



+ Risk Based Approach to
Natural Hazards under the
RMA

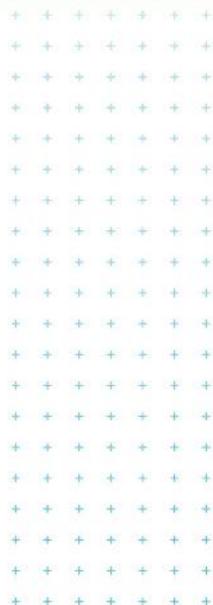
Prepared for
Ministry for the Environment

Prepared by
Tonkin & Taylor Ltd

Date

June 2016

Job Number
31463.001



Exceptional thinking together

www.tonkintaylor.co.nz

Distribution:

Ministry for the Environment

1 copy

Tonkin & Taylor Ltd (FILE)

1 copy

Table of contents

1	Introduction	1
1.1	Project Objectives	1
1.2	Methodology	1
1.3	Report Overview	3
2	Regulatory Context	4
2.1	National Regulatory Context	4
2.1.1	Resource Management Act	4
2.1.2	Civil Defence and Emergency Management Act	10
2.1.3	Local Government Act	12
2.1.4	Local Government Official Information and Meetings Act	12
2.1.5	Building Act	13
2.2	International Requirements and Drivers	14
3	ISO 31000:2009 Risk Management – Principles and Guidelines	16
3.1	Introduction	16
3.2	Definition of Risk	16
3.3	ISO 31000 Principles	17
3.4	Framework	18
3.4.1	Mandate and Commitment	19
3.4.2	Designing the Framework	19
3.4.3	Implementing the Framework	19
3.4.4	Monitoring, Review and Improvement	20
3.5	Risk Management Process	20
3.5.1	Communication and Consultation	20
3.5.2	Establishing the Context	20
3.5.3	Risk Assessment	23
3.5.4	Risk Treatment	24
3.5.5	Monitoring, Review and Recording	25
3.6	Key Good Practices	25
4	Research and Analysis Findings	26
4.1	Good Practice for Risk Management in Natural Hazards Planning	26
4.1.1	Introduction	26
4.1.2	Good Practice for Risk Management Processes	26
4.1.3	RMA Context	30
4.1.4	Dealing with Complexity Associated with Natural Hazards	35
4.1.5	Approach to Engagement	37
4.2	Issues and Challenges to Achieving Good Practice	40
4.2.1	Clarity about the Overall Objective	40
4.2.2	Getting the Context and Scope Right	41
4.2.3	Complexity and Understanding the Science	41
4.2.4	The Truly Hard Issues	41
4.2.5	Process Issues	42
4.2.6	Information and Mapping	42
4.2.7	Using the Tools	42
4.2.8	Matters of Detail	43
4.2.9	“Spoilers”	43
4.3	Overcoming Barriers to Good Practice	43
5	Recommendations	45
5.1	Structure and Content of a NPS	45

5.1.1	NPS Structure	45
5.1.2	NPS Content – Outcome Objective	45
5.1.3	NPS Content – National Framework	46
5.1.4	Substantive Issues and Normative Material	50
5.1.5	Strawman Text for NPS	54
5.2	Content and Nature of Supporting Guidance and Tools	57
5.3	The Process to Develop the NPS and Related Guidance and Tools	60
5.4	Other Interventions	60
6	Acknowledgements	62
7	Applicability	63
	References & Bibliography	64
Appendix A:	Key Characteristic/Aspects for a Risk-based Framework	
Appendix B:	Case Study Records	

Executive Summary

Tonkin & Taylor Ltd (T+T) was engaged by the Ministry for the Environment (MfE) to provide a framework for a risk-based approach for managing and planning for natural hazards under the Resource Management Act (RMA). MfE intends that this framework will become the foundation for a possible new National Policy Statement (NPS) and other national level guidance or interventions on natural hazards, providing consistency across the country.

T+T's work to develop recommendations on a NPS and related guidance has included:

- analysis of the relevant regulatory context including proposed changes to the Resource Management Act (RMA);
- analysis of the international standard ISO 31000:2009 Risk management – Principles and guidelines and its supporting Handbook for good practice risk management process;
- an extensive literature review; and
- analysis of six New Zealand case studies.

Information from the research and analysis has been used to determine:

- good practice for risk management in natural hazards planning;
- issues and challenges to achieving good practice; and
- what would overcome the barriers to good practice?

A set of recommendations for a NPS and other national level guidance or interventions is provided drawing on the outcomes of the research and analysis; the expertise and experience of the T+T team of natural hazards experts, and our independent challenge team. Recommendations are made on:

- the structure and content of a NPS, including some suggested "strawman" text;
- content and nature of supporting guidance and tools;
- the process to develop the NPS and related guidance and tools; and
- other interventions.

1 Introduction

Tonkin & Taylor Ltd (T+T) was engaged by the Ministry for the Environment (MfE) to provide a framework for a risk-based approach for managing and planning for natural hazards under the Resource Management Act (RMA). MfE intends that this framework will become the foundation for a possible new National Policy Statement (NPS) and other national level guidance or interventions on natural hazards, providing consistency across the country.

Living on a young island nation on the backbone of the Pacific Rim, New Zealanders are subject daily to the risks posed by natural hazards. There have been attempts by councils to manage risk associated with natural hazards through a risk-based approach, but approaches have tended to be ad-hoc and often with varying degrees of success.

Proposed amendments to the RMA are intended capture in Part 2 of the Act, the national importance of managing significant natural hazard risks. Proposed changes to s106 will further define and embed a risk assessment approach in the determination of appropriate land subdivision. A risk-based framework is the next step in the process towards a consistent, nation-wide approach to risk-based natural hazards management.

1.1 Project Objectives

The principal objective of this project is to provide a risk management method/process and guidance, centred on a NPS. The method/process is to be suitable for local government to follow and to improve risk-based land use planning for natural hazards in New Zealand.

Once in place, the NPS will sit within the overarching framework of the RMA. The risk-based framework must therefore be developed within the current New Zealand legislative framework. It will need to link with other RMA instruments, including the New Zealand Coastal Policy Statement 2010 (NZCPS), national environmental standards and other guidance. It will also need to identify and recognise links to other elements of the New Zealand regulatory framework that are relevant to natural hazards, including under the Civil Defence and Emergency Management Act, Building Act and Local Government Act.

This framework must be implementable, providing a robust and consistent approach to address and manage natural hazards, providing a good practice framework for councils to be able to acknowledge and manage risk.

The framework must be flexible to account for the variance in data, resource and capacity limitations of the country's councils and the hazards they face. The approach needs to be adaptable and scalable where necessary, to reflect specific circumstances faced by local authorities and communities.

A good practice approach to stakeholder and iwi engagement must also be clearly defined within the framework. Stakeholder engagement is not a separate process and should be incorporated throughout the risk management process.

To deliver a sound framework document, the key elements of good practice for natural hazard management must be determined from literature review and practical case study experience.

1.2 Methodology

T+T's approach to developing the risk-based approach involved literature review and case study research, and analysis.

At the start of the research project we held a workshop with MfE at which we presented, explored and tested our preliminary thinking on Key Characteristics/Aspects for a Risk-based Framework

(attached in Appendix A). With MfE's agreement, these formed the starting point for the research and the outline framework we developed and tested early in the project.

The literature review included all literature identified in the MfE's Request for Quotation and an extensive range of other material. This included relevant and important contextual information on the RMA, proposed changes to the RMA, the wider regulatory framework in New Zealand that is applicable to natural hazards, and international obligations and drivers.

We agreed six relevant New Zealand experience case studies with MfE:

- Northland Regional Council Regional Policy Statement, Natural Hazards Provisions;
- Bay of Plenty Regional Policy Statement (Proposed Change 2);
- Christchurch City Council, Coastal Hazards Information on LIMs and Provisions in Replacement District Plan;
- Kapiti Coast – Proposed District Plan, Coastal Hazard Provisions and Information on LIMs;
- West Coast Alpine Fault/Franz Josef Plan Change; and
- Auckland Council Proposed Auckland Unitary Plan.

We reviewed information available about the case studies to establish and record key details of the case. We analysed the information to identify elements of good practice natural hazard management and challenges to achieving this. We conducted telephone interviews with relevant council staff involved in the case study examples. These conversations provided invaluable first-hand understanding around the issues and challenges of risk-based natural hazard management and insight into how these challenges might be able to be addressed or overcome. During the interviews we also tested our evolving risk-based framework options within the context of the experience of each case study. We confirmed the accuracy of our case study records with each person we interviewed. The case study details are recorded and included in Appendix B.

The analysis and synthesis of literature and case studies focused on MfE's three research and analysis outcomes, which were to determine:

- key elements of good practice natural hazards risk management in planning;
- key issues/challenges to achieving good practice; and
- what would overcome these barriers that should be covered in a possible National Policy Statement and if any other interventions are necessary (e.g. linkages to non-statutory guidance, national environmental standard or national planning template content such as definitions).

The literature review provided the primary source of information on elements of good practice. We added to this elements of good practice we identified in the case study examples.

We used the case study examples as the primary source of information on the second two research outcomes: key issues and challenges, and the potential solutions through a NPS, guidance or other interventions. This was to ensure this information reflected challenges, issues and potential solutions in the New Zealand context. Where the literature review identified similar issues or solutions, we included the relevant information in the analysis.

The international standard for risk management processes, AS/NZS ISO 31000:2009 Risk management – Principles and guidelines (ISO 31000) and its companion Handbook, SA/SNZ HB 436:2013 Risk management guidelines – Companion to AS/NZS ISO 31000:2009 were fundamental sources of key characteristics related to risk management processes. We used the ISO 31000 model to identify the key characteristics of good practice for risk management processes and used these as a lens to examine the literature on the use of risk-based processes to address natural hazards. This

enabled us to identify examples that aligned with elements of good practice and to analyse how effectively risk-based approaches have been applied in a range of natural hazard contexts.

Key definitions from the RMA underpin the aspects that are critical to applying risk management process in the context of natural hazards planning in New Zealand. Accordingly, these provided a second lens for our analysis. Our analysis of literature highlighted two other broad themes: dealing with complexity and approaches to engagement. We used these as additional areas of focus for our research and analysis on good practice.

1.3 Report Overview

This report presents our research, analysis and recommendations. It has been prepared in accordance with our proposal dated 10 February 2016 and our Contract for Services with MfE dated 8 March 2016.

- Section 2: Presents the relevant regulatory contextual information.
- Section 3: Presents the key elements of best practice in risk management process, based on ISO 31000 and its companion Handbook.
- Section 4: Presents the findings of our research and analysis under three headings:
- good practice for risk management in natural hazards planning;
 - issues and challenges to achieving good practice; and
 - overcoming barriers to good practice.
- Section 6: Presents our recommendations.

2 Regulatory Context

The outcomes MfE is seeking from this project are a risk management method/process and guidance centred on a NPS prepared under the RMA. MfE's brief also includes proposed changes to the RMA on natural hazards and NPSs in the scope. In addition, the scope includes "linkages to other local government statutory processes e.g. long term plans infrastructure strategies under the Local Government Act, LIMs under Local Government Official Information & Meetings Act and PIMs under the Building Act, CDEM group planning under the Civil Defence and Emergency Management Act and flood control under the Soil Conservation and Rivers Control Act". Given this scope, the current provisions of the RMA and proposed changes that concern natural hazards and NPSs, and the provisions of other national legislation relevant to natural hazards are important context for the research and analysis in this project and the resulting recommendations. This section of the report sets out this important contextual information. In addition to the national regulatory information, it also includes information on relevant international obligations and drivers.

2.1 National Regulatory Context

2.1.1 Resource Management Act

This section describes the provisions of the RMA that are specifically relevant to natural hazards and NPS and it includes information on relevant proposed changes to the RMA in the Resource Legislation Amendment Bill (RLAB). In the interests of clarity, **information on proposed changes is presented in red text.**

2.1.1.1 Definitions

Two definitions are important, the definition of natural hazards and the meaning of effect.

Natural Hazards

"Any atmospheric, 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".

Meaning of Effect

"Unless the context otherwise requires, the term effect includes

- (a) any positive or adverse effect and*
- (b) any temporary or permanent effect and*
- (c) any past, present or future effect and*
- (d) any cumulative effect which arises over time or in combination with other effects - regardless of the scale, intensity, duration or frequency of the effect and also includes*
- (e) any potential effect of high probability and*
- (f) any potential effect of low probability which has a high potential impact" (emphasis added).*

The natural hazard definition is about effects. It establishes the breadth of sources of effects (any atmospheric, earth or water related occurrence) and breadth of receptors of effects (human life, property or other aspects of the environment) that are relevant. The breadth in both cases is very wide.

Because the natural hazards definition is about effects, the meaning of effect is important. Specific parts of the meaning of effect that are particularly relevant to natural hazards are identified in bold. Two aspects are particularly important to note. The first is that the effects-based approach of the RMA is a risk-based approach, using the risk management language of probability and impact. The second is that it expressly captures low probability/high potential impact effects.

2.1.1.2 Purpose

The purpose of the RMA is important.

“(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment”
(emphasis added).

The purpose sets the decision context in which natural hazards are to be considered, i.e. decisions on use and development of natural and physical resources. It identifies outcomes, i.e. social, economic and cultural well-being, health & safety and safeguarded life supporting capacity of air, water, soil and ecosystems. It sets a long forward timeframe i.e. reasonably foreseeable needs of future generations. It identifies approaches to treat or manage effects (or risk) i.e. avoid, remedy or mitigate.

2.1.1.3 Matters of National Importance

The RLAB proposes including a new matter of national importance in Section 6 of the RMA:

“(h) the management of significant risks from natural hazards”

The intention of this proposed change is to provide a greater emphasis to consideration of risks from natural hazards in all resource management decisions. It is also intended to support proposed changes to Section 106. The meaning of “significant” is not defined.

2.1.1.4 Functions and Responsibilities

The RMA sets functions related to natural hazards on regional and district councils as follows:

- regional council functions include *“the control of the use of land for the purpose of ...the avoidance or mitigation of natural hazards”*;
- district council functions include *“the control of any actual or potential effects of the use, development or protection of land, including for the purpose of ...the avoidance or mitigation of natural hazards”*.

Regional councils have a lead role and are required to allocate responsibilities for natural hazards in their regional policy statements. These arrangements in the RMA enable regional and district rules to be established for natural hazards. The significance of regional rules is the ability to avoid the constraints of existing use rights.

2.1.1.5 Section 106

Section 106 of the RMA provides for a consent authority to refuse and/or place conditions on subdivision consent if it considers that "*the land...or any structure on the land is likely to be subject to material damage by erosion, falling debris, subsidence, slippage or inundation from any source*". Conditions must be for the purpose of avoiding or mitigating those listed effects. Section 106 is a strong provision and can over-ride the Section 87A obligation on a consent authority to grant consent for a controlled activity subdivision. It is also called up for consideration when consent conditions are reviewed under Section 132.

Section 106 has a companion set of provisions in the Building Act (Sections 71-74 discussed in section 2.1.5.2 below). The provisions in these Acts share some legislative history. Specific provisions concerning subdivision consenting and natural hazards have been in place since at least 1979¹. A provision requiring councils to refuse subdivision approvals due to natural hazard issues was inserted to the Local Government Act 1974, in 1979. This was the same year as companion provisions were inserted in the Local Government Act (as Section 641) providing power to refuse building permits. These changes were responses to the Commission of Inquiry into the Abbotsford Landslide Disaster.

Section 106 (or its predecessors) have been subject to changes (as outlined in the table below) and a further change is proposed. The blue text identifies the most significant provisions and changes that have occurred to date.

Time and legislative provision	Subdivision Consents
From 1 April 1979 Section 274(1) LG Act	Councils required to refuse consents. Overall test - is land suitable for subdivision. Applied to land subject to erosion, subsidence, slippage, or inundation by sea, river, stream, lake or any other source. Subdivision may accelerate, worsen or result in above listed effects on land not part of the subdivision. Provision for protection to satisfy council to grant consent.
Oct 1991-July 1993 Sec 106 RMA	Councils shall not grant consents. Applied to land or structures that is, or is likely to be subject to material damage by erosion, subsidence, slippage, inundation from any source. Subsequent use of land likely to accelerate, worsen or result in material damage to that land, other land, or structures. Can grant consent if district plan rules, consent conditions or works avoid, remedy or mitigate effects to council's satisfaction .
July 1993-July 2003	Falling debris added to list of effects.
August 2003- Sept 2009	Despite section 77B, consent authority may refuse or may grant consent subject to conditions . Same lists of effects and subsequent use of land. Sufficient provision for access . Conditions must be to avoid, remedy or mitigate effects and of the type that could be imposed under Section 108 .
Oct 2009 – current	Reference to section 77B removed Note: from 2003-2009 Section 77B included provisions related to all types of activities in the Act, regulations or plans; and included requirements about how the status of activities related to the need for, and discretion to grant consents. From October 2009 Section 77B refers only to controlled activity rules and provisions about the requirement to grant consents were moved to Section 87A.

¹ The Municipal Corporations Amendment Act of 1959 introduced some similar powers in Section 351A.

Some key points are evident from the historic development of the provisions now in place as Section 106 of the RMA:

- save for the addition of falling debris, the range of specific effects identified has remained the same;
- the provisions have always required that council be satisfied about protection (LGA) or provision of means to avoid, remedy or mitigate effects (RMA), in order to be able to grant consents;
- when the provisions were transferred to the RMA
 - structures as well as land were captured
 - consideration of likelihood of effects occurring (a future-focussed, risk approach) was introduced
 - the concept of material damage was introduced
 - consideration of subsequent use of land was introduced;
- from 2003:
 - the provisions are presented as a discretion for Councils to refuse or grant consents (subject to conditions)
 - councils' considerations have narrowed to focus on conditions to avoid, remedy or mitigate effects (rather than also provisions in district plan rules)
 - legal and physical access to subdivided land has been added as a matter of concern alongside the natural hazard effects.

Changes to Section 106 are proposed in the RLAB as marked below.

106 Consent authority may refuse subdivision consent in certain circumstances

- (1) A consent authority may refuse to grant a consent, or may grant a consent subject to conditions if it considers that –

~~(a) the land in respect of which a consent is sought, or any structure on the land, is or is likely to be subject to material damage by erosion, falling debris, subsidence, slippage or inundation from any source; or~~

~~(b) any subsequent use of that is likely to be made of the land is likely to accelerate, worsen, or result in material damage to the land, other land, or structure by erosion, falling debris, subsidence, slippage, or inundation from any source; or~~

there is a significant risk from natural hazards; or

- (c) sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.

(1A) For the purpose of subsection (1)(a), an assessment of the risk from natural hazards requires a combined assessment of –

(a) the likelihood of natural hazard occurring (whether individually or in combination); and

(b) the material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and

(c) any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

- (2) Conditions under subsection (1) must be –
- (a) for the purpose of avoiding, remedying or mitigating the effects referred to in subsection (1); and
 - (b) of a type that could be imposed under section 108.

The use of the term natural hazards (rather than the list of some specific effects from natural hazards) removes any uncertainty about the scope of coverage of Section 106. Because the terms liquefaction and earthquake are not used in the current Section 106, there have been concerns that earthquakes and the resulting liquefaction may not be a relevant consideration under Section 106. This concern was raised in evidence presented to the Auckland Independent Hearing Panel (AIHP) for the Proposed Auckland Unitary Plan. However, Section 106 does apply to “inundation from any source”. Use of the term inundation to describe the effects of liquefaction is standard geotechnical practice, including in reporting on natural hazard damage to the Earthquake Commission. Liquefaction can also result in subsidence. Interim Guidance issued by the AIHP sets out the Panel’s view that liquefaction is a relevant consideration under Section 106. This view is supported by case law. In *Kotuku Parks Ltd v Kapiti Coast DC EnvC A073/00* (paragraph 110 which concerns Section 106) reference is made to houses on land “likely to be subject to material damage by subsidence induced by earthquake”. In this case, no challenge was made to Section 106 capturing an earthquake-induced Section 106 effect.

The reference to significant risk from natural hazards, picks up the wording proposed as a matter of national importance. The requirements for an assessment of risk are new and expand on the existing requirement in Schedule 4 of the RMA (see section 2.1.1.7 below).

2.1.1.6 Conditions on Subdivision Consents

There are special provisions in the RMA for conditions to be set on subdivision consents. These include, the ability to:

- require esplanade strips or reserves to mitigate natural hazards under Section 229;
- set conditions on bulk, location, foundations and floor level heights under Section 220;
- require provisions to protect land from subsidence, slippage, erosion or inundation under Section 220; and
- set requirements for filling, compaction and earthworks under Section 220.

Some of these conditions can have follow-on impact on building consent processes under the Building Act, as these conditions will need to be met and may impact on the measures proposed to meet building code requirements.

The RLAB proposes changes to Section 220(1)(d) of the RMA to replace references to “~~erosion, subsidence, slippage, erosion or inundation~~” with the words natural hazards. As with the proposed changes to Section 106, this should ensure the provisions on conditions on subdivision consents can address all types of natural hazards.

2.1.1.7 Schedule 4

Schedule 4 sets out requirements for Assessments of Effects on the Environment which must be prepared for any application for a resource consent. Section 7 in the Schedule requires these assessments to address “*any risk to the neighbourhood, the wider community, or the environment through natural hazards*”.

This obligation applies to all types of applications, not just applications for consents for subdivision (discussed in section 2.1.1.5 above).

2.1.1.8 National Policy Statements

Section 45 of the RMA addresses the purpose of NPSs which is *"to state objectives and policies for matters of national significance that are relevant to achieving the purpose of this Act"*. It also sets out the matters the Minister may have regard to when considering whether it is desirable to prepare a national policy statement, as follows:

- "(a) the actual or potential effects of the use, development, or protection of natural and physical resources;*
- (b) New Zealand's interests and obligations in maintaining or enhancing aspects of the national or global environment;*
- (c) anything which affects or potentially affects any structure, feature, place, or area of national significance;*
- (d) anything which affects or potentially affects more than 1 region;*
- (e) anything concerning the actual or potential effects of the introduction or use of new technology or a process which may affect the environment;*
- (f) anything which, because of its scale or the nature or degree of change to a community or to natural and physical resources, may have an impact on, or is of significance to, New Zealand;*
- (g) anything which, because of its uniqueness, or the irreversibility or potential magnitude or risk of its actual or potential effects, is of significance to the environment of New Zealand;*
- (h) anything which is significant in terms of section 8 (Treaty of Waitangi);*
- (i) the need to identify practices (including the measures referred to in section 24(h), relating to economic instruments) to implement the purpose of this Act;*
- (j) any other matter related to the purpose of a national policy statement."*

The matters emphasised in bold text have particular relevance to planning for natural hazards.

Section 46 sets out the process the Minister must follow to seek and consider comments from iwi authorities and other organisations, prepare a proposed NPS and evaluate it in accordance with Section 32.

The RLAB proposes adding a new section to the RMA on NPS which would provide extensive new enabling provisions for the content of a NPS as set out below. Aspects that are of particular relevance to the ability to establish a risk-based approach for natural hazards planning are on bold text.

45A Contents of national policy statements

- (1) A national policy statement must state objectives and policies for matters of national significance that are relevant to achieving the purpose of this Act.*
- (2) A national policy statement may also state—*
 - (a) the matters that local authorities must consider in preparing policy statements and plans:*
 - (b) methods or requirements that local authorities must, in developing the content of policy statements or plans, apply in the manner specified in the national policy statement, including the use of models and formulas:*
 - (c) the matters that local authorities are required to achieve or provide for in policy statements and plans:*
 - (d) constraints or limits on the content of policy statements or plans:*
 - (e) objectives and policies that must be included in policy statements and plans:*

(f) directions to local authorities on the collection and publication of specific information in order to achieve the objectives of the statement:

(g) directions to local authorities on monitoring and reporting on matters relevant to the statement, including—

(i) directions for monitoring and reporting on their progress in relation to any provision included in the statement under this section; and

(ii) directions for monitoring and reporting on how they are giving effect to the statement; and

(iii) directions specifying standards, methods, or requirements for carrying out monitoring and reporting under subparagraph (i) or (ii):

(h) any other matter relating to the purpose or implementation of the statement.

(3) A national policy statement or any provisions of it may apply—

(a) generally; or

(b) to any specified district or region of any local authority; or

(c) to any other specified part of New Zealand.

(4) A national policy statement may include transitional provisions for any matter, including its effect on existing matters or proceedings.

2.1.2 Civil Defence and Emergency Management Act

The purpose of the Civil Defence and Emergency Management Act 2002 is wide-ranging and includes the following elements:

- to improve sustainable management of hazards to contribute to social, economic, cultural and environmental well-being, safety and property protection;
- to enable communities to achieve acceptable levels of risk by identifying and reducing risk;
- planning and preparation for emergency response and recovery;
- to coordinate local authority and other agencies; and
- to integrate local and national CDEM with the national plan and strategy.

The purpose shares important concepts with the purpose of the RMA, including in particular, the reference to sustainable management.

The Act is based on the concept of 4 “Rs” which are summarised below.

Reduction	Identify and analyse long-term risk to human life and property. Take steps to eliminate risk, if practicable and if not reduce magnitude of impact or likelihood of occurrence
Readiness	Develop operational systems and capabilities, including self-help and response for the public and specific programmes for emergency services, lifeline utilities and other agencies
Response	Action taken in civil defence emergency to save lives and protect property and help communities to recover
Recovery	Coordinated efforts and processes for immediate, medium and long-term holistic regeneration of a community after a civil defence emergency

The Act is also underpinned by the concept of the precautionary approach which is established in Section 7:

“All persons exercising functions in relation to the development and implementation of civil defence emergency management plans under this Act may be cautious in managing risks even if there is scientific and technical uncertainty about those risks”.

The concept of a precautionary approach, in relation to natural hazards, has also been included in the New Zealand Coastal Policy Statement issued under the RMA.

A complex set of plans, strategies and relationships is established under the Act. As shown in the figure below², there is an expectation that the risk reduction “R” will be delivered through RMA mechanisms. At central government level, the National CDEM Strategy and National CDEM Plan link directly with other national strategies and legislation and policies for risk reduction and so are relevant to proposals for a NPS on natural hazards under the RMA.



Linkage between national, regional, and local operational plans and arrangements and risk reduction policies and programmes.

