Lessons Learned or Still Learning?
A historical overview of how planning for natural hazards in New Zealand has influenced urban development

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New Zealand has a rich history of natural hazard events, including flooding, coastal erosion, tsunami, volcanic eruption, earthquakes, and landslides. In many instances, these natural hazards have determined the location of our towns and cities, including relocating our towns when the risk becomes intolerable.

Our planning history provides the opportunity to learn from past events, and ensure future planning remains sustainable by not increasing risks to people and property. Historic planning decisions have led to ‘legacy’ planning, where many councils are having to balance the relationship between protecting existing development that has occurred over the previous decades - and century - and managing the risks posed by natural hazards to these developments. However, have we learnt anything from our planning history in terms of where and how we develop our towns and cities? Or are we continuing to provide ‘legacy planning’ for the future?

Examples will be provided of historical natural hazard planning, highlighting how planning for natural hazards has determined how New Zealand’s towns and cities have developed. Several historical planning decisions will be explored including:

- The 1840 European settlement of Britannia, located on the banks of the Hutt River, and the subsequent relocation to Wellington;
- The gazetting of the major active volcanoes in the North Island as national parks in 1887, which exemplifies avoidance planning;
- The Totara Park subdivision in Upper Hutt, planned in the 1960s just as plate tectonic theory was emerging, which avoids the Wellington Fault;
The Tahunanui slump in Nelson, which was developed in the 1970s and is monitored for ground movement; and

- The lessons that are currently being learnt from Christchurch from the 2010-2011 earthquake sequence.

Using these and other modern day examples, we will explore whether we have learnt any lessons regarding how we plan our town and cities around natural hazards, or whether we are repeating previous mistakes and creating a new generation of “legacy planning”.

**Keywords:** Relocation, avoidance, reduction, land use planning, flood, volcanic, landslide, earthquake

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**Introduction**

New Zealand is a geologically and meteorologically active country, with a history of natural hazard events including flooding, coastal erosion, tsunami, volcanic eruption, earthquakes, and landslides. These natural hazard events have provided many challenges for how we have designed urban areas, and in many instances, have determined the location of our communities, towns and cities - including relocating when the risk becomes intolerable.

We have an opportunity to learn from our planning history. We need to learn, to ensure future planning remains sustainable by managing the risks to people and property (Nathan, 2011). Historic planning decisions have led to poor ‘legacy’ planning, where many councils are balancing the relationship between protecting existing development that has occurred, and managing the risks posed by natural hazards to these developments. As such, two questions are posed: Have we learnt anything from our planning history in terms of where and how we develop our towns and cities? Or are we continuing to make poor planning decisions that is creating a poor legacy for future generations?

To assist in answering these questions, Section 2 provides examples of historical natural hazard planning, the locations of which are shown in Figure 1. These examples are based around the mitigation measures of avoidance, relocation, and risk reduction:

**Avoidance**

- Gazetting of the major active volcanoes in the North Island as national parks in 1887, which had the long-term benefit of avoiding development in a volcanic hazard area;
- Totara Park subdivision in Upper Hutt, planned in the 1960s, which avoids the Wellington Fault.

**Relocation**

- The 1840 European settlement of Britannia, located on the banks of the Hutt River, Petone, was relocated to Wellington due to flooding;
- The relocation of areas of Christchurch due to liquefaction from the 2010-11 earthquake sequence.

Reduction

- Tahunanui slump in Nelson, developed in the 1970s, now has land use controls to reduce future risks; and
- Lower Wairarapa Valley Development Scheme, one of the largest flood schemes in New Zealand, and took 20 years to construct.

Figure 1: Location of historical examples of hazard planning outlined in this paper.

These examples highlight how planning for natural hazards has determined how New Zealand’s towns and cities have developed. Using these examples, in Section 3 we provide two examples of modern day planning decisions, to explore whether we have learnt any lessons regarding how we plan our town and cities around natural hazards, or whether we are repeating previous mistakes and creating a poor legacy for future generations. Section 4 explores a selection of influences on whether we are learning – or not.
Examples of historical natural hazards planning

This section provides two examples each of avoidance, relocation, and reduction, from early European settlement in 1840 to recent-day land use changes in Christchurch.

