTN Ltd sponsored text messaging service. This service allows Civil Defence to send weather warnings and emergency information during emergencies to all subscribers.

The great advantage for this system is it allows Civil Defence to reach potentially a large number of people very quickly. The receiver of the message can then decide whether they wish to take an action as a result of the message or not. Also during emergencies, text messaging doesn't use up large amounts of charge on the recipient's cellphone.

There is no cost for receiving the messages or to enroll by signing an enrolment sheet at the Waimate District Council or in the library.

You can also join by texting OPTNWECD to 2678 - this is a free service."

Waimate's Emergency Management Officer, J. Keenan, comments: "In terms of cost/time effectiveness I think it would be hard to beat." Text messaging as a form of public notification in emergencies has been reviewed by Leonard et al. (2007). Potential limitations include the need to enrol, the distribution list must be kept up to date, cell phones must be in an area with coverage and switched on, and there may be delays in transmitting large numbers of messages (thousands to millions). However for a small population (Waimate District has about 7200 people and 3000 dwellings according to the 2006 census) the text messaging service may be an effective tool.

Overall, the site appears to be reasonably current, and several improvements and updates were noted since it was first accessed in November 2007. The text messaging service is worthy of investigation by other districts.

7.0 FLOODPLAIN MANAGEMENT STRATEGIES

Flooding from rivers is identified by all districts in this study as a major hazard. Although the effects of flooding are local, for historical reasons the control of flooding has fallen to the Canterbury Regional Council (ECan). In some areas the issues have been addressed by floodplain management strategies, which explore the nature of the hazards and options for

mitigation, during a consultation process between affected people and experts from regional to local levels. The actual implementation of the strategies is through local council policies and rules; through investigations and capital works undertaken by ECan; and through public education.

Floodplain management strategies are non-statutory documents and come under the heading “planning tools” in Figure 1. Several floodplain management strategies were viewed on the ECan website: (www.ecan.govt.nz/Plans+and+Reports/Natural+Hazards/) on 12 March 2008.

Strategies for Kaikoura, Ashburton River, Pareora River (Timaru and Waimate districts) and Waihao River (Waimate District) are available. The ECan website also has numerous reports on water quantity and quality, which do not deal with the hazard aspects of rivers.

7.1 Kaikoura

The Kaikoura strategy (2000) sets out the issues and the history of flooding in the area at length, and examines almost 70 measures to address the problem. Most of the measures are physical (structural) and relate to engineering works on specific rivers and streams, but the last group applies to the floodplain as a whole and includes non-structural methods of minimising flood damage. The general statement sets the tone:

“52. Adjust developments to recognise flood risk.

• This measure is aimed at ensuring development in hazardous areas is compatible with flood damage potential. It is important to note that no attempt is being made to restrict development simply because the land is flood-labile. If development is to proceed in such areas, for whatever reasons, then the concern is simply to ensure measures are implemented which minimise flood damage.”

There is a strong desire not to prevent or restrict development, except in order to minimise flood damage. Ways of achieving this then follow and include planning measures such as:

- Raising of floor levels
- Elevation of building sites
- Establishment of secondary flow paths
- Extension of existing building codes
- Re-zoning

and response measures such as:

- Development of techniques of waterproofing
- Development of flood warning/forecasting systems
- Identification of areas for evacuation
- Development of techniques and methods for flood fighting

The various measures are then assessed in terms of their acceptability to the community, and some of the planning measures are classed as “politically sensitive” and even as “politically very sensitive”. Finally an agreed strategy is set out, in which several of the measures deemed sensitive or uneconomic are discarded.

Planning measures retained are:

- Adjust developments to recognise flood risk

- Construct floor levels above predicted flood levels.
- Set buildings back from stopbank systems, so that, if bank failure does occur, structures will not be in the path of deep, fast flowing floodwaters. This measure is applicable to new development. The lines run parallel to the stopbanks or echelon banks.
- Raise the building areas of complete subdivisions above flood levels. This measure is applicable to new development. This measure and [the next] measure [...] are complementary.
- To allow breakout floodwaters to flow through development with a minimum of damage. Development can be designed leaving clear channels for the dispersal of floodwaters.