At the regional/local level, there is an expectation of a strong link between CDEM Group Plans and RMA plans. A recent Resource Management Law Association Road-Show on Natural Hazards (March – May 2016) confirmed that the strength and effectiveness of this link is highly variable around the country. In some regions there was low awareness of, and in many cases no connection between, the work of CDEM Groups and RMA planning processes and RMA practitioners. In other regions, there is close and effective collaboration, for example, work on a Natural Hazards Strategy in the Wellington Region. An important opportunity exists to strengthen this link across the country, particularly in relation to the CDEM Group functions to identify, assess and manage hazards and risks, consult and communicate about risks and identify and implement cost-effective risk reduction (Section 17 (1) a of the Act).

Last year the National CDEM Plan was reviewed. Civil Defence and Emergency Management now has an obligation to review the National CDEM Strategy in 2017. Work on this has begun, with the

² Source: National Civil Defence Emergency Management Strategy 2007.

expectation that this will be developed as a national Resilience strategy. The international drivers on risk reduction (discussed in Section 2.2 below) will play an important part of this work. There is also an important opportunity for resource management practitioners to engage in this process, better to understand, and in turn deliver on, the risk reduction “R”. A number of commentators have identified the need for national strategy on natural hazards (MWH, 2009; LGNZ, 2014; ICNZ, 2014) and this could provide an appropriate platform to develop this.

2.1.3 Local Government Act

There are two matters dealt with under the Local Government Act 2002 that are particularly relevant to natural hazards. Amongst other things, these provisions introduce some timeframes that differ from those that appear in the New Zealand Coastal Policy Statement (and typically are considered in RMA planning) and under the Building Code.

2.1.3.1 Long-Term Plan

Section 93 sets obligations and requirements for councils to have a long-term plan covering a period of 10 years. The purposes of the long-term plan include describing the community outcomes of the local authority’s district or region, providing integrated decision-making and coordination of resources and providing a long-term focus for decisions. The long-term plan is required to include an infrastructure strategy.

2.1.3.2 Infrastructure Strategy

Section 10 sets out the purpose of local government and this includes “*to meet the current and future needs of communities for good-quality infrastructure... that is efficient, effective and appropriate to present and anticipated future needs*”. This is to be done in the context of the core services to be considered in performing its role, which include “*the avoidance or mitigation of natural hazards*” (Section 11A) and the principles relating to local authorities (Section 14). These principles include “*prudent stewardship and the efficient and effective use of its resources...including planning effectively for the future management of its assets and taking a sustainable development approach*” which includes taking into account “*the reasonably foreseeable needs of future generations*”.

Section 101B sets requirements for local authorities to prepare and adopt infrastructure strategies that cover at least 30 consecutive financial years. One of the matters that must be taken into account in preparing the strategy is the need to “*provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and making appropriate financial provision for those risks*”.

2.1.4 Local Government Official Information and Meetings Act

The key provision in the Local Government Official Information and Meetings Act 1987 Act relevant to natural hazards concerns Land Information Memoranda (LIMs). Section 44A provides that any person can apply to a territorial authority for a LIM. The LIM must include “*information identifying each (if any) special feature or characteristic of the land concerned, including but not limited to potential erosion, avulsion, falling debris, subsidence, slippage, alluvion, or inundation...being a feature that is known to the territorial authority but is not apparent from the district scheme...or district plan*”. Information about any notices about the land (including under the Building Act) must also be provided. In addition the territorial authority may provide other information concerning the land that it considers to be relevant.

As identified in and discussed in relation to the case studies, these obligations on councils have caused considerable concern for property owners, due to the potential impact of this information on property values, saleability of their properties and the ability to obtain mortgages and/or insurance.

The nature and presentation of information on natural hazards and how councils exercise discretion on other information have presented challenges to councils around the country.

2.1.5 Building Act

The key provisions of the Building Act 2004 in relation to natural hazards are summarised below, along with key provisions related to the Building Code.

2.1.5.1 Project Information Memoranda

Sections 31-35 deal with Project Information Memoranda (PIMs). The owner of a building is able to apply to a territorial authority for a PIM for building work if the owner is considering building work and a building consent is required. The content of the PIM must include (amongst other information) *"information likely to be relevant to the proposed building work that identifies...each special feature of the land concerned".* A special feature of the land *"includes, without limitation, potential natural hazards... that is likely to be relevant to the design and construction or alteration of the building or proposed building, and is known to the territorial authority, and is not apparent from the district plan"*. There is clear link to the RMA in these provisions. As with LIMs (discussed in Section 2.1.4 above) there are concerns about what information about natural hazards a council needs to include on PIMs and how that information is presented on PIMs.

2.1.5.2 Powers to Refuse Building Consents

Sections 71-74 address limitation and restrictions on building consents and the construction of building on land subject to natural hazards. Section 71 requires a building consent authority to refuse to grant a building consent if the land is subject to one or more natural hazards or the building work is likely to accelerate, worsen or result in a natural hazard on the land or any other property. However, this restriction does not apply if the consent authority is satisfied adequate provision is made to protect the land, building work or other property from the natural hazard. Section 72 establishes an obligation to grant building consents where consent authority considers the building work will not accelerate, worsen or result in a natural hazard. Sections 73 and 74 provide for conditions to be included on the consent that result in a notice about the natural hazard being entered on the title of the property concerned.

These sections of the Building Act are companions to Section 106 of the RMA, which enables subdivision consents to be refused. This has been discussed in Section 2.1.1.5 above.

2.1.5.3 Building Code

The Building Act provides for the establishment of the Building Code and establishes the requirement that all building work must comply with the Code (Section 17). The relationship between the Building Code and other legislation is complex and subject to some controversy. Section 18 establishes a principle that building work is not required to achieve performance criteria additional to or more restrictive than the Building Code. This principle is, however, *"subject to any express provision to the contrary in any Act"* (Section 18(2)). The appropriate interpretation of Section 18(2) has been the subject of significant and differing legal opinion in the hearing process for the Proposed Auckland Unitary Plan (PAUP)³. At issue were provisions in the PAUP on floor level requirements to mitigate flooding effects that were more restrictive than those in the Building Code. The Building Code sets floor level requirements based on a 50 year return period flood. The PAUP provisions were set for a 100 year return period. Resolving this interplay between the Building Act

³ *Direction of the Independent Hearings Panel on the Resource Management Act 1991 and the Building Act 2004 and proposed PAUP rules*, 8 October 2015 and *Relationship between the Resource Management Act 1991 and the Building Act 2004 – Legal Submissions*, 3 November 2015 available under 022 Natural hazards and flooding hearing topic stream documents tab on <https://hearings.aupihp.govt.nz/hearings>

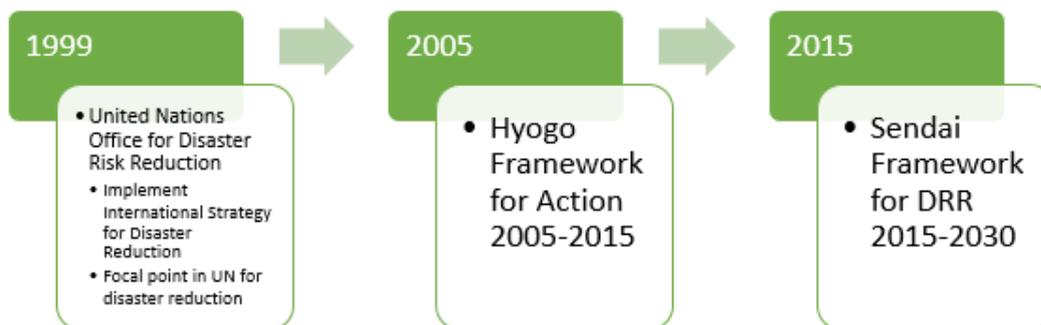
and the RMA may require legislative change, or may be able to be addressed in a NPS or associated guidance.

Other issues related to the Building Code concern the comprehensiveness of its coverage of natural hazards. For example, the Code addresses earthquake shaking, referencing performance requirements in New Zealand Standard 1170.5. This standard sets requirements for residential buildings based on Serviceability Limit State (SLS) for shaking at a 25 year return period and Ultimate Limit State (ULS) at a 500 year return period (i.e. a 10% chance of occurring over the 50 year design life of the building). ULS single level load ranges from 1:100 to 1:2500 are set for other types of buildings. The Code does not address other effects of earthquakes, such as liquefaction or lateral spreading.

2.2 International Requirements and Drivers

There are important international agreements to which New Zealand is a signatory that are providing new and strong drivers on disaster risk reduction. These will impact on New Zealand's domestic regulations and policy framework.

The United Nations has been actively focussed on disaster risk reduction since the establishment of a coordination office in 1999, as illustrated in the figure below. New Zealand was a signatory to the 2005 Hyogo Framework for Action and has been reporting on progress. In March 2015, a new Framework for Disaster Risk Reduction was signed at Sendai. A large New Zealand delegation was involved and had a significant influence on the agreement, which New Zealand has signed.



The scope, purpose, expected outcome and goal of the Sendai agreement are ambitious and are presented in the figure below. Of note, the outcome includes substantial reduction of disaster risk and the goal includes preventing new and reducing existing risk. The goal also introduces the concept of resilience.



The Agreement has seven targets which have a strong emphasis on reducing effects of disasters, as follows:

- reducing mortality;
- reduce number of affected people;
- reduce direct economic loss;
- reduce damage to infrastructure;
- increase the number of countries with Disaster Risk Reduction strategies;
- enhance international cooperation to developing countries; and
- increase early warning systems, information and assessments.

There are four priorities for action, as follows:

- understanding disaster risk;
- strengthening disaster risk governance to manage disaster risk;
- investing in disaster risk reduction for resilience; and
- enhancing disaster preparedness for effective response and “build back better”.

It is clear that there are strong, new international drivers for risk reduction that New Zealand, as a signatory to the agreement, must respond to in our own domestic regulatory framework.

3 ISO 31000:2009 Risk Management – Principles and Guidelines

3.1 Introduction

Taking a risk-based approach to natural hazards requires the use of current good practice standards and guidance. ISO 31000 is the most current and up-to-date international standard setting out principles and guidelines for risk management processes. The ISO 31000 standard is supported by a substantial companion Handbook produced as an Australian/New Zealand Handbook SA/SNZ HB 436:2013 (referenced here as the Handbook). Both of these documents have been drawn on in this section.

ISO 31000 introduces a new definition of risk and it establishes:

- eleven principles to effectively manage risk;
- a framework for managing risk; and
- a detailed risk management process.

In this section we address the definition, the principles, the framework and the process, drawing out how these can be applied to planning for natural hazards. The content on definition, principles and framework in ISO 31000 is new, while the content on the process is largely similar to that of the predecessor (and now superseded) AS/NZS 4360:2004 risk management standard.

3.2 Definition of Risk

Risk – the effect of uncertainty on objectives

ISO 31000 defines risk as the "*effect of uncertainty on objectives*". This definition represents a significant change in the concept of risk from previous standards (e.g. AS/NZS 4360:2004) and commonly referenced definitions. AS/NZS 4360 defined risk as "*the chance of something happening that will have an impact on objectives*". Notes to the AS/NZS 4360 definition state that risk is measured in terms of a combination of the consequences of an event and their likelihood. Other commonly referenced definitions are that risk is "*the likelihood and consequence of a hazard*" (LGNZ 2014).

The ISO 31000 concept of risk builds a conceptual logic, linking outcomes, consequences, complexity, a systems approach and uncertainty. This requires decision makers and other stakeholders to be more focussed on understanding complexity and uncertainty (and the significance of these) rather than the statistics or mathematics (associated with quantification or semi-quantification of likelihood or consequence to calculate or derive a risk index or number) that have tended to be the focus of previous approaches to risk management.

As explained in the Handbook, "*the objectives being referred to...are the overarching outcomes that the organisation⁴ is seeking. These are its highest expression of intent and purpose, and typically reflect its explicit and implicit goals, values and imperatives or relevant enabling legislation*". This focus on objectives translates into a focus on consequences "*The level of risk is expressed as the likelihood that particular consequences will be experienced. Consequences relate directly to objectives and arise when something does or does not happen....Therefore the likelihood being referred to here is not just that of the event occurring, but also the overall likelihood of experiencing*

⁴ The Handbook explains that the term organisation is used in the standard "*to describe any type of entity that is able to establish and pursue objectives and therefore ranges from an individual to all forms of public, private and community enterprise, association or group, to communities, governments and their agencies, and international bodies.*"

the consequences that flow from the event". This in turn recognises complexity and the need for a systems approach " the mechanisms through which consequences arise will be complex rather than simple and can involve interactions between multiple risk sources. This means that it will usually be necessary to take a "whole of system" approach in order to understand both how consequences can arise and the likelihood of them occurring". These important aspects of risk in turn focus decision makers on uncertainty "Assumptions and presumptions (e.g. with respect to how people or systems will behave or how events might occur) are a common source of uncertainty. It is necessary, therefore, that decision makers are aware of any assumptions made, and the nature and extent of the associated uncertainty".

The definition of risk and the conceptual logic outlined above is applicable and useful in the context of planning for natural hazards under the RMA. The RMA framework of policy statements and plans captures community expectations and aspirations for environmental, social, economic and cultural outcomes in objectives and policies. These outcomes will include expectations around the effects and consequences of natural hazard events. There is certainly a great deal of uncertainty about natural hazards; about if and when a hazard event may occur and about what the effects of any event may be. How natural hazard events "play out" and result in effects (including cascading effects) is also complex and requires a "whole of systems" approach. In addition, the need to clearly understand and communicate about uncertainty is a strong theme in the literature reviewed and in the case studies in the research for this project.

The ISO 31000 definition of risk includes the following notes:

- 1 An effect is a deviation from the expected – positive and/or negative.
- 2 Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organisation-wide, project, product and process).
- 3 Risk is often characterised by reference to potential events and consequences, or a combination of these.
- 4 Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

The definition of risk, together with the notes, provides a flexible approach to how risk is characterised or expressed. This allows a range of risk assessment methods to be used ranging from narrative, descriptive and qualitative approaches, through semi-quantitative and fully quantitative methods. This enables approaches and methods to be tailored to different issues and topics, and to the relevant context and objectives. The Environment Bay of Plenty Change 2 to the Regional Policy Statement provides an interesting perspective on this, describing how Maori traditional knowledge contributes to understanding natural hazard risk. This information will be narrative rather than quantitative.

3.3 ISO 31000 Principles

The eleven principles for risk management are that it:

- creates and protects value;
- is an integral part of all organisational processes;
- is part of decision making;
- explicitly addresses uncertainty;
- is systematic, structured and timely;
- is based on the best available information;
- is tailored;

- takes human and cultural factors into account;
- is transparent and inclusive;
- is dynamic, iterative and responsive to change; and
- facilitates continual improvement and enhancement of the organisation.

Some elements of the commentary in ISO 31000 on each of the principles is particularly relevant to the context of risk management in planning for natural hazards as follows:

- the principle of value creation in ISO 31000 includes improving performance in human health and safety, public acceptance and environmental protection, and this expectation of creating value in these aspects is clearly relevant to planning and managing the potential effects of natural hazards;
- the principle that risk management is part of decision making includes helping decision makers make informed choices, prioritise actions and distinguish among alternative courses of action, and this should clearly apply to those involved in resource management processes and decisions;
- the principle that risk management should explicitly take account of the nature of uncertainty and how it can be addressed is directly applicable to planning for natural hazards;
- the principle on best available information provides that information sources include historic data, experience, stakeholder feedback, observation, forecasts and expert judgement and decision makers should inform themselves and take account of any limitation of the data or modelling used or the possibility of divergence among experts, all of which are relevant to natural hazards; and
- the principle of being transparent and inclusive includes appropriate and timely involvement of stakeholders to allow them to be properly represented and to have their views taken into account in determining risk criteria, which is directly relevant to natural hazards planning.

3.4 Framework

The framework ISO 31000 sets out (illustrated below) is a flexible model that is intended to be adaptable for different organisations and contexts. The purpose of the flexibility is to enable the standard's logical and systematic risk management process to be applied appropriately by different organisations (including communities).

The framework is the overall structure within which the detailed risk management process will be implemented to support specific activities or decisions.



3.4.1 Mandate and Commitment

Key elements of mandate and commitment that are relevant to natural hazards planning and management under the RMA, and in particular, the framework that could be established by a NPS, include:

- assigning accountabilities and responsibilities at appropriate levels;
- ensuring necessary resources are allocated;
- communicating the benefits of risk management to all stakeholders; and
- ensuring the framework continues to remain appropriate.

3.4.2 Designing the Framework

Designing the framework involves seven activities that are described in the standard:

- understanding the organisation and its context;
- establishing the risk management policy;
- accountability
- integration into the organisational processes;
- resources;
- establishing internal communication and reporting mechanisms; and
- establishing external communication and reporting mechanisms.

Understanding the context is required to enable appropriate tailoring of the framework. ISO 31000 highlights two aspects of the external context that are particularly relevant when considering a national framework for a risk-based approach to natural hazards planning:

- *“the social and cultural, political, legal, regulatory, financial, technological, economic, natural and competitive environment, whether international, national, regional or local; and*
- *key drivers and trends having impact on the objectives of the organisation.”*

These external contextual issues relevant to establishing a risk-based approach for natural hazards planning in New Zealand have been outlined in Section 2 of this report.

Internal contextual matters that are most relevant include capabilities (e.g. resources, tools, knowledge and information systems). These factors need to be considered in assigning accountabilities and responsibilities within the risk management framework. It will also be important for the risk framework and its risk process to be integrated in the resource management planning and decision making frameworks and the related reporting, consultation and engagement processes.

3.4.3 Implementing the Framework

The ISO 31000 requirements for implementing the risk management framework that are most relevant for a national framework for a risk-based approach to natural hazards planning include:

- defining timing for implementation;
- communication and consultation to ensure the framework is understood and remains appropriate; and
- ensuring the risk management process is applied.

A NPS could specify implementation timeframes. Its implementation will need to be supported with communications and consultation.

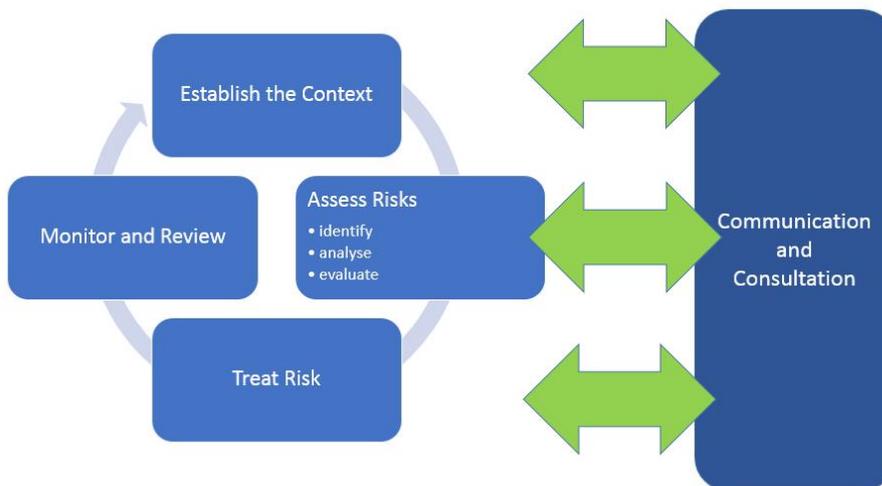
3.4.4 Monitoring, Review and Improvement

Key elements of ISO 31000 requirements for monitoring, review and improvement include measuring performance (outcomes) and implementation progress, as well as review of changes in the context.

The natural hazard risk management framework established in a NPS will need to be subject to monitoring and review.

3.5 Risk Management Process

The ISO 31000 process is intended to be tailored and applied at different levels and contexts (for example for different activities, issues and decisions) within the organisation's risk management framework. As illustrated in the figure below, the process is iterative.



It is this risk management process that the NPS framework should require or provide to be implemented in resource management planning and decision-making processes.

3.5.1 Communication and Consultation

Communication and consultation are critical to the risk management process and accordingly, ISO 31000 addresses this as a first item in the process. This is to ensure engagement occurs at the start and throughout the whole process cycle. Engagement at the start is important as stakeholders make judgements about risk-based on their perceptions of risk and these perceptions need to be taken into account. ISO 31000 notes that "*communication and consultation should facilitate truthful, relevant, accurate and understandable exchanges of information*".

Communication and consultation is important for natural hazard planning and decision making. It will involve a number of stakeholders and communities of interest. It is also likely to be a process that not only looks to identify and take account of perceptions of risk, but also to raise awareness and understanding that may change or shape these perceptions.

3.5.2 Establishing the Context

Establishing the context for any particular application of the risk process (to a particular issue or decision for example) includes some similar requirements as for establishing the context for the risk management framework, in particular understanding the external and internal context.

Additional work is required to establish the context for the particular application of the risk management process. Considerations that ISO 31000 identifies which are most relevant in the context of natural hazards planning and management include:

- defining the goals and objectives of the process;
- defining the risk assessment methodologies;
- defining the way performance and effectiveness is evaluated in the management of risk;
- identifying and specifying the decisions that have to be made; and
- identifying, scoping or framing studies needed, their extent and objectives and the resources required for such studies.

The Handbook suggests that the topic may be subdivided to "*help show whether special expertise is needed to understand particular elements*" and notes that "*after examining the pieces, the whole should also be considered to ensure that the big picture is not lost*". It also advises that planning for risk management activity should identify the methodologies to be used, such as whether quantitative or qualitative approaches are to be used.

More detailed consideration of the following matters is also required to define the risk criteria that will be used:

- the nature, types and causes and consequences that can occur, and how they will be measured;
- how likelihood will be defined;
- the timeframe(s) of the likelihood and/or consequence(s);
- how the level of risk is to be determined;
- the views of stakeholders;
- the level at which risk becomes acceptable or tolerable; and
- whether combinations of multiple risks should be taken into account and, if so, how and which combinations should be considered.

All of these matters are relevant to a risk-based approach to planning and managing natural hazards. ISO 31000 and the Handbook note that criteria should be derived from the objectives and the outcomes desired for each objective. Different outcomes could be associated with impacts on people, property, the economy, or the environment, for example. The Handbook notes that consequence and likelihood scales may vary for different outcomes and advises that "*the range of the scale includes the upper values that could possibly occur and even beyond to ensure that rare high-consequence conditions are not missed in risk assessment*".

The Handbook also provides useful guidance on deciding on how likelihood should be expressed, pointing out that this may be measured in terms of probability, frequency or by using descriptive scales. Probability-expressed likelihood is a number between 0 and 1 to represent the probability of a consequence (or perhaps an event) occurring over a particular timeframe. A frequency measure could be expressed as a return period. In natural hazard planning, and in particular for flooding, Annual Exceedance Probability (AEP) expressed as a percentage, is often used. The Handbook notes that even where data is available for quantified analysis, often descriptors are a more useful approach for some stakeholders. It includes a helpful table (reproduced below) illustrating different approaches for determining likelihood scales.

**EXAMPLE OF A LIKELIHOOD SCALE RELATING DESCRIPTORS,
FREQUENCY AND PROBABILITY**

Descriptor	Description	Indicative return period*	Indicative probability (over the time frame or activity of interest)
Almost certain	The consequence expected to occur on an annual basis	Every year or more frequently	>0.9
Likely	The event has occurred several times or more in your career	Every three years	>0.3, <0.9
Possible	The event might occur once in your career	Every ten years	>0.1, <0.3
Unlikely	The event does occur somewhere from time to time	Every thirty years	>0.03, <0.1
Very unlikely	Heard of something like that occurring elsewhere	Every 100 years	>0.01, <0.03
Extremely unlikely	Have never heard of this happening	Every 1000 years	>0.001, <0.01
Incredibly rare	Theoretically possible but not expected to occur	Every 10 000 years	<0.001

* Return period is an estimate of the likelihood of an outcome occurring. It is also known as recurrence interval.

The Handbook also addresses how the level of risk should be addressed by combining information on consequences and likelihood. It notes that "to determine the level of risk, measures of consequence and their likelihood have to be combined in a way that reflects the organisation's risk attitude and the way in which the risk assessment is to be used in decision making". It also notes that this can be done qualitatively (descriptively), semi quantitatively (using ordinal scales) or quantitatively. It cautions that often quantitative analysis is not justified, most importantly if decision makers do not need or cannot use quantitative results.

In Appendix C of the Handbook, a useful example is provided of a simple matrix approach (often called a heat map). The example is one where a "skew" is used so that risks with the highest levels of consequence, even if the likelihood is very low, are rated high to very high. The table (with colour added here) is reproduced below.

Likelihood	V	Medium	High	High	Very High	Very High
	IV	Low	High	High	Very High	Very High
	III	Low	Medium	Medium	High	Very High
	II	Low	Low	Medium	High	Very High
	I	Low	Low	Medium	Medium	High
		1	2	3	4	5
		Consequence				

Finally, as part of establishing the context, the companion provides guidance on how to evaluate risk, recommending that a rule set be created to provide decision support by helping to determine:

- *“whether all or some risks are to be considered in the aggregate with other risks;*
- *whether the risk is insignificant or otherwise acceptable and needs no further consideration (other than ongoing monitoring and review);*
- *whether, irrespective of the level of risk, the organisation would obtain benefit overall from treating the risk;*
- *any preferred priorities for treatment;*
- *the relative urgency for completion of treatment plans and continued tolerance of a level of risk pending completion;*
- *the potentially valid forms of treatment;*
- *whether an action that is generating or would generate particular levels of risk can be proceeded with; and*
- *whether more information is needed in order to make a decision”.*

It notes that these considerations should be *“directed to obtaining greater certainty that the organisation’s objectives will be achieved”*, bringing the focus of the analysis back to the concept of the effect of uncertainty on objectives.

For natural hazard planning and decision making processes, the step of establishing the context will be highly important and likely require significant effort that could, potentially, be supported with national-level guidance.

