

The Christchurch Earthquake Sequence: Government Decision-Making and Confidence in the  
Face of Uncertainty

by

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## **Abstract**

Natural disasters can create significant uncertainty for individuals and entire cities. This thesis examines the role of government decision-making and uncertainty in disaster recovery, focusing on a case study of post-earthquake Christchurch, New Zealand.

Beginning in September 2010, Christchurch has been shaken by a devastating sequence of earthquakes, stretching over 18 months. The most severe event took place on February 22, 2011, taking the lives of 185 people and causing significant damage throughout the city. Building damage has forced the closure of portions of the Central Business District (CBD) for over 2 years as of July 2013, and over 7,000 residential properties have been purchased by the government due to land damage.

The duration of the earthquake sequence, combined with the scale of damage, has created significant uncertainty for the city, specifically for the future of the CBD and the local property market.

This thesis seeks to examine how government decision-making can incentivize a community of self-interested actors facing uncertainty to pull together, and create an outcome that benefits all of them. A conceptual framework is developed through which three key government decisions in the Christchurch case are analyzed in terms of how uncertainty has been managed. The three decisions are: 1) maintaining a Cordon around the CBD, 2) Establishing the Christchurch Central Development Unit to plan the rebuild of the CBD, and 3) Establishing a system of zoning to classify land damage for residential properties. A detailed description of the earthquake sequence and context is also provided.

The primary research for this thesis was collected during 23 semi-structured key informant interviews conducted in New Zealand in May of 2012. Interviewees were selected with expertise in a range of different recovery issues, as well as different roles in the recovery, from decision-makers to those implementing the decisions, and those impacted.

In conclusion, this thesis argues that uncertainty has been a major driver in government decision-making, and that those decisions have had a significant impact in terms of reducing uncertainty. In particular, decisions have addressed uncertainty in terms of the residential property market, and the future of the CBD.

## Preface

The primary research for this thesis was conducted in collaboration with Dr. Stephanie Chang and Dr. Ken Elwood at the University of British Columbia, and Dr. Erica Seville and David Brunsdon at New Zealand-based *Resilient Organisations*.

Portions of Chapter four of this thesis have been published as preliminary findings in:

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The Primary research for this thesis received ethics approval from the University of British Columbia Behavioural Ethics Research Board (ID: H12-00005) as well as the Low Risk Human Ethics process by the University of Canterbury (New Zealand).

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## **Dedication**

This thesis is dedicated to my parents, Toni Ellis and Paul Taylor for all their support and guidance along the way.



## Chapter 1. Introduction

This thesis addresses the role of government in reducing uncertainty and building confidence, specifically in the context of the Christchurch, New Zealand, earthquake sequence of 2010-11. While the case focuses on a natural disaster, the overall issue is fundamental to the role of government in many policy contexts. This chapter will first introduce the theme of uncertainty and the original inspiration for this thesis, then provide a brief overview of the earthquake sequence, and finally present the research question and scope.

### 1.1 Motivation: The Cost of Uncertainty

This thesis was inspired by the power of confidence, and the role of government as a unique actor in creating confidence and managing uncertainty. The interest for this topic was originally sparked by the example of preventing bank runs through the creation of deposit insurance. Prior to the creation of deposit insurance, bank runs were not uncommon, the most dramatic of which began on October 29, 1929, when Black Tuesday triggered a cascading failure of banks in the United States, eventually leading to the Great Depression. As banks began to fail, individual depositors faced uncertainty as to the security of their money, and made the ‘rational’ decision to withdraw their savings. Cumulatively, this momentum created a self-fulfilling prophesy in which bank runs began to threaten previously healthy banks. The cost of uncertainty combined with fear was devastating, and meant a situation in which individuals created an outcome that was worse for themselves, and for society as a whole.

Following the Great Depression, the Federal Government introduced a system of deposit insurance. This meant the government offered a guarantee on deposits to qualifying banks up to a certain level, a policy that attempted to remove uncertainty and create confidence in the strength of private banks. This government intervention created an incentive for individual depositors not to withdraw their money; in other words, it incentivized a large number of self-interested private actors to do something that was in their collective interest. At the same time, if this type of intervention is structured correctly, it should cost the government almost no money. As a large, and credible market actor, the Government is uniquely positioned to intervene in the market by simply *saying* it will do something. If people believe the government, they will not withdraw their money, and then the government will not have to make any payouts. In this example, the government has created confidence and clarity in the face of uncertainty, and has incentivized a large number of actors to pull together and create an outcome that is better for the group as a whole, rather than running for the exits.

The impact of natural disasters can create significant disruption for individuals, businesses and investors. In the face of uncertainty, individual actors may then face incentives in terms of how

they participate in the recovery. While uncertainty may create incentives that are not in the interest of the community (such as choosing to move somewhere else), there may be an opportunity for government to reduce uncertainty, and thereby re-align the public and the private interest. This thesis will review the experience of Christchurch, New Zealand, as it went through an earthquake sequence that stretched over 18 months, and how the government sought to manage uncertainty throughout the recovery.

## **1.2 Summary of the Canterbury Earthquake Sequence Key Impacts**

Beginning in September 2010, the region of Canterbury has been struck by a sequence of over 10,000 earthquakes (Brook, 2012). The sequence has been punctuated by several major events, including four events over magnitude 6.0, and most notably, a magnitude 6.3 earthquake on February 22, 2011, within 10 km of the centre of Christchurch (GeoNet, 2012). This was the most severe event, and took the lives of 185 people. The sequence overall has been estimated as the third most expensive earthquake in history in terms of insurable losses (Swiss Re, 2012). The response and recovery to the earthquake sequence has presented decision-makers in New Zealand with difficult choices. Governments have faced challenges related to the number of earthquakes, the size of the impact relative to the national economy, and other factors unique to New Zealand such as the high level of earthquake insurance.

The earthquake sequence has created significant uncertainty for residents, businesses, and other actors involved in the recovery such as insurance companies. At the city-wide level, the face of the city has changed dramatically. As of May 2012, when field research for this thesis was conducted, the downtown had been closed to the public for over a year, with over 700 buildings demolished in the Central City (The Press, 2012b). The city has lost 103 of its 314 designated heritage buildings, including the iconic Cathedral, many of which were critical to the character and tourism industry of Christchurch (New Zealand Historic Places Trust, 2013). The local property market has been significantly disrupted, with widespread land damage and a government buy-out of more than 7,000 residential properties.

The earthquakes have created significant disruption and uncertainty for the citizens of Christchurch in terms of people's basic social and economic grounding. For homeowners, this includes the value and insurability of property, as well as the social fabric and support networks of established neighbourhoods and schools. Business owners have faced uncertainty at the city level in terms of the future of the downtown, and the commercial centre of Christchurch. In addition to this, individual businesses have faced uncertainty in terms of the building upgrading required for commercial and offices buildings, as well as other issues such as business interruption insurance.

At both the city and individual levels, the Canterbury Earthquake sequence has created significant disruption and uncertainty for the people of Christchurch. The local and national

Governments have responded throughout the sequence to reduce mitigate the impacts, and try to build confidence in the recovery.

### **1.3 Research Question**

This thesis will explore how governments have sought to manage uncertainty in Christchurch throughout the sequence, and the impacts of those policies in the context of recovery. Specifically, it considers how uncertainty can create incentives at the individual or business level, and how this can create feedback loops that generate outcomes at the wider community level. For example, uncertainty in the future of the downtown could create an incentive for individual investors not to invest. The resulting lack of investment could result in further uncertainty for the downtown overall.

From this perspective, the role of government in managing uncertainty will be explored through an analysis of how incentives can be created which align individual interests with that of the larger group, such as downtown businesses or a neighbourhood of homeowners.

This thesis seeks to explore this theme by addressing the overall question: *How can government decision-making facilitate recovery by managing uncertainty?*

This question will be explored through three sub-questions:

- What uncertainties were created at different levels by the earthquake sequence?
- How did government decisions affect uncertainty?
- What lessons can be drawn from these decisions and their impacts?