Re-zoning, however, was deemed too politically sensitive.

In conclusion, the Kaikoura strategy adopts a combination of structural (stopbanks and other engineering works) and non-structural measures within a general framework of not restricting development unless absolutely necessary. Since this strategy, the Proposed District Plan has included several of the non-structural flood mitigation measures such as floor heights, setbacks, and discouraging development on high-flood-risk land. This approach to flood hazard contrasts with the planning approach to coastal hazards, so it appears that Council has in fact actioned the planning measures decided in the strategy.

7.2 Ashburton River

The Ashburton River strategy is a much older document, dating probably from 1989 or 1990. It covers the Ashburton urban area, rather than the Ashburton River floodplain. It is an example of the older “catchment board” style of floodplain management, containing much detail on hydrology and stopbank costings. It is difficult to find the options laid out for consideration – they probably include 100, 200 and 500 year flood protection by way of structural measures, although planning and response measures are mentioned. In any case, these and other flood management options have presumably been implemented or discarded by the community long since. But flooding issues in the district continue, as seen in the “Future Ashburton” plan (section 6.2.5, above).

7.3 Pareora and Waihao Rivers

The strategies for the Pareora and Waihao Rivers are similar in age (2004) and approach, with several sections identical. Both have similar statements at the outset:

“River engineering works cannot therefore be relied upon to mitigate all flood damages. Other measures such as landuse planning, flood warning and community preparedness also need to be utilised. The Floodplain Strategy ... links the physical measures through the river control scheme with the land use measures in the regional and district planning processes.”

Structural (physical) measures include:

- Provide flood protection works
- Maintain channel capacity

Non-structural (physical) measures include:

- Monitor the effectiveness of these works
- Provide for subdivision and land use management (led by District Councils and implemented through District Plan) including control of subdivision and development, floor level controls for new buildings, and building line restrictions for new buildings
- Improve the standard of information about flood hazard
- Ensure effective emergency management

A useful summary list gives the measures, the lead agency and the mechanism for implementation of each measure.

Both strategies have an introductory section, 1.2 Flood Hazard Management, with many useful statements - for example:

“Floodplain management planning therefore emphasises a balance between keeping people away from floodwaters and floodwaters away from people.”

The strategies review the existing District Plan provisions for mitigating flood hazard:

“Both the Timaru and Waimate District Plans have development controls within 100 m of the stopbanks. Generally this is considered adequate for the lower Pareora floodplain.”

The Pareora strategy points out that different councils on the same floodplain have different rules:

“The Waimate and Timaru District Plans contain floor level rules based on the 0.2% AEP (500 year return period) and the 0.5 % AEP (200 year return period) flood events respectively. The difference in floodwater depths between the two events is generally in the order of 100 to 200 mm. ...”

It further recommends:

“The current floor level rules apply mainly to residential buildings. However in light of increased dairying and other intensive farming activities in the lower floodplain it is recommended that the inclusion of controls on structures associated with these activities also be investigated.”

The Waihao strategy also covers coastal inundation:

“4.2.1 Coastal flooding

Overtopping of the beach crest, flooding low-lying behind, occurs on average once every 3 to 5 years. The overtopping is due to a combination of very large swells and elevated sea level (storm surge) associated with high tides. ...Tsunami will also result in overtopping of the barrier beach crest...”

Both Pareora and Waihao strategies give an appendix table showing how the evaluation of potential measures was carried out. Measures not included in the final strategies are those assessed as uneconomic, high maintenance and/or prohibitively expensive.

The strategies conclude with a section on “Monitoring and review”:

“The effectiveness of the Waihao River Floodplain Strategy will be reported via:

- District Plan effectiveness monitoring
- Flood damage reports and mapping of flood extent following significant events
- Review of the Strategy 10 years from adoption”

Overall, the Pareora and Waihao strategies appear to follow international practice in floodplain management. They balance structural and non-structural measures, review and recommend extensions to existing planning rules, and mandate ongoing monitoring and ten-yearly review. The Pareora & Waihao strategies differ from the Kaikoura strategy in several ways. The approach is more willing to restrict development in the interests of keeping people away from floodwaters, and the reports are perhaps less transparent in giving details of acceptability and selection of all possible risk reduction measures.