3.5.3 Risk Assessment

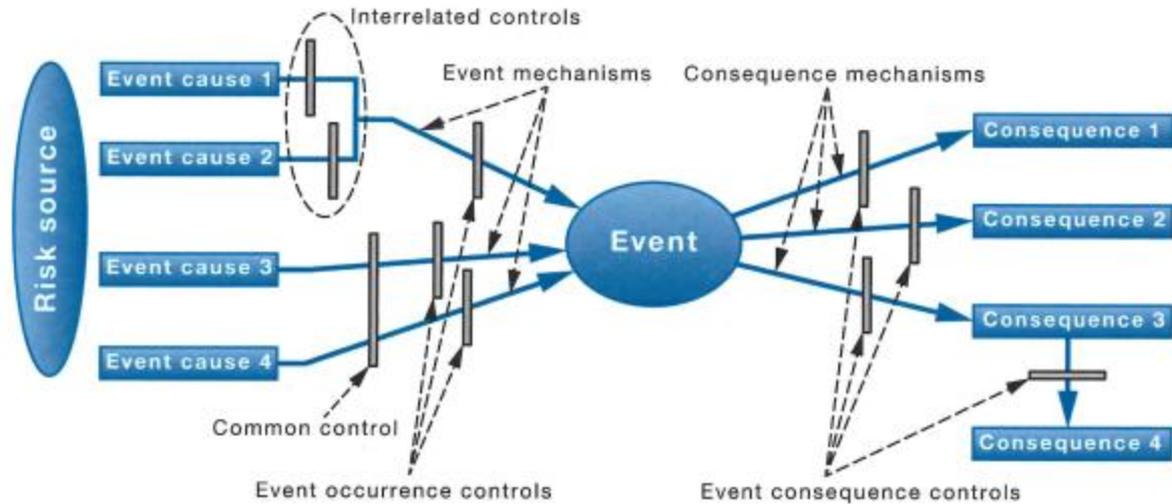
Risk assessment involves three activities that are likely to be carried out iteratively: risk identification, risk analysis and risk evaluation. The Handbook notes that assessment enables an organisation to:

- understand its risks so that subsequently their significance can be judged;
- appreciate whether the risk should be accepted or modified; and
- consider the relative modifying effect of different risk treatment options.

ISO 31000 prompts for risk identification to be comprehensive to ensure all risks are captured for analysis. It also prompts for consideration of cascading and cumulative effects in consequences and use of scenarios that show what consequences can occur. The Handbook adds that to ensure identification is efficient and the outputs are reliable, the process should be systematic, based on the best available information, collaborative and properly recorded.

ISO 31000 highlights that purpose of risk analysis is to provide an understanding of the risk as an input to decision making. It notes that the analysis can be qualitative, semi-quantitative or quantitative, depending on the circumstances. It emphasises the need to communicate to decision makers (and potentially other stakeholders) information about sensitivity to preconditions and assumptions and factors such as divergence of opinion among experts, uncertainty, limitations in information availability, quality, quantity and relevance or in modelling. The Handbook adds that *“risk analysis requires continual awareness of sources of uncertainty, including those implicit in assumptions”*.

The Handbook also explains how risk analysis may require cause and effect chains to be understood using techniques such as event trees and the bow tie analysis (extracted from the Handbook and illustrated below) to understand those relationships, their sequencing and the effects of controls.



Example Bow Tie Diagram

ISO 31000 describes the purpose of risk evaluation as assisting decision making about which risks need treatment and priorities for treatment. The Handbook adds that in some cases the need for treatment will be clear, but that in others some further analysis of treatment costs and benefits will be required to establish the case for treatment (if any).

The ISO 31000 approach to risk assessment and its associated guidance, is directly applicable and useful for natural hazards planning and decision making. Key concepts that are relevant include:

- the need to comprehensively capture potential risks for analysis;
- the need to consider cascading and cumulative risk and effects (including using tools like the bow-tie to understand these);
- using scenarios and best available information;
- the importance of selecting and using the most appropriate assessment methods (as should be determined as part of establishing the context); and
- the need to consider benefits and costs of treatment options (which should form part of a Section 32 analysis under the RMA).

3.5.4 Risk Treatment

ISO 31000 describes risk treatment as a cyclical process considering treatment options, deciding if residual risk is tolerable and reconsidering treatment options where risk levels are not tolerable. It identifies options as including:

- avoiding risk by deciding not to start or continue with the activity that gives rise to the risk;
- taking or increasing the risk in order to pursue an opportunity;
- removing the risk source;
- changing the likelihood;
- changing the consequences;
- sharing the risk with other parties; and
- retaining the risk by informed decision.

Many of these are relevant to risks associated with natural hazards. The Handbook notes that the process of searching for and considering the comparative merits of treatment options will include assessing costs and benefits. The costs should include compliance costs and the analysis should consider the distribution of costs and benefits.

3.5.5 Monitoring, Review and Recording

ISO 31000 concludes the requirements for the risk management process with requirements for monitoring and review of the processes and for records. This is to ensure controls are effective and efficient, to obtain further information, learn lessons, detect changes in the external or internal context and identify emerging risks.

3.6 Key Good Practices

The detail extracted from ISO 31000 and the Handbook and outlined above has informed our development of recommendations. We also identified four key good practice themes that we used as a lens to identify and evaluate good practice for risk management processes in natural hazards planning. Those four themes were:

- the importance of context, which should drive and determine how an overall framework is established and how the risk management process is applied to address specific issues or decisions;
- focussing on understanding and communicating about uncertainty;
- appreciating complexity and recognising that this will require robust and flexible approaches, and good choices about the methods used to assess risk; and
- engaging in adaptive and iterative processes.

4 Research and Analysis Findings

Our research and analysis findings are presented in three parts:

- good practice for risk management in natural hazards planning;
- issues and challenges to achieving good practice; and
- overcoming barriers to good practice.

4.1 Good Practice for Risk Management in Natural Hazards Planning

4.1.1 Introduction

In Section 3 we presented detailed information from the ISO 31000 risk management standard and its Handbook. In line with our preliminary thinking on Key Characteristics/Aspects for a Risk-based Framework (see Appendix A) we posit that ISO 31000 represents international good practice on risk management processes. From ISO 31000 we identified four key themes or characteristics of good practice for risk management processes. We have used those key themes as one lens through which to view the risk management process information from the wider literature on risk-based approaches to plan for and manage natural hazards. That view of the literature and analysis is presented in Section 4.1.2 below.

Our preliminary thinking also identified some key definitions from the RMA. We have developed the theme of RMA context further and this forms the basis of a second lens we have applied to the wider literature, as presented in Section 4.1.3.

As we completed our literature review, we developed our preliminary thinking around understanding consequences of natural hazard events first, then introducing concepts of likelihood into a broader theme – dealing with complexity. We have used that theme as a heading for our synthesis and analysis in Section 4.1.4.

Our preliminary thinking also identified engagement as a key aspect of a risk-based approach. We have addressed engagement issues in our synthesis and analysis in Section 4.1.5.

4.1.2 Good Practice for Risk Management Processes

4.1.2.1 Establishing the Context

Establishing the context is a critical first step in establishing an overall risk management framework and each application of the risk management process. The context sets the scene and will impact the methods for assessing risk and approach to risk management. ISO 31000 describes context setting covering external and internal environments when establishing a risk management framework and adds more detailed context work, including setting risk criteria for specific applications of the risk process. The importance of defining criteria and making decisions about the risk analysis methods to use is noted in RMA Quality Planning (2013) as an important part of establishing the context. The MfE guide on preparing for coastal changes (MfE, 2009) includes an excellent set of questions to consider when establishing the context.

Establishing the context has been a part of the risk management process described in other risk management standards (AS/NZS 4360:2004) and so it is common for natural hazard risk-based planning approaches to refer to this step where they have based the risk approach on AS/NZS 4360, for example: in the Climate Change guidance Manual (MfE, 2008) and on the quality planning website (RMA Quality Planning, 2013). For the most part, the descriptions and discussions are brief. However, there are examples where discussion of the external physical environmental context demonstrates good practice for natural hazards planning.

The external context includes the physical setting such as landforms, the natural processes at play and the shocks and stressors on that environment. The external context also includes the external social and cultural, political, regulatory, financial, technological and economic environment (ISO 31000:2009). The New Zealand Standard on Managing Flood Risk emphasises the importance of understanding the natural (including catchment processes) and social systems within which flood risk management occurs and the interactions between them (NZS 9401:2008). In the good practice guide for defining coastal hazard zones for setback lines (EnviroLink, 2012) the framework includes developing a conceptual model to understand the coastal system and frame the technical methodology to be used in the risk assessment.

Obtaining, sharing and maintaining information on the external context and about natural hazards is a good practice. In the stocktake and issues report for Greater Wellington Regional Council, MWH identified elements of good practice sharing information developed as part of the Civil Defence Emergency Management Group Plan (MWH, 2016). That report noted the importance of comprehensive information to help inform understanding of the consequences associated with natural hazard events. A list of “key parameters of good practice” is presented in the report for hazard information requirements. This notes the importance of information being available on GIS and to the public; the need for it to be updated and the use of protocols to manage information. The report also includes an extensive list of specific types of information that should be made available for different hazard types.

The internal context includes the aspirations, perceptions and objectives of the communities and councils. The land use context will also be a critical factor in any risk assessment. For example, where there is existing development, communities will likely want to minimise residual risk and mitigate or transfer risk. Whereas risk avoidance is likely to be more readily achieved with any new development or subdivision (NIWA, MWH, GNS and BRANZ, 2012).

Establishing context is a qualitative process and will use a qualitative narrative (EnviroLink, 2012). Determining the context will highlight the information/resource available around risk and the gaps in information and uncertainties present. It might also help to prioritise risks. Context setting will require inputs from stakeholders who often have important information on the local environment. Context setting will include some discussion at this point around how people understand effects and consequences, timeframes, risk attitude or acceptance and management methods.

Hazard mapping is an important part of context setting and a consistent approach to mapping should be taken. The scale of mapping should be fit for the intended use, for example regional scales (1:100,000 to 1:500,000), medium or district scale (1:25,000 to 1:50,000) and small scales or property level (1:500-1:15,000) (MWH, 2016 and RMA Quality Planning, 2013). This ensures that information is portrayed accurately and is not misrepresented (RMA Quality Planning, 2013). Maps should also be at a scale appropriate to the end use purpose and to the information available and tools utilised. GNS (2015) looked at the consistency of mapping across regional and district plans and found that there was no standard scale used for mapping coastal hazards. Sourcing of historic information such as newspaper reports, photographs and first-hand accounts of prior events and changes to the environment are also important in building an understanding of the context (RMA Quality Planning, 2013).

4.1.2.2 Focus on Uncertainty

There are often high levels of uncertainty surrounding information on natural hazards. As the Parliamentary Commissioner stated in her report on Preparing New Zealand for Rising Seas, *‘it is certain that the sea is rising and will continue to do so for centuries. But much is uncertain – how rapidly it will rise, how different coastal areas will be affected, and how we should prepare’*. (Parliamentary Commissioner for the Environment, 2015).

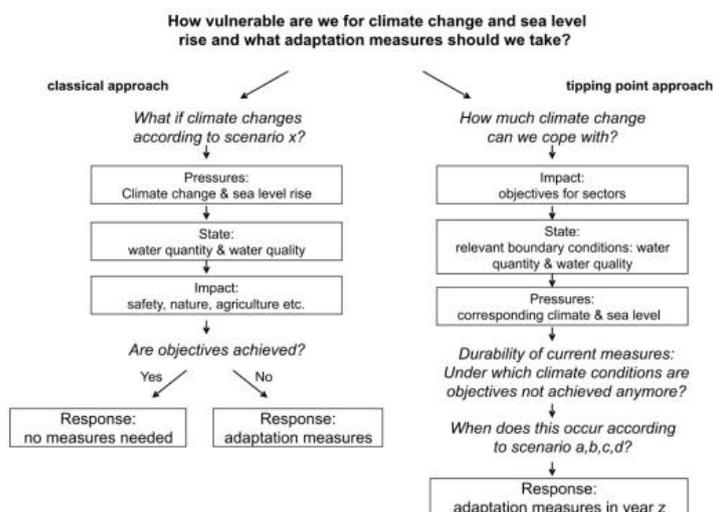
The focus of ISO 31000 is on uncertainty, defined as 'the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequences or likelihood'. For a natural hazard event there may be uncertainty relating to the consequence of a hazard event occurring, the scale or magnitude of hazard events, the frequency of events and appropriate mitigation measures. Uncertainties are likely to increase the further we attempt to predict into the future. In addition, there could be fundamental shifts in the nature of the hazard (e.g. as a result of climate change and sea level rise) in technology or human behaviour over time that may invalidate our future projections (NIWA, MWH, GNS and BRANZ, 2012b).

Where uncertainty exists it must be clearly described, outlining how the uncertainty has been incorporated into any analysis of risk. Uncertainty must also be appropriately communicated in a language suitable for a non-technical audience (EnviroLink, 2012; RMA Quality Planning, 2013).

It is also important to understand the impact uncertainty has on decisions and to make sure such uncertainty is transparent. Adopting a precautionary approach could be an appropriate way to address uncertainty, however 'precautionary' must be clearly defined (MFE, 2008, Coastal Hazards and Climate Change, 2nd edition). Information on the Quality Planning website (RMA Quality Planning, 2013) recommends that the precautionary principle should be applied in a risk-based approach and this provides some flexibility and transparency in how it is applied and an opportunity to engage with the community.

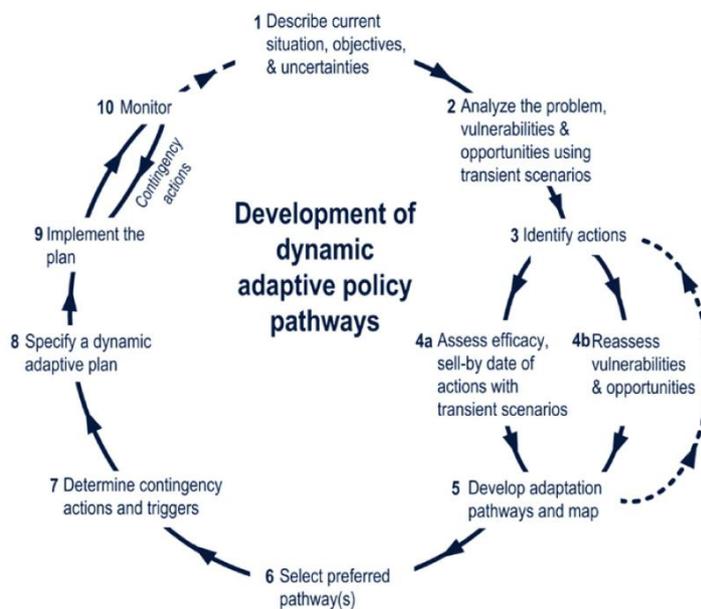
While it is important that ongoing research and monitoring is undertaken to reduce uncertainties, there is a need to adopt a flexible approach to risk which allows uncertainty to be accommodated and provided for. Using scenarios as a means of dealing with uncertainty is recommended in a wide range of the literature and examples of natural hazard planning, including EnviroLink, 2012; NIWA, 2011; MfE, 2010b; MfE, 2009. Sensitivity analysis will also be important to understand the significance of uncertainty (RMA Quality Planning, 2013).

More sophisticated planning approaches may also be worthy of consideration. Kwadijk et al, 2010 reports on an adaptation tipping points model applied to a case study in Netherlands to prepare for climate change and sea level rise. In this model, rather than using climate scenarios to deal with uncertainty, effects scenarios were used to examine how long current water management strategies would continue to be effective under different climate change scenarios. Uncertainty was expressed in terms of the period that the existing strategy is effective. The approach allowed adaptation tipping points to be identified, where a new approach would be required. The figure below (from Kwadijk et al, 2010) illustrates the Tipping Point Approach and compares it with the Classical Approach.



Classical top-down approach and adaptation tipping point approach to develop adaptation measures.

Haasnoot, M. et al, 2013 examined two techniques – Adaptation Pathways and Adaptive Policymaking; and developed a hybrid approach – Dynamic Adaptive Policy Pathways as illustrated in the figure below (from Haasnoot, M. et al, 2013), and applied this to develop an adaptive plan for long –term water management of the Rhine Delta. The approach supports adaptive planning in the face of what the authors describe as “deep uncertainties”.



The Dynamic Adaptive Policy Pathways approach.

4.1.2.3 Flexibility in Risk Assessment Methods

Risk associated with natural hazards is complex and is influenced by a multitude of factors. For example risk can change where natural hazards are cumulative, cascading or inter-related. Some risks may need to be examined in detail and varying degrees of risk analysis undertaken. Accordingly, a risk-based approach needs to provide flexibility to enable risk assessment to be completed to reflect the decisions that are to be made and the nature and quality of information available.

There are a number of techniques which can be used to assess risk, ranging from qualitative methods through to semi quantitative (risk matrix), statistical estimators to quantitative methods for which absolute measures of risk are derived e.g. Riskscape (NIWA, MWH, GNS and BRANZ, 2012b). Each technique has its own merits and applicability and that which is chosen must be fit for the purpose it is trying to achieve. Determining the appropriate method of risk analysis will be influenced by the context, objectives of the risk assessment, available information and resourcing. MfE (2010b) and RMA Quality Planning (2013) provide useful commentaries on qualitative and quantitative methods and the factors that could influence choices about which to use.

Qualitative analysis may be used to obtain a general indication of risk, to establish the context and a dialogue with the community around the types of risk present and possible mitigation options. It can be a way to assign priority for risks that need further evaluation (RMA Quality Planning, 2013). More specific, quantitative analysis may be used to support this assessment if the objectives warrant it and the relevant information is available.

A ‘Source-Pathway-Target-Consequence’ model is used within the MfE coastal guidance (MfE, 2008) to provide a means to understand how hazard events (risk sources) play out, interact and result in

effects. A SMG (Seriousness, Manageability & Growth) approach is reported to be used in civil defence and emergency management to understand and prioritise natural hazard risks and is recommended as an analysis tool for planning activities (RMA Quality Planning, 2013). Heat maps are used in a number of natural hazard risk-based examples to bring together consequence and likelihood scales and determine levels of risk.

Where there is uncertainty around risk, a more qualitative or descriptive approach may be better suited. MWH (2016) suggests that sensitivity analysis might be applied. Sensitivity analysis considers 'what if' the assumptions that have been made, do not eventuate in the manner or to the extent envisaged.

4.1.2.4 Iterative and Adaptive Process

The risk management approach should be iterative, with ongoing monitoring and review a key part of the process. An iterative process allows for the incorporation of new information and science on the nature and extent of a hazard and how this may impact risk (Auckland Council, 2014). Continual review of the risk assessment process can also help to address uncertainty factors and reassess any residual risk which might still be present. New information may become available which alters the level of risk and further consultation may subsequently need to be undertaken with key stakeholders (RMA Quality Planning, 2013). An iterative approach can allow for the changing perspectives and objectives of the community/organisation to be incorporated (Geological Survey of Canada, 2015).

Ongoing monitoring can assess the effectiveness of an existing natural hazard management regime. Monitoring may indicate that the policies in plans are not reducing natural hazard risk and further work needs to be done (RMA Quality Planning, 2013). A protocol should be established which ensures that the results of the monitoring are incorporated into an information review and update process (Deloitte, 2014).

The Coastal Hazards and Climate Change Guidance Manual (MfE, 2008), notes the importance of incorporating flexibility (adaptive management) to deal with changing risks and uncertainties. NIWA, MWH, GNS and BRANZ (2012) discusses the importance of adaptability and staging; when faced with making decisions in uncertain situations, seeking adaptable or staged solutions so that measures can be more easily adjusted to changing knowledge and circumstances. A good example of this iterative process is the six yearly reviews of the coastal hazard zones in the Hawke's Bay Regional Coastal Environment Plan, in association with the updated Intergovernmental Panel on Climate Change (IPCC) sea level rise scenarios. The process in Hawke's Bay ensures that uncertainties surrounding climate change and sea level risk are reviewed as information comes to light (GNS, 2015). The Parliamentary Commissioner for the Environment stated in her report regarding sea level rise that often a 'horses for courses' approach was required. Different stances on risk will be appropriate for different situations (PCE 2016).

4.1.3 RMA Context

A risk based approach to natural hazard management should fit within the context of the Resource Management Act (RMA). From our review of contextual information relevant to establish a risk-based approach to natural hazards planning under the RMA (see Section 2) and our initial scan of the literature, we identified six key aspects that are important elements of the RMA context:

- the purpose of the RMA;
- the definition of natural hazards;
- an all hazards approach;
- the effects of climate change;
- the use of the precautionary approach; and

- evaluating benefits and costs.

4.1.3.1 Purpose of the RMA

A sound risk assessment should meet the purpose of the RMA. As outlined in Part 2 of the RMA.

- 1 *“The purpose of this Act is to promote the sustainable management of natural and physical resources.*
- 2 *In this Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*
 - a *sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
 - b *safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
 - c *avoiding, remedying, or mitigating any adverse effects of activities on the environment.”*

One of the key points here is around managing use and development and protection of natural and physical resources in a way that sustains the potential of these resources to meet the reasonable foreseeable needs of future generations; the principle that decisions made now should not restrict the ability of future generations to meet their own needs (NIWA, MWH, GNS and BRANZ, 2012, Tool 3.1). Risk-based assessments should incorporate this purpose as part of key objectives and clearly outline how this will be achieved.

Good risk management is part of the process for achieving sustainability. With good risk management comes resilience. Resilience is defined in Australian Business Roundtable (Deloitte, 2013) document, ‘Building our nation’s resilience to natural disasters’ as:

“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”

Good risk management and resilience can be seen as stepping stones to sustainable communities (see Figure below). Resilient communities are able to recover and respond to stressors and changes quickly. Moving towards sustainability requires the ability to understand and live within natural systems, building capacity to anticipate, avoid and adapt to stressors.

Risk, Resilience and Sustainability

(Linking to Treasury's Living Standards Framework)



4.1.3.2 Definition of Natural Hazards

The Resource Management Act defines natural hazards as:

“Any atmosphere, 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.”

When taking a risk-based approach to natural hazards, this definition should be used and consistently applied. As highlighted above, this definition looks at risk beyond people and property and includes other aspects of the environment which may include social, cultural or natural elements. Much of the focus to date has been on impacts on people and property with no evaluation of impacts on other aspects of the environment. Some current risk-based methods do incorporate the environment or ecosystems as a consequence receptor but this is usually as an 'addition' to the main receptors and there is no explanation as to why different receptors have been chosen. The Risk Assessment Process outlined in MfE's Coastal Hazards and Climate Change, Guidance Manual (2008) does include ecosystems as a consequence receptor.

4.1.3.3 All Hazards Approach

When undertaking a risk assessment all hazards should be identified, irrespective of the frequency or consequence/effect. Grace et al. (2016) identified an 'all-hazards approach' to objectives and policies as an element of best practice in district and regional plans. An all hazards approach ensures that there is a consistent outcome being sought for all hazards. It addresses all types of hazards, including those which are cascading, inter-related and cumulative. It also captures hazards which have limited information or are not at the forefront of organisations' agendas. This 'all hazards' approach reflects the definition of 'effect' in the RMA which includes:

- a *any positive or adverse effect and*
- b *any temporary or permanent effect and*
- c *any past, present or future effect and*
- d *any cumulative effect which arises over time or in combination with other effects - regardless of the scale, intensity, duration or frequency of the effect and also includes*
- e *and potential effect of high probability and*

f *any potential effect of low probability which has a high potential impact*" (emphasis added).

The RMA defines an effect as one which includes any potential effect of low probability which has a high potential impact. This includes natural hazards such as earthquakes which have a low frequency and which have scientific evidence of being a threat to the community (GNS, 2015). These events could have a very high or catastrophic impact, as seen with the earthquakes in Christchurch.

4.1.3.4 Effects of Climate Change

The impacts of climate change should be an integral part of all risk assessment methodologies. This aligns with Section 7 of the RMA where particular regard must be had for the effects of climate change. Furthermore, the New Zealand Coastal Policy Statement (NZCPS 2010) highlights the potential effects associated with climate change and requires a precautionary approach to address the uncertainties around climate change impacts.

Climate change is unlikely to create new risks but will change the frequency and intensity of existing risks and hazards as well as introducing some long-term shifts in climate regimes across the country (MFE, 2008). Climate change will have gradual impacts, exacerbating coastal hazards through heightened coastal erosion and inundation and increasing rainfall which could lead to flooding and a higher potential for landslips. Climate change impacts may be particularly relevant for:

- subdivisions and developments in floodplain areas, close to rivers, or within or over river channels;
- subdivisions and developments close to or within the coast (cliffs, beaches or low-lying areas);
- subdivision and developments on or close to steeper hillsides (including at the top and bottom of the hill);
- lifeline infrastructure components in the above locations; and
- subdivision and developments that rely on rain water supply.

Information, modelling and mapping of natural hazards should incorporate the impacts of climate change. For example, the Parliamentary Commissioner for the Environment (PCE) recommended in her report that guidance on sea level rise should include protocols for the procurement of elevation data (LIDAR), and work with LIMs to create a national repository for such information (PCE, 2015). Such information is seen as essential for successful risk management.

The magnitude of uncertainty will increase with the influence of future climate change and sea level rise (NIWA, 2012). Uncertainties around climate change must be identified and acknowledged; monitoring and review will aid in redefining these uncertainties as new information comes to light. Appropriate consultation during the monitoring and review stage will be important to understanding how risk has changed over time.

4.1.3.5 Appropriate use of Precautionary Approach

The 2010 NZCPS promotes a precautionary approach to planning new development, infrastructure and services to avoid coastal hazard risks over the intended lifetime of the development. A precautionary approach to decision-making means you take into account the level of risk, use existing knowledge and account for uncertainties.

However, there are often multiple interpretations of 'precautionary' and these can be conflicting. Concern was expressed by the PCE that precaution was often embedded in scientific assessments on coastal hazards, sometimes to the extreme extent. This was evident with the Kapiti Case study where taking a precautionary approach led to double-counting of uncertainty around predicted sea level rise, and assuming accreting parts of the beach would not continue to accrete.

There must be a consistent approach to the definition and use of the precautionary approach. There has been debate in the literature as to whether the precautionary approach should be implemented during the planning stage and not integrated into the science of assessing risk and hazards. The Parliamentary Commissioner for the Environment (PCE, 2015) recommended, in relation to sea level rise, that 'best estimates' with uncertainty ranges for all parameters be used in technical assessments on coastal hazards.

There needs to be transparency and clarity around how a precautionary approach is defined and implemented, by whom and at what stages, in natural hazard risk assessments.

4.1.3.6 Evaluation of Benefits and Costs

A Section 32 evaluation under the RMA requires that benefits and costs of a proposal should be identified and assessed so decision makers have a sound understanding of the impact a proposal will have on the community, the economy and the environment (MFE, 2014).

A benefit and cost evaluation is an important part of a risk assessment process. The environmental, social, economic and cultural benefits and costs of each management option should be evaluated in order to identify and prioritise preferred actions (NIWA, 2011). This analysis should be applied throughout the applicable timeframe (50 year, 100 years, 500 years etc.) and should be compared to the benefits and costs of doing nothing.

The benefit and cost evaluation should include all elements, including the time required to engage with communicates and implement the management methods.

