

REFERENCE NUMBER: 82980

JULY 2002

REPORT PREPARED FOR:
WELLINGTON REGIONAL COUNCIL (WRC
PUBLICATION NO. WRC/RP-T-02/17)

REPORT PREPARED BY:
TONKIN & TAYLOR LTD

DISTRIBUTION:
WELLINGTON REGIONAL COUNCIL (WRC
PUBLICATION NO. WRC/RP-T-02/17) -
3 COPIES
TONKIN & TAYLOR LTD (FILE) 1 COPY

Wellington Regional Council Publication No. WRC/RP – T – 02/17

CONTENTS

	Page No.
1.0 Introduction	1
2.0 Approach to Project	4
3.0 Background	6
3.1 Overview of literature search	6
3.2 Review of regional/district plan provisions	7
3.3 Review of relevant Case Law	2
4.0 Summary of GeoEnvironmental Consultants' Report	4
5.0 Consultation with Territorial Authorities	7
6.0 Assumptions for this Project	9
7.0 Characterisation of Elements at Risk	11
8.0 Management Options	14
9.0 Evaluation of Management Options and Applicability to the Region	27
9.1 Preferred Management Options	28
9.2 Summary	32
10.0 Recommendations	36
11.0 Applicability	38



EXECUTIVE SUMMARY

Following on from previous work on tsunami hazard in the Wellington Region, the Wellington Regional Council decided there needed to be a more detailed investigation of options for managing and responding to the tsunami hazard to the Region. Accordingly WRC commissioned Tonkin and Taylor Ltd to undertake the current study.

The objectives for this project were identified as:

- To identify and assess options for managing risks from tsunami to the Wellington Region; and
- To recommend a management approach for each distinct section of the coastline or community.

The study of the tsunami hazard in the Wellington Region is a developing science, and ongoing debate and investigation is necessary to refine not only the hazard but also the degree of risk. The current study puts that to one side and acknowledges that further work to refine that issue will be ongoing.

The objectives of the current study are to identify management options that territorial authorities can consider for application in their district as appropriate, and apply them to specific areas when and as the required scientific information becomes available.

Seven management principles have been identified and examined as to their suitability for application to various parts of the Region's coastline. The study essentially provides a 'tool kit' or template for territorial authorities, enabling them to mix and match management options that best suit the characteristics, policies and objectives of their district.

1.0 Introduction

In 2001 the Wellington Regional Council (WRC) completed a scoping study that gathered together and assessed existing information on tsunami hazard in the Wellington Region. The report “*Wellington Regional Tsunami Hazard Scoping Project*” by GeoEnvironmental Consultants (June 2001) provided a summary of the scientific information and investigations undertaken to identify the tsunami hazard in the Wellington Region and the likely risks to the Region as a result of tsunami occurrence. In addition the report provided an initial attempt at identifying and discussing options for mitigating tsunami risk, ranging from public education and emergency management to land use planning and construction of protective measures.

Following on from that report, WRC considered that regardless of the level of scientific knowledge of the tsunami hazard there needed to be a more detailed investigation of options for managing and responding to the tsunami hazard to the Region. Accordingly WRC commissioned Tonkin and Taylor Ltd to undertake the current study.

The objectives for this project were identified as:

- To identify and assess options for managing risks from tsunami to the Wellington Region; and
- To recommend a management approach for each distinct section of the coastline or community.

‘Tsunami’ is a Japanese word meaning harbour wave or waves. Tsunami are a series of long period waves generated by an impulsive force which suddenly displaces the water column and the water surface (GeoEnvironmental Consultants, 2001). The displacement is normally generated by either a submarine earthquake, landslide (into or under the water), volcanic eruption or a bolide (eg asteroid) (de Lange, 1998 and in press, in GeoEnvironmental Consultants 2001). If they are locally-generated

they may come onshore within minutes, whereas distantly-generated tsunami may take hours to reach shore. Typically a tsunami consists of several waves, and may persist for some days. It is frequently the second or third wave that is the highest or most destructive (GeoEnvironmental Consultants (June 2001). While primarily a water body, tsunami may carry significant volumes of debris, particularly by the time they travel some distance onshore, thus increasing their destructive capacity.

In this report the following definitions are used to distinguish between hazard and risk.

Hazard: The physical event (ie the tsunami) (often expressed as a given probability of a damaging event)

Risk: The consequences of the hazard.

It is noted that the study of the tsunami hazard in the Wellington Region (or indeed anywhere in New Zealand) is a developing science, and that ongoing debate and investigation is necessary to refine not only the hazard but also the degree of risk. The current study to all intents and purposes puts that to one side and acknowledges that further work to refine that issue will continue contemporaneously.

It is not the intention of the current study to ‘draw lines on plans’ showing areas that are at risk from certain hazards. The objectives of the current study are to identify management options that territorial authorities can consider for application in their district as appropriate, and apply them to specific areas when and as the required scientific information is available. The study essentially provides a ‘tool kit’ or template for territorial authorities, enabling them to mix and match management options that best suit the characteristics, policies and objectives of their district.

This report addresses the following matters:

Section 2 – Approach to the project

Section 3 – Background

Section 4 – Summary of GeoEnvironmental Consultants’ report

Section 5 – Consultation and key issues

Section 6 – Assumptions for the project

Section 7 – Classification of elements at risk

Section 8 – Management options

Section 9 – Evaluation of management options and applicability to the
Region

Section 10 - Recommendations



2.0 Approach to Project

Tonkin & Taylor adopted the following methodology in undertaking the project to meet the objectives:

1. Review of current approaches

In an attempt to determine what approaches are currently used to mitigate tsunami risk, the following tasks were undertaken:

- Literature search
- Review of existing information held by WRC
- Review of Regional and District plans both within the Region and nationally to identify what management options currently are used
- Review of New Zealand RMA case law
- Discussions with the territorial authorities in the Region to determine current policies or practices in regard to tsunami hazard and risk.

2. Classification of the Elements at Risk

In order to identify the suitability of potential risk management options around the Region, the 'elements at risk' were classified. This involved identifying specific classes of use or development. This process is described more fully in Section 7.0 of this report.

3. Identification of Management Options

Based on the literature review, review of district and regional plans and RMA case law, and applying additional knowledge of management techniques, a list of management options was determined (see Section 8.0). This included consideration of the Seven Principles for Planning and Designing for Tsunami Hazards (contained in Designing for Tsunamis, National Tsunami Hazard Mitigation Programme, March 2001).

Once a list of probable options was identified this was evaluated in combination with the classification of the elements at risk to determine a range of appropriate management techniques for each of the 'elements at risk' classes. The evaluation process determined risk mitigation options for specific stretches of coast, communities or infrastructure. These options are identified in Section 9.0 below.

4. Consultation with territorial authorities

The project team met with various representatives of the eight territorial authorities in the Wellington Region:

- Wellington City Council
- Hutt City Council
- Upper Hutt City Council
- Masterton District Council
- Carterton District Council
- South Wairarapa District Council
- Porirua City Council
- Kapiti Coast District Council

This consisted of two meetings with the Emergency Management Officers of the councils, and one meeting with Policy/Planning/Asset Management staff.

In addition, a workshop was held on 24 May 2002 attended by representatives of the above groups to discuss the recommended management options and draft report. The workshop was chaired by Professor Michael Crozier, Earth Sciences School, Victoria University of Wellington. Workshop participants are listed in Appendix A.

3.0 Background

3.1 Overview of literature search

Relevant publications have been reviewed using the Wellington Regional Council information resources and Tonkin & Taylor's library, as well as WRC in-house papers and conference papers from a number of conferences.

A bibliography of relevant publications is included at the end of this report.

The overview of the literature provided the following conclusions:

- Early work undertaken by the WRC on tsunami risks in the Wellington Harbour including modelling and a vulnerability assessment. Although this is dated (1989/90), some parts are still relevant.
- The Wairarapa Division of the WRC has also undertaken a risk assessment of the tsunami hazard in the Wairarapa (May 2000) which provides a good basis of consideration for management options for this area.
- The WRC State of Environment Report 1999 identifies tsunami as a threat to the Region.
- Knowledge and science of tsunami hazards (the physical event) and risks (likelihood or probability of the event) are well documented and understood in general, but are not well defined for a particular part of the Wellington Region.
- Lifelines work undertaken in Wellington and other regions provides a good basis for considering tsunami hazard and risk.
- Other regions are considering tsunami events – publications by Auckland Regional Council, Marlborough and Southland are useful, but preliminary in nature.
- Other natural hazard work (including earthquakes, flooding, coastal erosion and sea level rise) have useful findings and mechanisms that

may assist (to some extent) to mitigate tsunami hazard and risk, depending on how these natural hazards are addressed and/or mitigated.

- Civil Defence Plans (Section 34 of the Civil Defence Act 1983) and Emergency Response Plans provide planning and systems for evacuations in an emergency for a range of sources – tsunami events are addressed with warning systems heavily relied upon.

3.2 Review of regional/district plan provisions

A review of eight regional plans and 14 district plans has been undertaken to establish how tsunami hazards and risks are addressed in other regions in New Zealand. Table 1 summarises the plans reviewed and identifies the plan provisions that may apply to tsunami. These plan provisions are included in full in Appendix C of this report.

From the review of plans, the following points are relevant:

- While a large number of plans reviewed (13) include the definition of *Natural Hazard* from the Act which refers to tsunami, only four plans reviewed (Marlborough Sounds RMP; Otago Coastal Plan; proposed West Coast Regional Coastal Plan; proposed Whakatane District Plan) define tsunami in detail
- A large number of plans reviewed (15) identify tsunami as an issue to their region/district either directly, or through a natural hazard section
- While a large number of the plans reviewed (16) have objectives relating to natural hazards (most directed towards the coast), no plans have objectives relating specifically to tsunami
- Of the large number of plans (17) that have policies to implement these objectives, only the proposed Hutt City and WRC Coastal Plan refer to tsunami

Regional Council Provisions

	Definitions	Issues	Objectives	Policies	Methods	Rules
Hawkes Bay - Proposed Resource Mgmt Plan (2001)		3.11.1				
Environment Waikato - Proposed Regional Coastal Plan (2001)	Glossary - Natural Hazard	8.1	8.1	8.1.1; 8.1.2	16.2	16.1
Otago - Proposed Coastal Plan (1994)	Appendix 1 - Tsunami & Natural Hazard	14.2.1 (e)	14.3.1 - 14.3.3	14.4.2		14.5 (no rules)
Taranaki - Regional Coastal Plan (1997)	Definitions - Natural Hazard		OBJ 7 (b)		METH 1 - 4	
Wellington - Regional Coastal Plan (2000)				4.2.21; 5.2.8; 6.2.5		
West Coast - Proposed Coastal Plan (2000)	Glossary - Tsunami & Natural Hazard	14.2.1 (e)	14.3.1 - 14.3.3	14.4.2		14.5 (no rules)
Southland - Proposed Freshwater Plan	Glossary - Natural Hazard					