Avoidance

Tongariro National Park, 1887

In 1887, the sacred peaks of Tongariro, Ngauruhoe, and part of Ruapehu, were gifted to the people of New Zealand by the paramount chief of Ngati Tuwharetoa. This was primarily to prevent the land being divided up, to ensure the mana of the Tuwharetoa people was preserved. Tongariro was the first national park to be established in New Zealand, and the fourth in the world. The original deed of gift made an area of 2640 hectare (ha) consisting of the immediate area around Ruapehu, Ngauruhoe and Tongariro. Over the years that followed, large-scale purchases of land were made by the Crown, so that when the Tongariro National Park Act was passed in 1894, its area had increased to some 25,000 ha. A survey report in 1904 recommended that the area should be more than doubled, and today the Park’s boundaries enclose over 79,000 ha (http://www.doc.govt.nz/parks-and-recreation/national-parks/tongariro/features/ - see Figure 2).
Being a national park, an indirect benefit is that development within the confines of the park boundary is restricted. While the park was established to protect the volcanic cones and for cultural and aesthetic reasons, it has subsequently reduced the risks to people from volcanic activity. The parks are primarily used for recreational and scientific purposes and are not able to be developed. This reduces the duration of time that people spend on the mountains, and limits the development and infrastructure that could be affected by an event (Becker, Saunders, Robertson, Leonard, & Johnston, 2010).

The gifting of Tongariro National Park provides an example of avoidance planning, as no development can occur within the park as of right. The ski areas of Turoa and Whakapapa, along with mountain lodges, have concessions from the Department of Conservation to operate. There is also a Tongariro National Park Management Plan to manage land use, conservation, and hazards (primarily volcanic; avalanche and erosion; and fire (Department of Conservation, 2006)). This management approach has allowed the immediate ‘danger’ zone from volcanic eruptions (including lahars, bombs, and flows) to remain relatively clear of development. Where there is development, such as the ski fields, lahar maps are distributed, a warning system has been installed, and annual testing of sirens and evacuation of the ski field is undertaken (Becker, et al., 2010).

Totara Park, Upper Hutt, 1960’s

Totara Park is a suburb located 2km to the north east of Upper Hutt, Wellington. During the 1950’s and 1960’s the towns of Lower Hutt and Upper Hutt extended into land that was formerly covered in native vegetation or used for farming and market gardens purposes. In the 1960’s, an urban development was planned for a large block of farm land (now known as Totara Park). This subdivision originally incorporated housing, a hospital, a school and an industrial estate (Stevens, 2005). The Wellington Fault bisected this suburb and was clearly identifiable by the fault scarplet located along the western side of the Hutt Valley (Lensen, 1958). The subdivision design of Totara Park did not take into account the Wellington Fault, which was clearly identified by the scarplet that passed through this area (Stevens, 2005).

The application for the plan change to allow the subdivision was considered under the Town and Country Planning Act 1953. The plan change was objected to by the Ministry of Works on the basis that the active fault was not taken into account when designing the subdivision. The Local Body Planning Tribunal was convened and the Geological Survey was asked by the Ministry of Works to provide evidence on the fault. In the hearing alternative subdivision designs were presented which took into account the Wellington Fault. However, the Planning Tribunal decision ruled in favour of the applicant and approval was given to the plan change and subdivision as submitted. The objections were dismissed not on the case of the scientific expertise (i.e. they didn’t believe the science), but because the Hutt City County was expressing its displeasure as what they perceived as unwarranted interference from central government (Stevens, 2005).

After obtaining dispensation for the development, the applicant redesigned the subdivision taking into account the Wellington Fault. A segment of one of the main roads (California Drive) was aligned with the fault scarp. The width of this roadway was sufficient to ensure that future dwellings would be located more than 20m from the fault. Non-return valves were also installed on the pipelines which crossed the Wellington Fault. Furthermore, the hospital and industrial park (which were to be
located on or close to the fault) were removed from the, development and the proposed school was repositioned well away from the fault line (Stevens, 2005).