This topic is addressed in the context of an emerging theme in the disaster recovery literature which argues that community consultation is necessary or conducive to building long-term resilience (Aldrich, 2012). An analysis of the effectiveness of community consultation in Christchurch is beyond the scope of this thesis. However, a potential avenue for further research could be to explore the trade-offs which may exist between more rigorous community consultation, and creating certainty. Community consultation can take more time, and during the process may increase uncertainty as to the final outcome. These factors could reduce the ability of the Government to make timely and definitive decisions, critical to reducing uncertainty and allowing actors to make informed.

### **1.4 Thesis Scope**

The data collection for this thesis was originally conducted during a research project focusing on government decision-making in the recovery of Christchurch. Primary research involved 23 key-

informant interviews conducted in Christchurch and Wellington by a team of Canadian and New Zealand researchers in May of 2012. The research was initiated by Dr. Stephanie Chang, Professor at the School of Community and Regional Planning, and Dr. Ken Elwood, Associate Professor of Civil Engineering, both at the University of British Columbia. The original project focused on first exploring what the most important decisions had been, and better understanding the rationale and consequences of those decisions.

The research identified a large number of decisions in the recovery, and this thesis will focus on three key decisions:

- Establishing and maintaining the Cordon around the Central Business District (CBD)
- Establishing the Christchurch Central Development Unit (CCDU)
- Establishing a system of residential land zoning.

These decisions have been selected for two reasons. Firstly, at the time of the interviews (May 2012), they were identified by interviewees as among the most important in the recovery of Christchurch to date. Secondly, these decisions are strong examples of the government's role in managing uncertainty for different stakeholders at different stages of the sequence.

## Chapter 2. Literature Review

The literature review will explore three areas. Firstly, it will explore the existing literature on disaster vulnerability and approaches to understanding the resiliency of actors (such as businesses) to disasters, with particular attention to the role of uncertainty in resiliency. Secondly, this gap will be contextualized with a review of an emerging theme in the literature, the role of engagement in building long-term resiliency to disaster events. This theme is relevant in the sense that there may be trade-offs between reducing uncertainty with decisive decision-making, and sacrificing certainty for inclusive decision-making. Finally, a brief overview of game theory, uncertainty, and the role of government will be provided. These concepts will be illustrated with the example of Federal Deposit insurance and the prevention of bank runs.

### 2.1 Vulnerability

A number of approaches have been taken to understanding vulnerability to disaster events, and the factors that impact a particular actor's ability to recover. Hewitt (1997) has argued that disaster vulnerability is a function of both social factors such as gender relations, as well as physical exposure to an event. Similarly, other scholars have stressed the importance of understanding disasters as occurring within their social structure, and as the "result of human-environment interaction" (Newton, 1997; Mileti, 1999).

At the macro-level, a number of scholars have shown that while disasters have clear short-term impacts, they can also have long-term structural impacts (Benson & Clay, 2004; Murlidharan & Haresh, 2001). Chang (2000) demonstrated the long-term impacts on traffic at the Port of Kobe following the 1995 earthquake. These can include national level impacts, as Charveriat (2000) demonstrated, looking at 35 natural disasters across Latin America and national debt levels.

At the level of individual businesses and people, academic studies have considered a large number of different factors to predict vulnerability to a particular event. Chang and Falit-Baiamonte (2001) constructed a conceptual framework of business vulnerability and loss in disasters based on a study in Seattle after the Nisqually Earthquake. The model was based on attributes of the business, for example how quickly it could re-open, if its market was local, etc. (Chang & Falit-Baiamonte, 2011). In another example, Tierney and Dahlamer (1998) conducted a large scale survey of businesses following the Northridge earthquake in Los Angeles. In this study, the authors suggested four overall factors which influence a firm's survival after a disaster event: these are firm characteristics such as size, direct and indirect disaster impacts, earthquake shaking intensity, and utilization of post-disaster aid (Dahlamer & Tierney, 1998). Alesch et al. (2001) took a different approach with in-depth open-ended interviews with a smaller number of businesses owners from a range of disasters across the United States. From the study, the authors concluded that "perhaps the most important variable in the survival equation is the extent to which the owner or operator recognizes and adapts to the post-disaster situation". Furthermore,

from this study the authors argued that “there are strong indications that the variables that set apart those that survive from those that do not cannot be isolated” (Alesch, Holly, & Mittle, 2001).

In the context of Christchurch, a number of organizations have been studying disruption to businesses. Kachali et al. (2012) recently published results from a study of businesses from the 2010 Darfield Earthquake. This study focused on characteristics of individual businesses, for example asking respondents to answer yes or no to statements such as “when we need to, our organization can make decisions quickly” and comparing that information to success rates in recovery (Kachali, et al., 2012).

Recovery from disasters remains as the least researched phase in the disaster cycle (Olshansky & Chang, 2009). Much of the existing research has focused on individual businesses, looking for trends in business characteristics. This research has also included how effectively businesses are able to access some government services, such as disaster assistance. However, relatively little research has been done on the wider context in which market actors such as businesses make decisions, and the role of government in creating that environment. Galbraith and Stiles (2006) undertook a literature review on entrepreneurial activity in disaster recovery and found that literature on the role of entrepreneurial activity is “sparse at best”.

Olshansky and Chang (2009) argue that “the central issue in post-disaster recovery is the tension between speed and deliberation”. Implicit in this trade-off is the level of community engagement, and the rebuilding of social capital. The term social capital was originally developed by Robert Putnam who defined it as “trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions” (Putnam, 1994). There is currently a lack of empirical evidence linking social capital with community resilience (Chandra, et al., 2010). However, a number of scholars have argued forcefully for the recognition and exploration of social capital in the disaster cycle (Nakagawa & Shaw, 2004). In *Building Resilience*, Aldrich (2012) argues that social capital can explain why some areas recover faster than others. The author argues that social capital is the key factor in recovery and social capital matters “more than such factors such as greater economic resources, assistance from the government or outside agencies, and lower levels of damage” (Aldrich, 2012). This follows an argument by other scholars that more engagement in all stages of the disaster cycle is important to building long-term community resilience (Magsino, 2009; Haines, Hurlbert, & Beggs, 1996). In the context of Sri Lanka following the 2004 tsunami, Kenned et al. (2008) found that “community involvement is essential, but that does not necessarily mean community control”.

One study was found that directly addresses the question of speed and deliberation in the recovery from the Tsunami in Sri Lanka. In this case, the Government quickly established a coastal buffer zone, and the authors argued that “the hasty application of post-disaster policies with long-term repercussions may only amplify socio-economic inequalities, compromise

livelihoods, community structure, and complicate environmental protection” (Ingram, Franco, Rumbaitis-del Rio, & Khazai, 2006).

Disaster recovery remains a critical area of study within the disaster cycle, and balancing the need to build back better or faster has been identified as an area requiring further research.

## **2.2 Game Theory and the Role of Uncertainty in the Disaster Cycle**

A limited number of studies were also found relating to the role of managing uncertainty in the disaster cycle. Goto et al. (2006) examined the psychological impact of uncertainty on survivors and evacuees following the 2000 Miyake Island volcanic eruption, finding that “material loss and uncertainty of material loss were associated with higher rates of reported PTSD” (Goto et al, 2006). Other research has examined the role of government in reducing and managing uncertainty in the context of terrorism, as well as the possibility of private corporations deliberately creating uncertainty following oil spills (Comfort, 2005) (Button, 2010).

One perspective to approach the impact of uncertainty is through the lens of game theory, and how actors respond to different sets of incentives. Very few examples were found in the literature which considered the role of game-theory or market failure in the disaster cycle. These studies focused largely on insurance markets, with an emphasis on pre-disaster timeframes, rather than recovery. For example, a number of studies have examined the role of “Charity Hazard” or the tendency of actors to underinsure because they anticipate government assistance (Raschky & Weck-Hannemann, 2011; Raschky P. , 2008; Browne & Hoyt, 2000). Several other examples were found focusing on market failures of insurance markets. For example, Auffret (2003) looked at market failures in Caribbean insurance markets and recommended policy interventions such as enforcing land-use regulations and the building code. A report from the World Bank on risk reduction in Mexico focused similarly on failures in insurance markets and new financing instruments to spread risk (Kreimer, et al., 1999).