District Council Provisions

	Definitions	Introduction /Overview	Issues	Objectives	Policies	Methods	Rules
Christchurch - Proposed District Plan		3.4 (Vol. 1)	3.4.5 (Vol. 1)	2.5 (Vol. 2)	2.5.1 (Vol. 2)		
Lower Hutt - Proposed District Plan (1995)		14H	14H 1.1.1	14H 1.1.1	14H 1.1.1 (b) (iv)		14H 2
Kapiti Coast District Plan (1999)	Q - Natural Hazard		B.10	C.15.1	C.15.1(5)	C.1.1	D.1.2.1
Manawatu - Proposed District Plan	9.1- Natural Hazard	9.1		9.2	9.2	9.2	
Marlborough - Resource Management Plan (1998)	Vol. 2	16.1	16.2	16.3	16.3		
New Plymouth - Proposed District Plan (1998)			12	12	12.1 - 12.2		
Porirua - District Plan (1999)	M - Natural Hazard	C12	C12.1; C12.2	C12.1	C12.1.1 - 5; C12.2.1		
Rodney - Proposed District Plan (2000)	3.0 - Natural Hazard	5.1	5.2	5.3	5.4		5.8: no rules
South Taranaki - Proposed District Plan (1996)	2.01.7 - Natural Hazard	2.01.7	2.01.7	2.01.7	2.01.7	2.01.7 A	12.01
South Wairarapa - District Plan Vol. 1	Append. 9 - Natural Hazard			5.12.1	5.12.2	5.12.4	
Tasman - Draft Proposed Resource Management Plan	2.2 - Natural Hazard	13.0	13.1		13.1.2A		
Tauranga - Proposed District Plan		2.4; 6.0; 6.1.13					
Western BoP - Proposed District Plan (1997)		12.0	12.1	12.2.1	12.2.2	12.4	12.3
Whakatane - Proposed District Plan: Rural		2.4.1.7	2.4.2				
Wellington City - District Plan (2000)	3.10 - Natural Hazard			14.2.7	14.2.7.1		

- In terms of methods, only 7 plans reviewed identified particular methods that include education and provision of information, co-ordination of responses, policies and rules, monitoring, and developing management options
- In terms of regulation, only 5 plans reviewed adopted rules which related to short-term structures for hazard management, earthquake faults, natural hazards (erosion, landslip, subsidence or flooding), coastline protection works, and coastal building line restrictions/relocatable building zone for coastal erosion – no rules specifically addressed tsunami hazard or risk

From this assessment, we conclude that while tsunami is identified either directly or indirectly as a coastal hazard in a large number of the plans reviewed, very few plans have adopted zoning or regulation to control the hazard or risk associated specifically with a tsunami event. However, regulations relating to coastal hazard may go some way to dealing with tsunami risk.

3.3 Review of relevant Case Law

We have undertaken a search of case law to identify whether there are any legal principles put forward by the Court that may be relevant when considering management options for tsunami hazard and risk. Using the Ministry for the Environment's case law database, no cases were found that have specifically dealt with tsunami events. While there are a number of coastal erosion/hazard cases, only one case has relevance to tsunami events.

In *Save the Bay v Canterbury Regional Council; C006/01* the appellant was not satisfied that the locations of Hazard Zone 1 and Hazard Zone 2 in the proposed Regional Coastal Environment Plan were defined correctly. Coastal erosion had been used as the determinant of these zones, and the

appellant sought the zone to also apply to areas of inundation and other forms of natural hazards. The Court commented that there was a lack of integration in the proposed management of hazards in the coastal environment, as not all hazards are dealt with. In particular the Court commented there was insufficient recognition of catastrophic events. The Court noted that 90% of the damage to the environment caused by natural hazards, occurs in 10% or less of serious but infrequent events. The Court considered plans should recognise the significant function of resource management in relation to natural hazards in the preparation and wording of their plans.

We consider these comments are relevant to current plan provisions, as reviewed above. We also consider the Court's comments may provide guidance for future court cases, and the test that plan provisions will be put to by the Court in the future. The Court's comments should provide impetus for councils considering tsunami events in their plans to consider management options, as developed in this report.

4.0 Summary of GeoEnvironmental Consultants' Report

The report “*Wellington Regional Tsunami Hazard Scoping Project*” prepared by GeoEnvironmental Consultants (June 2001) summarised the known scientific information on the nature of the tsunami hazard and associated risk in the Wellington Region. While it is acknowledged both in that report and elsewhere that in several aspects considerable additional work is required to refine the scientific basis, the GeoEnvironmental Consultants' report contains useful and relevant information as background to the current study. That report also made an initial attempt to identify and discuss options for mitigating tsunami risk in the Wellington Region.

The key findings of the GeoEnvironmental Consultants' report as they relate to the current study are set out below.

- Overall the tsunami hazard is not as great in the Wellington Region as in some countries, but is similar to some regions commonly perceived to have a problem with tsunami such as Indonesia and Hawaii
- The perception of the tsunami hazard and risk is low, as New Zealand has not experienced a large locally-generated tsunami since 1947AD (or 1855AD for the Wellington Region), or a large distantly-generated tsunami since the 1960AD Chilean earthquake
- The estimated return period for a >5.0 – 10.0 m tsunami for some part of the Wellington region coast (based on the existing historically-documented and prehistoric/pre-human record) is calculated to be about 84 years
- In general the coastline appears to be at a high risk from tsunami. This ranges from the highest risk on the East Coast to a lower risk on the West Coast, where there is less exposure to distantly-generated tsunami, but still with considerable risk from locally-generated events
- Several generic information gaps exist in the available information – these are prioritised in Section 5 of the report

Three types of mitigation approach were suggested in the GeoEnvironmental Consultants' report:

- Policy and management measures that reduce the likelihood of damage
- Preparedness and response planning to deal with the consequences of the event
- Engineering design measures that reduce vulnerability

Figure 6 in GeoEnvironmental Consultants' report contains a summary of the areas at risk from tsunami hazards. These are:

- West Coast – High Risk

Distantly-generated tsunami – Minor (possible reflection/refraction)

Locally-generated tsunami – Major (significant problem)

Urban areas at risk – Porirua Harbour area and Paekakariki northwards

Unpopulated areas at risk – All low-lying areas

- South Coast – High Risk

Distantly-generated tsunami – Moderate (South America)

Locally-generated tsunami – Major (faults and landslides)

Urban areas at risk – South Coast of City, possibly Eastern bays, Palliser Bay

Unpopulated areas at risk – All low-lying areas, especially Palliser Bay

- East Coast – Extreme Risk

Distantly-generated tsunami – Major (South America)

Locally-generated tsunami – Major (faults and Hikurangi Trough)

Urban areas at risk – Castlepoint & Riversdale

Unpopulated areas at risk – All low-lying areas such as Flat Point

It is stressed that these categories and definitions of 'High' and 'Extreme' are from GeoEnvironmental Consultants' report. Assessing and refining the risk in different parts of the coast is ongoing. The above summary however

does provide a useful basis for the Classification of Elements at Risk included in Section 7.0 of this report.



5.0 Consultation with Territorial Authorities

As outlined in Section 2 the meetings with the Emergency Management Officers and the Policy/Planning staff of the territorial authorities were used as an opportunity to introduce the project, outline the project objectives, desired project outcomes and the approach to the study. They also provided an opportunity to discuss the project assumptions (outlined in Section 6), and the classification of the elements at risk.

The key points from the meetings were:

- The acknowledgement of the tsunami hazard and the risk to the various districts varies considerably across the districts
- The state of scientific knowledge about the hazard does not lend itself to allowing territorial authorities to easily plan for or manage the likely risk
- There will be a need to improve the scientific knowledge to provide a justifiable basis for planning instruments if such are considered appropriate
- Some management options may have implications for land values.
- The issue of liability may arise depending on management options identified
- Suggested addition to classes of 'elements at risk'

The Workshop on 24 May had as its objective consideration of the draft report on this study. As a result modifications were made to the final report.

The main issues discussed at the Workshop were:

- The role of science and further research, and the necessity to know exact return periods of specific events. The Regional Council emphasised that the objective of the current study was 'given the current state of knowledge, what are the best management approaches available?'. In other words it was considered that the 'do nothing more than at present' option (which may include emergency response plans) was not appropriate given the possible consequences, the fact that a tsunami is

likely to occur at some time in some part of the Region - the difference in return periods of (say) 100 years was therefore non-material.

- There are greater opportunities to manage tsunami risk at ‘greenfield’ sites than for those areas that are already developed.
- The level of risk that a community is prepared to accept needs to be kept in mind, people like living in coastal areas – they make decisions based on balancing risks and benefits.
- Areas at risk from tsunami are often similarly at risk from other hazards (eg coastal erosion, storm surges, earthquakes, flooding, stormwater). There is a high coincident exposure to other hazards.
- The need to keep in mind that management approaches that may reduce tsunami risk may be counter to those for other hazards. For example, buildings designed to provide open free space on ground floors, while limiting potential damage from inundation, may be less resistant to earthquake shaking.
- The need to keep in mind the potential for effect on property values if ‘lines are drawn on maps’. However it has been shown in other cases that property values may decrease for a period (say 18 months), and then return to previous levels.
- A tsunami is not just a water body – it is also likely to carry significant volumes of debris picked up in transit, thus increasing its destructive power.
- If local authorities can plan appropriately, there is a reduced need for evacuation plans.
- Assume at this stage that planning should take into account areas below the 10m contour, and assume that these areas could be affected by a tsunami wave (or waves) of 5-10m height.
- There may be a need for more scientific information in order to determine priorities for managing the risks.

6.0 Assumptions for this Project

In order to make progress on the outcomes of this project, the following assumptions were made:

- Given that the Region has a record of tsunami, the specific calculated return period of a tsunami is not relevant – while there may be some debate regarding whether the return period for a tsunami >5.0 – 10.0 m is 84 years anywhere in the Region, the precision of return period calculation is not considered relevant for this project. What is relevant is that a tsunami >5.0 – 10.0 m can be expected to occur somewhere in the Region at some time in the future.
- Notwithstanding the above assumption, further work on return periods of various tsunami in the Wellington Region is needed, but this does not affect the findings of this project which can be overlaid at whatever stage or scale scientific information becomes available.
- The scale of a tsunami event is relevant – from findings of the GeoEnvironmental Consultants’ report it seems sensible to plan for a 5 – 10 m high tsunami wave (or waves). While there is likely to be some debate as to whether a 5m wave height therefore affects an area up to the 5m contour once the wave reaches shore, discussion at the Workshop (see section 5) expressed a preference for planning for the most significant effects up to the 5m contour, rather than 10m, based on the fact that the wave could be expected to lose energy beyond 5m. However, it may be prudent for a territorial local authority to choose a land contour level somewhere from 5m up to 10m for planning as appropriate for their district, bearing in mind that the lower the level (contour) and the closer to the coast, the greater the impact.
- In the classification of Elements at Risk in the Region, the key interest is protecting human life through good planning, building and infrastructure design and placement, and assisting recovery of the community through management of lifelines/infrastructure.

- Emergency Response Plans and Recovery Plans are required regardless of the management options chosen to manage the risk of a tsunami event

7.0 Characterisation of Elements at Risk

In this section, the elements at risk within the social community and physical environment are identified, and classified according to their characteristics. This then provides the broad structure within which to identify appropriate management techniques (see sections 8.0 and 9.0 of this report). This is a generic exercise and is likely to be able to be applied to any area of New Zealand or overseas country. In addition it can be applied at any scale, whether regional, district, or eventually, for example, at planning map scale. As a check to ensure all areas would be addressed, the classes were applied to the various parts of the Wellington Region's coast – see Appendix B (maps of the Wellington Region).

In this process the focus has been on characterising areas modified for human activity, and emphasising the threat to human life, either directly or indirectly through lifelines and essential infrastructure. Specifically it has focussed on the social and physical characteristics of the coastal stretches, communities of interest and infrastructure development. (It has been assumed that while areas of natural habitat (such as estuaries or sand dunes) may have high environmental value and indeed may have been enhanced with significant human effort and resources, these habitats would in their natural state be vulnerable to the tsunami hazard which would be a natural part of their formation and development.)