Guidance around planning for active faults is not new – the first guidance was released by the Ministry of Works in 1965 (Ministry of Works, 1965). However, it was not until 2003 when guidance was issued by MFE (Kerr et al., 2003) that many councils improved their land use planning practices in relation to active faults. The Totara Park development shows that for over 50 years there has been an awareness of the risks that active faults can present to development. It also demonstrates that it is possible to take into account active faults when their location is able to be ascertained, when designing developments.

Relocation

Britannia, Lower Hutt, 1840

Lower Hutt was first settled by Europeans in the early 1840's, with the first immigrant ship, the Aurora, arriving on 22 January 1840. Upon arriving, the settlers formed two distinct settlements, one being on Pito-one (now called Petone) Beach, the second being further inland from the beach. This township was named Britannia, located on the Hutt River (see Figure 3). Britannia’s population peaked at 1,000 inhabitants, was two miles in length with a boulevard, two churches, several taverns, major warehouses, an established police force, a jail, several hotels, a wharf, a riverside boulevard, a shipwright, a blacksmith, timber merchants, a bank and its own newspaper (Johnston, 2007).

Figure 3: Location of Britannia township, 1840 (adapted from Johnston, 2007, p35). Originally the township was on the banks of the Hutt River.
In March 1840, floods hit the fledging town. After 10 days of rain, the Hutt River burst its banks and flooded the town with ankle deep mud and water. Days later another flood hit after torrential rain. These events, coupled with a night-time fire, cumulated in the settlers moving from Britannia to Thorndon in Wellington (Johnston, 1999). Rather ironically, however, the settlers relocated from a flood hazard to an active fault hazard, with Thorndon being located on the Wellington Fault. The consequences of this hazard, and the nearby Wairarapa Fault, is well documented in Grapes (Grapes, 2000, 2011).

The relocation of Britannia provides one of the first examples of community-led relocation from the flood hazard. Within a very short period of time, flooding from the Hutt River instigated the relocation of the township, in order to avoid future flood losses. In contrast, modern day Hutt Valley has a network of stopbanks and bank protection works. This has allowed the Hutt Valley to become one of the most densely populated floodplains in New Zealand, with approximately 70,000 people living on the floodplain, and assets worth $6 billion at risk (Wellington Regional Council, 2004).

Christchurch – a modern day example of relocation

Christchurch, New Zealand’s second largest city, experienced a sequence of large earthquakes in 2010 and 2011 that resulted in extensive liquefaction in its eastern suburbs, including Bexley South (St.Clair & McMahon, 2011). The liquefaction resulted in extensive damage to land, local infrastructure (e.g roads, sewer, stormwater and water connections), and buildings, the outcome of which was the Government retiring some areas, and residents being relocated elsewhere. Unlike many of the other suburbs that experienced significant liquefaction damage, Bexley South was developed in relatively recent times. A review of the planning history of the site was undertaken in 2011 (ref). This review found that up to 1972, Bexley South was within the Rural Zone. In 1972, under the first review of the District Scheme, Bexley South was designated for filling purposes, with an underlying zoning Residential 1 and Rural. In the proposed District Scheme that was notified in 1979, the site was rezoned to Employment 1. This purpose of this zone was to provide increased employment opportunities to residents in the eastern suburbs. In 1990, a plan change was notified, which spilt the Employment 1 zone into two. The northern half was rezoned Residential 1 and the southern half Recreation 5. This plan change became operative in September 1992. This plan change did not consider either liquefaction or lateral spreading, however land drainage was an issue that was raised by submitters (St.Clair & McMahon, 2011).

The proposed District Plan was notified in 1995 and retained the Residential 1 and Recreation 5 zones, but were renamed to Living 1 and Conservation 5. These zones became operative in 2005 and no rules were developed to address liquefaction and lateral spreading hazards (St.Clair & McMahon, 2011).

In 1992, a 1:25,000 geological map of Christchurch was produced by GNS Science. This map included a liquefaction hazard map, and this map showed Bexley South as having soils susceptible to liquefaction (Brown and Weeber 1992). However, this information does not appear to be used to inform the proposed District Plan.