While a small number of studies were identified which considered uncertainty, no examples were found of modelling the impact of uncertainty, and specifically the impact of government decision-making, on different stakeholders in recovery. This is important because the government’s unique position allows it to manage uncertainty, and create incentives for a large number of self-interested private actors. To illustrate this concept, Federal Deposit Insurance will be used as an example. A thorough exploration of deposit insurance is beyond the scope of this thesis; however, this section will draw on the basic theory behind deposit insurance to develop a framework to approach thinking about the role of government in creating confidence during times of uncertainty.

### 2.3 Federal Deposit Insurance as a Model For Managing Uncertainty

Federal Deposit Insurance was first introduced in the United States following the Great Depression to prevent bank runs (Diamond & Dybvig, 1983). The Great Depression saw a cascading failure of banks across the United States, and deposit insurance was designed to protect banks from speculative withdrawals by depositors who were unsure of the bank's financial position. Without deposit insurance, if depositors saw the health of the bank as uncertain, it could be rational to withdraw their money just in case. Even if the bank is financially healthy, this can create a self-fulfilling outcome and initiate a bank run. In the language of game-theory, this would be called a "Nash Equilibrium" in which actors protect themselves and generate an outcome which is worse for everyone than the optimal scenario, but better than the worst-case scenario (Nash, 1951). In the event of a failure, a large number of depositors lose their money because the bank only carries a small fraction of its deposits on hand. This means depositors have a strong incentive to withdraw their money if they believe there is any chance of a bank failure.

Deposit insurance is a government intervention that guarantees deposits up to a certain amount. When the health of a bank is questioned, individual depositors know the government is backing their deposits, and in theory do not face the incentive to withdraw their money (White, 1989). Depositors know their money is safe, and they also know that the other depositors face the same situation. Because all depositors know this, none of them should be incentivized to withdraw their money (Wheelock & Wilson, 1995). This means the bank will have the opportunity to recover, and the insurance plan will not have to pay out any depositors. This does assume that depositors believe the Government will be willing and able to stand behind its guarantee of the bank.

In this way, the government insurance scheme has *incentivized a large number of self-interested private actors to do something that is in their collective interest at a very small cost*. In theory, the only cost of this program would be the transactional and administrative costs associated with running the program. At the same time, the benefits of not having bank failures are potentially very large to the economy and to depositors. In this case, the government is able to use its size and its credibility to intervene in the market and create incentives which align the public and the private interest at a very small cost.

In actuality, programs such as deposit insurance are not this simple and carry complex risks and moral questions. A key issue is the risk that is assumed by taxpayers which is sometimes called "moral hazard" (Keeley, 1990). In a deposit insurance scheme, the government and the taxpaying public agree to back a private, for-profit business. This may encourage or allow that businesses to engage in riskier lending behaviour, as was dramatically illustrated in the Financial Crisis of 2008. In this case, the taxpayer was exposed to the liabilities of banks that had engaged in risky lending practices. For this reason, deposit insurance programs often have rules for



participating institutions, such as minimum percentage of total deposits that must be kept on hand.

As previously stated, an exploration of deposit insurance is beyond the scope of this thesis. The program is only covered at this very theoretical level to introduce a framework for thinking about the role of government intervention in creating public-interest actions from self-interested private actors. In the context of recovery from a major disaster, there can exist significant uncertainty, and the government will be looked upon to make decisions that can create positive incentives through confidence. Similarly to the bank example, the role of uncertainty can be critical in the incentives faced by individual actors, and in disaster recovery there may be opportunities for the government to intervene and create confidence.

The literature review revealed significant work on vulnerability, and the role of community engagement in disaster recovery. However, the review found relatively little research on the role of uncertainty in disaster recovery, how that uncertainty can create incentives for different actors in the recovery, and the role of government in intervening to change those incentives. This thesis will focus on that gap, or the role of uncertainty in disaster recovery, and how government can manage that uncertainty.

## Chapter 3. Conceptual Framework, Methodological Approach, and Data Collection

This thesis seeks to explore the question: *How can government decision-making facilitate recovery by managing uncertainty?*

This question will be addressed with the following three sub questions:

- What uncertainties were created at different levels by the earthquake sequence?
- How did government decisions affect uncertainty?
- What lessons can be drawn from these decisions and their impacts?

A conceptual framework has been developed to explore each of the sub questions, and the framework is described in section 3.1. The framework is used to analyze data collected during 23 key-informant interviews conducted in Christchurch and Wellington New Zealand in May of 2012.

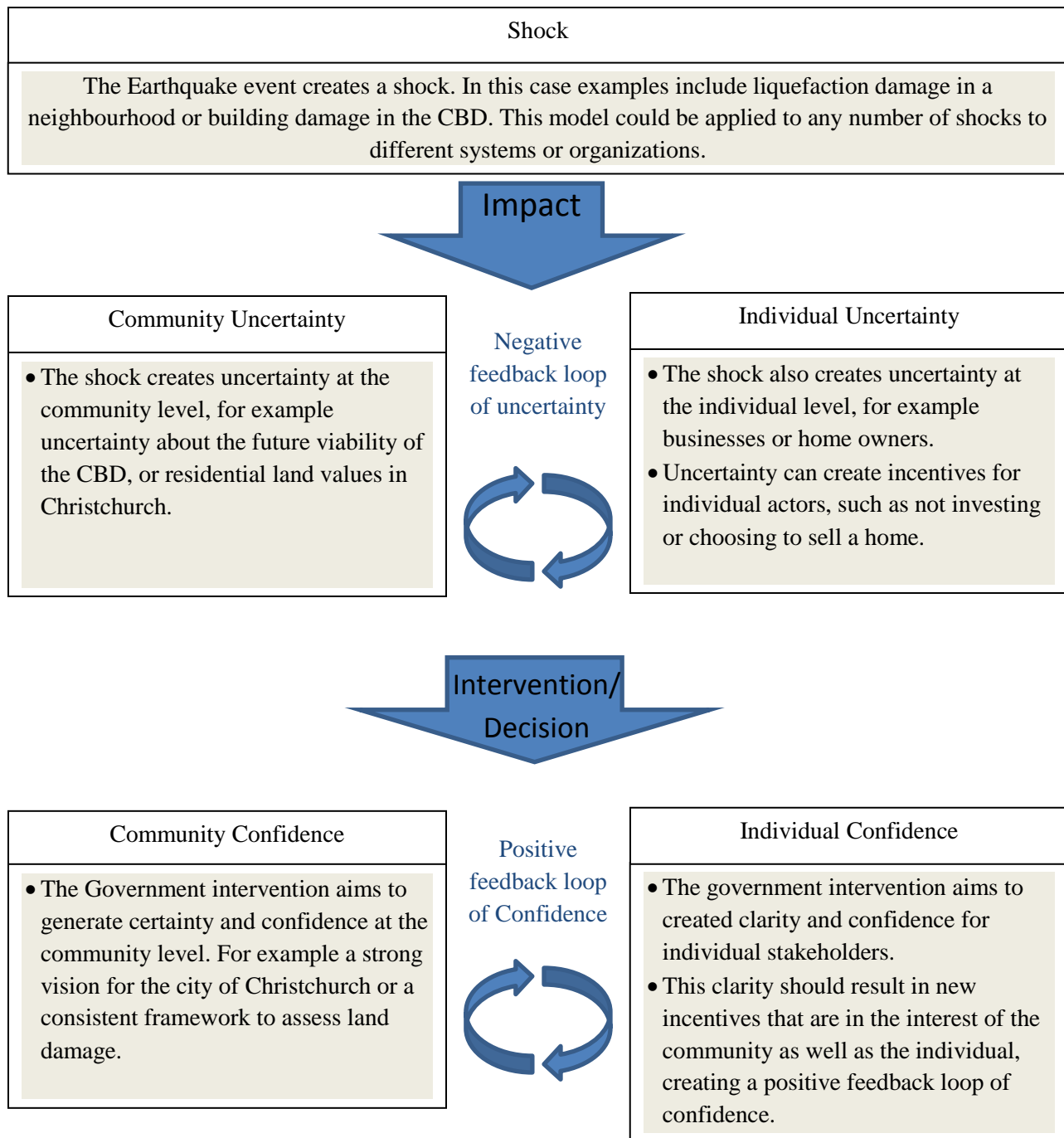
### 3.1 Conceptual Framework

The literature review revealed a lack of theoretical work on the role of uncertainty in disaster recovery. To analyze the role of uncertainty in the recovery from the Christchurch Earthquake, a conceptual framework has been developed which is shown in Figure 1.