It is also noted that while some areas may have significant elements at risk, the level of vulnerability to the tsunami hazard may vary considerably through design or other factors. For example, a stretch of state highway and/or specific bridges or buildings (such as Te Papa) may have been (or may be able to be) designed to withstand a tsunami of a certain magnitude or frequency. Conversely an area of intensive residential development may contain several retirement villages with people possessing limited mobility.

Seven classes have been determined as follows:

Class A: Lifelines/essential infrastructure

This includes strategic road networks such as State Highways or key district access routes to communities where no alternative access routes exist, railways, key infrastructure items such as hospitals, airports, water supply pipelines or storage facilities, and sewage treatment or collection systems.

Class B: Urban residential

This encompasses areas of current urban development that are predominantly residential, and relatively intensively populated, with high added value in terms of property.

Class C: Urban industrial/commercial

This encompasses areas of current urban development that are predominantly commercial or industrial in character, with high added value in terms of property development. Inherent in this class is the fact that at certain times these areas are likely to contain large numbers of people.

Class D: Semi rural/semi urban

This encompasses areas of lower density development – either smaller rural communities or low intensity urban development such as lifestyle blocks.

Class E: Potential/future development

This encompasses areas that are currently little developed but because of their physical characteristics are expected to be developed within the foreseeable future. Such areas include coastal areas that are attractive for development either because of their physical and climatic attributes, ease of access (road end), or proximity to urban centres.

Class F: No development/rural

This encompasses areas which are currently predominantly rural or reserves land with little potential for more intensive development for human settlement in the foreseeable future, either because of physical and climatic

attributes, lack of access, distance from urban centre, or tenure. These areas may include transient occupation such as recreational activities.

Class G: Coastal infrastructure

This encompasses areas that are developed for coastal and/or recreational use, such as marinas, resorts, recreational facilities, and marine farming/aquaculture areas. They may contain substantial added value in terms of property development and periodically contain large numbers of people.

Appropriate management techniques to mitigate the tsunami risk in each class are addressed in Section 9.0 of this report.

8.0 Management Options

The project has as its main objective the identification of management options to minimise the risk of tsunami on the social and physical environment. In this process the *Seven Principles for Planning and Design for Tsunami Hazards* developed as part of the National Tsunami Hazard Mitigation Programme (March 2001) has been examined closely in terms of its applicability to New Zealand conditions, and specifically the Wellington Region. This programme is a multi-state mitigation project funded by the US Department of Commerce and National Oceanic and Atmospheric Administration (NOAA).

The seven principles are set out below, followed by the strategies that are recommended to give effect to each principle. We then suggest means by which these strategies can be implemented in the New Zealand and Wellington Region context, using the following currently available mechanisms:

- Strategic Plans
- Annual Plans
- Regional Policy Statement
- Regional Plans
- Community Plans
- District Plans
- Building Act Requirements
- Development Plans
- Civil Defence Plans
- Emergency Response Plans/Recovery Plans
- Education/Public Awareness
- NZS/Codes of Practice

Principle 1 – Know your community’s tsunami risk: hazard, vulnerability, and exposure

Understanding the community’s tsunami hazard, vulnerability and exposure to damage is the foundation for land use and building strategies that can mitigate tsunami risk. Tsunami risk is a function of three factors:

- The nature and extent of the tsunami hazard
- The vulnerability of facilities and people to damage
- The amount of development or number of people exposed to the hazard

We consider the GeoEnvironmental Consultants’ report provides a basis for identifying the nature and extent of the tsunami hazard in the Wellington Region. The classification of key elements at risk around the Region identifies the amount of development or number of people exposed to the hazard. We consider further local assessment (at the district level) is needed to determine the vulnerability of facilities and people to damage.

We note Tsunami Loss Scenario Studies are introduced in the National Tsunami Hazard Mitigation Programme to assess potential loss to important buildings and structures, transportation systems and utility services, and provide the basis for reducing potential loss. We consider such a study undertaken at the district level would be a mechanism to address vulnerability of facilities and people to damage, and therefore the risk (consequences) from tsunami. An example of such a study is: California Division of Mines and Geology; Publication 115: “*Planning Scenario in Humboldt and Del Norte Counties, California for a Great Earthquake on the Cascadia Subduction Zone.*”

Management Option 1 – Identification of risk: hazard, vulnerability and exposure

The National Tsunami Hazard Mitigation Programme establishes the following strategies for applying hazard information to reducing future losses. We consider this is useful for the Wellington Region:

- Incorporate hazard information into short and long term planning processes
- Use hazard information to build public and political support for mitigation measures
- Estimate reduced future losses by evaluating the effectiveness of loss-prevention measures
- Periodically re-evaluate community vulnerability and exposure

We consider *implementation* of the above strategies in the Wellington Region would be through:

- Use hazard information in local authority strategic, annual and community plans
- Incorporate tsunami information into natural hazard planning in regional plans
- Local authorities initiate Tsunami Loss Scenario Studies for their districts
- Regional/district councils initiate public awareness and co-ordination through their Emergency Management Officer roles – information, signs etc
- Ensure annual plans provide financial support for these initiatives

Principle 2 – Avoid new development in tsunami run-up areas to minimise future tsunami losses

The effects from a tsunami event can be mitigated most effectively by avoiding or minimising the exposure of people and property through land use planning. This can be achieved by preventing development in high-risk areas wherever possible, and where development can not be prevented, land use intensity, building value and occupancy should be kept to a minimum.

Management Option 2 – Avoid new development in tsunami hazard areas

The National Tsunami Hazard Mitigation Programme establishes the following specific land use planning strategies to reduce tsunami risk. We consider these are relevant for the Wellington Region:

- Designate or zone tsunami hazard areas for open-space uses – parks and recreation, horticulture/agriculture etc
- Acquire tsunami hazard areas for open-space uses - could also include purchasing development rights and requiring easements
- Restrict development through land use regulations – strategically control the type of development and uses allowed in hazard areas and avoid high-value and high-occupancy uses; could also use large-lot zoning requirements for subdivision or clustering of activities on site areas where risks are lowest
- Support land use planning through Capital Improvement Planning and Budgeting – control community facilities and infrastructure in areas where hazards exist to discourage development; integrate hazard risk mitigation into infrastructure policy
- Adopt other programmes and requirements – use of regulations that are to address other matters (such as floor heights in flood prone areas, building line restrictions or set backs addressing coastal erosion or sea level rise) may be applicable to tsunami risk mitigation

We consider *implementation* of the above strategies in the Wellington Region would be through:

- Regional Plans – identify tsunami hazard as regionally significant issue and state preference for avoidance of new development in tsunami hazard areas; review other risk management provisions for earthquakes, flooding, coastal erosion and sea level rise in light of tsunami hazard information; co-ordination of integrated management

- District Plans - specific zoning of hazard areas with policies to avoid or control development, rules to prohibit development, and regulation (such as subdivision rules); build on existing plan provisions for earthquakes, flood prone areas, coastal erosion and sea level rise (building line restrictions/setbacks); require financial contributions to address tsunami hazards – including easements
- Strategic, Community and Annual Plans – identification of areas that should be open space and a purchase programme for land or development rights

If avoidance is not possible:

- Building Act/consents – identification of the tsunami hazard on LIMs and PIMs; consider not issuing building consents for new developments
- Development plans – require comprehensive development plans for new developments
- Community Plans - control community facilities and infrastructure

We note that throughout these and other processes it is important to ensure that the level of risk is communicated accurately and without exaggeration.

Principle 3 – Locate and configure new development that occurs in tsunami run-up areas to minimise future tsunami losses

When development is to be sited within a tsunami hazard area, the physical configuration of structures and uses on site can reduce potential loss of life and property damage. Techniques include strategic location of structures and open spaces, interaction of uses and landforms, design of landscaping, and the erection of barriers. A development plan could include site planning that determines the location, configuration, and density of development on particular sites in a way that reduces tsunami risk.

Management Option 3 – Control the location and nature of new development

The National Tsunami Hazard Mitigation Programme establishes the following specific site planning strategies to reduce tsunami risk. We consider these are relevant to the Wellington Region:

- Avoid inundation areas by siting buildings and infrastructure on the high side of a site or raising structures above tsunami inundation levels on piers or hardened podiums
- Slowing water currents by creating friction that destroys the destructive power of waves by using designed forests, ditches, slopes and berms
- Steer water forces away from vulnerable structures and people by strategically spacing structures, using angled walls and ditches, and using paved surfaces that create a low-friction path for water to follow
- Block water forces using hardened structures such as walls, compacted terraces and berms, parking structures and other rigid construction

Mitigation strategies (by type and development) are:

- Infill housing – raising buildings above inundation levels and adding engineering features to their design
- New neighbourhoods and subdivisions – provide maximum spacing between buildings; elevate buildings above inundation levels; placing houses behind a tsunami control forest or hardened buildings; siting primary access roads outside inundation areas and secondary access roads perpendicular to the shore
- High-rise hotels – lower levels can be designated for public areas such as lobbies and support uses (car parking); buildings can be designed to allow waves to pass through the ground floor without damaging upper floors
- Resorts – open space and tsunami forests, elevating or locating structures above estimated inundation levels, and buffering smaller buildings with larger buildings and waterfront structures
- Industrial – destruction or flooding of industrial facilities can add another environmental dimension to a tsunami event with burning oil,

toxic chemicals, and other hazardous materials; floating buildings, debris and boats can damage facilities on shore – protecting industrial facilities by walls and stronger anchoring is one option; locating these types of facilities outside of inundation zone is the most effective approach

- Essential and critical facilities – fire stations, power stations, hospitals, sewage treatment facilities etc should be located outside of inundation zone; relocation of existing facilities or retrofitting should be considered

We consider *implementation* of the above strategies in the Wellington Region would be through:

- District Plan - specific zoning of hazard areas with policies and rules to control location and nature of development, development of Design Guidelines associated with the zone requiring development plans, and regulation
- Building Act/consents – LIMs and PIMs identifying tsunami hazard area, building consents consider structural integrity of tsunami calming measures
- Development Plans - to determine location of structures and high occupancy buildings and measures to mitigate the effects of a tsunami
- See Principle 6 for critical facilities

Principle 4 – Design and construct new buildings to minimise tsunami damage

Where buildings are to be located in a tsunami hazard area, the design and construction of the buildings (including construction materials, building configuration and tsunami specific design features) can reduce loss of life and property damage. Performance objectives for buildings will depend on several matters including:

- location of building and configuration
- intensity and frequency of the tsunami hazard selected for design

- structural and non-structural design standards
- choice of structural and finished materials
- reliability of utilities
- professional abilities of designers
- quality of construction
- level of confidence in these factors

Management Option 4 – Regulate the design and construction of buildings in tsunami hazard areas

The National Tsunami Hazard Mitigation Programme establishes the following specific design and construction strategies to reduce tsunami risk. We consider these are relevant to the Wellington Region:

- Choose appropriate design solutions based on expected tsunami effects – design and construction of new buildings should address forces associated with water pressure, buoyancy, currents and waves, debris impact, scour and fire
- Require qualified architects and engineers to design large buildings – competent engineering, design, construction and quality assurance
- Inspect construction to ensure requirements are met

We consider *implementation* of the above strategies in the Wellington Region would be through:

- District Plan - specific zoning of hazard areas with policies and rules to control the design and construction of buildings through Design Guidelines associated with the zone requiring development plans, and regulation
- Building Act/consents – LIMs and PIMs identifying tsunami hazard area, building consents consider structural integrity of buildings to withstand a tsunami event

We consider a building code, adopting performance objectives for buildings in tsunami hazard areas, should be considered.