Bexley South, like many of the areas that experienced liquefaction were ‘red zoned’ by the Government due to their area-wide land and infrastructure damage, and an engineering solution to
repair the land would be uncertain, costly, and is likely to be highly disruptive (Canterbury Earthquake Recovery Authority, 2013). This zoning process has been partnered with government offer to buy the properties that have been red zoned. This process is allowing for people to sell their properties and to relocated away from areas that are susceptible to liquefaction damage. This ensures that as part of the recovery process, redevelopment is not undertaken in these high risk areas, thereby reducing the risk to Christchurch if another large earthquake was to occur.

The planning history of Bexley is not unusual in the New Zealand setting. Many developments have proceeded in locations that are subject to natural hazards with little or no consideration of that hazard. However, the Christchurch earthquake sequence visually demonstrated to New Zealand, the consequences that can result from a natural hazard event, particularly when areas have been developed with little or no consideration of natural hazards. The question remains whether we have learnt from the Christchurch earthquake sequence or whether we have already started to forget the lessons resulting from these earthquakes, before we have a chance to fully understand and learn from them?

**Reduction**

**Lower Wairarapa Valley Development Scheme**

Constructed between 1963 and 1983, the Lower Wairarapa Valley Development Scheme is one of New Zealand’s largest and most ambitious flood protection projects. Prior to the scheme being developed, a major flood could affect up to 20,000ha of land, with some areas being flooded eight times a year. Roads were blocked for days on end, communication lines damaged, and fences destroyed. And despite an efficient flood warning service which began in the 1950s, stock losses at times were severe. The scheme now benefits a total land area of 31,500 ha (Wellington Regional Council), creating a large reduction in risk from flooding for the local community.

Constructed over 20 years, the scheme covers the section of the Ruamahanga River from the Waiohine confluence downstream to the Lake Onoke outlet into Palliser Bay, the Tauherenikau River from the rail bridge downstream to Lake Wairarapa, and all the eastern and western tributary streams (see Figure 4). The Ruamahanga River was diverted from its direct course into Lake Wairarapa, across the Kumenga Peninsula and into the Lower Ruamahanga. The barrage control gates largely prevent all normal flows of the Ruamahanga from entering Lake Wairarapa. The barrage has also enabled levels of Lake Onoke to be raised quickly to either overcome impending blockage of the outlet or to aid in the formation of a new opening. This also means that the lake can be kept at a low level, ready to accept any flows from the Oporua Floodway. Such flows are the result of the overflow of flood discharges from the Ruamahanga River at various points further upstream. Flow size is dependent on the size of the flood event and cannot be controlled. The ability to be able to maintain an efficient and ever-lasting outlet from Lake Onoke to the sea has been of great worth since it is the key to preventing flooding in the Lower Wairarapa Valley. Subsequently, the scheme has produced much of the expected benefit. The flood protection works were tested in the major floods of 2004 and they held up well despite the extreme conditions (Wellington Regional Council).
Figure 4: Outline of Lower Wairarapa Valley Scheme (Wairarapa Times-Age, 3 March 1955).

In total, the scheme involves a total of 65km of Ruamahanga River channel, 190km of stopbanks, 12 drainage schemes, and a present day value of $86 million. It has a flood protection standard for the 20-year frequency in upper reaches, and 100-year frequency in lower reaches. As a result of the scheme, the land-use patterns and environment of the Lower Wairarapa Valley are now well-established, reflected by the increase in annual production generated by the scheme being $19.8 million (Wellington Regional Council).

The Lower Wairarapa Valley Development Scheme provides an example of how risk reduction was achieved through substantial engineering design and construction. The scheme has reduced the severity of flooding, enabling the surrounding (mostly rural) land to be utilised to its full potential, without putting livestock at risk. At the time of the design and construction, the environmental effects may not have been acceptable by today’s standards, and it is questionable as to whether a similar large scale scheme would be constructed today. From a ‘modern day’ perspective, the challenge is to work with nature, rather than to change nature.
Tahunanui, Nelson

Located in Nelson, the active Tahunanui Slump is 700m wide and covers a total area of approximately 26ha of hillside. Overlooking the popular local beach, bay and ranges, the active slump is ‘home’ to 120 houses (Denton & Johnston, 1996), as shown in Figure 5.