The diagram below summarizes the working hypothesis on the influence of uncertainty, in particular as a dynamic between individual actors and the larger group. This thesis will investigate to what extent this influence was borne out in the three case studies of Christchurch.

The first box represents a shock, in this case created by the earthquake sequence, such as liquefaction causing disruption to the property market. The next two boxes represent a negative feedback loop created by uncertainty between individual actors, and the larger group. The final two boxes represent the situation following the intervention, when a new positive feedback loop of confidence is created between individuals and the wider community.

**Figure 1: Conceptual Framework**



**Shock-** This is an impact of the earthquake sequence, example shocks include land damage in the Eastern Suburbs, or the large number of damaged buildings in the Central Business District. This model could be adapted to any number of shocks to demonstrate how they create uncertainty. In the example of Bank Insurance, a shock would be some event that suddenly

creates a lack of confidence in the health of the bank, such as a failing of one of its major creditors.

**Individual and Community Uncertainty-** The shock creates uncertainty at both the individual and community levels. In this model, the words *individual* and *community* are used to represent two different groups with individual representing an individual actor such as a household, a local business, or an insurance company. Community is used to represent the group overall, although this could be at a number of scales. For example, community could include all the local businesses, which would prefer to be in the CBD if it is revived. The model seeks to explore the dynamic created between individual actors and their wider community given the existence of uncertainty. For example, by examining how individual actors respond to uncertainty at the community level, and how in the aggregate it can create more uncertainty at the community level.

In the case of bank insurance, community uncertainty would pertain to the bank overall, and individual uncertainty would be faced by depositors who may have the incentive to withdraw their money. If all depositors try to withdraw their money, then the bank will fail, and the depositors will lose some portion of their savings. This is a negative feedback loop between the individual depositors and the perception of the bank overall.

**Intervention-** This is an intervention by some level of government. In the case of Christchurch these decisions could include the establishing of the CCDU, maintaining the Cordon, or creating a system of residential zoning. In this model, interventions are framed as mechanisms to reduce or manage uncertainty. In the case of a bank, the intervention would be the creation of a deposit insurance program.

**Individual and Community Certainty** This is the outcomes of the intervention, both in terms of creating certainty and how the dynamic between individual and community interests may have been altered. The intervention has the potential to align the private interest with the group interest, and create a positive feedback loop of confidence. In the bank insurance example, the insurance scheme would work correctly if depositors chose not to withdraw their savings and the bank was given the opportunity to recover. In this case, the depositors have created a better outcome for themselves as individuals and for the community as a whole.

### 3.2 METHODOLOGICAL APPROACH AND DATA COLLECTION

As noted in the first chapter, this thesis grew out of a research project on the Christchurch earthquakes for which the author was a research assistant. The original purpose of the research project was to identify, and better understand the key decisions made in the first 18 months following the Christchurch earthquake. During the original research, the role of uncertainty emerged as a central theme in the recovery and as a key driver in decision-making. The original fieldwork and research project provided the basis, and motivation for this thesis.

Data were collected through two methods; firstly, through an ongoing scan prior to the research trip of online resources including:

- Technical reports from the Central Government Recovery Agency, the Canterbury Earthquake Recovery Authority (CERA) and research organizations.
- Monitoring the websites and social media streams from different governmental and non-governmental agencies involved in the recovery.
- Popular media articles.
- A review of academic literature on disaster recovery, game theory in the face of uncertainty, and bank insurance.

The primary data source is a series of semi-structured key-informant interviews conducted during a research trip to New Zealand with the assistance of locally based research partners. The Canadian team worked with Dr. Erica Seville, and David Brunsdon at Resilient Organisations in Christchurch to develop and contact an appropriate list of interviewees.

Over a two week period in May of 2012, the Canadian and New Zealand research teams conducted 22 semi-structured, in person interviews in Christchurch and Wellington<sup>1</sup>. One additional interview was conducted in Vancouver for a total of 23 interviewees. All but one of the interviews were conducted by two or more members of the research team and interviews typically lasted 60 and 90 minutes. All interviewees were first asked to identify the three key decisions that they considered to be most important overall, and then to identify the three most important decisions within their area of specialty. One interviewer asked questions while a second made notes and audio-recorded the interview using a handheld recorder. The interviews sought to take advantage of the interdisciplinary nature of the research team, for example including an engineer interviewer with an engineer interviewee. Following the interview, the notes were transcribed using the audio recording. The author was involved as a note-taker or interviewer in the majority of the interviews, and was responsible for transcribing all the interviews.

Interviewees signed a consent form outlining the purpose of the research project, agreeing to be recorded and be acknowledged by name for their responses. All information that is cited from the interviews is as of May 2012. All the interviewees did agree to have their statements attributed to them. However, due to sensitivity of some of the information collected, and the ongoing nature of recovery in Christchurch, data from the interviews will be cited by a letter-based code by interviewee category as will outlined later in this section.

For a number of reasons, the research team was able to develop a very comprehensive snapshot of the different elements of the recovery up to the time of the interviews. First, New Zealand is an English speaking country with similar political and economic institutions to Canada. Second,

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<sup>1</sup> One of the interviews was conducted by video conference.

the team members from Resilient Organisations were very involved in the response and continuing recovery in Christchurch. The New Zealand team members were able to identify and provide connections to key interviewees. Furthermore, the New Zealand team was able to assist in developing interview questions that were relevant to the interviewees and participated in a number of the interviews. Without the assistance of David Brunsdon and Erica Seville, the project would not have been able to develop and contact the same list of interviewees. Finally, both Stephanie Chang and Ken Elwood had travelled to New Zealand, and had developed relationships with contacts there. In particular, Ken Elwood had been in Christchurch during the February earthquake, and had personally been involved in building evaluations during the response, building personal relationships with many of those involved later in the recovery.

For these reasons, the team had excellent access to information, and was able to gather detailed information on a large number of aspects of the recovery up to the time of the interviews. In addition to addressing the question of uncertainty outlined below, this thesis seeks to document this information and ‘tell the story’ of Christchurch in the first 18 months from the first earthquake.

The interviewees were selected based on their involvement within different areas of decision-making, and included engineers, insurance industry representatives, community group representatives, City and CERA staff and others. The sample of interviewees sought to balance expertise across four key areas:

- The Central Business District
- Suburban areas and Residential Zoning
- Building Codes and Evaluation
- Insurance

The initial research focused on decision-making, and the analysis groups interviewees into four groups based on their role in decision making.

- Decision Makers
  - This includes senior member of organizations tasked with making major decisions in the recovery.
  - This group is cited as (Decision-Maker) throughout the thesis.
- Decision Implementers
  - This category includes mid-level staff generally involved in the implementation and execution of decisions. Many of these interviewees were CERA staff.
  - This group is cited as (Implementer) throughout the thesis.
- Business and Community Groups
  - This category includes representatives of groups that were impacted by decisions. For example, business or neighbourhood associations.
  - This group is cited as (Community) throughout the thesis.

- Insurance
  - This category included representatives from insurance companies, as well insurance industry associations.
  - This group is referred to as (Insurance) throughout the thesis.

Information from the interviews is cited by category as outlined above, and using a letter code to indicate a particular interviewee. For example (Decision-Maker B) would refer to one of the decision-makers coded B, while (Community D) would refer to interviewee D from the Business and Community Group. As previously stated, due to the ongoing nature of the recovery, it was decided to cite interview data by person code.

Interviewees were balanced across these three groups when possible to maximize the understanding of decisions, from understanding on what basis an individual made a decision, to the reality of implementing that decision, and the impact on different groups. Interviewees are identified and grouped by these categories in Appendix A.

The interview questions in the original project focused on identifying what the most important decisions had been, and developing an understanding of those decisions. Interviewees were first asked to identify what they believed the three most important decisions overall had been, as well as the top three decisions within their area of expertise. For example, this could include insurance or building standards. Interviewees were then asked to elaborate on their understanding of those decisions: why they had been made, what the drivers had been, if the results of the decision had been expected, etc. A generic list of the interview questions can be found in Appendix B. The data gathered by this research has since been published in a report by Resilient Organisations (Taylor et al. 2012), and in a forthcoming article in *Earthquake Spectra* (Chang, et al., 2014).