8.0 CONCLUSIONS

Planning documents vary within and between districts in their coverage of natural hazards. All District Plans in this study cover natural hazards and present general and specific hazard data and management strategies, although some do not have a specific “Natural Hazards” section. In these cases, the statements about hazards and rules about avoiding or mitigating them occur in the “Zones” sections. All the District Plans contain statements and rules about natural hazard risk Reduction. LTCCPs generally have little or no coverage of natural hazards, and Annual Plans tend to be very close to their LTCCPs in terms of hazard content. Growth Strategies and similar documents tend to have minimal coverage of hazards and even less consideration of risk Reduction, as also found in the previous study (Forsyth 2006). Council websites generally do not have much coverage of natural hazards apart from their Civil Defence content. This varies from rather basic (Mackenzie) to very useful and school-friendly (Timaru).

In a considerable step forward in policy planning for natural hazards, ECan’s ten-year review of its **Regional Policy Statement** includes a significant re-write of the Natural Hazards chapter. The ongoing discussions between ECan and territorial authority staff should result in much more workable strategies and methods for dealing with natural hazards at both regional and district levels. As future district plans will need to “give effect to” the RPS, the result should be more agreement on known natural hazards and a more unified approach to their management.

The existing **Regional Coastal Environment Plan** of ECan has been used in the district plans for Timaru and Kaikoura. Timaru uses ECan’s coastal hazard and inundation lines on its planning maps, while Kaikoura leaves policies or rules for the coastal area to ECan, explicitly avoiding duplication. Waimate and Ashburton District Plans pre-date the Regional Coastal Environment Plan, and Mackenzie District has no coastline. ECan is currently updating this coastal plan, and new district plans prepared in the future should be consistent with the latest version. The use of ECan coastal hazard lines in district plans is useful in terms of public awareness; however, in general ECan is the consenting authority in the coastal area, whatever the content of district plans.

The **Greater Christchurch Urban Development Strategy**, now moving into the implementation phase, includes a reasonable understanding of the known natural hazards,

and sets a useful context of natural hazard avoidance and risk reduction. Councils are now cooperating to align their plans and policies around this growth and development strategy.

Flood hazard is identified as a major concern by all districts in this study, and all have some coverage of this hazard on planning maps or on associated specialised maps. Local **floodplain management strategies** have been prepared for rivers in Kaikoura, Ashburton, Timaru and Waimate districts. The strategies vary in their content and approaches, from the older “catchment board” style of plan to more modern formats that integrate structural and non-structural measures and review relevant planning provisions.

One useful planning tool for hazard avoidance is the use of **setbacks** or buffer zones. There are examples of these in all the District Plans studied.

- Kaikoura has setbacks from stopbanks, water bodies and the coastal marine area
- Ashburton has setbacks from stopbanks, waterways, and “the line of permanent vegetation along the coast”
- Timaru has setbacks from stopbanks, and also uses coastal erosion and inundation lines to restrict development and assets near the shoreline
- Mackenzie has setbacks from waterways, wetlands and lakes (it has no coastal area)
- Waimate has setbacks from watercourses generally, greater setbacks from some named rivers, and a building restriction landward of an erosion line in one area.

All the districts contain active faults, with associated seismic hazard, but none of the plans mark active fault lines or require setbacks from them. Guidelines have been prepared by experts, suggesting suitable setbacks and other ways of minimising the risk from these structures (Kerr et al. 2003). Similar guidelines for minimising landslide risk have also been published recently (Saunders & Glassey 2007).

Methods of **analysing hazard and risk are not stated**. They may be quite subjective. One good example of a more objective risk assessment is the high and low flood risk specifications given in the definitions sections of the Mackenzie and Waimate District Plans:

“High Flood Risk: means areas where the product of water depth (metres) multiplied by velocity (metres per second) equals or exceeds 1 in areas subject to inundation during an event of 0.2% Annual Exceedence Probability”.

Many plans state that an expert opinion, often that of the Regional Council, is needed to determine risks (flooding and otherwise) at any particular site.

Several interesting examples of **good practice** were noted during the study.