![Figure 5: Approximately 120 houses are located on the Tahunanui slump in Nelson](http://www.teara.govt.nz/en/photograph/8805/tahunanui-slump)

However, the movement of the slump area is not a new phenomenon. Significant, extensive movements and related damage are documented within the Tahunanui Slump in the 1890s, 1929 and 1962, involving roads and houses (see Figure 6). While on-going resurveys of the area confirm that less damaging movements are continuing, these are at different rates in different areas of the slump (Denton & Johnston, 1996).

Residential development, which commenced in the 1920s, has been restricted since 1985 by the Nelson City Council (Denton & Johnston, 1996). To manage the risks to people and property, the Nelson Resource Management Plan requires resource consent for earthworks as a Discretionary Activity and heavy structures, such as pools, which may detrimentally surcharge the landslide, are a Restricted Discretionary Activity. Subdivision, other than for such things as boundary adjustments, is not allowed and to build new dwellings on existing lots is a Non-Complying Activity. Except for minor alterations or additions, building consents are granted under Section 72 of the Building Act 2004 and the title of the lot is endorsed accordingly (Saunders & Glassey, 2007). All applications for resource or building consent must be accompanied by a geotechnical assessment from a Chartered Professional Engineer practising in geotechnical engineering or an experienced engineering geologist and recognised as such by the Nelson City Council. The assessment must list any mitigation
measures that should be implemented as part of the consent, such as designing the house so that it can be re-levelled and/or the use of lightweight cladding, installation of additional drainage with readily accessible inspection points or removal of material equal to the weight of the structure to be built (Saunders & Glassey, 2007).

Lessons learned or still learning?

As Mileti (1999,155-156) states,

‘No single approach to bringing sustainable hazard mitigation into existence shows more promise ... than increased use of sound and equitable land-use management ... by planning for and managing land use to accomplish sustainable hazards mitigation, disasters – though not wholly eliminated – can be reduced ...’.

So are we learning lessons from the past and putting that knowledge into land use planning – a powerful tool in reducing risks to communities?
As demonstrated in Section 2, there are a number of examples historically where decisions have been made to reduce the risks from natural hazards. The science and understanding that has resulted in these historical changes has been easily available for many years, yet as demonstrated below, we are still making poor land use planning decisions that is resulting in a significant increase in risk to people’s lives and property. Following these examples, we will explore the potential reasons why we continue to make poor land use planning decisions in regards to natural hazards.

**Kaihikatea Estate**

In 2005 an application was received by the Thames-Coromandel District Council for a gated community development. Located on the Tairua River floodplain, the site is tidally influenced and had been flooded from the river five times during the previous 12 years. As such, the site is expected to flood on average every two to five years (Tonkin & Taylor, 2005). The site is deemed a high hazard site by the regional council (Waikato Regional Council), as the depth of flow in the main floodway is greater than one metre and/or speed of flow is greater than one metre per second. Rather than avoiding the risk altogether, this hazard was addressed by the applicants with mitigation options, their philosophy being to “recognise the risk of flooding that exists and to take measures to overcome the hazard risks, without endeavouring to impede the natural flow patterns of floodwater through the site” (Bhana, 2005, p7).

In May 2008 the Environment Court issued a consent notice which included the following conditions on the consent holder (Judge Dwyer, 2008):

- A detailed emergency management plan (approved by the Thames-Coromandel District Council) detailing the provisions to be made to ensure the safety of occupants of the subdivided lots in the event of inundation of the site;
- The upgrade of an existing river gauge, and the installation and on-going maintenance of a new river level recorder;
- The installation and on-going maintenance of a 24 hour a day river level monitoring system, connected to all residential buildings and the Regional Council.
- An evacuation plan, developed and maintained by the Residents Association of Kahikatea Estate, around different responses corresponding to onsite water levels;
- Members of the residents association receive has annual training in compliance with the provisions of the plan;
- Culverts under the internal driveway are regularly maintained including at least annually the clearance of any accumulated debris, and rectifying any visible signs of erosion;
- On-going maintenance of the building platforms for flood defence purposes for each of the residential lots;
- The area defined as ‘Restricted Planting Area’ is managed so its primary purpose as a floodway is not compromised; and
Provide Council with an annual report demonstrating on-going compliance with the plan. This is to be prepared by an independent certifier appointed by the Association and acceptable to the Council’s Monitoring Officer.