Data for the analysis in this thesis is based on the time when the interviews were conducted. Because of the timing of the intervention relative to when the interviews were conducted, data collected is weighted more to different sections of the Conceptual Framework for different decisions. In the case of the Cordon, that intervention had been in place since the February 2011 earthquake, and interviewees were able to report on outcomes of the intervention playing out. In contrast, the CCDU decision had just been announced prior to the research trip, and interviewees spoke more to the situation prior to the intervention, and their hopes for the outcome of the CCDU. Residential zoning is in the middle, with zoning decisions still ongoing during the research trip. During the interviews, residents were still in the orange zone, red zone residents were still negotiating purchase offers, and significant uncertainty remained for TC3 residents (described further in Chapter 4, below). While the ultimate outcomes of these interventions will take years to be known, the interventions were at different stages in terms of short-term impacts, and this reality is explored in the analysis. The approach allows for the conceptual framework to be applied in three different circumstances, to explore different instances of uncertainty and how the government has responded.

Chapter four will provide more detail on the Christchurch context, including specific pre-existing policy related to the recovery. This chapter will also provide a more detailed overview of the earthquake sequence based on data and perspectives gathered during the interviews. Chapter Five applies the conceptual framework firstly to the decision to maintain the Cordon, then to establish the CCDU, and finally to establish residential zones.



## **Chapter 4. Earthquake Sequence Context**

This Chapter provides an overview of the Christchurch context as well as the earthquake sequence as it has unfolded. Section 4.1 provides a summary of the City of Christchurch and the key local economic drivers. Section 4.2 provides background on key policies relevant to the earthquakes, including insurance and the earthquake prone building policy. Section 4.3 provides a sequential narrative of the earthquake sequence, from the first earthquake in September 2010, to the time of the interviews in May of 2012.

### **4.1 The City of Christchurch**

Over the past 10 years, New Zealand has experienced more than 25 earthquakes over a magnitude of 6.0, making it one of the most tectonically active countries in the world. The City of Christchurch is New Zealand's second largest city and is the largest city on the South Island. As of 2012, Christchurch had a population of 375,000 and region of Canterbury (including Christchurch) accounted for 12% of national gross domestic product (CCDU, 2012).

The city is centred on a Central Business District, which is generally demarcated by four avenues of the city's grid pattern (Bealey Avenue, Fitzgerald Avenue, Moorhouse Avenue, and Deans Avenue) (Figure 3). Prior to the earthquake sequence, some 50,000 people were employed in the CBD, working at 6,000 different businesses (Stevenson, Seville, & Vargo, 2012). Prior to the earthquake sequence, the city had a total of 314 registered heritage buildings, and as of June 2013 103 had been demolished (New Zealand Historic Places Trust, 2013). A number of interviewees reported that prior to the earthquake sequence, the CBD was in a state of commercial decline, with high vacancy rates and low rents.

Along the Avon River to the Northeast of the CBD lie the 'Eastern Suburbs' (Figure 2). This is generally a lower socio-economic area, and was known to be hazard-prone prior to the earthquakes, especially to flooding (Decision-Maker C). To the South of the CBD is the Port Hills, a higher socio-economic area consisting of houses built on the slopes overlooking the city and the ocean.

**Figure 2: Impact Reference Map**



**Figure 3: The Christchurch Central Business District**



## **4.2 Policy Context**

Earthquake hazard is well known in New Zealand with a number of key policies in place. This section provides a brief overview of key policy context in the earthquake recovery including Christchurch's Earthquake Prone Building Policy, and the Earthquake Commission (EQC), Zealand's national earthquake insurance scheme.

### **4.2.1 Earthquake Prone Building Policy**

In New Zealand, the building code is organized at the Central Government level through the Building Act. The building Act defines an “earthquake-prone building” as one that is likely to suffer collapse, causing injury or death, in a moderate earthquake (Department of Building & Housing, 2004)<sup>2</sup>. A moderate earthquake is defined as one that is one third as strong as the shaking level to which new buildings are designed. While the Building Act defines earthquake prone buildings, it delegates to local governments the responsibility of creating a policy to identify and strengthen earthquake prone buildings (Department of Building & Housing, 2004)<sup>3</sup>. Prior to the earthquake, the Christchurch City policy required that buildings be strengthened to more than 34% of new building standard (Christchurch City Council, 2011b).

### **4.2.2 Earthquake Insurance and the Earthquake Commission (EQC)**

New Zealand has among the highest levels of earthquake insurance in the world, with residential insurance organized into a dual public-private system. All households with home insurance are required to buy earthquake insurance through the Earthquake Commission (EQC) with the option of purchasing further privately provided insurance. The Earthquake Commission was established in 1993 as a Crown Entity to provide a base level of residential insurance with a guarantee from the National Government (Parliament of NZ, 1993). EQC covers property owners for damage caused by earthquake, natural landslip, volcanic eruption, hydrothermal activity, tsunami; in the case of residential land, a storm or flood, or fire caused by any of these events. EQC covers damages up to 100,000 NZD for housing or property damage, and 20,000 NZD for contents, for a total of 120,000 NZD *per event* (EQC, 2013c). This is referred to the EQC ‘cap’. Once damages for an event have surpassed the cap, the private insurer becomes involved and covers

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<sup>2</sup> New Zealand Building Act 2003 Section 122

<sup>3</sup> New Zealand Building Act 2004 Section 131

damages above the cap. However, until it is established that damages for an event have exceeded the cap, every household must deal first with EQC (Community A).

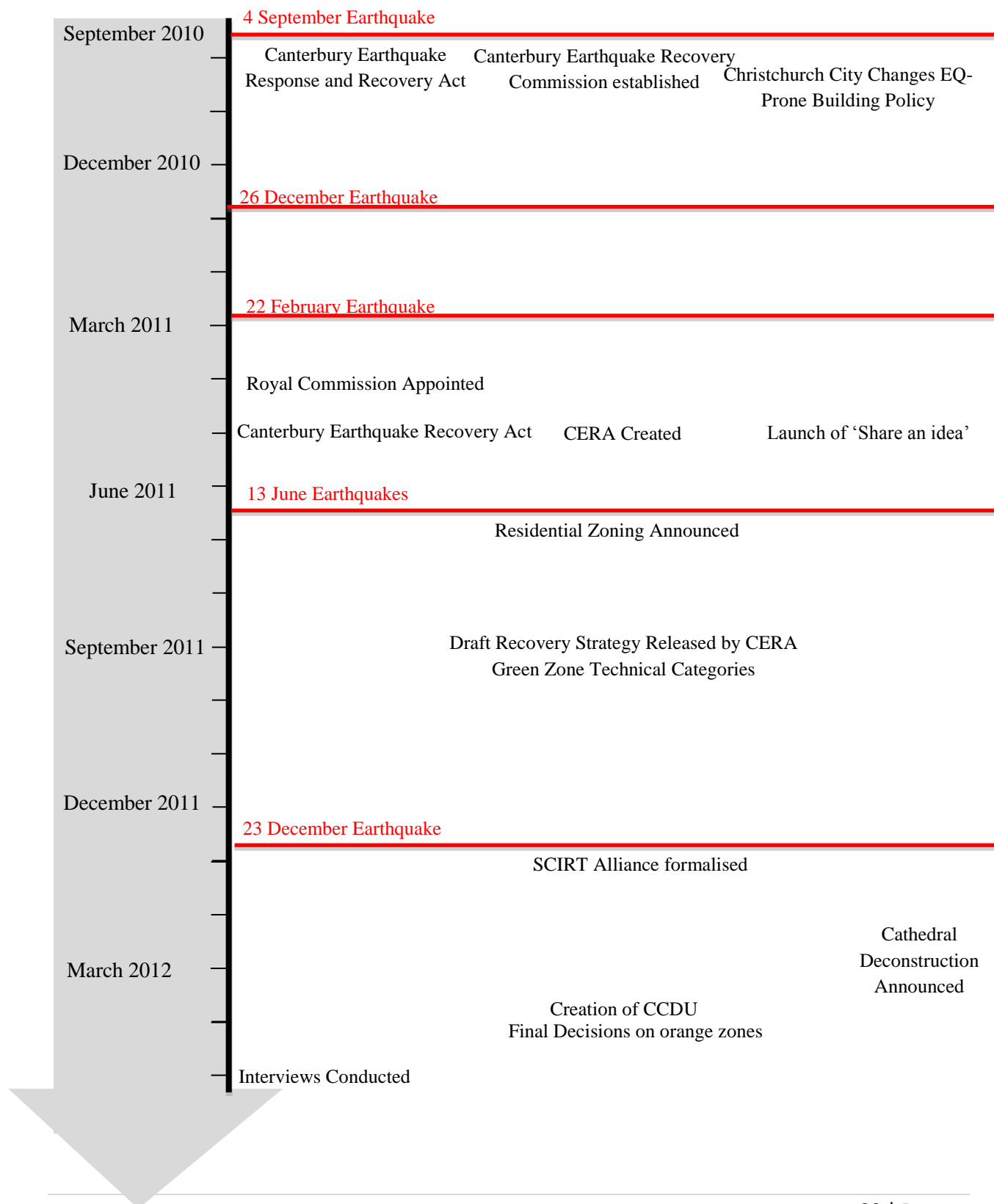
Prior to the Canterbury earthquake sequence, EQC understood its “maximum probable liability” event to be a 7.5 magnitude earthquake in Wellington. EQC estimated that this would require a fund of 7 billion NZD, supported by 2.5 billion NZD of reinsurance (EQC, 2010). Before the first earthquake, EQC had built up the fund to approximately 6 billion NZD.