There are international examples of more formal cost-benefit analysis being used as a key tool in risk reduction and building resilience. The Economics of Climate Adaptation Working Group (ECA, 2009) reports on a project to address two gaps in information and tools to address climate change risk: limits in quantifying risk from climate change; and lack of a decision support tool that is systematic and efficient. The project delivered tools, using cost-benefit analysis to help decision makers, testing these on a number of case studies. The process included:

- rigorous assessment and identifying the full range of impacts of climate change;
- developing an accurate understanding of measures to address risks (including the costs and benefits of those measures); and
- prioritising the most effective measures.

After an initial feasibility screening of possible measures by local experts for each case study, the cost-benefit analysis was used to identify a portfolio of measures for decision makers. The project confirmed that it was possible to do this with limited data and provide a clear indication of magnitude of threats and broad costs for adaptation. The case studies looked at all climate hazards, used a comprehensive risk management approach, and used scenarios (base, moderate & high) to prioritise adaptation and resilience measures.

The Australian Business Roundtable has commissioned a series of research reports (Deloitte, 2013, 2014, 2016). These have focused on:

- building resilient infrastructure;
- building an open platform for disaster resilience decisions;
- the economic cost of the social impact of natural hazards; and
- building national resilience to natural disasters.

One of the conclusions from this extensive research and reporting is that resilience needs to be integrated into design and decision making and to be accommodated in cost/benefit analysis to assess cost-effectiveness of options.

UNEP (2014) explores measures for risk reduction under the headings of behavioural, structural and ecosystems (for example maintaining mangroves). It presents an estimate that \$1 spent on building resilience can deliver a \$10 return in the form of savings in response and recovery.

4.1.4 Dealing with Complexity Associated with Natural Hazards

Our initial scan of the literature highlighted the challenges that complexity associated with natural hazards presents. That complexity includes how natural hazards may “play out” in different natural hazard events as effects on people, property and the environment. It also includes how natural hazards may inter-relate (for example the impact of liquefaction subsidence on future flood vulnerability, as has occurred in Canterbury), cascading effects and cumulative effects. We identified and have used four themes to examine how this complexity can be dealt with or managed.

4.1.4.1 Focus on Consequence

It is important to first understand the potential consequence of a natural hazard event occurring before starting to introduce the likelihood of such an event or develop effective and appropriate risk management and reduction measures (GNS, September 2013). A focus on consequence provides a good starting point for consultation with stakeholders, focusing the discussion generally around natural hazards, the context, consequences and possible mitigation measures. This is best done before any mention of frequency, because frequency is often confusing and distracting from the issues confronting communities.

Much of the literature reviewed within this report focuses on frequency as a starting point. This can lead to low frequency, high consequence hazards or high frequency, low consequence hazards tending to be dismissed, effectively narrowing the discussion with stakeholders from the beginning.

ISO 31000 defines consequence as *an outcome of an event affecting objectives*. The notes under the definition include:

- *“an event can lead to a range of consequences;*
- *a consequence can be certain or uncertain and can have positive or negative effects on objectives;*
- *consequences can be expressed qualitatively or quantitatively;*
- *initial consequences can escalate through knock on effects;*
- *consequence ratings need to be defined and described.”*

Hazard scenarios are a useful way of describing the consequence of a potential hazard event (GNS, 2015). Hazard scenarios provide a clear way to communicate to stakeholders a range of plausible scenarios for addressing a hazard (Carley et al. 2014). Consequences can be discussed with stakeholders through these scenarios before any discussion around frequency is introduced. NIWA 2011 recommended that it was useful to define a ‘credible’ scenario as a basis for discussion.

4.1.4.2 ‘Fit for Purpose’ Science & Methods

It is important that the methodologies and resources used to undertake risk assessments are ‘fit for purpose’ and relevant to the type of hazard/risk in question (PCE, 2015). Methodologies and resources need to be based on best practice and up-to-date guidance (Deloitte, 2013).

The type and quality of information available on a natural hazard will dictate the risk assessment process taken. Natural hazards with poor scientific understanding may require more of a qualitative assessment, using historical information and discussions with a range of stakeholders to compile current and historical information on an issue. Alternative sources of information may include:

- historical photographs, newspaper reports and first-hand accounts of prior events, and about changes to the environment that may mask or alter this pre-existing hazard;
- information held by local libraries;
- information collected for other purposes such as university research;
- information collected by former catchment boards; and
- historical records for organizations such as the Ministry of Works and Development (RM Quality Planning, 2013).

4.1.4.3 Clear Communication of Science and Assumptions

Implementation of coastal hazard information into pragmatic and effective land use planning and policy requires effective communication and collaboration between technical and planning staff through the entire process. The importance of this was highlighted in many of the case studies and in particular the cases of Kapiti, Christchurch and Franz Josef.

4.1.4.4 Timeframes

Once the consequences of a natural hazard have been assessed and mitigation options identified, appropriate timeframes can then be applied for decision-making. These are timeframes for which development is designed or risk is managed. The question of timeframes that should be considered is challenging in the regulatory context for natural hazards. It is also closely linked to how likelihood or probability is considered as part of risk assessment.

Regional policy statements, regional plans and district plans prepared under the RMA do not have a prescribed timeframe, but are subject to the requirement for 10-yearly review (which may be done on a rolling basis). The New Zealand Coastal Policy Statement does impose a timeframe of at least 100 years for considering coastal hazards.

GNS (2015) identified that only a small number of regional or district plans actually provided estimations on coastal hazard timeframes. Where these were referred to, 50 years and 100 years were dominant. However, such timeframes are not always applicable or best represent the scale of consequence.

In only focusing on 100 years there is a lost opportunity to incorporate the following:

- low probability, high consequence hazards;
- low probability, high consequence damage to critical or potentially dangerous infrastructure developments; and
- avoidance of substantial long term increases in risk from changes in land use (subdivision) (GNS, 2015).

A 100-year timeframe is reasonably consistently used in engineering design, for example, set as the design level for protection to be provided by flood banks. Where timeframes are expressed in local authority documents such as engineering design standards or in guides for decision-making related to natural hazards, 100 years is also reasonably consistently referenced.

Other regulatory instruments relevant to natural hazards do have timeframes, for example local authority long-term plans need to consider a 10 year timeframe and infrastructure strategies to consider a 30 year timeframe. Timeframes may also be established based on design life, for example the design life for buildings is considered under the Building Code as 50 years.

The timeframe adopted should also be influenced by the potential consequence associated with a particular hazard or event. For example, a tsunami has a low probability of occurring in a given

timeframe but a potentially catastrophic consequence and should be assessed and management/treatment options considered over a longer timeframe. Timeframes should also be flexible depending on the development or use of the land. For example when developing a new suburb which will establish new existing use rights, or designing critical infrastructure 100 years is not likely to be sufficient for these types of developments which require a long term, sustainable approach. Consideration of timeframe will also be important for selecting an appropriate discount rate to use on any cost-benefit analysis.

4.1.5 Approach to Engagement

Community or stakeholder engagement is critical to best practice natural hazard management. Good stakeholder involvement leads to a shared and better understanding of the risks faced and the range of treatment options (SNZ HB327:2010). The key elements of best practice stakeholder/community engagement have been identified through the literature review and case studies and are discussed below.

4.1.5.1 Process of Engagement

The process of engagement should be iterative, it should be early, it should be active and it should be time rich. Communication and consultation are a necessary part of each step of the risk management process illustrated in ISO 31000. The importance of this is discussed below for each step.

Context – early consultation helps to ensure that the context is considered broadly and all stakeholders are considered. As part of context setting, the criteria used to make decisions about risk are defined and these should take into account the views of stakeholders. This also provides a backbone for the communication plan (SNZ HB327: 2010). Early and active engagement here is very important in gaining acceptance by a community. This includes what might be considered the ‘directly affected’ community and the wider community (NIWA, 2012). NIWA (2012) discussed that without early engagement, local authorities would tend to struggle to overcome the many barriers and vested interests that can prevent successful coastal hazard risk reduction and adaptation. Furthermore, long term residents and local people can hold valuable information about coastal processes and the history of hazards and human impacts on the local area. This knowledge will be a vital part of defining risk and providing reasons for mitigation required.

In the Northland Regional Council case study, early engagement took place with Department of Conservation, with district councils and with landowners in floodplains. This was done working with community committees and enabled all participants to assess risk and develop a shared understanding of risk attitudes and acceptance.

Risk Identification – Comprehensive risk identification is not easy and wide stakeholder engagement can help ensure that as little as possible is overlooked. Different methods can be used for engagement including workshops, structured interviews, questionnaires, paper audits and analysis of data (SNZ HB 327:2010). NIWA, MWH, GNS and BRANZ (2012) outlines how a workshop provides a forum for sharing disparate knowledge from people with different values and expertise. Workshops can allow successive iterations of alternatives to be presented, assessed and modified. Participation in workshops promotes partnerships and supports mutual learning and capacity building. To be effective a workshop should be well structured and facilitated by an individual with some knowledge of the topic being discussed but not necessarily an expert (NIWA, MHW, GNS and BRANZ, 2012). The person communicating to stakeholders should be able to do so in a non-technical fashion so the information can be more easily received/understood.

Bay of Plenty Regional Council used workshops as a way to engage the community. The workshops involved a semi-structured approach using focus groups and took people through a 5-step process of

developing understanding and making judgements. One of the key aims of the community sessions was to identify themes in regards to the communities' perceptions of risk and risk tolerance.

Risk Analysis – Risk analysis builds understanding of risk and involves consideration of source of risk, controls in place, consequence and likelihood. When people are involved throughout the process it can help them to understand the outcomes of complex analyses which determine these factors.

Risk evaluation – Communicating the rationale for decisions and consulting regarding implementation can aid acceptance by stakeholders.

Risk Treatment – Risk mitigation or management methods can affect communities. Successful implementation of risk treatment will require buy-in from local communities.

Monitoring and Review – An organisation should be constantly monitoring and reviewing risks and management methods to incorporate new information and redefine uncertainties, to make modifications where management methods aren't working and also to take account for changes in the community. Overtime the character and demographics of communities can change as can hazards (NIWA, 2011). The Bay of Plenty process was an adaptive approach, providing an opportunity for the project team to reflect on the process and amend where necessary.

4.1.5.2 Communication Plan

A Communication and Consultation Plan (CCP) is a useful tool for outlining how to consult/engage with both internal and external stakeholders throughout the risk management process. SNZ HB327:2010 notes that a CCP should be developed during the early stages of the process and could address some of the following questions:

- What are the objectives of the specific communication or consultation?
- Who will be involved (define the community to be engaged)?
- How will the communication channels work?
- What is to be communicated; what is to be consulted about?
- How will the information be communicated?
- How will consultation be conducted?
- Who is information being sought from?
- How will you overcome barriers?
- How will this be resourced?

Resourcing requirements for consultation and engagement are often not determined (or not able to be foreseen or determined) early enough in the process. The Kapiti case study provides us with an example where there was significant resourcing requirements to respond to official information requests.

There is also the question is bigger better? The Bay of Plenty case study took a participatory approach to engagement, engaging with key stakeholders and representatives, rather than large numbers. A balance needs to be found between quantity of participants, where decisions affect whole communities but meaning and context might be sacrificed, and quality engagement. Bay of Plenty Regional Council undertook intensive participative engagement which resulted in an understanding of the communities' tolerance of risk, albeit only of the small number of participants engaged.

4.1.5.3 Style of Engagement

How we engage with stakeholders/communities will define the success of engagement. Early, time-rich and iterative engagement is vital but so is the behavioural approach to that engagement.

Dialogue must be two way and focused on mutual education. Often local people have a good understanding of local hazards and the history of hazards and their impact. Engagement should be personal and those engaging should take an empathetic approach to local communities and their situation. SNZ HB 327:2010 discusses the importance of understanding stakeholders' perception of risk. Perceptions may influence:

- willingness to consider new information;
- confidence or trust in such information (or its source);
- the relative importance given to information; and
- the selected methods of transferring information and the form of information provided (SNZ HB 327: 2010).

NIWA (2011) discusses the use of a participatory approach as part of the project on Coastal Adaptation to Climate Change. The research team decided that a participatory method was best because of the well documented advantages of participatory approaches in engaging with the community over complex issues, where multiple values are at stake, and there are many possible outcomes and solutions. A participatory approach incorporates locally relevant social, economic, cultural and scientific concerns into an agreed solution (NIWA, 2011). This is more likely to increase the effectiveness of management methods. NIWA (2011) also identified challenges to participatory approaches and these need to be managed. These include a lack of information or high levels of uncertainty, tensions between local level solutions and national or global interests and that achieving consensus can be difficult. It is important to get the right people around the table, the right stakeholders and the decision makers.

Defining the 'community' or your 'stakeholders' is important to ensuring the right people are involved in the decision making. In the Bay of Plenty it was recognised that there were particular stakeholders in the Region that might be under-represented in public forums. An invited parties session was subsequently held to deliberately invite stakeholders with specific knowledge and interest in decisions affecting risks borne by communities through natural hazard management and to discuss the cost implications of making decisions that affected the choices for future development in the region. Furthermore, following initial sessions it was also determined that there was insufficient participation by young people and by young families. A creative approach to engagement was implemented here, approaching Bay of Plenty Lifeline groups, early childhood education centres and a youth jam centre to run community sessions.

The Christchurch case study identified a range of good practice examples for styles of engagement, including:

- a briefing session/seminar with Council staff and politicians, involving the scientists/engineers, which got Councillors understanding and "lined-up" behind the science;
- good communication information prepared for Councillors to use with their constituents;
- drop-in sessions for members of the public to sit-down with Council planners to understand the plan provisions and their implications (resulting in some good decision making by property owners on rebuilding);
- public seminars with expert presentation on risk management (also recorded and available on-line);
- information sessions for the public on the technical engineering report – with good feedback; and
- using simple examples/analogies to illustrate risk concepts – e.g. comparing return periods and how hazard events happen with the difference between the bus timetable and when buses actually show up.

4.1.5.4 Engagement Outcomes

Successful engagement is likely to exhibit some or all of the following:

- a good degree of consensus is achieved;
- stakeholders are involved in determining what is ‘acceptable’, ‘tolerable’ or ‘intolerable’ risk (important that these key terms are defined throughout the process);
- all issues and matters are addressed, there are no unresolved concerns;
- people understand the bigger context around natural hazards and risk; and
- people understand how to live well and resiliently in their environment.

SNZ HB327:2010 notes that engagement should specifically seek to obtain an understanding of the perceptions of those being consulted. Resolving differences in perceptions and differences in understanding can be assisted by careful preparation, clear definition of issues, choice and definition in the language used, how things are explained and wider scene setting. This approach is clearly outlined in ISO 31000 which discusses context setting as the initial and vital element in the risk assessment process.

Following the withdrawal of the coastal hazard provisions of the Kapiti Coast District Council (KCDC) Proposed District Plan, KCDC has formed a Coastal Advisory Group comprised of statutory agencies and community representatives to guide Council’s future work programme in consultation with the community. The Council has had to go back to the beginning, starting with a wider context and asking the question of ‘what does it mean to live here?’ and ‘how do we live where we live and do so resiliently’. These wider conversations should better be the starting point for engagement.

4.2 Issues and Challenges to Achieving Good Practice

The case studies identified a wide range of issues and challenges to achieving good practice natural hazards risk management in planning. Many of these were also reflected in the literature review. We draw on both of these sources to discuss the challenges.

4.2.1 Clarity about the Overall Objective

There is a lack of clarity and consensus about what the overall objective for managing natural hazards is. There are differing views and drivers. There are strong international drivers on risk reduction and this will strengthen the reduction “R” in New Zealand’s Civil Defence and Emergency Management Framework. As has been noted by a number of commentators, the reduction “R” has lacked and needs national ownership, leadership and coordination (LGNZ, 2014; ICNZ, 2014; GNS 2014; MWH, 2009).

The RMA is an effects-based statute which certainly enables a risk-based approach to managing natural hazards. The functions assigned to councils are, however, expressed in language of avoiding or mitigating natural hazards. This has led to some confusion and a lack of clarity about the desired outcome. The proposed changes to Section 6 of the RMA⁵ will provide some assistance regarding a risk-based approach, but not on the overall outcome that is being sought.

In relation to flood risk, there appears to have been a wide consensus view since 2007/8 that future effort should be primarily directed towards flood risk reduction (reported as a conclusion of the Flood Risk Review by MWH, 2009).

• ⁵ The proposed change is to add “the management of significant risks from natural hazards” to Matters on National Importance in Section 6.

The case study for the Proposed Auckland Unitary Plan (PAUP) revealed the range of views about desired outcomes – ranging from managing, through minimising, not increasing, mitigating, avoiding to reducing risk from natural hazards and further through to the concept of building resilience. There is strong support from many commentators on the concept that risk reduction should be clearly established as an intended outcome (LGNZ, 2014; ICNZ, 2014, GNS, 2014) and for some also the concept of building improved resilience is supported (LGNZ, 2014; Treasury Living Standards and in the text of parts of the PAUP). Indeed the LGNZ think piece recommends that a sector resilience strategy be developed and comments on the limitations of an approach that focuses on reducing discrete risks rather than building overall resilience. In a similar vein, the Insurance Council advocates for building resilience and having a funding mechanism to support it (ICNZ, 2014).

Another element of clarity concerns the level of tolerance and/or acceptance of risk. Lack of a national view on this or an agreed mechanism to define this is a challenge to achieving good practice as raised in a number of the case studies and observed more generally (LGNZ, 2014, ICNZ 2014). Related to this is the principle of a precautionary approach and national level guidance or direction on how this should be applied is also needed (MWH, 2009).

4.2.2 Getting the Context and Scope Right

The challenge of getting the context right for natural hazard risk management processes was identified in several of the case studies. In the Franz Josef case, the focus on a specific plan change was seen to be at the expense of investigating the wider issue of risk or resilience in the context of more than one natural hazard. Participants noted the need to have a bigger conversation in this case study and also in the Christchurch case study. In the Auckland case study there was considerable debate about the difference in the context of greenfield situations or existing developed areas.

The challenge of if, when and how to deal with low probability/high impact natural hazard events arose in the PAUP case study, with low probability events seen to be the domain of emergency response. Other case study participants expressed concern about this issue, for example in relation to Tsunami in the Northland Regional Council case study.

4.2.3 Complexity and Understanding the Science

This issue was evident in most of the case studies and throughout the literature. In the Kapiti case in particular, issues of all parties understanding the science, clarity of communication of science, clarity of roles of scientist/engineers and decision-makers and other stakeholders were all highlighted. This is particularly important when dealing with complex natural processes and uncertainty. Similar concerns were evident in the Christchurch case study. Comments such as “planners in awe of the science” and “communities overwhelmed” illustrate the challenges here.

4.2.4 The Truly Hard Issues

The two linked issues of dealing with existing use rights and managed retreat arise repeatedly in the case studies and throughout the literature (including MWH, 2009; RMA Quality Planning, 2013; GNS, 2014; LGNZ 2014 and most of the MfE guidance documents). Managed retreat was a topic of extensive debate in the early stages of the PAUP mediations on natural hazards. It features significantly in the Franz Josef case study, where some managed retreat has occurred. A strong tool, in the form of regional plan rules, already exists but has not been used. Questions of who and how to fund retreat and what this might look like presented challenges in most of the case studies. There is a clear need for a consideration and provision of an effective mechanism to support good practice on these truly hard issues.

4.2.5 Process Issues

Issues with engagement processes arose in the case studies and is addressed in much of the literature (e.g. EnviroLink, 2012; NIWA 2011). In the Kapiti case, inadequate engagement before notification of the proposed revised district plan and following the 2012 revision of coastal hazard assessment was noted. Also engagement with one group early in the process and other groups emerging at later stages presented significant challenges. In the Franz Josef example members of the community were concerned about the level and timing of consultation with affected parties and delays in formal processes between submissions and hearings created an “in-limbo” concern. In the Bay of Plenty example concerns were identified about having participation from groups that were representative of the community. Timing of engagement was raised as an issue in the Christchurch case study.

The need for engagement at a national level has been raised by a number of commentators, extending back to a recommendation for a local government forum from the Flood Review in 2007/8 (MWH, 2009, LGNZ, 2014).

4.2.6 Information and Mapping

The availability and adequacy of information on natural hazards presents a number of challenges. These include the costs associated with obtaining information and then also maintaining it. The level of detail and how information is presented, including maps, is also highly variable around the country and across different types of hazards. MWH identified inadequate information, issues with how accessible it was (particularly for the public) and resourcing as concerns in relation to flooding hazards (MWH, 2009).

MWH (2016) stocktake report for the Wellington Region noted with concern the trend to reducing the explanatory material in planning documents about natural hazards. It recorded a high variability in the nature, comprehensiveness and consistency of information on different natural hazards held by councils in the Region. The stocktake also noted that the most significant gap in good practice identified in the Wellington Region RMA planning documents was the integration of risk-based planning approach and risk assessment in natural hazard provisions.

A number of commentators have recommended establishing some form of national database or repository for information about natural hazards (MWH, 2009; LGNZ, 2014; ICNZ, 2014). The Insurance Council has noted the importance of information at a national level being of a quality to support cost-benefit analysis of risk reduction measures. The concept of a hazard register on a GIS platform is also promoted on the Quality Planning website, noting the value of this sort of information for education and awareness (RMA Quality Planning, 2013). MWH (2009) also noted the need for information to be available at regional and local levels. Gathering and maintaining information at regional level, in particular, would provide a means of presenting it in the context of the natural environment as regional government boundaries have, for the most part, been based on physical catchments. Availability or ready access at local government level would also be important to support local government functions, including producing LIMs and PIMs.

4.2.7 Using the Tools

There is a range of existing tools available that can be applied to manage natural hazard risk and achieve risk reduction. However, these have often not been used, or not used effectively. MWH (2009) observed that local government has the full spectrum of tools to undertake flood risk reduction, but that non-structural planning tools are not well developed and applied in practice. As noted above, regional rules could be, but to date have not been used to address the challenges of existing use rights and managed retreat.

4.2.8 Matters of Detail

Some issues and challenges are evident from case studies and literature sources that concern important matters of detail. These include:

- definition issues raised in several case studies. In particular, the need to define terms such as “likely” and “potential” where they are used in the New Zealand Coastal Policy Statement;
- clarity and consistency on which scenarios should be used to consider sea level rise or which IPCC emissions scenarios; and
- the best scale to use to address likelihood (e.g. return periods, AEP, word descriptors); how this works for different hazards or when considering multiple hazards; and what stakeholders understand about likelihood (LGNZ, 2014; EnviroLink, 2012; MfE, 2012).

4.2.9 “Spoilers”

Several issues fall within the broad theme of “spoilers”.

The lack of consistency and conflicting drivers from different parts of the regulatory framework relevant to natural hazards is a persistent theme in the literature and in the case studies. In the Kapiti and Christchurch case studies the interplay of information gathering to support a RMA planning process and disclosure requirements on LIMs played out in a way that resulted in planning provisions being withdrawn and changes to LIMs. This tension is felt and concern is expressed around the country by RMA practitioners. Other case studies, including PAUP and Northland Regional Council, raised issues about the interaction of Building Act and RMA requirements. These and the wider issue of needing to have “joined-up” regulatory requirements and responses is raised by LGNZ, the Insurance Council and others (LGNZ, 2014; ICNZ, 2014; GNS, 2014; MWH, 2009).

Timeframe challenges and resourcing challenges arose in case studies. For Bay of Plenty the work on Change 2 to the Regional Policy Statement was driven by a tight Environment Court-determined timetable. In Kapiti the timeframe for notifying a proposed district plan review (as opposed to issuing a draft for wider engagement) created challenges and the highly contentious coastal provisions nearly derailed the entire review process. In addition, the resource requirements to respond to community concerns and multiple official information requests presented a huge challenge for a small team. In the Christchurch example, a streamlined replacement district plan process set tight timeframes and the timing of information and engagement was challenging where the community was already strained and dealing with the impact of the earthquakes.

Inconsistency or what were described as “bad” or “unhelpful” court decisions was raised in case studies and by LGNZ (LGNZ, 2014).

4.3 Overcoming Barriers to Good Practice

Strong themes emerged from the case studies about the opportunity for national guidance to provide leadership and a national view on nationally important issues and concepts. There was the view that national guidance could provide some “whole of country thinking” about difficult challenging matters so that these did not need to be litigated and then re-litigated a local government level.

There was a strong sense that a clear national lead is required on the principle of risk reduction. How and where risk avoidance should be pursued. Also whether, when and how it may or may not be appropriate to pursue “not increasing risk”.

There was a common view that a NPS should embed risk management principles and processes and that national level guidance should cover when, if and how to do quantitative assessment. For some, specific guidance was sought on if, when, and how to address Average Individual Fatality Risk.

There were strong views that national-level engagement and solutions needed to be developed for truly hard issues, including:

- effective mechanisms to deal with existing use rights and achieve managed retreat (including how and who should pay)
- in relation to requirements for LIMs and PIMs, there is a need for a mechanism to create a “safe harbour” to allow information on natural hazards to be obtained, shared, explored and communicated to all parties; without prompting unnecessary, premature and unhelpful alarm and possible outrage about the nature of and inclusion of information on LIMs and the challenge of its impact on individual properties and property owners.

There were common views around the need to national guidance on substantive issues, including:

- setting thresholds for tolerance or acceptability of specific risks;
- providing criteria or other mechanism for determining what risks should be considered to be significant;
- the appropriate application of the precautionary principle;
- describing or prescribing appropriate planning responses to specific risks;
- describing or prescribing means to manage the more difficult types of effects (for example the effects of sea level rise);
- how to carry out appropriate Section 32 analysis, including cost-benefit analysis;
- how to address multiple hazards and cascading effects of natural hazards;
- how to address hazards with low probability of occurrence;
- how to deal with climate change in a nationally consistent manner;
- use of best available information and how to deal with uncertainty;
- transparency and effective communication of science; and
- effective consultation and engagement processes (including education and awareness raising).

Amongst the issues and challenges there was a number of very specific normative matters on which a national position or standard could be developed, including:

- definitions for terms such as likely and potential as used in the New Zealand Coastal Policy Statement;
- what sea level rise scenarios should be used on a nationally consistent basis;
- which IPCC emissions scenarios should be used;
- consistency for timeframes that should be applied in plans;
- consistency on how hazards should be mapped or described in planning documents; and
- use of AEP (probability) rather than return periods to express likelihood.

For some of these matters there was a desire for a process that allowed for rapid update, for example following release of new information from the IPCC.

There was a strong sense of the importance and reliance that councils wish to be able to place on national guidance and sources of trusted information. There were views that national level policy and/or guidance should assist in ensuring better or more consistent outcomes from court decisions.