- Kaikoura’s District Plan recognises that coastal systems are dynamic, some features may migrate inland, natural features may offer protection from coastal hazards, and sea level rise needs to be monitored and taken into consideration. It also discourages utility lifelines from locating the highest risk areas.
- Ashburton’s Civil Defence web page has a useful list of local hazards that could be used by schools and for general public hazard awareness. The main planning maps show natural hazards.

- Timaru's Civil Defence web page has good school project level information about hazards, with excellent links and an amusing quiz. The main planning maps show natural hazards.
- Mackenzie's District Plan has a useful list of locations at risk from the major identified hazards; while not exhaustive, it serves to increase public awareness.
- Waimate's adoption of a text messaging service for Civil Defence emergency events may be a useful tool that deserves closer attention (although it may have limitations in more populous areas). The list of tasks in the Civil Defence activity is very comprehensive.

Sources of information on hazard planning maps are not given on the maps themselves. Some maps have this information in a covering note nearby, others have it in the plan text and some do not give it at all. It would be best to give the source of map information on the map itself or in the legend. In the event of Environment Court or other hearings, the source and accuracy of data can be critical.

Finally, several **more general points** should be noted.

Firstly, understanding of natural (or any) hazards is changing all the time, as new information or new ways of dealing with existing information come to light. Neither databases nor council and community knowledge can ever be considered complete, and there needs to be an active ongoing commitment at all levels to upgrading hazard information. Hazard information is held by many organisations and councils must integrate their in-house knowledge with that from other sources.

Monitoring and review of hazard- and risk-related outcomes is a powerful tool that should be more widely used. It is normal, after an emergency or other hazard-related event has happened, to evaluate the effectiveness of any risk reduction measures. Routine monitoring of how hazard registers are operating, how well district and regional policies are being implemented, whether implementing the policies yields the best results, and whether theoretical knowledge is being translated into practice, are less common. Such studies have the potential to improve hazard-related outcomes and make better linkages between agencies.

There is a need for continued community engagement and dialogue to gain community and political support for risk reduction activities. Discussions about hazards, risk reduction measures, and the effectiveness of such measures, should always be taking place between councils, communities and researchers. This type of dialogue is effective in raising awareness of hazards and mitigation strategies.

Lastly, it should always be remembered that plans are implemented by people. Neither good policies in planning documents, nor agreement in philosophies between planning documents, will be effective unless the words are translated into an active joint commitment by the staff and communities involved.

9.0 RECOMMENDATIONS

1. Development strategies and discussions for future land use options should adequately consider hazard-related constraints. Apart from the Greater Christchurch Urban Development Strategy, none of those examined for this study and the previous study have demonstrated enough awareness of natural hazard issues.
2. Guidelines for building near active faults (Kerr at al. 2003) and landslides (Saunders & Glassey 2007) should be consulted and where possible incorporated into future versions of District Plans. None of the plans consulted had adequate provisions on these topics.
3. Monitoring and review of hazard- and risk-related outcomes is a powerful tool that should be more widely used. This includes both post-event studies of the effectiveness of risk reduction measures, and routine monitoring of how well policies are implemented, whether hazard registers are functioning well, and whether theoretical knowledge is translated into practice.
4. Future district plans and plan variations should incorporate the coastal hazard lines/zones established in the Regional Coastal Environment Plan (and in future updates of this). This would serve to raise public awareness.
5. The Canterbury CDEM Group Plan Hazards section review (2008-2009) provides the opportunity of incorporating the most recent information on hazards from research organisations such as GNS, NIWA and universities and from ECan reports. This information should also be incorporated in the local CDEM arrangements.
6. Council websites should consider including material from the local CDEM arrangements for each district, available online at www.cdemcanterbury.govt.nz/information-for-emergency-managers.htm. At present, the useful information about the hazardscape of each district, the Civil Defence sector posts and so on, is variably displayed on the Civil Defence pages of council websites. Such a comprehensive body of information for each district should be distributed more widely in the interests of public awareness.
7. The Plans and Reports/Natural Hazards section of the ECan website should either include, or give access to, a comprehensive list (bibliography) of the natural hazard-related documents held by ECan.

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