These conditions offer a form of warning for prospective buyers, as these are considered rather extreme measures, yet still put property at risk from flooding. The website for the development states that:

‘Sites will have a high standard of amenities including a gravelled driveway to improve water dispersal ... The development exceeds local body resource consent standards, preventing any possible risk of flooding to platforms or homes: so your house is safe as ... well, houses’ (Kahikatea Estate).

This statement provides an example of the developer bearing the risk until properties are sold. Local body resource consent standards are exceeded due to the risk of flooding; it is still possible that platforms and homes can be flooded (hence the requirement for a warning system and evacuation plan).

This case highlights the multi-faceted issues involved in developments of this nature (of which there are many). It provides an example of the wider implications for risk reduction, including the importance of qualifying and/or quantifying the levels of risk for natural hazards to ascertain and clarify what is acceptable, tolerable and intolerable; who accepts the short- and long-term risks i.e. the developer versus a future purchaser; and the paradoxical relationship between mitigation and risk reduction (i.e. mitigation does not necessarily result in a reduction of risk). In this case, risks to property are still potentially problematic for those dwelling in these properties. While the developer was willing to accept the risk, future owners/generations (and council) will have a legacy of flood risk to live with and manage if they choose to. The mitigation measures proposed lead to an increase in risk from the original land use, otherwise the consent conditions would not be required. To date, the development has not commenced due to the 2009-10 economic recession.

**Petone Plan Change 29, Lower Hutt**

In June 2012, Hutt City Council notified a plan change (proposed Plan Change 29) for the south-western corner of Petone, Lower Hutt. The purpose of this plan change was to create a mixed use area in this area of Lower Hutt. In particular, this plan change sought to introduce the ability for residential, childcare, visitor accommodation and retail activities to be established as a Permitted Activity (Hutt City Council, 2012).

The area of Petone is however subject to a number of hazards. The Wellington Fault passes through the area. This fault is expected to produce an earthquake with a magnitude of 7.5 once every 880 years (Rhoades, Van Dissen et al. 2011). The soils under Petone are also highly susceptible to liquefaction, which may also result in subsidence (ref). It is also expected that this area of Petone would subside between 1.1m and 1.2m in a Wellington Fault earthquake (ref) and is also located in a tsunami evacuation zone. Finally, the area is susceptible to flooding from the Korokoro Stream and experienced significant flooding in 1976. Furthermore, due to the low lying natural of the suburb, it is susceptible to sea level rise as a result of climate change.
The existing natural hazard rules for the south-western corner of Petone only relates to the Wellington Fault Special Study Area. In this area, all new buildings require resource consent as a Restricted Discretionary Activity. There are no rules pertaining to liquefaction, flooding, tsunami, or climate change.

When Proposed Plan Change 29 was notified, no additional rules were proposed to address the risk from the natural hazards to future development. At the close of the submission period, approximately 250 submissions on the plan change were received, with the majority of these raising concerns regarding natural hazards and seeking further measures to reduce the associated risks. In the report prepared by the Council for the hearing it stated:

‘We are of the view that the plan change increases the risk of property and persons to damage from natural hazards as a result of providing for the intensification of the area. Existing provisions in the Operative District Plan will not adequately manage the range of natural hazards and the increased risk….. It is recommended that additional natural hazard provisions be introduced within the plan change area which:

1. Limits the location of high intensity and particularly vulnerable types of development within the Wellington Fault Special Study Area (WFSSA);
2. Require geotechnical investigation as a matter of consideration for new buildings within the plan change area; and
3. Inclusion of additional information which communicates the level of natural hazard risks within the plan change area’ (Tindale, Wesney, & Baily, 2013a).