Principle 5 – Protect existing development from tsunami losses through redevelopment, retrofit, and land reuse plans and projects

For existing coastal communities, protecting existing resources may be the only real mitigation option available. Changes in land uses, buildings, and infrastructure create opportunities to incorporate tsunami loss-prevention measures to help make communities less vulnerable in the future.

Techniques for renewing of communities include redefining permitted land uses, changing zoning standards, changing building uses and occupancies, retrofitting and rehabilitation of buildings and redeveloping districts to improve their economic vitality.

Some special considerations in tsunami vulnerable areas: protecting landmarks and historic structures; creating scenic vistas; providing improved access to coastal amenities; improving services and accommodating needed housing and commercial activities.

A process for reducing vulnerability through renewal efforts might include:

- Inventory of at risk areas and properties
- Evaluation and revision of plans and regulations to address redevelopment, retrofit and reuse issues

Management Option 5 – Protect existing natural and physical resources

The National Tsunami Hazard Mitigation Programme establishes the following specific strategies to reduce tsunami risk. We consider these are relevant to the Wellington Region:

- Adopt special programmes and development regulations – redesignating and rezoning land in tsunami hazard areas for uses more consistent with the risk as non-conforming uses are phased out; limiting additions to

existing buildings in tsunami hazard areas; buying specific properties in tsunami hazard areas and removing or relocating buildings

- Use redevelopment strategies to reduce tsunami risk – reconfigure uses or infrastructure, retrofit specific buildings or remove buildings altogether
- Use incentives and other financial measures to support loss prevention – reduced property rates, waiving application, permit and inspection fees, waiving financial contributions
- Adopt and enforce special provisions for the retrofit of existing buildings – require retrofitting of all buildings within a defined hazard zone, or may be mandatory only when substantial modifications are made to existing structures or where there are changes to the building occupancy
- Require qualified architects and engineers to design effective measures to protect existing development – important when considering measures to strengthen existing development where experience and judgement are paramount

We consider *implementation* of the above strategies in the Wellington Region would be through:

- Regional Plans – identifying existing development in tsunami hazard areas is a regionally significant resource management issue that needs to be addressed; provide direction regarding regionally significant resources; co-ordination of integrated management of resources
- District Plan changes - redesignating or rezoning land in tsunami hazard area; policies and rules to control change in land uses and building extensions
- Community Plans – consider redevelopment of community resources and infrastructure when due for renewal or replacement
- Building consents – require compliance with Code of Practice for retrofitting of existing buildings

- Strategic and Annual Plans – financial incentives to encourage change in land uses – rates relief and fee waiver

Principle 6 – Take special precautions in locating and designing infrastructure and critical facilities to minimise tsunami damage

Key infrastructure such as transport systems for people and goods and utility systems such as communication, natural gas, water supply, power generation and transmission/distribution networks are essential to the continued operation of a community. These facilities need to be planned and designed to minimise any tsunami damage to them.

Critical facilities such as fire stations, hazardous facilities (chemical and fuel storage tanks) and buildings with large occupancy or occupants who are difficult to evacuate also need careful planning and design.

Management Option 6 – Planning and design of key infrastructure and critical facilities

The National Tsunami Hazard Mitigation Programme establishes the following specific infrastructure and critical facility location and design strategies to reduce tsunami risk. We consider these are relevant in the Wellington Region:

- Locate new infrastructure and critical facilities outside the tsunami hazard area or design to resist tsunami forces - examine plans to see if alternative locations, alignments and routes can be used; designate/zone sites outside tsunami hazard area for these facilities; develop standards for facilities in tsunami hazard area (coastal location dependent; risk reduced by mitigation and emergency planning measures; need for facility outweighs the consequence of loss during a tsunami); control infrastructure improvements that will encourage construction of other facilities; employ design professionals qualified in key areas – coastal, structural, geotechnical engineering; where location is essential in

hazard zone, ensure mechanisms to isolate damage such as shut off valves, detours etc

- Protect or relocate existing infrastructure and critical facilities – only allow expansion or renovation of existing facilities in tsunami hazard areas with measures to reduce risk; construct barriers to protect against impact forces and scour; elevate existing facilities above inundation level; relocate high-risk facilities; relocate facilities that require renewal or incorporate new design standards
- Plan for emergency and recovery – prepare emergency response plans to cope with the emergency situation and expedite recovery; plan for evacuation, emergency response, recovery and replacement facilities

We consider *implementation* of the above strategies in the Wellington Region would be through:

- District Plans to control location and design of key infrastructure and critical facilities, and information to be included with consents to assist with decision making
- Community and Strategic Plans to provide a strategic approach to these facilities
- Building Act/consents – to ensure integrity of buildings and structures
- Emergency Response Plans
- Public awareness and signs etc

Principle 7 – Plan for evacuation

A key strategy to saving lives before a tsunami arrives is to evacuate people from the hazard area. This may be through horizontal evacuation by moving people to more distant locations or higher ground, or vertical evacuation by moving people to higher floors in buildings. Vertical evacuation is linked to issues of land use, siting, and building design and construction.

Management Option 7 – Emergency Response Plans

The National Tsunami Hazard Mitigation Programme establishes the following specific strategies reduce tsunami exposure to people. We consider these are relevant for the Wellington Region:

- Identify specific buildings to serve as vertical shelters
- Work out agreements and procedures with building owners and occupiers to ensure access to shelter buildings is able to be achieved in an emergency
- Ensure procedures exist to receive and disseminate warnings
- Implement effective information and education programmes
- Maintain the programme over the long term

We consider *implementation* of the above strategies in the Wellington Region would be through:

- Emergency Response/Recovery Plans
- Establishment of appropriate warning systems
- Annual Plans – to provide financial support
- Public awareness, education and signs etc

Planning and management for evacuation and emergency response need to recognise that two situations may exist. The first is one in which a distantly sourced tsunami provides some degree of warning, and the second is where a locally sourced tsunami is instantaneous and there is no opportunity for warning. In all cases, evacuation plans need to consider not only the removal of people from impact sites but also where the affected people will reside.

We note that some tsunami (such as on the west coast of the Wellington Region) are more likely to be locally generated than distantly generated, and therefore warning systems are less likely to be relevant or successful.

9.0 Evaluation of Management Options and Applicability to the Region

The identification of management options and implementation techniques in the previous section provides a basis to determine which management option should be adopted at any particular place to minimise the risk of a tsunami event on people and facilities.

The choice of the best management option (including the possibility of doing nothing) depends initially on an assessment of the risk (ie; how often a damaging tsunami is likely to occur and what damage or loss it would cause). Knowledge of this within the Region is still evolving and scientific work needs to continue in this area. Before management options are chosen for a specific location, risk also needs to be evaluated in relation to the values and benefits that are seen to be derived from living in a particular locality. In other words the benefits may make a given level of risk acceptable or tolerable; or alternatively dictate that mitigation methods are necessary. Part of the decision for any particular management option is also an assessment of the cost/ effectiveness of the proposed measure.

In addition it is necessary to keep in mind the risks from other hazard types, that may require similar or sometimes conflicting management responses.

Choice of the best management option (or part of an option) for a specific part of the coastline or specific community therefore requires the following:

- A detailed classification of a district's elements at risk
- An assessment of the vulnerability of any element at risk
- An identification of critical and non-critical resources
- The currently understood level of risk from tsunami
- An understanding of the expectations and values of the particular community involved, particularly in relation to their acceptable levels of risk from tsunami

- Roles and responsibilities, and liabilities
- Consideration of other hazards and co-ordination of appropriate management responses

This detailed level of investigation is beyond the scope of the current project, but is seen as a logical and necessary next step by the relevant local authority.

Notwithstanding this, this project is able to provide a generic evaluation of the management options identified in Section 8, and provide some guidance as to the preferred management options for particular elements at risk within the classifications identified in Section 7 of this report, and broadly delineated in the maps in Appendix B.

9.1 Preferred Management Options

Class A: Lifelines/essential infrastructure

Management Option 6 primarily addresses these elements at risk. In essence, we consider the preferred options are:

- Any new critical facilities should be located outside of the tsunami hazard area wherever possible
- Any new critical facilities that cannot be located outside the tsunami hazard area should be sited and designed to withstand a tsunami event
- Any existing critical facilities should be relocated where possible, or assessed for vulnerability and retrofitted if relocation is not possible
- Any existing non-critical facilities should be assessed to determine vulnerability and retrofitted if required

The above options can be implemented through Community, Strategic and District Plans, and consent decision-making processes.

We also consider a Tsunami Loss Scenario Study referred to in Management Option 1 is desirable for all lifelines/essential infrastructures.

Class B: Urban residential

Management Options 2, 3, 4, 5 and 7 are relevant to urban residential areas. We consider the following are the preferred approaches, depending on the nature of the residential areas:

- Avoid new development in tsunami hazard areas (Management Option 2)
- If avoidance is not possible, place an emphasis on location, configuration and building design (Management Options 3 & 4) and purchase of vulnerable areas for open spaces and tsunami protection mitigation (Management Options 2 & 3)
- For those residential areas with vulnerable communities and facilities, protect existing facilities (Management Option 5) and plan for evacuation and recovery (Management Option 7)

The above options can be implemented through Regional and District Plans, Community Plans, building consents, Annual Plans and Emergency Response Plans.

Class C: Urban industrial/commercial

Management Options 2, 3, 4, 5, 6 and 7 are relevant to urban industrial/commercial areas. We consider the following are the preferred approaches, depending on the nature of the industrial/commercial areas:

- Avoid new development (particularly high occupancy uses) in tsunami hazard areas (Management Option 2)
- If avoidance is not possible, place an emphasis on location, configuration and building design (Management Options 3 & 4) and purchase of vulnerable areas for open spaces and tsunami protection

mitigation (Management Option 2 & 3), and protection of existing facilities (Management Option 5)

- For those industrial/commercial areas with critical facilities including hazardous facilities, take special precautions with existing facilities (Management Option 6) and plan for evacuation and recovery (Management Option 7)

The above options can be implemented through Regional and District Plans, Community Plans, building consents, Annual plans and Emergency Response Plans.

Class D: Semi rural/semi urban

Management Options 2, 3, 4, 5 and 7 are relevant to semi rural/ semi urban areas. We consider the following are the preferred approaches, depending on the nature of the semi rural/semi urban areas:

- Avoid new development in tsunami hazard areas or restrict development through land use regulations including large-lot zoning requirements (Management Option 2)
- If avoidance is not possible, place an emphasis on location, configuration and building design (Management Options 3 & 4)
- For those semi rural/semi urban areas with vulnerable communities and facilities, protect existing facilities (Management Option 5) and raise public awareness through information and signs for evacuation (Management Option 7)

The above options can be implemented through Regional and District plans, Community Plans, building consents, Annual plans and public awareness programmes.

Class E: Potential/future development

Management Option 2 is relevant to potential/future development areas. On the assumption, however, that people may still visit such areas (as distinct from develop and reside in such areas), Option 7 is also appropriate. We consider the following are the preferred approaches, depending on the nature of the potential/future development areas:

- Avoid new development in tsunami hazard areas is the most preferred option through zoning with land use restrictions and controls (Management Option 2)
- Public awareness of the tsunami risks through information and signs for people visiting these areas (Management Option 7)

The above options can be implemented through Regional and District Plans, building consents, and public awareness programmes.