At a national level, there was a desire for resolution of inconsistencies and for new clarity on the interaction between the RMA and other Acts and legislative instruments (including, Building Act, Building Code, Local Government Act, Local Government Information and Meetings Act requirements for LIMs).

5 Recommendations

Our recommendations for a NPS and other national level guidance or interventions draw on the outcomes of our research and the expertise and experience of the T+T team of natural hazards experts and our independent challenge team. We provide recommendations on:

- the structure and content of a NPS, including some suggested “strawman” text;
- content and nature of supporting guidance and tools;
- the process to develop the NPS and related guidance and tools; and
- other interventions.

We have included some commentary about our recommendations, drawing links to the contextual information on the RMA and wider regulatory and policy environment; and the results of the literature review and case study work.

5.1 Structure and Content of a NPS

5.1.1 NPS Structure

1. We recommend that a NPS on natural hazards should have two main parts:
 - the first establishing a national framework for a risk-based approach to plan for and manage natural hazards under the RMA (the national framework), including;
 - o national level objectives and policies;
 - o specifying requirements for a risk management process to be implemented by Ministry for the Environment, regional councils and district councils when preparing national environmental standard, regional policy, regional plan or district plan provisions that address natural hazards; and
 - the second addressing substantive issues and setting out more detailed normative requirements.

Commentary

The concept of establishing a national framework aligns with ISO 31000 good practice for risk management, which is to establish an overall risk management framework within which a risk management process is implemented. The NPS can establish mandate and commitment (e.g. assigning accountabilities and responsibilities and providing direction on outcomes and resourcing). It can define processes to be followed (e.g. for assessing risk, deciding on risk treatments, monitoring, review and reporting) and timeframes for activities to occur.

The NPS for Freshwater Management 2014 takes a similar approach to structure. The main part of that NPS sets some outcome objectives and policies and specifies a number of process requirements for regional councils. This is supported by normative material in appendices in the form of national values and uses and detailed attribute tables.

The content of substantive issues and normative requirements is discussed in Section 5.1.4 below.

5.1.2 NPS Content – Outcome Objective

2. We recommend that the NPS should contain a clear and strong overarching objective on risk reduction and resilience and associated policies (should content be agreed based on ALARP, for example).

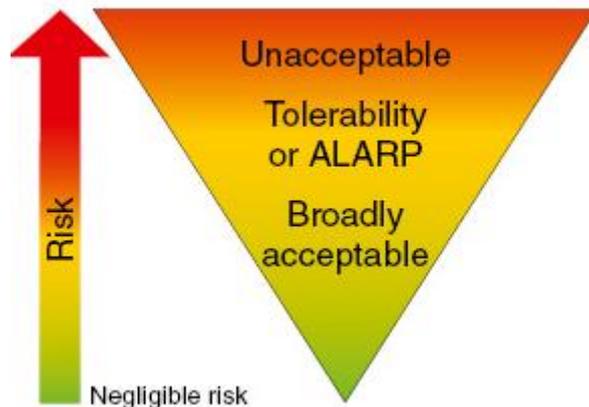
Commentary

New Zealand is a signatory and thereby committed to the Sendai Framework with its strong drivers on disaster risk reduction and resilience as expressed in the expected outcome, goal and targets.

New Zealand’s domestic legislative mechanism for giving effect to the Sendai agreement is primarily through the Civil Defence and Emergency Management (CDEM) Act and its associated framework of strategy and plans. The CDEM Act framework for Reduction, Readiness, Response and Recovery allocates the risk reduction “R” to RMA plans and processes.

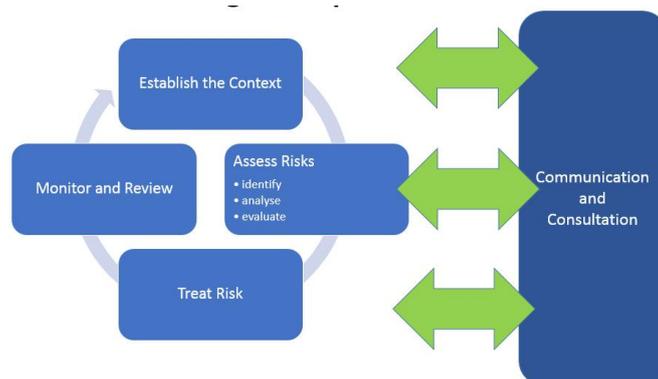
Lack of clarity about this key outcome has been identified as an important issue and challenge to achieving good practice natural hazards risk management in planning in the literature review and in case studies.

ALARP (as low as reasonably practicable) is a principle that is widely applied internationally, in particular in the arena of health, safety and environmental management. It is generally applied to tolerable risks as indicated in the ALARP triangle diagram below. If this concept was considered appropriate to introduce, it could form a basis for expanding the risk reduction and resilience outcome objective with supporting policies. In our view the appropriateness of applying this principle in the NPS is a substantive issue that should be addressed in the national engagement process we discuss in Section 5.3 below.



5.1.3 NPS Content – National Framework

3. We recommend that the national framework specifies a risk management process to be applied by the Ministry for the Environment and councils that is based on the international standard ISO 31000 process as shown below.



4. We recommend that the national framework should require the risk management process to be used in a flexible, iterative and adaptive manner. It should reflect the context and accommodate varying information quality and availability, new information, learning and adaptation (especially over time to accommodate the effects of climate change).

Commentary

The iterative risk management process is the heart of a risk-based approach. Our understanding of natural processes and systems, and the stresses and shocks in those processes and systems that result in natural hazard events, will grow over time. Some of those natural processes and systems are also changing over time, including as a result of climate change and sea level rise. Risk exposure is, in some cases, increasing as development extends into new areas which have remained undeveloped in the past. In addition, community attitude and acceptance of the risks and adverse effects associated with natural hazards will also be subject to change. The risk management process ensures that: context is established for decision making, communities are engaged, an appropriate risk assessment approach is applied, options to manage risk are explored and selected, and there is monitoring and review. Flexibility for the risk assessment process should enable descriptive/qualitative, semi-quantitative or quantitative (or a mix) of approaches to be taken, depending on the context. National guidance material on specific hazards could assist in identifying and recommending the most appropriate risk assessment methods to use.

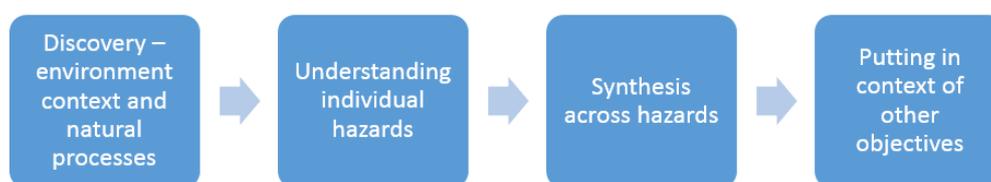
5. We recommend that the national framework assign a strong lead role to regional councils in implementing the risk management process for natural hazards planning and management.

Commentary

This is consistent with the functions assigned to regional and district councils in the RMA and with the requirement for regional councils to allocate responsibilities via provisions in regional policy statements.

This also recognises the practical matters of where the appropriate capacity, capability and resources are most likely to be available, or most likely to be able to be established in a cost-effective manner.

6. We recommend that the national framework require the risk management process to be applied to the following policy and plan-making activities.



Commentary

Understanding natural hazards and how to manage the effects of these should begin with a broad level understanding of the natural processes and systems that give rise to natural hazard events; and the relevant economic, social and cultural context. That context could include development pressures (such as housing affordability and availability), financial constraints, political will or cultural mores. More detailed understanding of specific hazards and the interaction of different hazards can then follow. Finally, proposed means to mitigate or adapt (avoid, remedy or mitigate adverse effects and build resilience) should be considered in the wider context of the communities' and councils' environmental, economic, social and cultural objectives and aspirations, as expressed (or proposed to be expressed) in the relevant policy statement or plan.

Planning processes under the RMA are hierarchical, with high-level regional objectives and policies being established in regional policy statements, then cascading, in turn, through regional and district plans as regional or district objectives, policies, rules and other methods. The four planning activities described here apply across this RMA hierarchy, for example:

- the discovery activity should support developing regional policy statement content (initially in a draft form) and inform work required in more detailed understanding and synthesis activities;
- understanding individual hazard activities should support developing draft possible provisions to include in regional or district plans and refined provisions for regional policy statements;
- the synthesis across hazards activity should support developing a suite of regional and/or district plan provisions in a further draft format; and
- the activity to put the suite of draft provisions in the context of other objectives in regional and district plans should support developing and confirming proposed provisions in regional and district plans .

DISCOVERY

7. We recommend that the national framework require regional councils to take a strong lead in applying the risk management process at a Discovery level.
8. We recommend that the Discovery process focus on a general understanding about natural processes, hazards, the consequences of hazard events and (at an overview level) possible mitigation or adaptation measures, rather than the likelihood or probability of events occurring. The purpose of this is to aid communities to develop a clear understanding of the natural processes, hazards and consequences, and to explore the possibility of no/low regret mitigation or adaptation options.
9. We recommend that the Discovery process be supported by a regionally-based GIS platform.

Commentary

We have used the term “discovery” for the process of building understanding about the natural systems and processes (geological, hydrological and atmospheric) of the region and the stresses and shocks in those that result in natural hazard events. We see this, primarily, as an information gathering process should help identify potential natural hazards and their consequences. It should also identify things that the community values and allow some high-level identification and exploration of possible mitigation or adaptation measures. Information is likely to be of varying nature (descriptive, narrative, traditional knowledge, photographs, diagrams, historical articles, maps, technical reports) and variable quality. Risk assessment approaches and methods will predominantly be descriptive and qualitative.

The recommendation that this be coordinated and led at the regional council level recognises the resource capacity and capability most likely to be available at regional level. It also recognises these boundaries are generally based broadly on physical catchments which is helpful in understanding natural systems and processes. In addition, it provides an opportunity to link with civil defence and emergency management group planning. An important outcome will be the use of this information to inform regional policy statements and spatial planning (including, for example, planning for the location of future development areas). A GIS platform would allow information to be linked to locations. Managed open access could allow stakeholders in the community to contribute and interact with information, including an ability to test values and risk assessment criteria and outcomes.

UNDERSTANDING INDIVIDUAL HAZARDS

10. We recommend that the national framework specify that regional councils should take a lead in applying the risk management process to understand individual hazards, but allow flexibility for that lead to be allocated to district councils for some specific and appropriate hazard types.
11. We recommend that work on individual hazards be focussed on developing a detailed understanding of the natural processes and consequences in terms of potential adverse effects of specific natural hazards, using scenarios representing the range from small-scale, moderate-scale and high/extreme-scale events.
12. We recommend that early conceptual work on benefits and costs be focussed on potential mitigation or adaptation options and look to assess the economic and other benefits and costs that may be associated with building increasing resilience.

Commentary

This application of the risk management process should be focussed on developing a technical (and potentially detailed) understanding of the natural processes and potential adverse effects and consequences of specific natural hazards, as well as the likelihood of the natural hazard events. The purpose of this is to inform regional policy (at a more refined level) and the content of regional or district plan provisions addressing natural hazards. In line with good practice identified in the literature review and case studies, a scenario approach should be applied to present and communicate what small, moderate and large/extreme events could look like. This should enable the spatial extent of potential effects to be shown and mapped for the range of scenarios. It should also provide a basis to identify and explore potential mitigation or adaptation options, and the benefits and costs associated with risk treatment options that could be included in regional or district plan provisions.

Different modelling techniques and approaches to the technical aspects of the risk assessment are likely, depending on the natural hazard. Some approaches may be semi-quantitative or quantitative. It is important that the tools that are used, the assumptions they involve and how they deal with uncertainty is clearly and simply described so that this can be communicated effectively between the engineers/scientists, planners, decision-makers and other stakeholders. A sound understanding about the nature and quality of the information that is available and the implications of uncertainty in our understanding of the natural hazard and its potential effects is important to inform the nature of decisions that need to, or can be, made. For example, where there is a very high level of uncertainty, a more precautionary and adaptive approach may be necessary. The importance of this communication was highlighted in the literature review and in the case studies.

Engagement with stakeholders and communities in this application of the risk management process should be focussed on building awareness and understanding of the potential nature, scale and location of effects and consequences of natural hazard events, along with an understanding about the level of complexity and uncertainty associated with our understanding about the natural hazard. It should test stakeholder and community attitude and likely acceptance of the potential consequences and possible mitigation and/or adaptation options. This will need to include information on the nature and distribution of benefits and costs associated with risk treatment or management options. It is likely that more than one iteration of the risk management process will be required to develop refined regional policy statement provisions and draft provisions for regional and/or district plans, including supporting evaluation of benefits and costs under RMA Section 32.

SYNTHESIS ACROSS HAZARDS

13. We recommend that the national framework require regional councils to take the lead, and work in collaboration with district councils, on this application of the risk management process.
14. We recommend that the synthesis be focused on: understanding the inter-relationships between natural hazards and cascading effects of natural hazard events; and developing a suite of possible provisions to include in regional policy statements, regional plans and district plans.

Commentary

Natural hazards, like natural processes and systems can be inter-related and there may be cascading effects when a natural hazard event occurs. In this application of the risk management process the focus is on understanding the relationships between natural hazards. By considering information on all natural hazards together, the process can be used to consider the different quality of information and levels of uncertainty in the information and how this is reflected in treatment options and responses. The opportunity can be taken to evaluate the interaction, calibration and overall suite and balance of treatment options. The risk criteria and assessment completed will likely be qualitative or semi-quantitative and be centred on the use of a heat map. Some adverse consequences and sensitivity analysis will likely be required including across the benefits and costs evaluations completed for treatment options on individual natural hazards. Engagement with stakeholders and the community will need to confirm that the risk assessment method and the outcomes of the assessment reflect their views and values, as informed by an awareness of risk across all hazards. The outcomes here should be a suite of natural hazards provisions drafted for possible inclusion in regional and/or district plans.

PUTTING NATURAL HAZARD PROVISIONS IN THE CONTEXT OF OTHER OBJECTIVES

15. We recommend that the national framework require regional and/or district councils to apply an overlay test within the risk management process used here to assess the impact of natural hazard provision on other objectives and topics in regional and district plans.

Commentary

Before finalising draft provisions on natural hazards, a fourth application of the risk management process should focus on how these fit within the context of other objectives and provisions in regional policy statements, regional and district plans. In this case the risk assessment process is likely to be based on using an overlay impact test. This would identify and assess how the suite of provisions on natural hazards would affect what and where activities end up being allowed or not allowed, promoted or discouraged. Engagement with stakeholders and communities should test trade-offs that will be associated with confirming or modifying the suite of provisions on natural hazards, or other objectives, policies or provisions in the relevant plan.

5.1.4 Substantive Issues and Normative Material

There are a number of substantive issues and normative matters that should be addressed or included in the NPS. Decisions to include these and on the content should be determined through a process of national engagement as discussed in Section 5.3 below. We have provided some recommendations on these matters as a potential starting point for that engagement. We have indicated some “placeholders” for these matters in the NPS strawman, but have not presumed to prepare draft text.

Significance, tolerance and acceptability of risk

16. We recommend that the NPS should:

- provide criteria or other mechanism to determine what risks (or in what circumstances risks arising from natural hazards) should be considered to be significant; and
- set thresholds for tolerance or acceptability of specific risks, or provide guidance on how this should be carried out in the risk management processes implemented under the national framework.

Commentary

Proposed changes to the RMA will introduce the concept of managing significant risks from natural hazards. The concept is closely related to ideas of setting thresholds for tolerating or accepting/not accepting risks.

The NPS could define risk criteria as provided for in ISO 31000 and further developed in The Handbook to ISO 31000 in the form of:

- descriptors and/or measures for effects or consequences of natural hazard events;
- a means or scale to describe or define likelihood; and
- a means to combine information on consequences and likelihood and describe a level of risk (most commonly in the form of a heat map).

A number of examples of these are available in the literature and have been used in some of the case studies. They have been the subject of mixed success and/or contest and debate, including over the level of quantification.

In our view, flexibility in how risk criteria (as conceived within ISO 31000 and its Handbook) are defined is important to reflect the specific context in which they are to be applied. This should allow for descriptive, qualitative, semi-qualitative or quantitative approaches to be taken, as appropriate. At a NPS level, some broad principles could be provided to guide decisions on significance, tolerance and acceptance and/or a high-level descriptive set of risk criteria could potentially be developed.

Dealing with low likelihood or probability events

17. We recommend that the NPS should expressly require low likelihood or low probability natural hazard events to be considered in risk assessment and could provide guidance on how this can be achieved.

Commentary

The definition of natural hazards (an "*occurrence...which adversely affects or may adversely affect human life, property, or other aspects of the environment*") and meaning of effects (which includes "*any potential effect of low probability which has a high potential impact*") in the RMA, taken together establish a requirement to consider low probability natural hazard events so as to determine if they may result in high potential impacts.

Addressing low probability natural hazard events has proved challenging in RMA processes. The Proposed Auckland Unitary Plan, for example, suggested low probability events could not be addressed in land use planning and should be dealt with under emergency management processes. Attempts to define likelihood/probability scales based on return periods that can be used for all types of natural hazards have also proved challenging (including in the example of the Bay of Plenty Change 2 to the Regional Policy Statement). If a range, or indeed all types of natural hazards are to be considered on a single scale, an extremely extended scale would be required, to

capture very low probability events such as tsunamis and this results in compression (and potential loss of useful resolution) at the higher probability end most relevant for hazards such as storms and flooding. In addition, low probability expressed in the terms of return periods such as 1 in 1000, or 1 in 10,000 years can be difficult for many people to engage with and usefully differentiate between. One possible approach might be to use just a descriptive scale (without quantification) and a skewed heat map (as identified as an option in the ISO 31000 Handbook) when considering multiple hazards and using appropriate quantified scales, when this level of accuracy/precision is helpful to understand individual hazards. A very simple example heat map with skew to ensure low probability events are considered is illustrated below.

		Impact / consequence scale		
		High Impact	Moderate Impact	Low / No Impact
Event Probability	Small (high probability) event	High	High	Low
	Moderate event	High	Medium	Low
	Extreme event (low probability)	High	Medium	Low

Planning Timeframes

18. We recommend that the NPS set requirements or provide guidance on whether, and if so what timeframes that should be considered for addressing natural hazards in regional policy statements, regional and district plans.

Commentary

The New Zealand Coastal Policy Statement requires a timeframe of at least 100 years to be considered for coastal hazards. It is reasonably common and consistent practice to consider 100 year return periods for flooding (dating back to engineering practice for design of flood defences prior to the RMA) and this timeframe has been applied more widely to other natural hazards. Different timeframes apply to other regulations and tools relevant to natural hazards, for example 30 year timeframe for Infrastructure Strategies and Asset Management Planning and a 10 year timeframe for Long Term Community Plans under the Local Government Act. A 50 year return period applies to flood floor level requirements in the Building Code. Design standards (referenced in the Building Code) that address earthquake shaking for residential buildings with a design life of 50 years, require Serviceability Limit State at a 25 year return period event and an Ultimate Limit State (ULS) to a 500 year return period event to be considered (i.e. a 10% chance of occurring over the 50 year design life). ULS single level load ranges from 1:100 – 1:2500 for other types of buildings).

Views on whether and, if so, what timeframe should be considered in land use plans and for natural hazards (and particularly long-term trends such as climate change and sea level rise) are varied. Agreeing on and setting a timeframe in the NPS would provide some clarity, including whether the NZCPS concept of 100+ or some other timeframe should be considered more widely.

Another potential benefit of providing clarity on the timeframe, could be the potential to link this with the concept of likelihood by using an expected probability of an event occurring within the timeframe being considered for the planning activity (rather than the concept of a return period discussed above or AEP – annual exceedance probability - which is often used for planning for flood hazards). Information from the case studies indicated that AEP is generally preferred over a return period approach.

Key principles

19. We recommend that the NPS include objective and policy guidance on use and application of the precautionary principle.

Commentary

The precautionary principle is used in the New Zealand Coastal Policy Statement in relation to coastal hazards, but is not used in the RMA. The way in which the principle has been applied has been the subject of concern (for example in the Kapiti Case Study). It would be helpful for the NPS to include guidance on whether this principle should be applied to natural hazards other than coastal hazards and if so how and when it should be applied. This should clarify how this should be applied by decision-makers and how science and engineering assessment and inputs should recognise this and assist its appropriate application by decision-makers. Considering a range of scenarios may be a better way of addressing this matter.

Existing Use Rights and Managed Retreat

20. We recommend that the NPS include objectives and policies to provide guidance and a framework for regional and district councils to address existing use rights and managed retreat where risks of adverse effects are unacceptable to stakeholders and relevant communities of interest.

Commentary

Addressing existing use rights and achieving managed retreat is one of the truly hard issues in natural hazards planning and came up in most of the case studies and throughout the literature. There are limited examples of the issue being addressed in practice, and to date no examples of the existing tool of regional rules being used to remove the existing use rights constraints and risk treatment options. A national level lead on this through objectives and policies in a NPS could provide the mandate councils are seeking to address this most challenging of issues. How this should be provided and what that lead should comprise should, in our view, be addressed in the national engagement process we discuss in Section 5.3 below.

Definitions

21. We recommend that the NPS use the ISO 31000 definition of risk (including its accompanying notes).
22. We recommend that the NPS define the terms “likely” and “potential”.

Commentary

The definition of risk in ISO 31000 is an important step forward in the approach to risk management internationally. It recognises the importance of understanding and communicating uncertainty as that is crucial information for good decision making. Uncertainty will impact on whether we can achieve our objectives and should also influence what objectives we should set. It will be a significant determinant of the type of decisions we can make. Where uncertainty is high and related to important information, our decisions may need to be precautionary or establish a process to reduce the uncertainty or to monitor, review or adapt our decisions. The notes to the definition are also important as they make the link to how practically risk can be characterised or expressed (some may say “defined”) in specific circumstances or contexts.

The terms likely and potential are used in the New Zealand Coastal Policy Statement, but are not defined. This has caused some concern in case studies and the literature. Providing definitions

that can apply across all hazards would provide clarity and national consistency. How these should be defined should be addressed in the national engagement process we discuss in Section 5.3 below. Considering a range of scenarios may be a better way of addressing this matter.

5.1.5 Strawman Text for NPS

We propose that the following text be considered as a potential starting point for engagement over the content of a NPS. This text is not comprehensive, has not been subject to any legal review and is put forward purely as a strawman to stimulate discussion.

Our “strawman” identifies some important substantive issues that should be addressed in the NPS, but does not include suggested text. As discussed in section 5.3 below, our recommendation is that a national-level engagement process (modelling the use of the risk management process) should be used to establish the context for the NPS, importantly, including establishing the criteria to determine significance, tolerance and acceptability of risks.

Matter of National Importance

The management of significant risks from natural hazards is a matter of national importance⁶.

Objective 1

To build New Zealand’s resilience to the adverse effects of natural hazards on people, property or other aspects of the environment by: and

- avoiding or preventing creating new or increasing existing adverse effects where new development, subdivision or land use change is proposed or occurs
- reducing existing risk of adverse effects, where this is not at a level that is acceptable to the relevant communities of interest.

Objective 2

To establish and implement a risk-based approach to plan for and manage natural hazards in New Zealand.

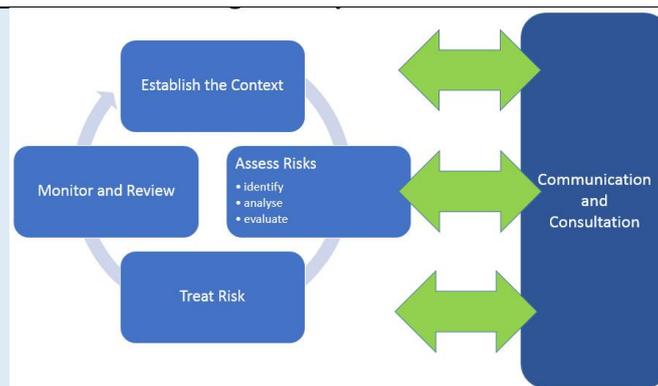
Policies

Risk Management Process

Policy 2.1

A risk management process based on the figure below shall be implemented to develop all national environmental standard, regional policy statement, regional plan and district plan provisions addressing natural hazards.

⁶ This is based on assumption that the proposed change to Section 6 of the RMA is enacted without modification.



Policy 2.2

The risk management process shall be applied flexibly to reflect the context in which, and purpose for which, it is being used. The risk assessment approach and methods to be used shall be determined as part of establishing the context and in consultation with stakeholders and relevant communities of interest.

Policy 2.3

The risk management process shall be applied to the following four steps for developing RMA regional policy, regional plan or district plan provisions on natural hazards:

- building awareness and understanding of natural processes, systems and natural hazards that result from shocks or stresses in those processes and systems;
- developing detailed understanding of individual natural hazards and the potential effects of natural hazard events;
- developing an understanding of the interaction between natural hazards, including cascading effects from natural hazard events; and
- understanding how natural hazard policy and plan provisions best fit within the context of other planning objectives.

Roles and responsibilities

Policy 2.4

The Ministry for the Environment shall prepare, issue and maintain national environmental standards and guidance on risk assessment approaches and outcomes, where there is a need for, or benefit from achieving national consistency.

Policy 2.5

Regional councils shall take a lead role in planning for natural hazards and this shall include:

- building stakeholder and community awareness and understanding about natural processes, systems and hazards in their region
- developing a detailed understanding of individual natural hazards, or allocating responsibility for this for specific and appropriate types of hazards to district councils; and
- synthesising information and providing the basis for potential policy and plan provisions across natural hazards.

Policy 2.6

Regional and district councils shall evaluate the potential impact of natural hazard provisions on other objectives in regional policy statements, regional plans and district plans and whether other provisions need to be amended.

*Engagement***Policy 2.7**

Regional councils shall facilitate an ongoing engagement process with their communities of interest and stakeholders for the purposes of building awareness and understanding of natural processes, systems and hazards in their region; and exploring attitudes to risk and options to mitigate or adapt to the adverse effects of natural hazard events. This process shall be supported by a publicly-accessible, interactive GIS platform that enables a wide range of stakeholders and communities of interest to contribute information (including traditional information from tangata whenua) and to access and interact with information.

Policy 2.8

To aid wide understanding of the potential effects of natural hazards, a scenario approach that presents a range of natural hazard events (at least a small scale, moderate scale and large/extreme scale) shall be used to present and communicate with stakeholders and communities of interest about natural hazards. Information shall clearly communicate uncertainties in information and the understanding or knowledge about events, their consequences or likelihood of occurring.