### **4.3 The Canterbury Earthquake Sequence**

The earthquake sequence and recovery efforts have been unfolding since September 2010, up to the time of the interviews in May of 2012. This section will provide a brief overview of the sequence based on background research for the project, and on data collected during the interviews in Christchurch and Wellington, New Zealand.

The Earthquake sequence did impact the areas surrounding Christchurch, including the Districts of Selwyn and Waimakiriri, as well as the Port of Lyttelton. Data collected for this project focused on the city of Christchurch, and specifically the CBD as well as the Eastern Suburbs. This overview will focus on the city and the areas shown in figure 2. A timeline of the key events and earthquakes is shown below in figure 4.

## Figure 4: Earthquake Sequence Timeline

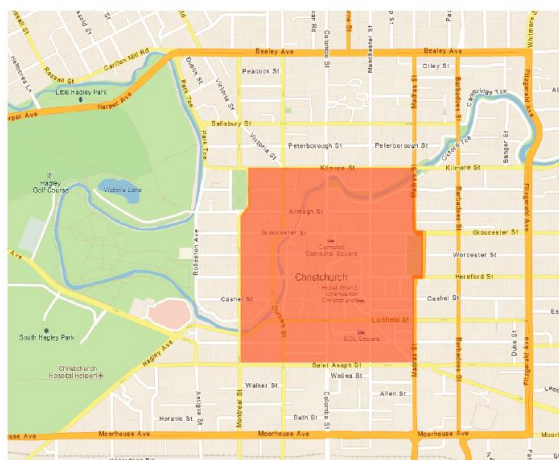


### 4.3.1 September 4, 2010

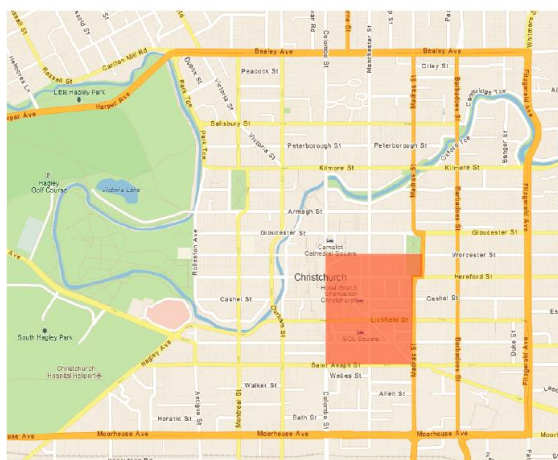
The first event occurred at 4:35am on September 4, 2010, when a 7.1 magnitude earthquake struck 35 km west of Christchurch. This became known as the Darfield Earthquake, named after the town closest to the epicenter. While no fatalities were caused by the event, there was land damage including liquefaction, and a large number of unreinforced masonry buildings across the city were damaged. Local engineers began conducting building safety evaluations by issuing red, yellow, and green placards to buildings under guidelines established by the New Zealand Society for Earthquake Engineering (Middleton & Westlake, 2011, p. 29).

Damage was concentrated in the centre of the CBD, and immediately following the earthquake, a Cordon was established around the most heavily damaged area for public safety reasons. City Staff began reducing the Cordon as inspections were completed, and the Cordon was reduced to individual buildings within approximately one week (Decision-Maker A). See figure 5 for time sequence of Cordon reductions following the September event.

**Figure 5: Cordon Reduction Following the September 2010 Earthquake**



4 September 2010



7 September 2010

(Christchurch City Council, 2010a) (Christchurch City Council, 2010b)

Prior to the earthquake sequence, approximately 50,000 people were employed within the CBD, and building damage coupled with the Cordon created uncertainty and disruption for these businesses. Providing short-term certainty for businesses in terms of cash flow was seen as

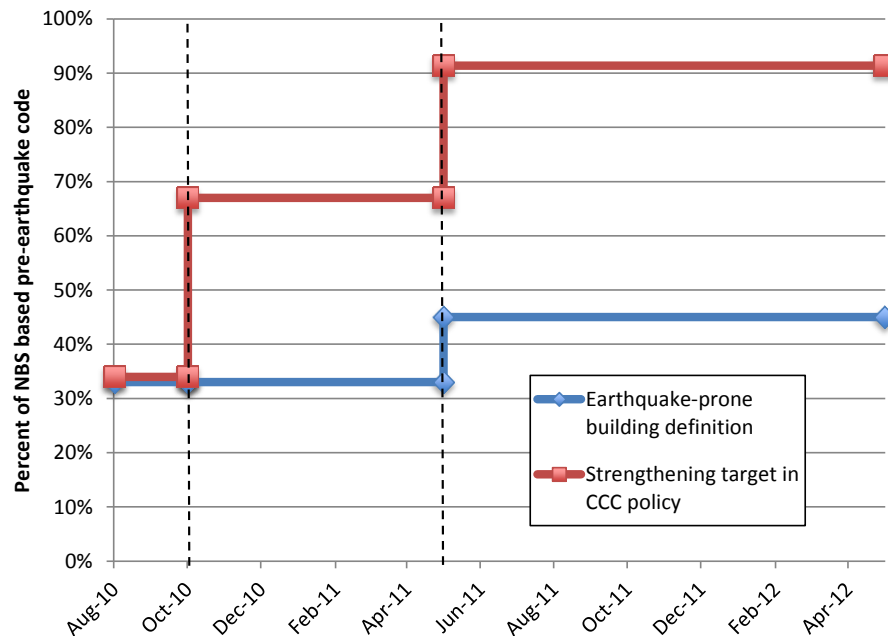
critical, and immediately following the September earthquake, the Central Government initiated an Earthquake Support Subsidy (Work and Income NZ, 2013). This subsidy provided businesses with funding to pay their employees for six weeks. The subsidy was seen as critical in preventing layoffs, and allowing businesses to retain staff while deciding how to best recover (Community H). Furthermore, the subsidy was seen as preventing large numbers of people from signing up for other government support programs.

The September earthquake also prompted an immediate review of Christchurch's earthquake-prone building policy. In an emergency meeting on September 10, 2010, Christchurch City Council voted to change the earthquake-prone building policy and raised the strengthening target from 33% to 67% of new building standard (Christchurch City Council, 2011b). This new strengthening level was a target rather than a requirement, and council retained the power to decide whether the target was practical on a building-by-building basis. The policy applied mainly to commercial buildings constructed prior to 1976, and excluded residential buildings unless they were two-storeys or more, and contained more than three dwelling units. The policy applied to all earthquake-prone buildings including those undamaged in the earthquakes, although undamaged buildings were given target timelines to comply (Christchurch City Council, 2011b).