Class F: No development/rural

Management Option 7 is relevant to no development/rural areas. We consider the following is the preferred approach, depending on the nature of the no development/rural areas:

- Provide information and signs to raise public awareness (Management Option 7)

The above options can be implemented through a public awareness programme.

Class G: Coastal infrastructure

Management Options 3, 4, 5 and 7 are relevant to coastal infrastructure areas. We consider the following are the preferred approaches, depending on the nature of the coastal infrastructure areas:

- Place an emphasis on location, configuration and building/structure design (Management Options 3 & 4)

- For those coastal infrastructure areas with vulnerable communities and facilities, protect existing facilities (Management Option 5) and plan for evacuation and recovery (Management Option 7)

The above options can be implemented through Regional and District Plans, building consents, and Emergency Response Plans.

9.2 Summary

The following table summarises the preferred management options for the classification of Elements at Risk, where 1 = most preferred and 5 = least preferred. It should be noted that evacuation plans are likely to be available for each class of elements, and the weighting below is primarily related to focussing on avoiding or minimising the risk of a tsunami event on buildings and structures at the planning and design stages.

Management Option	1 KnowledgeIdentifyin g risk	2 Avoid new uses	3 Plan for new uses	4 Plan/ design new buildings	5 Protect existing uses	6 Plan/ design critical facilities	7 Plan for evacua tion
Class A	2=					1	2=
Class B		1	2=	2=	4		5
Class C		1	2=	2=	4		5
Class D		1	2=	2=	4		5
Class E		1					2
Class F							1
Class G			1=	1=	3		4

The assessment of preferred management options can be taken one step further using the GeoEnvironmental Consultant's report findings for the three general areas (as outlined in Section 4).

West Coast – High Risk

Urban Areas – Porirua Harbour and Paekakariki northwards (refer to Maps in Appendix B).

Class A: Management Option 6 – locate critical facilities outside tsunami hazard areas or design to resist tsunami forces – through Community and District Plans.

Class B: Management Option 2 – avoid uses in tsunami hazard area (preferred option), or control location and design, and construction of buildings (Management Options 3 & 4) – through Regional and District Plans, Community Plans, building consents.

Class D: Management Option 2 – avoid uses in tsunami hazard area (preferred option), or control location and design and construction of buildings (Management Options 3 & 4) – through Regional and District Plans, Community Plans, building consents.

Class G: Management Options 3 & 4 – control location and design and construction of structures/facilities (preferred options), or protect existing structures/facilities (Management Option 5) – through Regional and District Plans, Community Plans, building consents.

Unpopulated Areas – all low-lying areas

Class E: Management Option 2 – avoid uses in tsunami hazard area (preferred option) - Regional and District Plans, building consents.

Class F: Management Option 7 – provide information and signs to raise public awareness.

Class G: Management Options 3 & 4 – control location and design and construction of structures/facilities (preferred options), or protect existing structures/facilities (Management Option 5) – through Regional and District Plans, Community Plans, building consents.

South Coast – High Risk

Urban Areas – South of City, possibly eastern bays, Palliser Bay

Class A: Management Option 6 – locate critical facilities outside of tsunami hazard areas or design to resist tsunami forces (preferred option) – through Community and District Plans.

Class B: Management Option 2 – avoid uses in tsunami hazard area (preferred option), or control location and design and construction of buildings (Management Options 3 & 4) – through Regional and District Plans, Community Plans, building consents.

Unpopulated Areas – all low-lying areas, especially Palliser Bay

Class E: Management Option 2 – avoid uses in tsunami hazard area (preferred option) - Regional and District Plans, building consents.

Class F: Management Option 7 – provide information and signs to raise public awareness.

Class G: Management Options 3 & 4 – control location and design and construction of structures/facilities (preferred options), or protect existing structures/facilities (Management Option 5) – through Regional and District Plans, Community Plans, building consents.

East Coast – Extreme Risk

Urban Areas – Castlepoint and Riversdale

Class A: Management Option 6 – locate critical facilities outside of tsunami hazard areas or design to resist tsunami forces (preferred option) – through Community and District Plans.

Class B: Management Option 2 – avoid uses in tsunami hazard area (preferred option), or control location and design and construction of buildings (Management Options 3 & 4) – through Regional and District Plans, Community Plans, building consents.

Class G: Management Options 3 & 4 – control location and design and construction of structures/facilities (preferred options), or protect existing structures/facilities (Management Option 5) – through Regional and District Plans, Community Plans, building consents.

Unpopulated Areas – all low-lying areas such as Flat Point

Class E: Management Option 2 – avoid uses in tsunami hazard area (preferred option) - Regional and District plans, building consents.

Class F: Management Option 7 – provide information and signs to raise public awareness.

Class G: Management Options 3 & 4 – control location and design and construction of structures/facilities (preferred options), or protect existing structures/facilities (Management Option 5) – through Regional and District Plans, Community Plans, building consents.

10.0 Recommendations

It was clear from the workshop that there was a desire to identify possible next steps from this project, that territorial authorities may follow.

Consideration of this issue leads to the following recommendations:

1. Territorial local authorities (TLAs) prepare a map showing land potentially susceptible to tsunami risks – where information is available, such a map could show the 3 or 5m contour lines; where information is not available, the 10m contour is recommended as this is the credible height a tsunami has been known to reach. The precise land contour for the spatial area to be decided by Councils relating to:
 - the likely run-up area of a 5 – 10m high tsunami wave(s)
 - the level of vulnerability of the area to a tsunami – different degrees of vulnerability according to topography
 - the availability of information on vulnerable areas
2. TLAs overlay the classification of elements at risk developed in Section 7 of this report to the spatial area identified
3. TLAs to use the template included in Appendix D of this report to evaluate management options outlined in Section 8 of this report, for the classification of elements at risk most appropriate for their district, taking into account any provisions they may already have in place, and assigning their own priorities.
4. TLAs and Wellington Regional Council to co-ordinate an implementation strategy for the preferred management options that would include:
 - a review of the effectiveness of current mechanisms available to manage the tsunami risk in the spatial areas with key elements at risk to a tsunami event
 - consideration of changes to regional and district plans where regulatory mechanisms are required

- consultation with the community and the elected members of Councils to raise the awareness of risks from tsunami events and to gain support for the preferred management options
 - development of new mechanisms where identified as best practice and effective and practical
 - incorporation of implementation strategy into annual and strategic plans
5. Within the 10m contour, development proposals, planning, policy and management proposals, retrofitting and maintenance options, as well as consent procedures should as a matter of procedure be measured against the options outlined in this report for reducing risk from tsunami. ie; make such an assessment part of the hazard mitigation protocol in potential impact areas.
6. A review of the progress on these recommendation by the Wellington Regional Council within 12 months of the acceptance of this report and recommendations

11.0 Applicability

This report has been prepared for the benefit of the Wellington Regional Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

TONKIN & TAYLOR LTD
Environmental and Engineering Consultants

Report prepared by:

Authorised for Tonkin & Taylor by:

.....
Chris Hansen and Sally Marx

.....
Ed Breese

Peer Reviewer:

Professor M J Crozier
School of Earth Sciences
Victoria University of Wellington

J:\82980\Report - June 02.doc



Bibliography

Technical Reports

Auckland Regional Council. (1994). *Tsunami Hazard for the Auckland Region*. Auckland Regional Council Technical Publication No. 50, Auckland

Barrow, S., & Hartstein, N. (2000). *Tsunami Hazard for the Marlborough District: A Preliminary Report*. School of Earth Sciences, Victoria University of Wellington, Wellington.

Becker, J., Johnston, D. (2000). *Planning and Policy for Earthquake Hazards in New Zealand*. Institute of Geological & Nuclear Sciences Ltd, Lower Hutt.

Berry, P. (1985). *The Silent One – Tsunami*. Ministry of Civil Defence.

Bradley, D. (2001). *Tsunami*. Environment Southland, Invercargill.

Dahm, J. (1999). *Coastal Flooding Hazard in the Waikato Region*. Environment Waikato Technical Report, Hamilton.

Davey, R. A. (1995). *Earthquake Risk Assessment Study: Review of Risk Assessment Methodologies*. Works Consultancy Services Ltd, Wellington.

Davey, R. A. & Shephard, R. B. (1995). *Earthquake Risk Assessment Study: Study Area 1 – Wellington City*. Works Consultancy Services Ltd, Wellington.

Davey, R. A. & Shephard, R. B. (1995). *Earthquake Risk Assessment Study: Study Area 2 – Hutt Valley*. Works Consultancy Services Ltd, Wellington.

Davey, R. A. & Shephard, R. B. (1995). *Earthquake Risk Assessment Study: Study Area 3 – Porirua Basin*. Works Consultancy Services Ltd, Wellington.

Davey, R. A. & Shephard, R. B. (1995). *Earthquake Risk Assessment Study: Study Area 4 – Kapiti Coast*. Works Consultancy Services Ltd, Wellington.

Davey, R. A. & Shephard, R. B. (1995). *Earthquake Risk Assessment Study: Study Area 5 – Wairarapa*. Works Consultancy Services Ltd, Wellington.

Downes, G., Stirling, M. W. (2001). *Groundwork for Development of a Probabilistic Tsunami Hazard Model for New Zealand*. Institute of Geological & Nuclear Sciences, Wellington.

Downes, G., Webb, T. (2001). *Tsunami Hazard: Research in GNS; Seismic Hazard in New Zealand*. Institute of Geological & Nuclear Sciences, Wellington.

GeoEnvironmental Consultants. (2001). *Wellington Regional Tsunami Hazard Scoping Project*. Prepared for the Wellington Regional Council

Grindell, D. S. (1990). *Vulnerability Assessment for Tsunami: Wellington Harbour*. Technical Note LN1990/24, Wellington Regional Council, Wellington.

Hodge, W. C. (1998). *Legal Responsibility for Disaster Mismanagement*. Disaster Management Conference, Institute for International Research.

Johnston, D. M., & Pearse, L. J. (eds). (1999). *Natural Hazards In Hawkes Bay*. Technical Report AM 99/03. Hawke's Bay Regional Council, Napier.

Ministry for Emergency Management. (1999). *Tephra*. Volume 17. Ministry for Emergency Management, Wellington.

National Tsunami Hazard Mitigation Program (2001): *Designing for Tsunamis*. NOAA, USGS, FEMA, NSF, Alaska, California, Hawaii, Oregon, and Washington.

Palmer, Dr K. A. (1993). *Regional Council Liability and Natural Hazards Functions*. Faculty of Law, University of Auckland, Auckland

Pennington, M. (1999). *Wellington Regional Council: Hutt River Model Update*. Montgomery Watson New Zealand Ltd, Hamilton.

Tonkin & Taylor Ltd. (2002). *Onetangi Beach Coastal Hazard Management Strategy*. Tonkin & Taylor Ltd, Auckland

Wellington Regional Council Landcare Division. (1997). *Waikanae Floodplain Management Plan: The Community's Plan for the Waikanae River and its Environment*. Publishing Solutions Ltd, Wellington.

Wellington Regional Council Landcare Division. (1997). *Otaki Floodplain Management Plan for the Otaki River and its Environment*. Hutcheson Bowman & Stewart Ltd, Wellington.

Wellington Regional Council. (1999). *Measuring Up: The State of the Environment Report for the Wellington Region 1999*. Wellington Regional Council, Wellington.

Wellington Regional Council. (2000). *Coastal Hazards in the Wairarapa, Technical Report No. 00/19*. Planning and Resources: Hazard & Emergency Management, Wairarapa Division, Wellington Regional Council, Wellington.