Policy 2.9

Regional and district councils shall engage with stakeholders and communities of interest on their acceptance of risk of potential adverse effects on human life, property or other aspects of the environment that may result from natural hazard events; and on mitigation or adaptation measures to avoid, mitigate or remedy those effects and build resilience. That engagement shall include considering the benefits and costs of mitigation or adaptation options and the distribution of those benefits and costs.

Objective 3

Criteria or other mechanism to determine significance, tolerance or acceptability of risks of natural hazards.

Objective 4

Dealing with low likelihood or probability events.

Objective 5

Planning timeframes.

Objective 6

Precautionary principle.

Objective 7

Existing use and managed retreat.

Definitions

Risk: Effect of uncertainty on objectives.

NOTES

- *an effect is a deviation from the expected (positive and/or negative)*
- *risk is often characterised by reference to potential events and consequences, or a combination of these*
- *risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.*

Likely

Potential

5.2 Content and Nature of Supporting Guidance and Tools

23. We recommend that the NPS be supported by a suite of guidance documents and tools⁷ building on, updating and adding to those already in place.

Commentary

A number of existing guidance documents are in place and were included in the literature review. A review and update to the Coastal hazards and climate change guidance manual is currently in progress. These documents provide a vehicle to cover particular issues, topics and hazards in more detail and a more flexible means to communicate and update elements of good practice.

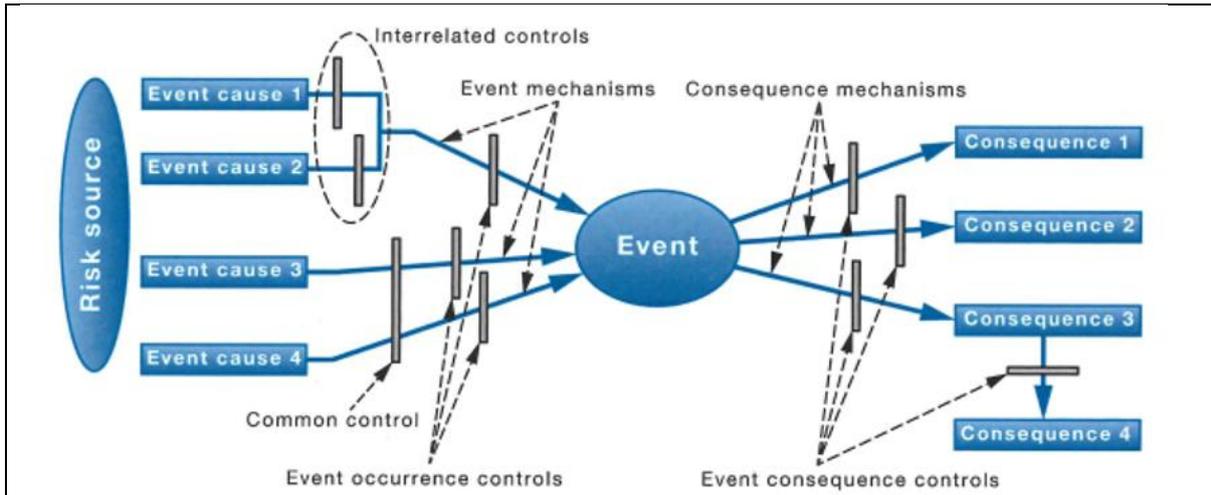
24. We recommend that guidance documents use or recommend the use of two unifying concepts:
- a systems mapping tool, such as the bow-tie or the Source-Pathway-Target-Consequence, on a GIS platform to organise information and understanding about how natural hazards sit within geological, hydrological and meteorological systems at a regional level; and
 - the Swiss cheese or similar model to aid understanding of the connections, processes and probabilities (and related uncertainties) associated with how natural hazard events “play out” to result in effects on life, property or other aspects of the environment.

Commentary

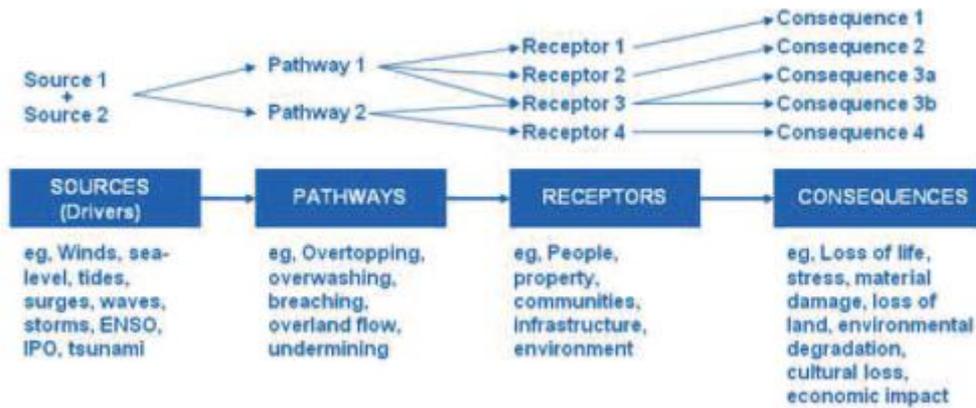
Systems thinking is fundamental to understanding natural processes and how stresses and shocks in these can result in natural hazard events occurring. It is also essential to understand how natural hazard events result, or may result in effects on human life, property or other aspects of the environment, including cascading effects. In addition, systems thinking enables potential intervention points and means to be identified and tested for effectiveness.

We are recommending two types of tools to be embedded, as appropriate, in guidance material that supports the national framework in the NPS. The first tool, the bow-tie system mapping tool is introduced in the ISO 31000 Handbook and is illustrated below (extracted from the Handbook).

⁷ Tools could include the RMA Plan Templates



The Source-Pathway-Target-Consequence tools is a similar systems mapping tool, used in environmental impact assessment and referenced in the current version of the Coastal Hazards and Climate Change Guidance Manual (extract shown below)



The Swiss Cheese model is commonly used in health and safety analysis as a tool to identify “gaps” in controls that may result in an incident occurring. It is illustrated below.



These tools are useful to understand natural processes and natural hazards. They are a means to analyse and collate information about the processes and the inter-relationships involved. They are useful to support interdisciplinary work and to communicate knowledge and information about the science and processes. The following questions can be asked at each point in the Bow-

tie or Source-Pathway-Target-Consequence diagram bow-tie and in relation to each hole in the cheese:

- What are the relevant characteristics?
- Why are they relevant?
- What do we know about them?
- What is the quality of that information?
- What do we not know?
- How important is information about this characteristic and uncertainty about what we know?
- Is there value in improving information and reducing uncertainty on this? Will this help us make a better decision?
- How could we do that and what could that cost?

25. We recommend that the following matters be addressed, as required, in detail, in guidance documents and tools:

- developing, using and maintaining a GIS platform to support multi-stakeholder engagement and awareness raising about natural processes, systems and hazards and the effects of natural hazard events;
- detailed technical requirements and methods to complete risk assessment for specific hazard types;
- describing or prescribing appropriate planning responses to specific risks;
- describing or prescribing means to manage the more difficult types of effects (for example the effects of sea level rise);
- how to carry out appropriate Section 32 analysis, including evaluating benefits and costs;
- how to address multiple hazards and cascading effects of natural hazards;
- how to deal with climate change in a nationally consistent manner;
- use of best available information and how to deal with uncertainty;
- transparency and effective communication of science;
- effective consultation and engagement processes (including education and awareness raising);
- what IPCC emissions scenarios should be used;
- what sea level rise and rainfall scenarios should be used on a nationally consistent basis;
- consistency on how hazards should be mapped or described in planning documents; and
- use of AEP (probability of occurrence which might also be expressed in relation to design life) rather than return periods to express likelihood.

Commentary

This recommendation includes a long potential “shopping” list for material to be potentially covered in national guidance, based on matters identified in the case studies and literature review. We have included a suggested policy (Policy 2.4) in the NPS strawman assigning a responsibility to Ministry for the Environment to prepare, issue and maintain national guidance, where there is a need or benefit from achieving national consistency. In our view the Ministry for the Environment should also be guided by the output of the national engagement process we discuss in Section 10.3 to identify needs for, and benefits of providing, national guidance.

5.3 The Process to Develop the NPS and Related Guidance and Tools

26. We recommend that a national engagement process, modelled on the Land and Water Forum, be completed to develop the content (and in particular the substantive and normative content) of the NPS and to outline the content and needs for related guidance and tools, before formal statutory processes for a NPS are commenced. This represents an important opportunity, at the national level, to model the use of the risk management process and its early engagement to establish context, including criteria such as those to define significance, tolerance and acceptability of risk.
27. We recommend that the national engagement process be coordinated with the process Civil Defence and Emergency Management is engaged in to develop a New Zealand Resilience Strategy (the review of the Civil Defence and Emergency Management Strategy) and continue beyond the completion of the New Zealand Resilience Strategy.

Commentary

There will be a wide range of opinions and positions amongst stakeholders on most aspects of the possible content of a NPS on natural hazards, as well as any associated guidance and other interventions. As demonstrated by the case studies, risk treatment and management solutions for natural hazards can generate high levels of anxiety and outrage. This is a situation that is similar to the challenges that led to the establishment of the Land and Water Forum, charged with addressing intractable and difficult water and land management issues on a nationwide, multi-stakeholder, collaborate basis.

Case studies where information on LIMs has been revisited and proposed planning provisions have been withdrawn have shown the need for a wider engagement over a longer timeframe. For example in the Christchurch City Council case study a key lesson was the need to engage about how “we” can live in the environment and with the natural hazards it presents. A similar outcome has occurred in the Kapiti case study and to some extent in the Franz Josef case study. In all these cases, a much longer timeframe, over years rather than months, is now considered to be necessary. Northland Regional Council’s Regional Policy Statement has provided for a staged process to address different hazards and to address existing use issues through a regional plan process that is yet to commence.

In our view a national multi-stakeholder, collaborative engagement process similar to the Land and Water Forum is required to address the challenges central and local government, communities and other stakeholders face in planning for and managing natural hazards. There is a need for “joined-up” responses and solutions for New Zealand Inc. The National Resilience Strategy work of CDEM is an opportunity to begin a national level process.

5.4 Other Interventions

28. We recommend that other interventions be considered, as required, to establish a “safe harbour” to allow information on natural hazards to be obtained, shared, explored and communicated to all parties; without prompting unnecessary, premature and unhelpful alarm and possible outrage about the nature of and inclusion of information on LIMs and the challenge of its impact on individual properties and property owners.

Commentary

District councils around the country are struggling with conflicting needs and obligations:

- the need to be able to engage effectively with their stakeholders and communities of interest about information on natural hazards for the purpose of developing appropriate planning provisions under the RMA; and

- the obligation under the Local Government Official Information and Meetings Act (LGOIMA) to disclose information they have about properties in LIMs (and to a much lesser extent on PIMs under the Building Act).

The Kapiti and Christchurch case studies demonstrate how this can play out in significant anxiety and outrage and derail effective planning processes. In our view, an intervention is needed to provide an opportunity for councils, stakeholders and communities of interest to engage constructively and build their collective understanding of natural hazards and explore options to avoid, remedy or mitigate adverse effects without unhelpful pressure and anxiety about information on LIMs or PIMs. We have referred to this as a “safe harbour”. This could potentially be created by providing guidance under the LGOIMA and Building Act about how information about natural hazards is referenced in LIMs and PIMs when it is still in a “discovery” or awareness raising stage and before any decisions are made about what provisions, rules or requirements could or will apply to specific properties. In our view it is still important that land owners and potential purchasers are alerted to information via LIMs and PIMS, but that should not prompt and assist awareness rather than premature alarm. If guidance is not sufficient to achieve this, amendments to LGOIMA and/or the Building Act may be required.

- 29 We recommend that other interventions be considered to enable more effective interactions between the resource management, local government, building and civil defence and emergency management regulatory regimes and ultimately “joined-up” resilience outcomes.

Commentary

Issues and concerns about inconsistencies and apparent conflicting needs, drivers and obligations in the various regulatory requirements that apply to local government and natural hazards management were consistently raised in the literature and the case studies. There have been many calls to resolve some of these issues. A NPS under the RMA will not provide a mechanism to resolve these, however, a national engagement process as discussed in Section 10.3 could provide a forum to develop solutions that likely will include the need for some legislative change.

6 Acknowledgements

Tonkin + Taylor Team of Experts:

- Marje Russ, Executive Director, Project Lead and Coordinator

Planning team:

- Reuben Hansen, Principal Resource Management Specialist
- Emma Brosnahan, Senior Resource Management Planner

Technical team:

- Richard Reinen-Hamill, Technical Team Lead
- Mike Jacka, Technical Lead (Earthquake and Subsidence)
- Dr Tom Shand, Technical Lead Coastal (tsunami, coastal erosion and sea level rise)
- Dr Tim Fisher, Technical Lead (Flooding, Fluvial Erosion and Sedimentation)
- Dr David Milner, Technical Lead (Volcanic, Geothermal and Landslip)
- Charlotte Reed, Technical Lead (Drought and Climate Change)
- Nick Rogers, Natural Hazards Specialist.

The Independent Challenge Team:

- Sylvia Allan, Director, Allan Planning and Research
- Gerard Willis, Director, Enfocus Ltd
- Ian Harrison, CBA expert, Tailrisk Economics

7 Applicability

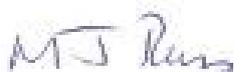
This report has been prepared for the exclusive use of our client Ministry for the Environment, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

Authorised for Tonkin & Taylor Ltd by:



.....
Marje Russ
Project Manager

.....
Richard Reinen-Hamill
Project Director

29-Jun-16

\\albtpfile.ttgrouplocal\data\rep\aukland\live\tt\projects\31463\31463.0010\issueddocuments\mjr300616_nps_natural hazards framework_final report.docx

References & Bibliography

- Allan, S. and Fowler, R. 2014. Independent Review of the Kapiti Coast Proposed District Plan.
- AS/NZS ISO 31000:2009. Joint Australian New Zealand International Standard. Risk management –principles and guidelines. AS/NZS ISO 31000:2009, 20 November, 2009.
- Auckland Council, 2014. Natural Hazard Risk Communication Toolbox: Natural Hazard Risk Management Action Plan.
- Auckland Council, 2014. Hearing Topic RPS 006 Natural Resources, Natural Hazards: Parties and Issues Report. Released on 6 November 2014 to incorporate outcomes from the hearing direction setting meeting.
- Auckland Council, 2014. Mediation Record for Hearing topic 006 RPS Natural Resources B.6.7 Natural Hazards, Mediation of proposed track changes to B.6.7. Friday 24 October 2014.
- Auckland Council, 2015. Mediation Joint Statement for Hearing Topic 022 Natural Hazards and Flooding, Reconvened Mediation. Dated Monday 29 and Tuesday 30 June 2015.
- Auckland Council, 2015. Hearing Topic 022 Natural Hazards and Flooding: Parties and Issues Report updated and released on 3 July 2015 after Interim Guidance and 2nd round of mediation.
- Auckland Council, 2015. Interim Guidance Text for RPS General: PAUP Chapter B – Regional Policy Statement. Issued 9 March 2015.
- Auckland Council, 2015. Interim Guidance Text for Topic 022 Natural Hazards and Flooding. Issued 5 May 2015 – updated 10 June 2015.
- Auckland Council, 2015. Updated Interim Guidance Text for RPS Topic 11: PAUP Section B8.3 – Rural Subdivision. Issued 10 June 2015.
- Bay of Plenty Regional Council, 2015. Proposed Change 2 (Natural Hazards) to the Bay of Plenty Regional Policy Statement: Amended in accordance with Council decisions on submissions. Clear copy 3 December 2015, version 9.0b.
- Carley, J. Komar, P., Kench, P. and Davies, R. 2014. Coastal Erosion Hazard Assessment for the Kapiti Coast: Review of the Science and Assessments undertaken for the proposed Kapiti Coast District Plan 2012.
- Christchurch City Council, 2015. Response to Parliamentary Commissioner for the Environment Report on sea level rise. Report to the Christchurch City Council, reference 15/1486480.
- Deloitte, 2013. Building our Nation's Resilience to Natural Disasters, Australian Business Roundtable for Disaster Resilience and Safer Communities.
- Deloitte, 2014. Building an Open Platform for Disaster Resilience Decisions, Australian Business Roundtable for Disaster Resilience and Safer Communities.
- Department of Conservation, 2010. New Zealand Coastal Policy Statement. Department of Conservation, issued by notice in the New Zealand Gazette on 4 November 2010.
- ECA, 2009. Shaping Climate-Resilient Development: A Framework for Decision-Making. A report of the Economics of Climate Adaptation Working Group, Economics of Climate Adaptation.
- EnviroLink, 2012. Defining Coastal Hazard Zones for Setback Lines: A Guide to Good Practice. Doug Ramsay, NIWA, Bronwen Gibberd, 4D Environmental Ltd, Jim Dahm, Eco Nomos Ltd, Rob Bell, NIWA.
- GNS, 2015. Natural Hazards: RMA plan analysis to manage existing use rights and implementation of the New Zealand Coastal Policy Statement 2010. WSA Saunders, M Ruske, MA Coomer, GNS Science Report 2015/30, August 2015.

- GNS, 2012. Putting Risk in the RMA: Technical Advisory Group recommendations on the Resource Management Act 1991 and implications for natural hazards planning. WSA Saunders, JS Beban, GNS Science Miscellaneous Series 48, August 2012.
- GNS, 2013. Risk Based land use planning for natural hazards risk reduction, GNS Science Miscellaneous Series 67, September 2013. WSA Saunders, JG Beban, M Kilvington.
- GNS, 2014. Analysis of natural hazard provisions in regional policy statements, territorial authority plans, and CDEM Group Plans, GNS Science, May 2014.
- GNS, 2014. Case studies on national and international approaches to risk reduction through land use planning. WSA Saunders, JG Beban, T Taig, B Morris, DH Mieler, CI Massey, GNS Science Report 2014/46, July 2014.
- Grace, E.S. 2016, Good Practice Case studies of regional policy statements, district plans, and proposed plans. GNS Science Report 2015/03, ES Grace, WSA Saunders, January 2016.
- GSC, 2015. Risk based Land-use Guide: Safe Use of Land Based on Hazard Risk Assessment, Volume 1. LC Struik, LD Pearce, F Dercole, J Shoubridge, S van Zijll de Jong, JD Allan, NL Hastings, JJ Clague, Geological Survey of Canada, 2015.
- Haasnoot M. et al, 2013. Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. Global Environ Change
- ICNZ, 2014. Protecting New Zealand from Natural Hazards: An Insurance Council of New Zealand perspective in ensuring New Zealand is better protected from natural hazards. Insurance Council of New Zealand, October 2014
- IPENZ, 2012. A Safer New Zealand: Reducing our exposure to natural hazards. Institute of Professional Engineers New Zealand, October 2012.
- Kilvington, M. and Saunders W.S.A 2015 "I can live with this", The Bay of Plenty Regional Council Public Engagement on Acceptable Risk.
- Kwadijk et al, 2010. Using adaptation tipping points to prepare for climate change and sea level rise: a case study in the Netherlands. John Wiley & Sons Ltd, 2010.
- Land Use Planning for Natural Hazards, New Zealand Centre for Advanced Engineering, April 2009.
- LGNZ, 2014. Managing natural hazard risk in New Zealand – towards more resilient communities: A think piece for local and central government and others with a role in managing natural hazards. Local Government New Zealand, October 2014.
- Local Government and Environment Select Committee, 2016. Report from the Parliamentary Commissioner for the Environment, Preparing New Zealand for rising seas: certainty and uncertainty. Report of the Local Government and Environment Committee, NZ House of Representatives, Undated.
- MfE, 2008. Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand. 2nd edition. Revised by Ramsay, D, and Bell, R. (NIWA). Prepared for Ministry for the Environment, July 2008.
- MfE, 2008. Climate Change Effects and Impacts Assessment: A Guidance Manual for Local Government in New Zealand – 2nd Edition. Ministry for the Environment May 2008. Mullan B, Wratt D, Dean S, Hollis M, Allan S, Williams T, Kenny G.
- MfE, 2009. Preparing for coastal change: A guide for local government in New Zealand. Ministry for the Environment, March 2009.
- MfE, 2010. Tools for Estimating the Effects of Climate Change on Flood Flow: A Guidance Manual for Local Government in New Zealand. Ministry for the Environment May 2010. Woods R, Mullan AB, Smart G, Rouse H, Hollis M, McKerchar A, Ibbitt R, Dean S, Collins D.

- MfE, 2010. Preparing for Future Flooding: A Guide for Local Government in New Zealand. Ministry for the Environment May 2010.
- MfE, 2014. A Guide to section 32 of the Resource Management Act 1991, incorporating changes as a result of the Resource Management Amendment Act 2013.
- MWH 2009. A Strategic Framework and Practical Options for Integrating Flood Risk Management – to reduce existing flood risk and the effects of climate change. Prepared for Ministry for the Environment by Judy Lawrence, PS Consulting & Sylvia Allan, MWH, February 2009
- MWH, 2016. Wellington Regional Natural Hazard Management Strategy, Stocktake and Issues Report. Prepared for Greater Wellington Council, April 2016.
- Northland Regional Council, 2009. Northland Regional Policy Statement – 10 year Efficiency and Effectiveness Review, December 2009, Section 11 Natural Hazards.
- Northland Regional Council, 2012. Section 32 Analysis Report: Proposed Regional Policy Statement for Northland.
- Northland Regional Council, 2015. Proposed Regional Policy Statement for Northland – Appeals Resolution, 31 March 2015 – Tracked Changes.
- NIWA, 2011. Coastal Adaptation to Climate Change: Pathways to change. Britton, R, Dahm J., Rouse, H., Hume, T., Bell, R., Blackett. P.
- NIWA, MWH, GNS and BRANZ, 2012. Impacts of Climate Change on Urban Infrastructure and the Built Environment: Toolbox Handbook.
- NIWA, MWH, GNS and BRANZ, 2012b. Tool 1.3: An Introduction to Risk Assessment, Impacts of Climate Change on Urban Infrastructure and the Built Environment. Oldfield. S.G. 2012.
- NZS 9401:2008. Managing Flood Risk – A Process Standard. Standards New Zealand, Wellington.
- PCE, 2015. Preparing New Zealand for rising seas: Certainty and Uncertainty. Parliamentary Commissioner for the Environment, November 2015.
- QRA, 2012. Planning for stronger, more resilient floodplains: Part 1 Interim measures to support floodplain management in existing planning schemes. Queensland Reconstruction Authority.
- Quality Planning, 2016. Natural Hazards/ Risk based approach to planning for natural hazards. www.qualityplanning.org.nz. Ramsay et al, 2012. Defining coastal hazard zones for setback lines: A guide to good practice. Ramsay D, B, Dahm J, Bell RG. National Institute of Water and Atmospheric Research Ltd, New Zealand.
- RMA Quality Planning, 2013. Plan Topics Natural Hazards. The RMA Quality Planning Resource.
- SA/SNZ HB 436:2004. Risk Management Guidelines: Companion to AS/NZS 4360:2004. Standards Australia/Standards New Zealand, Reissued December 2005.
- SA/SNZ HB 436:2013. Australian/New Zealand Handbook: Risk management guidelines – Companion to AS/NZS ISO 31000:2009.
- Shand, R. 2008. Kapiti Coastal Erosion Hazard Assessment, Coastal Systems Ltd.
- SNZ HB 4360:2000. New Zealand Handbook: Risk Management for Local Government. Standards New Zealand.
- SNZ HB 327:2010. Communicating and consulting about risk. Standards New Zealand 2010.
- The Treasury, 2015. Guide to Social Cost Benefit Analysis. New Zealand Government, July 2015.

- Tonkin & Taylor Ltd, 2015. Coastal Hazard Assessment: Stage two, Prepared for Christchurch City Council (job number 851857.001 v2.1).
- UNEP, 2014. The PSI Global Resilience Project: Building disaster-resilient communities and economies. Part one of a research series by the UNEP FI Principles for Sustainable Insurance Initiative. United Nations Environment Programme Finance Initiative June 2014.

Appendix A: Key Characteristic/Aspects for a Risk-based Framework

Key Characteristics/Aspects for a Risk-based Framework: preliminary thinking

For discussion 15 March

Characteristic/Aspect		Notes
<i>Definition of Risk</i>	<p>Will use the ISO 31000 Risk Management standard⁸ definition</p> <p><i>Effect of uncertainty on objectives.</i></p> <p><i>Notes:</i></p> <ul style="list-style-type: none"> <i>an effect is a deviation from the expected (positive and/or negative)</i> <i>risk is often characterised by reference to potential events and consequences, or a combination of these</i> <i>risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.</i> 	<p>This forward looking framing of risk is current best international practice thinking and a significant change in approach from previous risk management standards. It is particularly helpful in the context of natural hazards management under the RMA, because it:</p> <ul style="list-style-type: none"> uses the term effect (which is fundamental in the RMA) focusses attention on objectives (in the case of the RMA this is, at the broadest, the sustainable management purpose and in turn the objectives and policies in policy statements and plans) brings the concept of uncertainty to the fore supporting a wider range (flexibility) of options for how risk can be characterised or expressed (as shown in the notes). This will enable the framework development to consider qualitative, semi-quantitative and quantitative approaches (as appropriate to circumstances) and options other than the simple likelihood x consequence formula. Alternatives include, for example, the risk triangle (exposure, vulnerability, hazard) or formulations that consider combinations of hazard, exposure, vulnerability and capability.
<i>Uncertainty</i>	<p>Will use the ISO 3100 definition and concept</p> <p><i>The state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequences or likelihood.</i></p>	<p>Uncertainty will exist over most information related to the location, frequency and magnitude of natural hazards and their effects. Use of this concept in the risk framework will focus attention on the nature, utility and quality of information and how this can and should influence analysis, judgements and decisions.</p>
<i>Natural hazards</i>	<p>Will apply to all natural hazards as defined by the RMA</p>	<p>Important elements of this definition, and helpful in the context of a risk-based framework, include the:</p>

⁸ AS/NZS 4360: 1999 Risk Management on which a number of other approaches have been based has been superseded by ISO 31000: 2009 Risk Management – Principles and guidelines

Characteristic/Aspect		Notes
	<p><i>Any atmospheric, 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, the economy or other aspects of the environment.</i></p>	<ul style="list-style-type: none"> • wide scope of hazard types = “risk sources” in risk management language • concept of occurrence = “event” in risk management language • concept of link between event and effects - “<i>the action of which</i>” • focus on effects and wide range of receptors “<i>human life, property and other aspects of the environment</i>” • use of the words “<i>may adversely affect</i>” – introducing concepts of probability or likelihood
<p><i>Effects</i></p>	<p>The RMA definition of Effects will be important to underpin the framework</p> <p><i>Unless the context otherwise requires, the term effect includes (a) any positive or adverse effect and (b) any temporary or permanent effect and (c) any past, present or future effect and (d) any cumulative effect which arises over time or in combination with other effects - regardless of the scale, intensity, duration or frequency of the effect and also includes (e) and potential effect of high probability and (f) any potential effect of low probability which has a high potential impact.</i></p>	<p>This definition sets up key concepts that are fundamental to a risk-based approach, including consideration of:</p> <ul style="list-style-type: none"> • positive or negative • temporary or permanent • present or future • cumulative - over time which is particularly important for impacts of climate change • cumulative – with other effects which is important for considering cascading effects of hazard events. <p>Most importantly it expressly includes potential effects of low probability which have high potential impact – which will be the case with many natural hazards.</p>
<p><i>First address and understand effects / consequences</i></p>	<p>We anticipate that the framework will direct/guide users to focus first on information on the potential effects or consequences of natural hazard events.</p>	<p>Event scenarios representing extreme, moderate and more minor consequences/effects could be used to provide information that represents the full range of high probability to low probability events and can “show” what they may “look like”. It will be important here to accommodate and be transparent about the nature and quality of information that is available and how to manage uncertainty in the information. Also important will be guidance on improving information quality over time.</p>
<p><i>Then introduce likelihood concepts</i></p>	<p>We anticipate that the framework will provide a range of options for addressing likelihood and combining this with consequence.</p>	<p>This will be important to provide the flexibility required to accommodate different levels of information available (and uncertainty about this) and different nature and levels of decisions needing to be made.</p>

Characteristic/Aspect		Notes
<i>Include guidance on engagement</i>	The framework will expressly address key engagement requirements to establish tolerance/acceptability of risk.	<p>We anticipate that this will cover separate engagement activities/processes to explore/test risk appetite with stakeholders/communities on:</p> <ul style="list-style-type: none"> • effects/consequences (and probably also mitigation/adaptation options/costs at a very broad level) • risk (including information on likelihood) associated with the hazard consequences.