During the hearing, submitters expressed concern that the proposed rules to address the natural hazard risk did not go far enough. As a result, in the Officers right of reply, further rules were proposed to address the natural hazard risk as well as the introduction of an objective and policies which were specific to natural hazards(Tindale, Wesney, & Baily, 2013b).

Plan Change 29 demonstrates that even after Christchurch, councils are still considering intensifying development in areas that are at high risk from natural hazards. In the case of this plan change, the community played an important role in changing the content of the plan change. The large community response can in part be contributed to the high level of media and national interest in the recent Christchurch earthquakes. This was reflected by a number of submitters referring to these earthquakes and the desire to prevent a corresponding level of damage in Petone.

**What are the influences on lessons learned or still to learn?**

While human occupation in New Zealand has been short, we have experienced a significant number of natural hazard events. The examples of natural hazard planning presented are only but a few of a number across the country regarding reducing the risks from natural hazards to current and future developments. However, while there are numerous examples, we still allow for inappropriate development in natural hazard zones. Glavovic et al. (2010) provide four burning issues that require action to improve land use planning for natural hazards. One of these is to prioritise risk reduction measures – so why we have not taken the opportunity to learn from natural hazard events to reduce the risk to current and future development? Potential influences, include experience and knowledge
of events, turn-over of council staff; planning for hazards rather than risks; and economic benefits. These influences and tensions are examined below.

**Experience and knowledge of events**

On the 1st September 1888, a magnitude 7 – 7.3 earthquake struck North Canterbury, with heavy shaking lasting up to 50 seconds in Christchurch (GeoNet, 2013; McSaveney, 2012; Nathan, 2011). Many buildings in the region were destroyed, and the Christchurch Cathedral lost 7.8 metres of its spire – which was subsequently rebuilt - and collapsed again in an earthquake in 1901 (GeoNet, 2013; McSaveney, 2012; Nathan, 2011). This proved to be last rebuilding required from earthquake damage – until 2011.

So is generational experience and knowledge of events required to learn lessons? Do we need to personally experience an event, to gain important first-hand knowledge on its consequences, and plan for them? Knowledge, experience, values, attitudes and feelings all influence the thinking and judgement of people about the seriousness and acceptability of risks. People may feel so connected to a particular place that the risk forms part of their identity. In some cases, not only do people accept and coexist with the hazard, but they may also develop an emotional link to it, which downplays its potential risks (Wachinger & Renn, 2010). It is therefore essential to involve the community and decision makers in any conversations of hazards and risks.

Within the context of volcanic hazards, Paton et al (2008), found that an important aspect of any risk management strategy involves community participation – and decision makers - when discussing hazard issues. If agencies do not engage with communities that reinforce the complementary actions, required by both community and agency to reduce risks, those communities may overestimate the effectiveness of structural mitigation, reduce their efforts to manage their risk, and pass the responsibility of their safety back to the agency. While this research was undertaken in a volcanic context, the findings are applicable to other hazards. It is therefore crucial that the experience and knowledge of scientists, planners, decision makers, and communities are actively sort, lessons learned documented, then implemented (Mercer, 2012).

**Turnover of planning staff**

Duties undertaken by a council planning officer are not limited to the preparation of resource consent decisions. They are often also responsible for public enquiries, responding to official information requests, undertaking pre-application meetings and assessing new applications. These various demands, combined with the 20 working day statutory processing time under the Resource Management Act 1991 (RMA), means that there are a significant pressures on council planners. Consequently, anecdotal evidence suggests that the turnover in council planning staff if high. This turnover of staff reduces the opportunity for the development of institution knowledge around natural hazards. Furthermore, inexperienced planners may be unaware of areas that are susceptible to natural hazards or how to address the risks associated with natural hazards.

**Planning for hazards verses planning for risk**

Under the RMA framework, natural hazards are planned for, rather than the risk of natural hazards (i.e. risk = consequence x likelihood). This subtle difference may have contributed to the
consequences of hazard events not being fully assessed. The Government has recognised this shortfall, particularly in light of the Christchurch earthquake sequence and subsequent consequences of developing in liquefaction susceptible areas and in the Port Hills, an area subject to land instability. As such, part of the RMA reforms include the addition of risk as a Section 6 matter, where decision makers would be required to “recognise and provide for” natural hazard risks (Ministry for the Environment, 2013). Saunders & Beban (2012) have outlined the implications of this, and encourage the inclusion of ‘risk’, and its priority being raised.