Wellington Regional Council. (2000). *Tsunami Hazard in the Wairarapa, Technical Report No. 00/20*. Planning and Resources: Hazard & Emergency

Management, Wairarapa Division, Wellington Regional Council, Wellington.

Wellington Regional Council. (2000). *Tsunami Hazard: 20m Contours for Risk Assessment, Wairarapa Coastal Settlement, Technical Report No. 00/18*. Planning and Resources: Hazard & Emergency Management, Wairarapa Division, Wellington Regional Council, Wellington.

Civil Defence Plans

Carterton District Council (1999). *Civil Defence Plan*. Carterton District Council, Carterton.

Hutt City Council (2002). *Hutt City Council Civil Defence Plan 1998/2001*. Hutt City Council, Lower Hutt.

Masterton District Council (1999). *Civil Defence Plan*. Masterton District Council, Masterton.

Ministry for Emergency Management. (2000). *Civil Defence Emergency Management Planning: Information for Local Government*. Ministry for Emergency Management, Wellington.

Upper Hutt City Council Emergency Management. (1999). *Civil Defence Plan 1999 –2002*. Upper Hutt City Council, Upper Hutt.

Wellington City Council Emergency Management Office. (1999). *Civil Defence Plan*. Wellington City Council, Wellington.

APPENDIX A

PARTICIPANTS AT WORKSHOP 24 MAY 2002



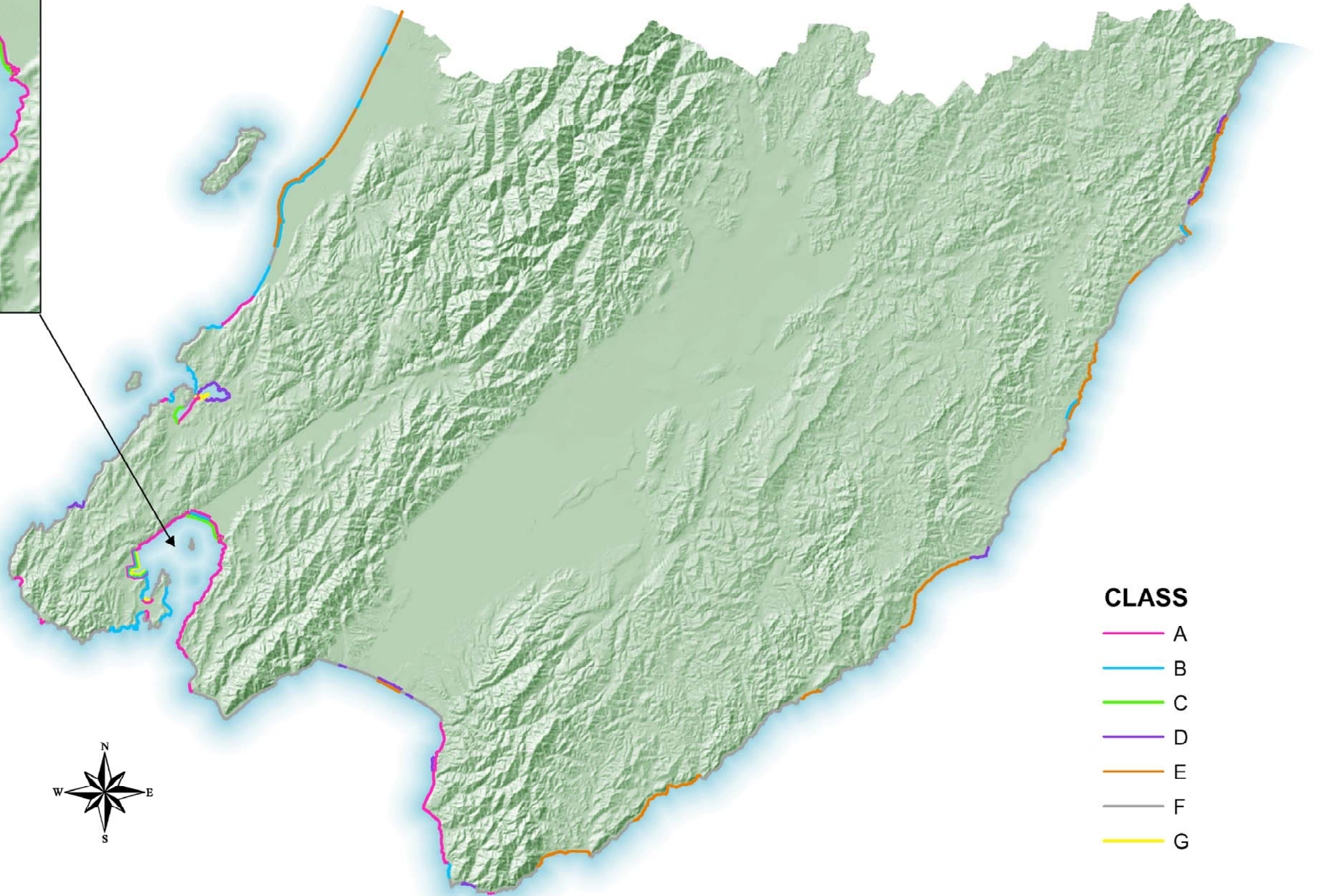
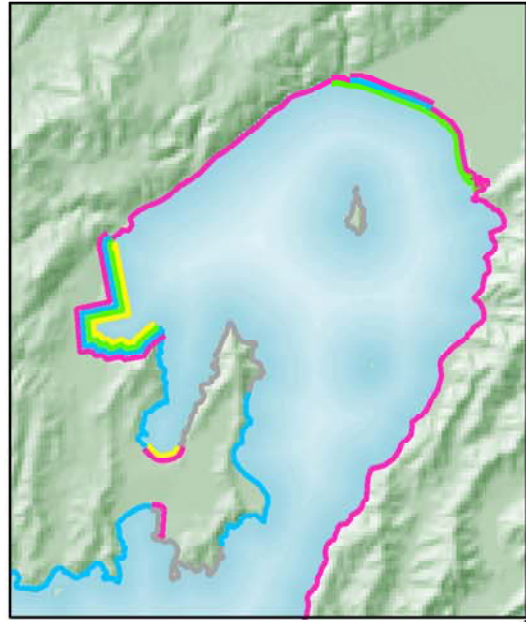
WORKSHOP PARTICIPANTS








Wayne Hastie	– Wellington Regional Council
Debbie Cunningham	– Wellington Regional Council
Rian van Schalkwyk	- Wellington Regional Council
Steve Blakemore	– Wellington Regional Council (Wairarapa Division)
Sam Barrow	– Wellington Regional Council (Wairarapa Division)
Scott Blair	- Porirua City Council
Marshall Hyland	- Porirua City Council
John Halson	- South Wairarapa District Council
David Etchells	- Upper Hutt City Council
Graeme Brown	- Wellington City Council
Karen Stevens	- Wellington City Council
Dave Jack	- Hutt City Council
Robyn Fisher	- Hutt City Council
Bronwyn Little	- Hutt City Council
Paul Walker	- Masterton District Council
Peter Kloosterman	- Masterton District Council
Professor Michael Crozier (Chair)	– School of Earth Sciences, Victoria University of Wellington
Chris Hansen (Presenter)	- Tonkin and Taylor Ltd
Sally Marx (Presenter)	- Tonkin and Taylor Ltd

APPENDIX B

CHARACTERISATION OF REGIONAL COAST ACCORDING TO CLASSES OF ELEMENTS AT RISK





- CLASS**
-  A
 -  B
 -  C
 -  D
 -  E
 -  F
 -  G

APPENDIX C

SUMMARY OF REGIONAL AND DISTRICT PLAN PROVISIONS



Definitions

“Natural Hazard – Any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.”

This definition contained in:

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN (2001)
MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN (1998)
MANAWATU PROPOSED DISTRICT PLAN (1998):
OTAGO REGIONAL COASTAL PLAN(1994)
PORIRUA CITY DISTRICT PLAN (1999)
RODNEY PROPOSED DISTRICT PLAN (2000)
TARANAKI REGIONAL COASTAL PLAN (1997)
TASMAN RESOURCE MANAGEMENT PLAN (1996)
WEST COAST PROPOSED REGIONAL COASTAL PLAN (2000)
SOUTH TARANAKI PROPOSED DISTRICT PLAN (1996)
SOUTH WAIRARAPA DISTRICT PLAN (1998)
SOUTHLAND PROPOSED REGIONAL FRESHWATER PLAN (2000)
WELLINGTON CITY DISTRICT PLAN (2000)
KAPITI COAST DISTRICT PLAN (1999)

“Tsunami – A sea wave of local or distant origin that results from sea-floor fault movement, large scale sea-floor slides or volcanic eruption on the sea-floor.”

This definition contained in:

MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN (1998)
OTAGO COASTAL PLAN
WEST COAST COASTAL PLAN

“The word “tsunami” describes a wave system in the sea which follows a large scale, short duration disturbance of the sea surface. Tsunami are usually generated by earthquakes but can also be caused by submarine landslides and volcanic eruptions. All can cause flooding of the coastline and river mouths.”

This definition contained in:

WHAKATANE PROPOSED DISTRICT PLAN (RURAL) – Chapter 2.4.1.7

Issues

CHRISTCHURCH PROPOSED DISTRICT PLAN:

3.4.5 Tsunamis represent a serious hazard, particularly for the eastern suburbs.

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN:

8.1 A lack of both public awareness and integrated planning increases the likelihood of adverse effects when coastal hazard events occur.

HAWKES BAY REGIONAL RESOURCE MANAGEMENT PLAN (2000):

3.11.1 The susceptibility of the Regional to flooding, droughts, earthquakes, volcanic ash falls, and tsunami, and the impact of these on people's safety, property and economic livelihood

HUTT CITY PROPOSED DISTRICT PLAN (1995):

14H 1.1.1

There is a risk of harm to people and damage to their property from natural hazards associated with seismic action, landslides, flooding and coastal hazards. The risks to people and their property should be avoided or mitigated

KAPITI COAST DISTRICT PLAN:

B.10 Effects of development on the integrity, functioning and resilience of the coastal environment in terms of the dynamic coastal processes of sediment, water and air movement.

MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN (1998):

16.2 The variability of natural hazards location, frequency, severity, and potential to reduce the safety of the community or cause damage to property, infrastructure or the environment.

The natural hazards which occur in the Marlborough Sounds are include:

- Coastal inundation, tsunami and potential sea level rise...

NEW PLYMOUTH PROPOSED DISTRICT PLAN (1998):

- 12** Actual and potential adverse effects of natural hazards on people, property and the environment
- Earthquakes can affect the environment in a number of ways including... tsunami and seiching
 - It is considered appropriate to plan for such and event because of the potential adverse effects on human life and property

OTAGO REGIONAL COASTAL PLAN:

- 14.2.1** Natural Hazards which occur within and adjacent to Otago's coastal marine area can adversely affect the use and enjoyment of the area by Otago communities.

Natural Hazards can cause the loss, within the coastal marine area, of structures and natural features. The types of events or processes that give rise to natural hazards in Otago's coastal marine area include:

- (e) Tsunamis or tidal waves causing possible loss of life and property as a result of inundation of areas within and adjacent to the coastal marine area

PORIRUA CITY DISTRICT PLAN (1999):

- C12** Tsunami, or tidal wave, is a potential hazard to the inhabited lowland coastal parts of the City

RODNEY PROPOSED PLAN:

- 5.2.1** Natural events can pose a hazard to people, property, the environment, and the social, economic and cultural wellbeing of communities.
- 5.2.2** Inappropriate subdivision, use and development of land can change natural processes, exacerbating natural hazards or creating new risks for humans, property, social, economic and cultural wellbeing; and other aspects of the environment.