While providing confidence for building stock going forward, the change in the earthquake-prone building policy did complicate the recovery. In part this was because insurance companies had not included the cost of strengthening buildings to 67% in their original underwriting, and some parties saw it as a retroactive change to an existing contract (Insurance A). In contrast, other parties saw "your policy is your policy," or that insurance companies were contractually obligated to replace a building deemed safe under the previous policy with a building deemed safe under the new policy (Community B).

Following the February earthquake, the Department of Building and Housing assessed that the region would see increased seismic activity, and raised the seismic loading factor (i.e., the base number by which the 67% is calculated), and raised the strengthening required. This further raised the differential between what had been originally calculated and what would be ultimately required. The impact of these changes is illustrated in Figure 6 below.

**Figure 6: Changes to the Christchurch City Council Earthquake Prone Building Policy**



(Taylor, et al. 2012)

The earthquake was seen as requiring a response from the National Government, and on September 14, the Central Government responded by passing the Canterbury Earthquake Response and Recovery (CERR) Act 2010. This Act established a seven-member Canterbury Earthquake Recovery Commission (Parliament of NZ, 2010). The Commission consisted of the mayors of each of the three affected territorial authorities (Christchurch, Waimakariri, and Selwyn) as well as four Government appointees. Overall, the primary role of the commission was to channel information from the local level up to the national level, and to advise how these new powers could be most effectively used, as well as where resources were most needed.

The CERR Act also gave the Executive Branch of the Central Government new powers to alter existing legislation through a mechanism called Orders in Council (Parliament of NZ, 2010). An Order in Council enabled the central Government to “grant an exemption from, or modify, or extend any provision of any enactment” (Parliament of NZ, 2010). This allowed the executive branch to overrule any existing legislation, including the Building Act, The Local Government Act, the Social Security Act and others. The New Zealand legal community initially reacted strongly in an open letter arguing that MP’s had made “a mistake, and they too quickly



abandoned basic constitutional principles in the name of expediency” (The Press, 2010b). However, the government did begin passing Orders in Council, for example to modify the Building Act. Interviewees generally saw this action not as an abuse of power, but as necessary to address the unique situation faced by those in Christchurch.

After the September event, EQC made a decision to manage a large number of repairs that were under the cap as opposed to cash-settling them. EQC entered into a contractual agreement with Fletcher Construction, a large contractor, and began to deploy assessors and contractors across Canterbury. By February 2011, EQC was approximately “6-8 weeks” short of completing all the assessments from the 4 September earthquake (Insurance B).

#### **4.3.2 December 26, 2010**

On Boxing Day, a series of aftershocks struck within 2 km of the CBD, with the strongest occurring at 10:30am, just at the beginning of New Zealand’s most important shopping day (Community D). Businesses in the CBD had been impacted from first earthquake and had been looking to Boxing Day to begin generating momentum and drawing shoppers back downtown.

In spite of city staff recommendations, Christchurch City Council chose not to declare a local state of emergency. This impacted the response in several ways: firstly, through the resourcing of the response, and secondly through the indemnity of the engineers conducting building assessments (Implementers A). In New Zealand, during a state of emergency, engineers volunteering to conduct building assessments are covered as agents of the Emergency Act. This was done following the September earthquake, with the issuing of red, yellow, and green placards. After the December earthquake, engineers could not issue placards because there was no state of emergency. As a result, Section 124 notices were issued (Implementers A). Section 124 notices are issued under the Building Act, and are used when a building is considered “dangerous” (Department of Building & Housing , 2004). A Section 124 notice prohibits persons from entering a building. Later on in the recovery, dealing with the large number of outstanding 124 notices as well as buildings with placards became another complicating factor for city staff as well as confusion for the general public (Implementers G).

The Boxing Day aftershock had a significant impact on retail businesses, which had already been affected by the September Earthquake. Spearheaded by the local Business Improvement Association, the business community organized a “Boxing Day Replay” sale that took place on the February 12, 2011 (The Press, 2010a). The sale was a coordinated effort including all the major retailers, and fully recovered sales (Implementers D).

#### **4.3.3 February 22, 2011**

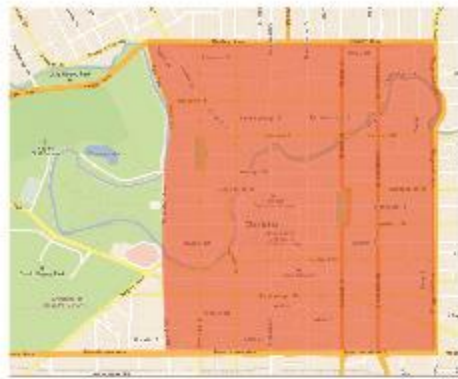
The earthquake on February 22 was the most severe of all the events in the Canterbury Earthquake sequence. The earthquake took the lives of 185 people, and caused significant damage across the city. A national state of emergency was declared, and handling the response was transferred to Civil Defense and the National Controller, John Hamilton.

The earthquake caused significant damage to buildings in the CBD, and immediately following the earthquake, a Cordon was established for public safety reasons around the four avenues bordering the CBD (Figure 3). Building safety evaluations were separated into different operations to most effectively triage engineering resources. For example, “Operation Shops” focused on essential retail outlets like grocery stores and pharmacies, while the “Critical Buildings Project” brought together the most experienced engineers to evaluate the tallest and most complex buildings in the CBD (Implementer E). The organizing of evaluations into different projects, and in particular the Critical Buildings Project, was raised during the interviews as key to triaging engineering resources and facilitating the response (Implementer H).

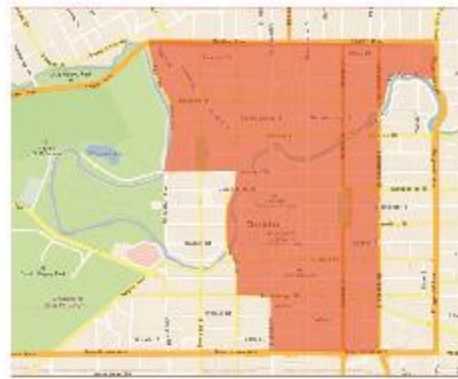
The extent of damage in the CBD made it clear to local businesses that the Cordon would be up for much longer than after the September Earthquake, and businesses began relocating to suburban areas around the city (Community H). Business access to the CBD became a recurring issue as Civil Defence sought to manage public safety with the need of businesses to access materials critical to their operations. A number of access operations were organized; however business owners were never given completely open access to their businesses. The Earthquake Support Subsidy program for affected businesses was immediately re-instated for an additional six weeks, and was extended further for some businesses (Community F).

The Cordon from the February Earthquake would gradually be reduced over time. However, the complexity and scale of demolitions meant that a portion of it would remain standing over 2 years later (Figure 7).

**Figure 7: Cordon Reduction Following the February 2011 Earthquake**



22 February 2011



10 March, 2011



14 March 2011



11 April 2011



27 May 2011



16 March 2012

(Taylor et al. 2012)

Liquefaction occurred throughout the Eastern Suburbs with some areas sinking by over one and a half meters (Implementers F). Land damage was also a major factor in the Port Hills, with landslip and rock-fall creating complex geotechnical problems. Managing land damage in residential areas became a major factor in the recovery and created significant disruption and uncertainty for those in the most affected areas. The issue of land damage and the government's response is discussed in further detail in Chapter Five.