Appendix B: Case Study Records

Bay of Plenty Regional Policy Statement (Proposed Change 2):

To insert natural hazards provisions into the Operative Bay of Plenty Regional Policy Statement

Dates	2014 - 2016
Background Summary	
January 2014 – May 2014	Work stream was initiated to facilitate community involvement in the process, specifically around the question of what was “acceptable”, “tolerable” or “intolerable” natural hazard risk (Kilvington and Saunders 2015).
October 2014	Change 2 was publicly notified and 35 submissions were received
December 2014	Summary of decisions requested in submissions was notified and 18 further submissions were received. The key submission issue was around the default risk assessment methodology (Appendix K) and it was requested that the methodology was tested. A consultant was commissioned to test the application of the methodology to ‘real world’ scenarios. The consultant’s overall finding was that Proposed Change 2 is workable, and with appropriate analysis and judgement can be implemented successfully.
June 2015	Hearing committee heard submissions and further submissions. The hearing was adjourned to allow staff to prepare a supplementary report responding to matters raised during the hearing by submitters and the hearing committee.
August 2015	Presentation of supplementary report.
October 2015	Council decisions on submissions notified 20 th October
December 2015	An appeal lodged with the Environment Court against Council’s decisions: ENV-2015-AKL-000151 Te Tumu Landowners Group, Te Tumu Kaituna 14 Trust, Te Tumu Kaituna 11B2 Trust, Ford Land Holdings Pty Ltd & Carrus Corporation Limited. Tauranga City Council joined proceedings as a Section 274 party.
May 2016	Environment Court issued consent order on appeal.
Current Status	
Consent order will now go to Council so that Change 2 can be made operative and be incorporated in the existing Regional Policy Statement (may occur in June). Council has undertaken to produce guidance on the implementation of Change 2 and its default method (Appendix K) to accompany the Change being made operative.	
Elements of Good practice	
Information identified from references	
Approach to public engagement	
<ul style="list-style-type: none"> The “I can live with this” project was based on good public engagement practice – as recommended in Quality Planning guidance and the IAP2. The process was also specifically designed to meet some of the unique challenges of communication on risk, particularly the need for engagement processes that: 	

- Build capacity for judgment by providing a means for people to understand complex risk concepts; consider the implications for themselves and their community; and enable them to realistically reflect on both the consequences and likelihood of natural hazard events before making decisions about risk acceptability, and
- Link judgements on risk acceptability to implications for local government policy or action (Kilvington and Saunders 2015).

Core elements of the engagement process

- Good interdisciplinary collaboration; planners, scientists, engineers, iwi, community members etc.
- Use of risk based planning framework and the resources provided in the Risk Based Planning Approach (RBPA) toolkit from GNS
- Adaptive approach
- Semi structured approach of focus group methodology with public meeting design and took people through 5 step process of developing understanding and making judgements (Kilvington and Saunders 2015).

Proposed Change 2 (see references for version)

Introduction	Natural hazard policies
<ul style="list-style-type: none"> • Reflects RMA definition of natural hazards including effects on other aspects of the environment (but not followed through consistently as reference to other environmental aspects is dropped in later text). • Identifies links with Civil Defence and Emergency Management and risk reduction function of RMA planning. • References CDEM Group Plan information on natural hazards. • Good text on Maori view and information on natural hazards. • Recognises responsibilities of territorial authorities for LIMs and PIMs. • References ISO 31000 and its risk management process (but does not pick up on ISO 31000 definition of risk). • Good general text on uncertainty 	<ul style="list-style-type: none"> • Risk management approach includes low likelihood events (NH 1B) • Recognises need for fast and longer-timeframe responses to high risks (NH 6B) • Provides for staged work to map hazard susceptibility (NH 3A) • Recognises role of regional rules related to existing use rights (NH 13C) • Allocates responsibilities between regional and district councils. <p>(Note that the policy numbering may change with Change 2 is merged into the operative RPS.)</p>

Information identified from interview

- Community engagement involved regional council communications and public engagement staff and engagement staff from district councils. One-day workshop with academic input to design community engagement process – clear view that the people affected by a risk should be involved.
- Community, technical specialist and lifeline personnel input to setting risk tolerance thresholds.
- Councillors aware of CDEM plans and processes and insisted on link between the Regional Policy Statement and CDEM.
- One of the drivers for taking a risk-based approach was to ensure that natural hazards with a low likelihood of occurrence would be considered.

What did not work so well? (issues and challenges to achieving good practice)

Information identified from references

Although BOPRC took an inclusive approach to engagement, the number of people consulted was small. This was due to a constraint on time (due to Environment Court directed timeline) and the complexities of engaging with a large number of members of the public. The BOPRC had discussed the use of an online survey but decided against this and went for more detailed workshop sessions with key members of the community, raising questions of representativeness.

Information identified from interview

- Getting representative community input (sample size for statistical significance and some “self-selection” for participants). Did link up with Council’s Youth Jam programme to get high school student involvement.
- Decision to use a workshop approach rather than an online survey was cognisant of the need to manage potential participant anxiety about natural hazard risks, which could better be done in a workshop environment.
- Timeframe constraints on the engagement process.
- How the default method deals with likelihood scales – some concern about how these work between different parts of the methodology.

Key Lessons (what would/could have overcome barriers/issues that should be covered in a possible NPS and other interventions)

Information identified from references

- Use AEP language rather than return periods.
- National guidance setting, or about how to establish, thresholds for acceptability of risk or significance of different consequences.
- National guidance on how to deal with multiple hazards and cascading effects.
- National guidance on planning timeframes that should be used and how to use them.
- Ability for national guidance to be rapidly updated – especially to reflect updated sea level rise information from IPCC.
- National guidance on how to deal with more difficult types of effects (for example economic and on other aspects of the environment).

References

- M. Kilvington and W.S.A. Saunders 2015 “I can live with this” The Bay of Plenty Regional Council public engagement on acceptable risk.
- Proposed Change 2 (Natural Hazards) to the Bay of Plenty Regional Policy Statement: Amended in accordance with Council decisions on submissions. Clear copy 3 December 2015, Version 9.0b

People Interviewed

Martin Butler, Regional Planner, Bay of Plenty Regional Council

Christchurch City Council, Coastal Hazards Information on LIMs and Provisions in Replacement District Plan

Dates	2014 - 2016
Background Summary	
July 2014	<p>Under the Canterbury Earthquake Recovery Act, Government directed Christchurch City Council to complete a new District Plan (Christchurch Replacement District Plan) by March 2016. This was to be completed following a special fast-track process.</p> <p>The expectations for Plan in the Order included: <i>"Facilitating and increase in the supply of housing ...having regard to constraints on environmental and infrastructure capacity, particularly with regard to natural hazards"</i> <i>"Sets a clear direction on the use and development of land for the purpose of avoiding or mitigating natural hazards"</i></p> <p>Council decides to produce the Christchurch Replacement District Plan in three stages (to reflect availability of information and capacity). Natural hazards provisions to be included in the following stages: Stage 1: Flooding, Port Hills land instability and liquefaction Stage 2: Coastal hazards</p>
October 2014	<p>Christchurch City Council commissioned Tonkin & Taylor Ltd (T&T) to identify areas susceptible to coastal hazards (inundation and erosion) for the main coastal settlements selected by Council. The areas were termed coastal erosion hazard zones (CEHZ) and coastal inundation zones (CIHZ). The zones were mapped over a 50 year (2065) and 100 year (2115) planning timeframe for the open and harbour coast to a standard suitable for inclusion in the District Plan.</p> <p>The CEHZ methodology used combined standard and well-tested approaches for defining coastal erosion hazard zones by addition of component parameters. This method was refined for the open coast to include parameter bounds which are combined by stochastic simulation. The resulting distribution is a probabilistic forecast of potential hazard zone width, rather than including single values for each component and one overall factor for uncertainty. This approach produced a range of hazard zones (probability distribution) corresponding to differing likelihoods which may be applied to risk-based assessments as advocated by the NZCPS and supported by best practice guidelines.</p> <p>Following consultation with Council, the P66% CEHZ value at 2065 and the P5% CEHZ value at 2115 were adopted as prudent likely and potential CEHZ values (termed CEHZ2065 and CEHZ2115 respectively).</p> <p>T&T implemented separate methodologies to assess coastal hazards for the open coast and the harbour coast sites due to the different processes driving each of the two coastal environments. The harbour coast CEHZ methodologies combined two approaches to account for the low-lying morphology typical of these sites. Although the harbour coast methodology was not developed to incorporate the probabilistic approach, the method is in accordance with best practice guidelines.</p> <p>A peer review of the assessment methodology and reporting was undertaken by Hume Consultancy Ltd. All the suggested amendments documented in the peer review were included in the T&T report.</p>

March 2015	Canterbury Regional Strategy and Policy Forum agreed to the development of a region-wide strategy for natural hazards management as well as further development of the Canterbury Maps portal for storing and disseminating natural hazards information.
3 July 2015	Tonkin & Taylor report issued. Council uses the report to: <ul style="list-style-type: none"> • Update information on hazards (including on LIMs) • Inform consenting under the Building Act • Develop district plan provision • Assist with longer-term project to understand and plan for river and tidal flooding over 10-50-100 year timeframes.
	Public meetings raised questions about what Council was going to do about the hazards and about why information was being provided now (and not earlier).
25 July 2015	Coastal hazard provisions included in notified Stage 3 proposals for the Christchurch Replacement District Plan
	Council held drop-in sessions for the public, allowing individuals to ask questions and get information about the proposals and implications for their properties. Some members of the public began expressing concerns at the rushed process, lack of transparency and late time in the process information was made available. Concern also about the predictions and precautionary approach in the assessment.
September 2015	Regional Planners and Emergency Management Officers Group agreed a terms of reference and timeline for a Regional Risk Reduction Committee to lead preparation of a regional hazards strategy.
16 October 2015	Submissions closed on proposed coastal hazards provisions. Government Order in Council directed the coastal provisions to be removed from the Christchurch Replacement District Plan process. Council confirmed that the information in the T+T report has not changed and is still applicable to informing the Council's processes and statutory obligations, including LIM notations and issuing building consents. Council welcomed more time to work with local communities on district plan provisions following removal of coastal hazard provisions from the District Plan Review process. This may progress in parallel with work on a regional hazards strategy and pick up previous Christchurch City Council plans for a community engagement process on natural hazards and adaptation to climate change.
November 2015	The Parliamentary Commissioner for the Environment releases her report on sea level rise and comments on the Christchurch coastal hazards as an example.
December 2015	Council decides to: <ul style="list-style-type: none"> • Commission a second peer review of the T&T report • Review the wording on LIM reports.
Current Status	
Second peer review report awaited. District plan provisions for coastal hazards now to be developed following normal Resource Management Act process.	

<p>Elements of Good practice</p>
<p>Information identified from references</p>
<ul style="list-style-type: none"> • Briefing session/seminar with Council staff and politicians, involving the T&T scientist/engineer got Councillors understanding and “lined-up” behind the science. • Good communication information prepared for Councillors to use with their constituents. • Drop-in sessions for members of the public to sit-down with Council planners to understand the plan provisions and their implications (resulting in some good decision making by property owners on rebuilding). • Public seminars with expert presentation on risk management (also recorded and available on-line). • Information sessions for the public on the T&T report – with good feedback. • Using simple examples/analogy to illustrate risk concepts – e.g. comparing return periods and how hazard events happen with the difference between the bus timetable and when buses actually show up.
<p>What did not work so well? (issues and challenges to achieving good practice)</p>
<p>Information identified from interview</p>
<ul style="list-style-type: none"> • Individual members of the community who had property impacted by mapped hazards and LIM information were overwhelmed and concerned with this and what Council would do about it, even if they understood that a risk-based process was being taken. • Timing of the conversation. Many Christchurch residents, particularly those living in the east of the city, had been severely impacted by the Canterbury Earthquake Sequence. They were dealing with abnormal levels of disruption and stress from the physical and financial effects as well as the challenges of navigating their way through subsequent insurance claims, repairs and/or rebuilds for their homes. • Use of unclear (obtuse) language e.g. “conservative”, “precautionary”. • Community understanding of 50 and 100 year timeframes over which sea level change may occur and that this will not be just two step changes (and could indeed be more than predicted).
<p>Key lessons (what would/could have overcome barriers/issues that should be covered in a possible NPS and other interventions)</p>
<p>Information identified from interview</p>
<ul style="list-style-type: none"> • A longer-term process is needed to engage with communities about how “we” can live in the environment and with the natural hazards it presents. • There is considerable value in trusted sources of information, especially in the form of National Policy Statement (NPS) and/or MfE guidance. • An NPS could provide consistency in approach to flood modelling, including how to handle future projections of climate change and its impact on storm events and sea level rise. • Including numbers for prudent planning assumptions for sea level rise in national guidance (provided this can be updated readily). • Embedding risk management principles in a NPS. • National guidance on if/when/how to do quantitative assessment of Average Individual Fatality Risk, including considering the cost/benefit of this level of analysis. • National guidance on taking a multiple-hazard approach and how to deal with low frequency events, such as tsunami. • There needs to be a comprehensive and integrated strategic package of options developed and detailed actions within the options that paint a full picture of the different mechanisms/methods available. This would enable community evaluation of the options (do nothing, adapt, retreat, combination).

References

- Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014.
- Coastal Hazard Assessment: Stage Two. Prepared for Christchurch City Council, Tonkin & Taylor, July 2015 (Job No. 851857.001.v2.1)
- Preparing New Zealand for rising seas: Certainty and Uncertainty. Parliamentary Commissioner for the Environment, November 2015.
- Response to Parliamentary Commissioner for the Environment report on sea level rise. Report to the Christchurch City Council reference 15/1486480, 10 December 2015.

People interviewed

Helen Beaumont, Head of Strategic Policy, Christchurch City Council

Kapiti Coast – Proposed District Plan, Coastal Hazard Provisions and Information on LIMs

Dates	2008 - 2016
Background Summary	
2008	<p>Coastal Systems Ltd prepared a comprehensive Coastal Erosion Hazard Assessment (CEHA) for the 38km long Kapiti Coast (Shand, 2008). The CEHA was based on a 50 year prediction period and was regarded as one of the background reports for the District Plan Review.</p> <p>Some (limited) consultation with the public was undertaken at this stage. There were only a small number of properties affected by the 50 year hazard lines and consultation feedback was limited. KCDC placed the process on hold pending the expected release of the revised NZCPS. However, relevant material from the assessment was included in LIM reports at this stage.</p>
March 2010	<p>Release of a District Plan Review Scoping Discussion Document and Summary providing information on “focus areas” (including coastal processes), and setting out an expected timeline for the review process and seeking feedback</p>
November 2010	<p>Seven discussion documents for the District Plan Review were released for consultation including one covering coastal hazards. These gave general indications of the thinking of the Council about various aspects of the plan, and sought feedback. There were draft maps and a clear indication of the intention to require setbacks and to avoid increasing community exposure to natural hazards through managed retreat. Submissions on the coastal document were supportive of the approach. There were open nights/public forums held but few people attended (10-15 typically). The district plan review was running concurrently with a wider discussion on resilience with the community and draft coastal maps were used to inform that wider discussion.</p>
2011	<p>A high-level separate report on coastal planning options was prepared for the Council (Focus Resource Management Group), which was high level but roughly equivalent to a S32 report. It was not open to public scrutiny and not focussed on the level of detail of the updated coastal hazard assessment and mapping work.</p>
2012	<p>The Coastal Systems Ltd 2008, erosion hazard assessment was updated in a way that the authors considered to be consistent with the requirements of the NZCPS. A 100/year prediction period had to be assessed along with increased sea level rise values in keeping with the revised IPCC reports. This resulted in the landward offset of 2008 erosion prediction lines.</p> <p>The report was highly anticipated (a draft had been seen) and when it was received letters were sent about resulting information on LIMs. Very soon after this the Plan was notified.</p>
November 2012	<p>The KCDC PDP was notified. The revised CEHA hazard lines were included as part of the natural hazards chapter of the KCDC Proposed District Plan.</p>
2012 – 2013	<p>There was outrage by some affected residents over the coastal hazard lines generated and potential impact on their properties. Property owners were concerned about the LIM information and also about the District Plan provisions and restrictions. Residents argued that erosion assessments should be carried out at a ‘likely level’ not erosion ‘occurring under an</p>

	extreme set of circumstances'. There was a high level of scrutiny of the supporting coastal hazard reports
2013	Council convened an independent Coastal Experts Panel to review the science behind the coastal hazard mapping used for the Proposed District Plan. The Panel was asked to review the science relating to coastal hazard assessments after it was challenged by coastal residents.
2014	The review concluded that "the existing recommended hazard lines are not sufficiently robust for incorporation into the Proposed District Plan" (Carley et al. 2014). It proposed further work to improve understanding of coastal erosion hazards on the Kapiti Coast. An Independent Review of the Kapiti Coast Proposed District Plan (Allan and Fowler, 2014) noted that it was clear that the opportunities for people within coastal properties to be involved in developing assessment methodologies for coastal hazards, to receive the results of work and to be involved in developing response options, were not provided prior to the notification of the Proposed District Plan.
July 2014	KCDC chose Option 4 recommended by the Independent Review (Allan and Fowler, 2014) to withdrawal the contentious coastal hazard provisions. KCDC commit to a 2-3 year programme of scientific and engineering research and formed a Coastal Advisory Group to guide Council's future work programme in consultation with the community.
October 2014	Notice given to withdrawal coastal hazard provisions of the KCDC Proposed District Plan. Information on LIMs modified to include a general comment on coastal erosion rather than the mapped information.
Outcomes/Current status	
Council has formally withdrawn the coastal hazard provisions of the KCDC Proposed District Plan and has committed to a two-to-three year programme of scientific and engineering research. Council decided to form a Coastal Advisory Group (CAG) comprised of statutory agencies and community representatives to guide Council's future work programme in consultation with the community.	
Elements of good practice	
Information from interviewer	
<ul style="list-style-type: none"> • Attempt to raise awareness early on with information on draft maps. • Was right to put information on the LIMs – the Council did not "bury" this information. • When information on the hazards was ready, the Council had a planning response ready. • Council took the initiative to get and act on information even though there were no examples or guidance to assist. 	
What did not work so well? (Issues and challengers to achieving good practice)	
Information from references	
<ul style="list-style-type: none"> • Inadequate engagement with the community prior to the notification of the PDP and following the 2012 revision of the coastal hazard assessment. • The science (in particular the uncertainty) behind the maps was not explained, key assumptions were not clearly defined. There was no involvement of the community in the development of the methodology, in understanding consequences or implications. • The science advisor considered that it was his role to build in precaution, resulting in very conservative hazard line locations. Other omissions included no allowance for sedimentation changes. • It appears that some consultation was done on management options such as managed retreat as part of an initial discussion document, however the communities most affected by coastal hazards 	

<p>were not identified and consulted with before the Proposed District Plan was notified (Allan and Fowler, 2014).</p>
<p>Information from interviewer</p>
<ul style="list-style-type: none"> • Timeframe was too compressed – did not have time to issue a draft District Plan and so moved directly to proposed plan. • The process was challenging – not just the timeframe but also dealing with such a complex and controversial issue in a comprehensive district plan review. It threatened to bring down the whole district plan review. • Needed a communications plan as well as a consultation plan. Resourcing responses to official information requests was significant. • Planners were “in awe” of the science. Did not challenge it or understand all the assumptions built into the science – particularly about what is important and what the community would/should be concerned about.
<p>Key Lessons (what would/could have overcome barriers/issues that should be covered in a possible NPS or other intervention)</p>
<p>Information from references</p>
<ul style="list-style-type: none"> • Having a clear consultation strategy from the beginning. There is also an element of public education required throughout. • A great deal of time and resourcing is needed for these processes. • Involving the public early and having an iterative process so the community feels involved and has ‘buy-in’ to the process. • In coastal hazard assessment - use “best estimates” rather than precautionary values, with margins of error or factors of safety kept separate from the estimates (needs to be transparent, after taking account of the uncertainties involved in the estimates) – alternatively give several scenarios based on best, worst and mid-way cases. • Need for a range of adaptive responses to be considered and their quantitative and qualitative costs and benefits evaluated before finalising policy and rules in the Proposed District Plan (Carley et al. 2012).
<p>Information from interviewer</p>
<ul style="list-style-type: none"> • Providing some “whole of country thinking about what could go wrong and how to get processes right”. • How to get information and consult on it without the causing the issues that arise with LIM information. • How to move the conversation with the community in appropriate manageable steps (from broad information to detail on maps). • How to provide for communities to move beyond defence and debate on the science and for planners to understand what is in the “black box” of the science.
<p>References</p>
<ul style="list-style-type: none"> • Shand, R. 2008 Kapiti Coastal Erosion Hazard Assessment, Coastal Systems Ltd. • Carley, J.T., Komar, P.D., Kench, P.S and Davies, R.B. 2014 Coastal Erosion Hazard Assessment for the Kapiti Coast: Review of the Science and Assessments Undertaken for the Proposed Kapiti Coast District Plan 2012. • Allan, S. and Fowler, R. 2014. Independent Review of the Kapiti Coast Proposed District Plan.
<p>People Interviewed</p>
<p>Jim Ebenhoh was Sustainable Development Manager at Kapiti District Council from January 2008 until December 2013</p>

Northland Regional Council Regional Policy Statement Natural hazards Provisions

Dates 2009 – 2016

Background Summary

December 2009	10-year efficiency and effectiveness review of the Regional Policy Statement – finds that it reflects early 1990s approach and thinking on natural hazards. Provisions do not have focus on how natural hazards should be managed and are not sufficiently directive or prescriptive. Provisions do not allocate responsibilities between councils. 2009 review document notes CDEM group plan identifies flooding and coastal hazards as most significant hazards for Northland and that climate change and tsunami needed to be addressed.
October 2010	Issues and Options report.
October 2011	Draft Regional Policy Statement – Council worked with tangata whenua and key stakeholders to develop draft and released this for public comment. Feedback reviewed and used as input to notified RPS.
October 2012	Proposed RPS notified and 888 submissions received.
May 2013 – July 2013	Hearings by independent commissioners.
September 2013	Commissioner recommendations to Regional Council.

Current Status

Regional Policy Statement operative (apart from Genetic Engineering provisions) on 9 May 2016. Regional Council is continuing work to map coastal hazards and is expecting to release new maps in June. Regional Plan expected by to available as draft in August 2016.

Elements of Good Practice

Information identified from references

- Operative RPS objective reflected RMA definition of natural hazards.
- 2009 review document includes comments on effects on the environment from flooding.
- Section 32 report recognises: RMA role in CDEM risk reduction, role of RPS to allocate responsibilities and role alongside Building Act (with its limitations in preventing building in hazard-prone areas).
- Objective 3.13 addresses risks and impacts across all of RMA natural hazards definition and wider (communities, infrastructure) and includes long term risk reduction and need for ongoing work to understand hazards and risks.
- Policy 7.1.1 refers to risk management techniques and addresses uncertainty. Some specific effects (on access and building platforms) identified.
- Reference to ISO 31000.
- Policy 7.1.2 refers to specific source of effects (hazardous substance storage in flood areas – earthworks impact on floodplains) and introduces the concept of material damage.
- RPS provides for regional plan to implement retreat via consenting requirement when buildings damaged (policy 7.1.7).
- Regional council taking lead with assessment and mapping of flooding and coastal hazards.

Information from interviewer

- Transparent approach to “likely” – 66% likelihood and “potential” – 5% terms used in NZ Coastal Policy Statement.