SOUTH TARANAKI PROPOSED DISTRICT PLAN:

- 2.01.7** Minimisation of the risks and effects of the use, development or protection of land, including the implementation of rules for the avoidance or mitigation of natural hazards

TASMAN RESOURCE MANAGEMENT PLAN:

- 13.1** (a) Natural hazards can comprise human well-being and safety and cause damage to habitat, amenity values, property and infrastructure
(b) Hazards can be aggravated by inappropriate land use management practices and activities
(c) Where limited information exists about some natural hazards which could or do affect the District, a precautionary approach is appropriate

WEST COAST PROPOSED REGIONAL COASTAL PLAN:

- 14.2.1** Naturally occurring events can adversely affect community use, development and enjoyment of the coastal marine areas.

Naturally occurring events can cause the loss, within the coastal marine area, of structures and natural features. The types of naturally occurring events or processes that give rise to natural hazards in the coastal marine area include:

- (a) Erosion or inundation of the land adjacent to the coastal marine area as a result of the action of tides and waves
(e) Tsunamis or tidal waves causing possible loss of life and property as a result of inundation of areas within and adjacent to the coastal marine area

WESTERN BAY OF PLENTY DISTRICT PLAN:

- 12.1.1** The Western Bay of Plenty District is subject to a range of actual or potential natural hazards which adversely affect or may adversely affect human life, property or other aspects of the environment. The principal hazards affecting the District are... tsunami.

WHAKATANE PROPOSED DISTRICT PLAN (RURAL):

- 2.4.2** 1. The physical destruction, loss of life and cost which result from a natural hazard event
2. The need to quantify the degree of risk associated with particular natural hazard events and their effect on existing or proposed developments
4. The avoidance of future developments in areas identified as sensitive to the natural hazard of coastal erosion

1.1 Objectives

CHRISTCHURCH PROPOSED DISTRICT PLAN

- 2.5** To avoid or mitigate the actual or potential adverse effects of loss or damage to life, property, or other parts of the environment from natural hazards

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN:

- 8.1** Coastal hazard risk to people and property avoided or mitigated

HUTT CITY PROPOSED DISTRICT PLAN:

14H 1.1.1

To avoid or reduce the risk to people and their property from natural hazards associated with seismic action, landslides, flooding and coastal hazards.

KAPITI COAST DISTRICT PLAN:

C.15.1 To manage activities and development within natural hazard prone areas so as to avoid or mitigate the adverse effects of natural hazards.

MANAWATU PROPOSED DISTRICT PLAN:

- 9.2** NH 1) To reduce the potential for damage to people and property from natural hazard events to a level which is appropriate to the risk of those events happening
NH 2) To avoid development which would adversely affect people's health and safety and which would place unnecessary demands upon response agencies, including Civil Defence, during and after a hazard event

MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN (1998):

16.3 Objective 1

Manage the areas prone to natural hazards to avoid loss of life, and avoid, remedy or mitigate damage to property and infrastructure as a result of the occurrence of natural hazards.

Objective 2

Management of activities which could increase the frequency, severity or potential of natural hazards to cause loss of life or damage to property and infrastructure and other aspects of the environment.

NEW PLYMOUTH PROPOSED DISTRICT PLAN:

- 12** To avoid or mitigate the actual or potential adverse effects of natural hazards on people, property and the environment

OTAGO REGIONAL COASTAL PLAN & WEST COAST PROPOSED REGIONAL COASTAL PLAN:

- 14.3.1** To take into account the potential adverse effects of natural hazards within and adjacent to Otago's coastal marine area have the potential to result in the loss of human life and property, and of areas important to the community.

Taking into account the potential for adverse effects resulting from any natural hazard will assist in avoiding, mitigating or remedying of those adverse effects wherever possible.

PORIRUA CITY DISTRICT PLAN:

- C12.1** To minimise the risk from earthquakes to the wellbeing and safety of the community

- C12.2** To avoid or mitigate the adverse effects associated with flood hazard on the well-being and safety of the community

RODNEY PROPOSED PLAN:

- 5.3.1** To avoid the adverse effects of natural hazards on human life, property and the environment and, where this is not possible, to remedy or mitigate the effects of natural hazards.

- 5.3.2** To avoid natural hazards being exacerbated through changes to natural processes as a result of inappropriate subdivision, development and land use.

11.1.1.1

SOUTH TARANAKI PROPOSED DISTRICT PLAN:

2.01.7 – Objective 7

Identify and recognise the risks from natural hazards and enable the adverse effect on the environment from those hazards to be avoided or mitigated

SOUTH WAIRARAPA DISTRICT PLAN:

5.12.1 To reduce the risk to human life, damage to property and other aspects of the environment from natural hazards

TARANAKI REGIONAL COASTAL PLAN:

7(b) To avoid as far as practicable, the need for natural hazard protection works in the coastal marine area and to avoid, remedy or mitigate adverse effects on the environment that result from implementation of natural hazard protection works.

WELLINGTON CITY DISTRICT PLAN:

14.2.7 To avoid or mitigate the adverse effects of natural and technological hazards on people, property and the environment.

WESTERN BAY OF PLENTY DISTRICT PLAN:

12.2.1

1. Minimisation of the threat of natural hazards to human life and the natural and physical environment
2. Protection of the existing natural character of the coastal environment and other natural features having recognised ecological, landscape or other significance to the District.

1.2 Policies

CHRISTCHURCH PROPOSED DISTRICT PLAN:

- 2.5.1** To control the development within the City to protect life and investment, taking into account of the presence of natural hazards and the degree of risk that those hazards impose on the environment.

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN:

- 8.1.1** Identify areas of coastal hazard risk and develop integrated hazard management strategies for these areas.
- 8.1.2** Adopt a precautionary approach in the assessment of coastal hazard risk and in the assessment of potential risks for coastal permit applications.

HUTT CITY PROPOSED DISTRICT PLAN:

14H 1.1.1

- (b) That suitable engineering and civil defence measures be adopted to safeguard people and their property from liquefaction, groundshaking and tsunami hazards

KAPITI COAST DISTRICT PLAN:

C.15.1

1. *Permit subdivision and development where effects of natural hazards can be avoided, remedied or mitigated.*
2. Ensure services are designed to resist natural hazards
3. Ensure appropriate uses, zones and performance standards are developed for areas known to be liable to flooding, coastal erosion and ground rupture from faults
5. Promote community awareness of natural hazards to encourage avoidance of adverse effects of hazards
8. Recognise the ability of natural features (such as sand dunes) to buffer development from natural hazards through performance standards including minimum setbacks for new and relocatable buildings.

MANAWATU PROPOSED DISTRICT PLAN (1998):

- Policy b)** To take the potential effects of tsunamis, coastal erosion/deposition processes, and the possibility of sea level rise into account when planning for the beach settlements and coastal areas

MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN (1998):

16.3

- Policy 1.1 Locate new works and structures to avoid their damage from the effects of natural hazards
- Policy 1.2 Establish and maintain protection works designed to avoid, or mitigate the effects of natural hazards including adverse environment effects...
- Policy 1.3 Define areas of risk from natural hazards...
- Policy 1.4 Iwi consultation to identify areas of waahi tapu for protection against natural hazards...
- Policy 1.5 Warnings and emergency response procedures

- Policy 2.1 Locate new works and structures to avoid their damage from the effects of natural hazards
- Policy 2.2 Avoid activities that increase the risk of natural hazard occurrence

NEW PLYMOUTH PROPOSED DISTRICT PLAN:

- 12.1 Subdivision, land use and development should be designed and located to avoid or mitigate the adverse effects of natural hazards on people, property, infrastructure and the environment
- 12.2 The ability of natural features and systems to provide a defence against natural hazards should be recognised and the integrity of these features and systems protected where appropriate

OTAGO REGIONAL COASTAL PLAN & WEST COAST PROPOSED REGIONAL COASTAL PLAN (SIMILAR WORDING)

- 14.4.1 To avoid or mitigate the adverse effects of natural hazards through considering the need to protect areas within and adjacent to the coastal marine area.

The action of natural physical coastal processes may result in threats to human life or property or to areas of value to the community. In order to avoid or mitigate the adverse effect of such natural hazards, it may be necessary to consider measures to avoid or mitigate the threat.

- 14.4.2 The potential of activities on natural physical coastal processes operating within the coastal marine area, and the potential for those effects to result in adverse effects within other areas of the coastal marine area will be recognised and taken into account when considering applications for resource consents for those activities within the coastal marine area.
- 14.4.3 Where a resource consent is required under this Plan, to ensure that adequate provision is made in the design of any structure, reclamation, or other physical feature, to recognise the possibility of sea level rise and other natural hazards which may damage that structure, reclamation or feature.

The effects of natural elements should be considered when declining the design of new structures, reclamations or features to maximise their useful life.

The New Zealand Coastal Policy Statement states that the possibility of sea level rise should be recognised. Other natural hazards in the coastal marine area include storm inundation and tsunamis.

PORIRUA CITY DISTRICT PLAN:

- C12.1.1** To minimise the effect of earthquake ground shaking and amplified effects on soft ground through controls on the location and materials of pipelines and services

- C12.1.2** To minimise the effects of ground damage from Ohariu fault movement in rock or very stiff soil types.

- C12.1.3** To minimise the effects of ground damage from Ohariu fault movement in intermediate and flexible, or deep soil.

- C12.1.4** To manage the effects of ground damage from earthquake induced liquefaction of soils

- C12.1.5** To minimise the effect of ground damage created by slope failures, earthquake induced slope instability and landslides

- C12.2.1** To ensure the flood hazard is considered in the subdivision, use, development and protection of the land

RODNEY PROPOSED PLAN:

- 5.4.1** In areas prone to natural hazards, activities which are sensitive to those hazards should, where possible, be avoided. Where this is not possible, activities should ensure that any risk of loss of life or injury or environmental damage is minimised through appropriate mitigation or remedial measures.

TARANAKI REGIONAL COASTAL PLAN

POL 7.4 In the use, development and protection of the coastal marine area, the ability of natural features and systems to provide a natural defence to erosion, inundation or sea level rise should be recognised and the integrity of such features or systems protected, where appropriate.

TASMAN DRAFT PROPOSED RESOURCE MANAGEMENT PLAN

13.1.2A To avoid or mitigate the adverse effects of the interactions between natural hazards and the subdivision, use and development of land

SOUTH TARANAKI PROPOSED DISTRICT PLAN

2.01.7

Policy 7a: To co-ordinate with the Taranaki Regional Council methods to avoid or mitigate natural hazards

7b: To identify areas of known hazard potential, and collect and analyse relevant data to evaluate the potential risks of particular natural hazards

7e: To control the location of buildings on land prone to flooding, adjacent to major watercourses or other natural hazards

SOUTH WAIRARAPA DISTRICT PLAN

5.12.2 To the extent that information is available, to identify the nature and extent of natural hazards within the district and promote a better understanding in the community of the risks involved

WELLINGTON CITY DISTRICT PLAN:

14.2.7.1

Identify the hazards that pose a significant threat to Wellington, to ensure that areas of significant potential hazard are not occupied or developed for vulnerable uses or activities.

14.2.7.2

Ensure that the adverse effects of hazards on critical facilities and lifelines are avoided, remedied or mitigated.

14.2.7.3

Ensure that the adverse effects on the natural environment arising from a hazard event are avoided, remedied or mitigated.