The economic benefit argument

While a specific location may generate a particular risk, the same context may also provide economic benefits. Hence, the balance between risks and benefits as estimated by the individual can be a determining factor that influences risk perceptions (Wachinger & Renn, 2010). Part II of the RMA specifically requires the economic well-being of communities to be considered, when land use planning decisions are made. Often hazard mitigation works are viewed as an immediate cost, whose benefits are uncertain and may not be realised over the life of the development (Beatley, 1998). These additional costs can be seen to be discouraging development, and hence it is argued that the economic costs gained from undertaking these works, are disproportionately greater than the resulting benefits associated with their undertaking. Furthermore, it can also be argued that by allowing for development in areas subject low probability, high consequence natural hazards, allows for the community to provide for their economic well-being, through increased employment or improved housing, as it is unlikely that the area will experience the natural hazard during the life of the development. These economic arguments often gain traction, as in New Zealand, decisions on large developments are mainly made by Commissioners, who are often local politicians. This creates a natural tension as politicians often want increased development and the benefits it brings. However, they may have to decline an application based on an event that may have a low probability of occurring over the life of the development. Given this tension, the economic benefits argument often trumps the argument pertaining to natural hazard risk.

Summary and conclusion

New Zealand’s has a long history of planning for natural hazards. As this paper has demonstrated, there are a number of examples of where land use planning has taken into account the risks presented by natural hazards, and development has been planned accordingly. However, there are still many examples of poor planning practice in relation to natural hazards, and developments proceeding which increase the risk to both property and lives. As New Zealand’s population increases, the demand for additional development will increase. This demand will continue to place pressure on local government authorities to open up new areas for development, some of which may be at risk from a variety of natural hazards. It is important that planning practices change across the country to ensure that future development appropriately takes into account the risks from natural hazards.

The RMA, currently does not directly identify natural hazards as a matter the must be considered under Part II. All land use planning decisions are required to be consistent with Part II in order to proceed. In order to improve the consideration of natural hazards during the land use planning process it is important that natural hazards become a Part II matter. This was raised in a recent
government technical advisory group document (Technical Advisory Group, 2012) on changes required to the RMA to ensure that natural hazards are better recognised. This recommendation followed through into a discussion document released by the Ministry for the Environment (Ministry for the Environment, 2013) and into the proposed reforms (Ministry for the Environment 2013b).

The proposed reforms to the RMA would identify the management of significant risks from natural hazards (Ministry for the Environment 2013b) as a (s) 6 matter (Matter of National Importance). This is an important change as it introduces the concept of risk for the first time into the RMA. The inclusion of risk as a (s) 6 matter mandates land use planners to consider both the consequences and the likelihood of a natural hazard event. This will allow planners to make an informed decision around the level of risk that they are willing to accept and will expand the consideration of natural hazards away from the current approach of just considering the likelihood of an event.

Equally important as a change of legislation outlined above, is the need for land use planners in the country to be educated regarding risk and natural hazards (Saunders & Beban, 2012). Unless land use planners understand natural hazard risk and ways in which this risk can be reduced, New Zealand future development will continue to increase the risk to people and property.

Land use planning in New Zealand is a complex system involving politics, economic development, the management of risks from natural hazards and human behaviour. Every day, councils across the country are making a number of decisions on developments. After a natural hazard event, our awareness of the hazard increases and we adjust our land use planning response accordingly. However, as time passes, new issues arise and this can be to the detriment of planning for natural hazards. While mistakes have been made, it is hoped that the lessons from Christchurch and the changes to the RMA will result in future developments better addressing the risks from natural hazards. Planners are the custodians of the environment, which future generations will receive. To ensure that future generations live in sustainable cities, planners need to look to the examples of good practices in the past to address the future risks from natural hazards.

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References