<ul style="list-style-type: none"> • Policy 7.1.3 gives effect to the NZ Coastal Policy Statement and has Department of Conservation “sign-off” • Approach to flood AEP for river flooding (10% and 1%) based on NZ Standard 4404:2010. • Engagement with Department of Conservation and district councils early on in process and with landowners in floodplains. This has been done working with Community Committees. Use these groups to assess risks and risk appetite and present “draft” maps and information. • NRC’s approach with assessment and mapping is intended to avoid some of the costs associated with individual site development assessment. The level of prescription in the RPS could enable permitted activity status in areas that are outside areas of concern. • Policy 7.1.1 is the means that NRC has established to deal with natural hazards that are not so well understood and mapped using a risk-based assessment requirement. This has not really been “tested” as yet. • For flooding and coastal hazards approach is to map and manage the effects and activities known to be of concern and result in material damage. Intention is to give more “comfort” for district councils to use Section 106. For flood assessment did consider using more complex modelling (velocity and depth) but used 1-dimension modelling approach available at the time. It is simple and can be used across the board. • Council workshop with NIWA on sea level rise and climate change. NRC is now tracking observed sea level rise vs IPCC projections.
What did not work so well? (Issues and challenges to achieving good practice)
Information identified from references
Parliamentary Commissioner for the Environment has questioned 5% being used to identify land “potentially” subject to coastal erosion.
Information identified from interviewer
<ul style="list-style-type: none"> • Dealing with tsunami hazard – this is included but there was little information, so addressed as similar to storm surge and Council monitoring and research role (method 7.1.8) included. More recent GNS 100-year wave heights exceed storm surge inundation. • The interface between the Building Act and RMA is challenging. The RMA processes are needed to address the effects of buildings (e.g. building on floodplains that affects other properties and climate change which cannot be done under the Building Act and Building Code). • Lack of clarity around NZ Coastal Policy Statement and what “potential” means. Likely is defined by IPCC and that definition can be used, but there is nothing to assist with “potential”.
Key lessons (what would/could have overcome barriers/issues that should be covered in a possible NPS and other interventions)
Information identified from interview
<ul style="list-style-type: none"> • Guidance and clarity around interface/relationship of Building Act and RMA. • Guidance on natural hazards provisions of the NZ Coastal Policy Statement, in particular policies 25 (a), (b) and 27 (1)(a). DoC has not yet provided guidance on these. Need clearer definition of the term “potential” (likelihood based). Guidance should provide national consistency and avoid repeated challenges through regional/local planning processes. • National guidance should cover consistency in applying planning timeframes, what risks need to be managed and on how hazards should be mapped. Leave flexibility for how controls are applied to reflect local risk appetite. • Guidance on what IPCC scenario for emissions should be used (e.g. RCP 8.5 which itself has confidence range for upper/lower and mid-range). This should be nationally consistent. • National guidance on consultation.

References

- Northland Regional Policy Statement -10 year Efficiency and Effectiveness Review, December 2009, Section 11 Natural Hazards.
- Proposed Regional Policy Statement for Northland – Appeals resolution, 31 March 2015 – Tracked changes.
- Section 32 analysis report: Proposed Regional Policy Statement for Northland, October 2012.

People Interviewed

Toby Kay, Natural Hazards Advisor

Michael Day, Resource Management Manager, Planning and Policy

West Coast Alpine Fault Plan Change 7 : Managing fault rupture risk in Westland and Multiple Hazards

The purpose of the plan change is to manage development within areas predicted to be subject to fault rupture risk to reduce the effect of this natural hazard and provide for the health and safety of the District's residents and visitors. Alongside this process, the town has also been challenged with addressing flood risk.

Dates	2010 - 2015
-------	-------------

Summary Background

2001 - 2003	<p>Franz Josef is susceptible to many different natural hazards including:</p> <ul style="list-style-type: none"> • Earthquake • Flooding • Landslide dam formation • Land instability <p>The area is very dynamic with annual rainfall between 5,000-7,000mm, a retreating glacier, landslip potential and significantly geologically active catchments.</p>
-------------	---

Flooding	<p>The Waiho River is currently in an aggradation phase which has been occurring since the 1930s. The aggradation has accelerated more rapidly since 1980. The river is aggrading on average at 20mm per year, with the inputs of the Callery River and a retreating glacier this is predicted to continue and potentially increase without intervention. Cross section surveys of the river have shown aggradation in places of 2m within months.</p> <p>All the credible reports that have been produced on the Waiho River strongly state that restricting the river through protection structures is not recommended. Restrictions can severely impact on the natural flood carrying capacity of the river and have detrimental effects downstream of the restriction.</p> <p>Several reports and studies have been undertaken on the river examining the various issues and providing advice as to how to mitigate the impacts. With the dynamic nature of the catchment flooding is a major risk to the township and key infrastructure. West Coast Regional Council document references: <i>Davies, T; McSaveney, M; Clarkson, P. (2002). Anthropogenic aggradation of the Waiho River, Westland, New Zealand: Microscale modelling. Earth Surface [Processes and Landforms 28, 209-218 (2003).</i></p>
----------	--

Landslide Dam Formation and Land instability	<p>The Franz Josef area is susceptible to rain and earthquake induced landslides. Of most concern is the impact of a landslide dam in the Callery catchment which could form a 70m+ dam which would fail without notice and flood the State Highway and surrounding area to the south.</p> <p>This risk led to the December 2002 Cabinet Paper which released central government funds to purchase the properties in the immediate hazard area. West Coast Regional Council document also references <i>Davies, T.R; (2002) Landslide dambreak floods at Franz Josef Glacier township, Westland, New Zealand; a risk assessment.</i> Campground and motels south of the river have now relocated.</p> <p>The Parliamentary Commissioner for the Environment directed that guidance was needed on how to address the hazards associated with fault rupture. In 2003 the Ministry for the Environment commissioned planning guidelines to assist with addressing the hazard associated with fault rupture. These guidelines were entitled <i>Planning for the Development of Land on or Close to Active Faults.</i> These guidelines provide a risk-based approach for dealing with the fault rupture hazard.</p>
--	---

2010	<p>GNS prepared a report titled <i>Mapping and Fault Rupture Avoidance Zonation for the Alpine Fault in the West Coast Region</i>. In this report GNS predicted that the probability of an Alpine Fault earthquake event, with a fault rupture to the surface occurring, was 20% within the next 30 years. Estimated that there would be approximately 8-9m of horizontal displacement on the west (Australian plate) side, and 1-2 m of vertical uplift on the east (Pacific plate) side. GNS mapped the location of the alpine fault within the west coast region and overlaid a suggested Fault Avoidance Zone. Precise data on the location of the Alpine Fault was not available, thus, variable exclusion zones were proposed of between 100 and 340 m in width depending on risk.</p>
September 2011	<p>West Coast Regional Council document records the following:</p> <p>The Alpine Fault has been accurately mapped through the Franz Josef township by GNS. The fault line runs through key infrastructure and private properties in the main township. It is predicted to create a displacement of 6-9m horizontal and 1-2m vertically. It is likely it would result in a magnitude 8.1+ earthquake with ground shaking occurring for approximately 2 and half minutes. This would be followed by significant magnitude 7+ aftershocks.</p> <p>The science is evolving; however the estimated average recurrence interval is 333 years. The latest rupture event is believed to have occurred around AD 1717. This rupture was along 380 kilometres of the fault, and would have been accompanied by dramatic changes in the landscape, particularly with landslips and sedimentation of the catchments.</p> <p>Geologists estimate a 30% chance of an earthquake along the southern section of the alpine fault in the next 50 years.</p> <p>Franz Joseph/Waiiau township is located within the 190 m fault Rupture Avoidance Zone. Further study was undertaken by GNS to enable more precise identification and reduction of the extent of the zone. This is documented in the GNS report titled, <i>Planning for a safer Franz Josef-Waiiau community, Westland District: considering rupture of the Alpine Fault</i>. GPS geo-referencing and airborne LiDAR was undertaken to create digital elevation model and GIS maps. The fault is now considered 'well defined' under the MfE guidelines (<i>"Planning for Development of land on or close to Active Faults"</i>, 2004). The work was published in a second GNS report.</p> <p>This GNS report used Saunders et al (2011) and Saunders (2011) to outline a risk-based methodology. First step was to determine consequence. Used a matrix consisting of scale of impact, description of consequences and severity of consequence. It included health and safety, social, economic and environmental impacts.</p> <p>Thresholds were defined relating to death or injuries:</p> <ul style="list-style-type: none"> Intolerable above $\sim 10^2$ / year Generally tolerable with consent $\sim 10^{-3}$ to 10^{-4} / year Tolerable $\sim 10^{-5}$ to 10^{-6} / year Acceptable $\sim 10^{-6}$ to 10^{-7} / year <p>Once land use and consequences were determined then likelihood was evaluated, using AEP.</p>

The consequence and likelihood were then quantified to provide a level of risk. To achieve this, a matrix was used incorporating the relevant risk level, expressed as a function of consequences multiplied by likelihood. Consequences are relabelled from roman numerals into Arabic numerals to allow for the calculation. The risk then ranged from 1 (extremely low) to 42 (extremely high).

Likelihood	Consequences					
	1	2	3	4	5	6
7	7	14	21	28	35	42
6	6	12	18	24	30	36
5	5	10	15	20	25	30
4	4	8	12	16	20	24
3	3	6	9	12	15	18
2	2	4	6	8	10	12
1	1	2	3	4	5	6

Figure 21 Quantifying consequences and likelihood (Source: Saunders 2011).

The risk levels were determined from Figure 21. In practice, participation and associated debate should be required within Council and with the community to determine the thresholds for the levels of risk.

Risk Level of risk

- 1-6 Acceptable
- 7-14 Tolerable
- 15-24 Tolerable with consent
- 25-42 Intolerable

Likelihood	Consequences					
	1	2	3	4	5	6
7	7	14	21	28	35	42
6	6	12	18	24	30	36
5	5	10	15	20	25	30
4	4	8	12	16	20	24
3	3	6	9	12	15	18
2	2	4	6	8	10	12
1	1	2	3	4	5	6

Figure 23 Colour coding the matrix based on level of risk (Source: Saunders 2011).

Once levels of risk were been determined, the matrix was colour coded (Figure 23), based on the levels of risk. The use of colours allows a faster assessment of the levels of risk involved. The colours of green (acceptable), yellow (tolerable), orange (tolerable with consent) and red (intolerable) are considered standard colours for this approach (Standards New Zealand, 2004). The results of the risk based approach supported the non-complying activity status proposed. The final stage of the process used the colours, based on the levels of risk, to determine the consent status (i.e. treatment) of the activity (Figure 24).

Level of risk	Consent status
Acceptable	Permitted
Tolerable	Controlled
Tolerable with consent	Discretionary
Intolerable	Non complying, prohibited

Figure 24 Level of risk and associated consent status (Source: Saunders 2011).

Figure 25 provides the final framework where risk equates to consent status applied.

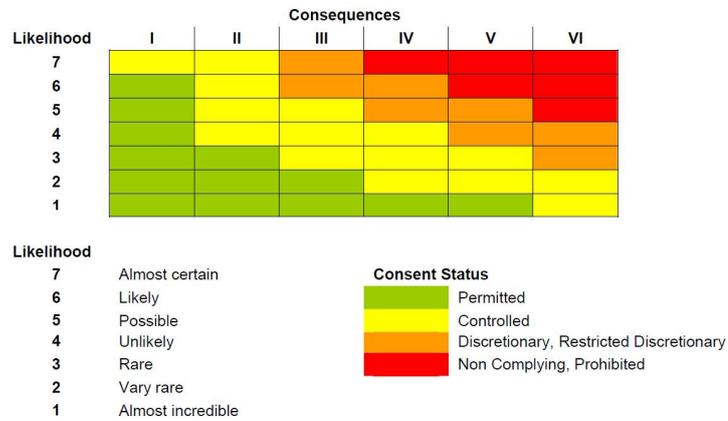


Figure 25 The risk-based planning framework (Source: Saunders 2011).

The GNS report noted that community engagement and participation are required to determine the level of risks and consequences. The evaluation of levels of risk and assigning consent categories may change depending on the context and community tolerability to risk. It was noted in the report that other options may also be available to reduce losses to a level which are acceptable or tolerable for communities; i.e. sharing of risk of potential losses via insurance.

February 2012 & April 2012	Council engaged in consultation during this time and prepared a draft plan change. Meetings were held with the Franz Josef Community Council and Franz Inc (local business association).
24 February 2012	Plan Change notified. Twenty submissions were received; 13 on behalf of Franz Josef residents and businesses, four from statutory bodies and three in relation to the General Fault Rupture Zone. Two late submissions were received from M and K Williams and D Bristowe.
19 April 2013	Summary of submissions was notified. Four parties made further submissions in support of nine original submissions.
30 – 31 March 2015	Hearing held. Although a risk-based method was recommended, the s32 report stated that it was not considered efficient to use the risk-based approach further as a method of approaching fault rupture hazard mitigation in Westland District due to high likelihood and consequence of the hazard “triggering” non-complying activity status, with no flexibility. There was also seen to be no opportunity for variation in the width of the Franz Josef/Waiiau Fault Rupture Avoidance Zone, although over time the General Fault Rupture Avoidance Zone will be able to be reduced through further study. A number of the submitters stated a view that the Council had not undertaken a thorough ‘risk-based analysis’ as suggested in the GNS reports. The risk-based approach anticipates further in depth discussion with the community to further explore varied activity status for buildings and associated risk.
18 May 2015	Commissioners released their decision on Plan Change 7 and associated submissions. The decision approved the Plan Change subject to modifications. The Plan Change has legal effect.

<p>Current Status</p>
<p>This Plan Change decision is subject to appeal to the Environment Court. The parties have agreed to place the appeal on hold until October 2016. The time on hold is to allow Council to review the risk-based approach and science and how this is aligned with Central Government approaches and to carry out wider community discussions about wider range of solutions, including questions of relocation (costs) and if to move, where to. GNS is doing some further work on risk profile for the town and surrounding areas as a base to provide some more confidence about areas suitable for future development. Some progress has been made in discussions about moving growth to the north. District Council is leading a working group that involved Regional Council, iwi, NZTA, DoC, tourism operators and nominees from the community. Regional Council is supporting the District Council and working group with expertise on natural hazards and is also currently preparing a long-term plan for managing the river. Council may still decide to withdraw the Plan Change.</p>
<p>Elements of Good practice</p>
<p>Information from interview</p>
<ul style="list-style-type: none"> • Council followed national planning guidance on fault lines – this is best practice approach. • There was not much debate about the science, it was more about what to do about it. • Council is now talking with the community about solutions that are wider than just RMA planning • Regional Council supporting the District Council plan change process, including joining formal processes as a Section 274 party
<p>What did not work so well? (issues and challenges to achieving good practice)</p>
<p>Information from references</p>
<p>Commissioners' report, section 5.20: "In questioning the submitters at the hearing, it became apparent to us that the depth of feeling of those opposed to the Plan Change was generally not so much in relation to whether there should be restrictions placed on new development and investment in an area at risk of fault rupture. The concerns were more that the Council had not carried out proper consultation with the affected community, and had focused entirely on the Plan Change at the expense of investigating the issue on a wider front. As we understand the concerns, the Plan Change should have been promoted together with a range of measures to provide an all-embracing solution to the problem (such as the matters we highlighted above, including a Master Plan for the relocation of the settlement, and potential mechanisms for relocation)."</p>
<p>Information from interviews</p>
<ul style="list-style-type: none"> • Long delay between close of submissions and hearing – leaving people "in limbo" • Council funded community to do work on a Franz Josef Urban Revitalisation Plan (led by Franz Inc), but this did not acknowledge the fault or the work on Plan Change 7. • Challenge in how to have and resource the bigger conversation. • How to deal with multiple hazards. River flooding issue in the past set a precedent on money to support relocation, river flooding also constrains where relocation can occur to avoid the fault line. • Challenges in how to deal with existing uses vs greenfield situations. With relocation of people/activities from properties at risk from flooding, there is no strong mechanism to achieve (or compel) this and then who pays? • Challenges for existing uses include when things change, for example the hazard gets worse, or new information is available and when there have been poor decisions made in the past. At Franz Josef there was knowledge of the Alpine Fault as long as 40 years ago, but only more recently accurately mapped. • Challenges when there are unhelpful Court decisions on natural hazard and risk issues. • Challenges with understanding and communicating multiple hazards and also understanding how "big" a hazard is/could be. • Challenges in funding mitigation. Regional Council uses targeted rates for flood management for example, but District Council does not use this rating approach.

Key Lessons (What would/could have overcome barriers/ issues that should be covered in a possible NPS and other interventions)

Information from interview

- How to take a multiple hazards approach
- A how-to guide for planners (though this may not be in the National Policy Statement itself)
- A process to enshrine national level guidance on acceptable levels of risk and appropriate planning responses, to avoid challenges at a local level.
- Strong provisions that will prevent future unhelpful Environment Court decisions on natural hazards and risk.
- Guidance on how to deal with existing situations and climate change.
- Need mechanisms to achieve managed retreat where this is necessary.

References

- Franz Josef Natural Hazards Summary. Undated document provided by West Coast Regional Council.
- Langridge, R.; Ries, W. 2009. Mapping and fault rupture avoidance zonation for the Alpine Fault in the West Coast region, GNS Science Consultancy Report 2009/18 47p
- Langridge, R.M. and Beban, J.G. 2011 Planning for a safer Franz Josef-Waiiau community, Westland District: considering rupture of the Alpine Fault.
- Westland District Council Plan Change 7: Managing Fault Rupture Risk in Westland Section 42A Hearing Report and amended Section 32.
- Commissioners' Decisions on Plan Change 7, Managing Fault Rupture Risk in Westland, May 2015.

People Interviewed

Jim Ebenhoh, Group Manager: Planning, Community and Environment at Westland District Council since January 2014.

Michael Meehan, Planning and Operations Group Manager, West Coast Regional Council.

Proposed Auckland Unitary Plan (PAUP)

Dates	2011 - 2016
-------	-------------

About the PAUP Process

In establishing the Auckland Council the government introduced special legislation to guide how Auckland's unitary plan would be developed and decided. Its aim is to ensure the unitary plan could be completed at a much faster pace than would typically occur under the Resource Management Act where it could take 8 to 10 years. Instead of the council appointing their own commissioners and making decisions based on public submissions under the Resource Management Act, the special legislation set up an Independent Hearings Panel. This is a statutory body appointed by the Government and independent of the council. It hears submissions, reviews evidence and makes recommendations to the council about any changes the Independent Hearings Panel thinks should be made to the PAUP. The council is responsible for preparing and notifying the PAUP and for running the public consultation and submission process. It then provides all public submissions to the Independent Hearings Panel for hearings. Once the submissions have been provided to the Independent Hearings Panel, the council steps back and lets the Panel get on with the job of holding hearings, reviewing evidence and deciding what changes to the Proposed Unitary Plan to recommend to the council.

Summary Background

2011	Work begins on the PAUP
------	-------------------------

March 2014	Draft Unitary Plan released
------------	-----------------------------

30 September 2013	<p>Proposed Auckland Unitary Plan notified</p> <ul style="list-style-type: none"> Natural hazard matters are addressed in many parts of the PAUP, including Part 1 Strategic Direction (including the RPS), Part 2 Regional and District Objectives and Policies as well as Part 3 Regional and District Rules. RPS has two objectives one to reduce risk and the other to protect natural functions of floodplains. RPS policies (9 in total) cover identifying areas at risk, risk assessment, precautionary approach, more specific matters on management approaches and infrastructure. RPS explanation – “these objectives and policies seek to ensure adequate spatial planning to reduce risk from natural hazards. They also seek to locate and design new development and infrastructure to deal with the impacts that may be experienced over their lifetime. This includes responding to the effects of climate change.” Reference is made to Auckland Council preparing and implementing a Natural Hazard Risk Management Action Plan for Auckland. Natural hazard risk defined as – “a measure of the consequences and likelihood of a natural hazard event”. Text in RPS 6.7 Natural Hazards expresses risk more widely as also considering size and nature of hazards and the exposure and vulnerability of elements at risk (people, buildings, infrastructure etc.). In Regional and District Objectives and Policies natural hazards are addressed in two separate sections – one on flooding (5.13) and the other on other natural hazards (5.12). Approach is to use best information – with maps as non-statutory layer (able to be updated) and to use a flexible risk-based approach for natural hazards that may not be spatially known. Adaptive
-------------------	--

	<p>management is proposed for existing development in areas where natural hazards have been mapped.</p> <ul style="list-style-type: none"> • Low frequency events are not addressed in the PAUP, rather they are to be addressed by emergency management. • There are 2 objectives and 22 policies on flooding representing a quite detailed and sophisticated approach based on mapped information. • There are 5 objectives and 16 policies on other natural hazards (including specifically on natural hazard risk management, bushfire and coastal inundation & sea level rise) – risk reduction approach in RPS is not strongly reflected. • Rules on natural hazards are set out in separate sections for flooding (4.12) and other natural hazards (4.11). All rules are district rules. Rules for flooding are very specific and detailed.
September 2013 – February 2014	<p>Submissions</p> <p>Some key issues – as identified in the Parties and Issues Report for Topic 022 Natural Hazards and Flooding:</p> <ul style="list-style-type: none"> • Objectives and policies approach to avoid, risk reduction/not increase; • Stronger links from rest of PAUP to RPS and NZCPS; • Non-statutory mapped information (accuracy and effect of updates); • Definition of land subject to instability; • Sea level rise – use of 2m and 100 year timeframe; • Addressing significant infrastructure; • Information requirements including engineering reports; • Combining natural hazards and flooding provisions.
June – July 2014	Further submissions.
September 2014 Hearing process begins	<p>The Hearing Panel process assigned submission points related to natural hazards to a series of different topic streams. For each topic stream the Panel produced (and updated) a Parties and Issues Report. These Reports:</p> <ul style="list-style-type: none"> • set out the process the Panel had determined for each topic stream, including as relevant pre-hearing meetings, expert conferencing, mediation and hearings; • identified the provisions included in the topic stream; • identified other relevant documents and other relevant provisions of the PAUP; • listed other topic streams the Panel considered relevant to the topic stream (35); • outlined the submissions received, parties to the topic, grouping of submissions and issues raised; • record the key documents associated with each step of the hearing process; • record in summary the issues and outcomes of each stage of the process. <p>The main topic stream for natural hazard submissions is 022 Natural Hazards and Flooding. Some 1011 submission points and 5760 further submission points were allocated to this stream and 779 submitters associated with those submissions requested to be heard. In the Parties and Issues report for Topic Stream 022, the Panel identified 35 other topic</p>

	streams that were relevant and many submission points on natural hazard provisions were allocated to these other topic streams. Natural hazard matters were therefore addressed in multiple mediations, expert conferencing sessions and hearings.
9 March 2015	Interim Guidance from Panel <ul style="list-style-type: none"> The Panel suggests moving natural hazard to a new section in the RPS on Environmental Risks.
6 May 2015 updated 10 June	Interim Guidance from Panel <ul style="list-style-type: none"> Supports merging provisions on natural hazards and flooding. PAUP should seek to not increase risk in areas of existing activities and avoid creating new risks with new development. Subdivision controls (including S106) are a direct way to avoid new risk. Concern at level of restriction on use and development in existing areas. Sea level rise of 1 m over 100 years should be used. PAUP should deal with 1%AEP storm tide event plus 1m sea level rise Maps should be accurate, Panel sought suggestions on how to improve mapping. Appropriate flood design level - overlap/consistency with Building Act controls for flood risks for buildings. Flood prone layer – not convinced of need for this. Rapid flood hazard assessment – improvements needed for reliability. Land instability definition needs to be clearer and liquefaction is relevant in Section 106.
10 June 2015	Interim Guidance from Panel <ul style="list-style-type: none"> Subdivision should provide resilience to effects of natural hazards.
May 2016	Hearings completed
Current Status	
The Independent Hearings Panel will make recommendations to the Council about any changes it thinks should be made to the PAUP no later than the 22 July 2016. The Council must make final decisions based only on these recommendations. The Council will decide to either accept or reject each Independent Hearings Panel recommendation. On the 16, 17 and 18 August the Council will make its decisions on the recommended Unitary Plan.	
Elements of Good Practice	
<ul style="list-style-type: none"> Natural hazards identified as a regionally significant issue. Risk reduction objective in RPS. RPS Policy 1 approach to identify (map) areas potentially affected by natural hazards. RPS Policy 2 to use best available information to identify and assess risk for subdivision and development. RPS Policy 3 on risk assessment for development in hazard areas to be based on: “type and severity of the event, the effects of other activities from development and vulnerability of the activity to adverse effects, including safety, resilience to damage and the effects on the environment and human health across a range of timeframes appropriate to the hazard, including a 100 year timeframe for flooding and coastal hazard”. 	

- Recognition of importance of key RMA tools (especially controls for subdivision – S 106 and S 220).
- Inclusion of concept of resilience (also highlighted by Panel).

What did not work so well? (Issues and challenges to achieving good practice)

- Challenges over attitude and approach to risk reduction vs not increasing risk and how this should apply to greenfield vs existing development:
 - “There was considerable debate regarding Objectives 1 and 2 and varying degrees of agreement or disagreement on various key words such as ‘manage’ or ‘reduce’; ‘minimising’ or ‘avoiding, remedying or mitigating’; and ‘where practicable” (RPS 006 Parties and Issues Report).
- PAUP not dealing with low frequency, high impact natural hazard events.
- Challenges over what level of sea level rise to provide for.
- Accuracy of mapping and use of a non-statutory layer for maps.
- Consistency and follow-through of RPS objectives and policy to the rest of the PAUP.
- Lack of prior community engagement/definition about the concept of managed retreat:
 - “Parties were concerned about the concept of ‘managed retreat’ in the policies and how this would be implemented through the Unitary Plan provisions and the associated actions and / or responsibilities of the Council in this respect” (RPS 006 Parties and Issues Report).
- No use of regional rules (lack of regional provisions commented on by the Panel during hearings).

Key lessons (what would/could have overcome barriers/issues that should be covered in a possible NPS and other interventions)

- Clear national direction on risk reduction/avoidance or not increasing approach.
- National guidance on sea level rise.
- Clarity on interaction/interplay of different legislation (e.g. Building Act).
- Consistency in approach to mapping and how to deal with new/changed information.

References

- Hearing Topic RPS 006 Natural Resources, Natural Hazards: Parties and Issues Report. Released on 6 November 2014 to incorporate outcomes from the hearing direction setting meeting.
- Hearing Topic 022 Natural Hazards and Flooding: Parties and Issues Report updated and released on 3 July 2015 after Interim Guidance and 2nd round of mediation.
- Interim Guidance Text for RPS General: PAUP Chapter B – Regional Policy Statement. Issued 9 March 2015.
- Interim Guidance Text for Topic 022 Natural Hazards and Flooding. Issued 5 May 2015 – updated 10 June 2015.
- Updated Interim Guidance Text for RPS Topic 11: PAUP Section B8.3 – Rural Subdivision. Issued 10 June 2015.
- Mediation Record for hearing topic 006 RPS Natural Resources B.6.7 Natural Hazards, Mediation of proposed track changes to B.6.7. Friday 24 October 2014.
- Mediation Joint Statement for hearing topic 022 Natural Hazards and Flooding, Reconvened Mediation. Date Monday 29 and Tuesday 30 June 2015.

People Interviewed

No parties were interviewed for this case study because of the nature and stage of the special process for the PAUP. The special hearing process means Council is a party to the process – setting out in evidence its position(s) in much the same way as other parties. The Panel has heard all parties on natural hazard provisions and has not yet released recommendations.

www.tonkintaylor.co.nz