WELLINGTON REGIONAL COUNCIL

4.2.21 Use and development of the coastal marine area must take appropriate account of natural hazards... which include erosion, sedimentation, inundation,, tsunami, and earthquake

5.2.8 To ensure that adequate allowance is made for the following factors when designing any reclamation which is to be used for major public works:

- waves and currents;
- storm surge; and
- major earthquake events

6.2.5 To ensure that adequate allowance is made for the following factors when designing any structure:

- waves and currents;
- storm surge; and
- major earthquake events

WESTERN BAY OF PLENTY DISTRICT PLAN:

12.2.2

1. Where possible adopt avoidance rather than mitigation or remedial measures
2. Control or prevent the establishment of activities which have the potential to increase the extent to which natural hazards have or may have an adverse effect on human life or the natural or built environment
3. Enable the development of land for urban purposes in areas not known to be at risk from natural hazards

1.3 Methods

KAPITI COAST DISTRICT PLAN

C.1.1

General

- Rules and Performance Standards
- Covenants/consent notices on titles
- Design Guidelines

Non-residential Activities

- Rules and Performance Standards
- Enforcement of the Kapiti Coast District Council Tradewaste and Water Supply Bylaws
- Ruling offensive trades, beekeeping, boarding or housing of animals for commercial gain, offensive signs, car wrecking within buildings and keeping of pigeons, doves, goats and deer **NON COMPLYING ACTIVITIES**

MANAWATU PROPOSED DISTRICT PLAN:

Appropriate information-gathering exercises on natural hazards.

- Providing hazard information to landowners and interested agencies via the LIM system and other avenues
- Information and education initiatives aimed at achieving more compatible use of potentially unstable hill country and sand country
- Building Act requirements, (including possible geotechnical reports and Section 36 registration)
- Effective Civil Defence and other responses to hazard events
- Taking natural hazards into account when designing and constructing Council works
- Stormwater control features for new subdivision and buildings in areas where stormwater runoff causes or aggravates flooding problems
- Council involvement in soil stabilisation measures, particularly to protect public assets such as roads
- Local Govt Act requirements which protect the structural integrity of the District's roads by requiring consent for excavations within 20 metres of a road
- Policy on assistance towards hazard protection for listed heritage buildings, (eg earthquake strengthening, fire-proofing)
- In exceptional cases assistance toward removing or stopbanking dwellings in flood-prone areas

SOUTH TARANAKI PROPOSED DISTRICT PLAN:

2.01.7 A The principal methods of implementation are:

- Rules and performance standards concerning the location and erection of buildings in areas of known or anticipated natural hazards, and siteworks on slopes in excess of 33 degrees
- Co-ordination and liaison with the Taranaki Regional Council particularly in the area of data gathering and analysis
- Development of environmental guidelines for areas of natural hazard

SOUTH WAIRARAPA DISTRICT PLAN:

5.12.4

- (2) The District Plan will also include information on natural hazards in South Wairarapa
- (3) Policies 2 and 3 will be implemented by the Council exercising its powers under the Act and the Building Act 1991 and by including specific powers within the District Plan. These include a cautionary approach to development in the coastal margin, and in the vicinity of rivers, the use of designations for floodways and “at risk” areas and rules preventing building on or near the West Wairarapa Fault.

WESTERN BAY OF PLENTY DISTRICT PLAN:

12.4.1 Information and monitoring

1. Develop and maintain an up to date and accurate record on the nature, location, dynamics and other characteristics of existing or potential natural hazards affecting the District and which are relevant to Council’s resource management functions
2. Continually monitor factors affecting existing or potential natural hazards and where necessary or appropriate update existing records and introduce new policies and rules consistent with the latest available information and with Council’s resource management functions
3. Identify within the District Plan and on the Planning Maps the nature and location of significant existing or potential natural hazards affecting or likely to affect the District.

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN:

16.2 Other Methods

The following methods primarily implement the policies in the Natural Hazards chapter, but they may also relate to other policies in the Plan.

63. Consultation with Other Agencies

Environment Waikato will consult with other councils and research agencies to promote research relevant to the assessment of coastal hazard risk.

64. Guidance on Assessment Methodology

Environment Waikato will provide guidance to other councils and applicants on appropriate methodologies for the assessment of coastal hazard risk.

65. Development of Hazard Management Strategies

In developing hazard management strategies, Environment Waikato will work with territorial authorities, iwi, communities and other relevant parties to:

- i. identify coastal hazards and assess hazard risk
- ii. identify and assess management options
- iii. develop and implement a plan of action
- iv. monitor and evaluate the effectiveness of the strategy.

66. Appropriate Management Options

In managing hazard risks, Environment Waikato will emphasise:

- i. proactive management of hazard risk by the avoidance of hazard risks
- ii. the use of district planning controls to restrict new or further development in areas of potential hazard risk
- iii. the use of measures which will protect and/or enhance natural buffers between coastal development and the sea
- iv. the avoidance of hazard management options which adversely affect public access and coastal values, in particular shore-line armouring works.

67. Consultation with Territorial Authorities

Environment Waikato will assist territorial authorities with technical support as appropriate, including advice on applications for subdivision, use or development in and on land adjacent to hazard risk areas, and advice on the proposed avoidance and/or mitigation measures.

68. Natural Hazards Awareness

Environment Waikato will raise awareness of the natural coastal hazards that can affect the Waikato Region, and promote community involvement in protecting buffer zones.

69. Identification of Vulnerable Areas

Environment Waikato will, where appropriate, undertake investigations in conjunction with territorial authorities to assess areas vulnerable to coastal hazard risk.

70. Adoption of Precautionary Approach

Environment Waikato will take a precautionary approach in assessing hazard risks of applications to subdivide, use or develop the CMA, and will encourage territorial authorities to adopt a precautionary approach when assessing applications for near-shore subdivision, use and development.

71. Protection of Natural Features

Environment Waikato will consult with the Department of Conservation and territorial authorities to ensure natural features that provide a buffer against natural hazards are protected and restored. Provision must be made for possible landward migration of features e.g. dunes and wetlands.

TARANAKI REGIONAL COASTAL PLAN:

The Taranaki Regional Council will use the following methods to implement the policies above

METH 1 Application of Policies 7.1 to 7.4 when considering an application for a coastal permit

METH 2 Application of regional rules which make the construction of natural hazard protection structures a discretionary activity

METH 3 Provision of information to coastal permit applicants of the possibility of sea level rise. The Taranaki Regional Council will not take any regulatory action in respect of sea level rise. Should sea level rise occur, policies 7.1 to 7.4 will apply to any protection works proposed for any subdivision, use or development

METH 4 Advocacy to district councils regarding the types and levels of land use that should be allowed, regulated or prohibited in area of the coastal environment that are prone to natural hazard occurrence, and advocacy and liaison regarding appropriate responses to coastal erosion hazards.

1.4 Rules

ENVIRONMENT WAIKATO PROPOSED REGIONAL COASTAL PLAN:

“Short-Term Structures for Hazard Management (Controlled Activity)”

The erection or placement of any structure in the CMA, for a period of time less than three months, for the sole purpose of managing hazard risk is a controlled activity provided it complies with the standards and terms stated in this Rule. Standards and Terms

- i. It shall be demonstrated that there is a functional need for the structure to be located in the CMA.
- ii. The structure shall not restrict public access to the CMA.
- iii. The structure shall be totally removed from the CMA within three months of the issue of a Resource Consent under this Rule.

Control Reserved Over
The matters over which the Regional Council reserves control are:

- location of the structure
- material used
- method of placement
- method of removal.

Principal Reasons for Adopting: This recognises that there are natural hazard situations when a rapid response is required to manage the hazard risk to the landward properties. Short-term structures provide protection while long-term solutions are investigated and actioned.”

KAPITI COAST DISTRICT PLAN

11.1.1.1.1 D.1.2.1

- (iii) Coastal Building Line Restriction
 - Waikanae, Te Horo Beach – 7.5 metres from the seaward title boundary
 - Peka Peka – 7.0 metres from the seaward edge of the existing Esplanade Reserve
 - Paraparaumu, Raumati, Paekakariki – 20 metres as shown on Paraparaumu Urban Zone Maps 1, 2, 6, 7, 11, 16, 21 and 26 and Paekakariki Urban Zone Maps 1-3
- (iv) Relocatable Buildings

Buildings within the relocatable area, as defined in Part Q of this Plan and shown on Paraparaumu Urban Zone Maps 1, 2, 6, 7, 11, 16, 21 and 26 and Paekakariki Urban Zone Maps 1-3, between 20 metres and 50 metres, shall be relocatable. Section 36 of the Building Act 1991 may be implemented for new and relocated buildings in areas subject to coastal erosion or flooding to indemnify Council against possible damages

LOWER HUTT PROPOSED DISTRICT PLAN:

14H 2.1 Restricted Discretionary Activities

- (a) All structures and buildings on any site where the whole site or a portion of the site falls within the Wellington Fault Special Study Area, excluding the following:
- (i) Proposed accessory buildings which are not required for habitable or working purposes; or
 - (ii) Utilities including associated uninhabited buildings;

which are Permitted Activities

14H 2.1.1 Matter in which Council has Restricted its Discretion and Standards and Terms

14H 2.1.1.1 Matters in which Council Seeks to Restrict its Discretion

- (a) Safe separation distance of structures and buildings from the Wellington Fault

14H 2.1.1.2 Standards and Terms

- (a) Safe separation distance of structures and buildings from the Wellington Fault

For all structures and buildings, an engineering report will be required to confirm that the Wellington Fault is not within 20.0m of any proposed structure or building; or that the necessary engineering precautions have been taken.

14H 2.1.1.3 Other Matter

All Restricted Discretionary Activities must comply with other relevant Permitted Activity Conditions.

SOUTH TARANAKI PROPOSED DISTRICT PLAN:

12.01 Limited Discretionary Activities:

The following are Limited Discretionary Activities if they are not listed in 12.01.4 and if they comply with the performance standards in 12.02.

- (a) All development on sites which:
- i. are or are likely to be subject to erosion, landslip, subsidence or flooding; or
 - ii. are listed as Class 7 or 8 on the New Zealand Land Resource Inventory worksheets
- or
- iii. involve land which slopes in excess of 33 degrees; or
 - iv. are underlain with unsuitable material; or
 - v. are within 100 metres of a geological fault line as identified in "Earthquake Hazards in the Taranaki Region" (January 1993) AG Hull & GD Dellow. Institute of Geological & Nuclear Sciences Ltd.;

WESTERN BAY OF PLENTY:

12.3.1 Discretionary Activities

Notwithstanding anything to the contrary in the provision of the zone in which it is situated, where land is:

- within the Coastal Protection Area as defined on the District Planning Maps, or
 - within any floodable area or land instability area identified on the District Planning Maps, or
 - adjoining the open coastline, zoned Rural G and within 100 metres of MHWS,
- the following shall be Discretionary Activities:

...(e) coastal and river protection works including groynes, seawalls, and stopbanks

OTAGO REGIONAL COASTAL PLAN &
RODNEY PROPOSED DISTRICT PLAN &
WEST COAST PROPOSED REGIONAL COASTAL PLAN:

“There are no rules contained within this chapter. The objective and policies contained within this chapter give guidance to the consideration of activities that require resource consents under any or all of the chapters of this plan.”

APPENDIX D

TEMPLATE FOR ASSESSMENT OF MANAGEMENT OPTIONS



Management Option	Class A	Class B	Class C	Class D	Class E	Class F	Class G
1 Knowledge/identifying risk							
2 Avoid new uses							
3 Plan for new uses							
4 Plan/design new buildings							
5 Protect existing uses							
6 Plan/design critical facilities							
7 Plan for evacuation							