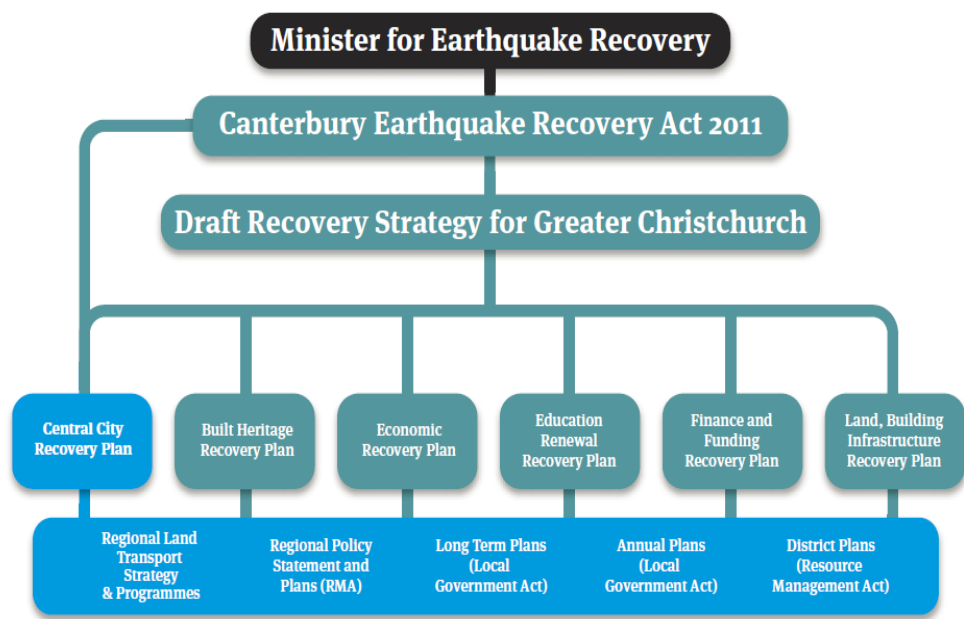
Damage from the February earthquake far surpassed damage from the previous events, and several interviewees stressed it was clear that the Recovery Commission was not the appropriate body to guide the recovery given the scale of the disaster (Implementers B). In April 2011, the Central Government passed the Canterbury Earthquake Recovery (CER) Act 2011. Canterbury Earthquake Recovery Authority CERA was created in part to “enable community participation in the planning of the recovery of affected communities without impeding a focused, timely, and expedited recovery” (Parliament of New Zealand, 2011). CERA was created as a new government department with its own minister, vested with powers designed to expedite the recovery. Gerry Brownlee, a Member of Parliament MP from Christchurch with the governing National Party, was appointed the Minister for Recovery. Lianne Dalziel, an MP from the opposition Labour Party, was appointed as the Critic in the shadow cabinet. Ms. Dalziel was interviewed as part of the research, and Mr. Brownlee was contacted, but was unavailable for an interview. Several senior CERA staff were interviewed, including Roger Sutton the Chief Executive Officer.

CERA took over from Civil Defence in May 2011 as the state of emergency ended and became the main agency driving the recovery. CERA became the driving body in many of the decisions analyzed in this thesis, and during the interviews, the formation of CERA was overwhelmingly identified as the most important decision in the Recovery of Christchurch. A summary of the most important decisions identified is provided below, in section 4.3.

The creation of CERA was a major change from the recovery body established following the September 2010 Earthquake. In contrast to the Recovery Commission, CERA was under the leadership of its own minister, as illustrated in figure 10, and was given wide ranging powers in the CER Act. While the Commission was about “facilitating and advising” the Authority was about “doing” (Implementers B). The structure of CERA was highlighted as a key factor in how decisions were made, and specifically that there was no board of directors between the minister and the chief executive (Community H and G). Several interviewees drew comparisons to the Queensland Recovery Authority in Australia, which was coordinating the recovery from a series of floods between November 2010 and April 2011 (Queensland Reconstruction Authority, 2011). The Queensland Reconstruction Authority was headed by a Chairman of the Board, and although it was empowered to overrule the local government, it had not had to do so at the time

of the interviews (Community G). This was highlighted as indicative of the positive relationship between the Queensland Recovery authority and local government.

**Figure 8: CERA Organizational Chart**



(Christchurch City Council, 2011a, Reprinted with Permission from CERA)

The response and recovery involved significant cooperation between City Council Staff and CERA, as well as the local Council and the Minister. Interviewees from both city staff and CERA saw the relationship between Council and CERA as relatively good given the circumstances, and improving as time went on (Decision-Maker D). Many interviewees, including city staff, recognized that the task of recovery was beyond the capacity of local government, and several interviewees called for much more intervention and leadership from the Central Government (Implementer E).

The CER Act delegated the creation of a recovery plan for the CBD to Christchurch City Council. This recovery plan was to be submitted to the Minister for Earthquake Recovery, and was to fit within the overall recovery strategy being developed by CERA. However, a number of interviewees saw Christchurch City Council as being burdened by political gridlock, and some saw local politicians using the recovery to advance existing political agendas (Community D). For example, some saw the Central City Plan that was developed by City Council as very similar to previous plans that had been developed by City Council planning processes (Community D).

One aspect of CERA that was highlighted was its value in retaining people and institutional knowledge as the state of emergency ended (Implementer C). During the initial response, formal records were not kept as they normally would, and substantial efficiencies were created by having continuity of staff. CERA was able to hire staff on a flexible basis, and this was critical to retaining individuals as the recovery progressed.

Overall, establishing CERA was widely recognized among the interviewees as the most important decision in the recovery of Christchurch (see section 4.3 below). CERA represented a greatly expanded role for the Central Government, and signalled a political willingness to become involved in the recovery, and expedite the process with additional Government powers. The Recovery Authority was critical in all of the decisions analyzed in this thesis, and its unique structure and powers allowed for the recovery to progress as it did.

#### **4.3.4 June 13, 2011**

Another major aftershock occurred on June 13, and the remaining CBD Cordon was sealed for several days while a small number of experienced CERA engineers evaluated additional building damage. The June earthquake did cause significant damage in the CBD, including the collapse of some previously damaged buildings. Prior to this event, there had existed sustained pressure to reduce the Cordon, and the aftershock highlighted the continued safety risk within the CBD.

The continuing aftershocks aggravated land damage, and the June aftershock caused further liquefaction. In June 2011, CERA announced a system of zoning for all residential properties in Christchurch to standardize land damage assessments. The city was divided into red, green, orange, and white zones.

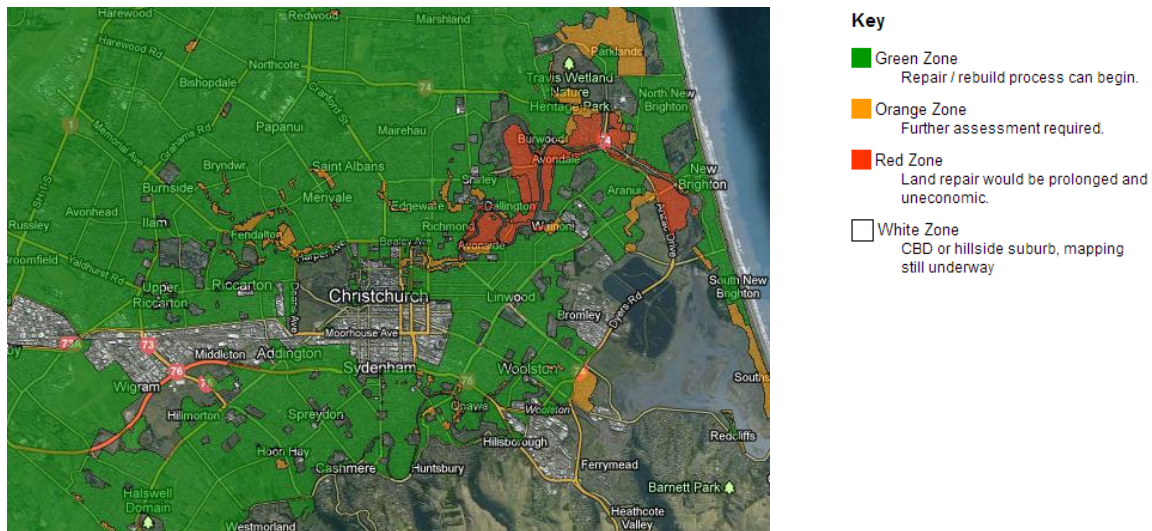
Red zone properties became subject to a Government buy-out. This land was deemed to require multi-property remediation, which was considered too disruptive and long-term for residents to continue living there. Five thousand properties were originally zoned into this category, and the government initiated a buy-out program for red zone properties.

The orange zone was created for properties that were still awaiting a final zoning decision. Zoning decisions considered a large number of factors including geotechnical work, and final decisions for orange zone property owners took longer than had originally been anticipated (Community A, Decision-Maker C). The final orange zone properties were not rezoned until May 2012.



The White zone was created for properties in the Port Hills. The damage in the Port Hills was different in nature, and included the consideration of life safety from rock-fall risk. The White zone was originally created as a holding pattern while further geotechnical work was completed.

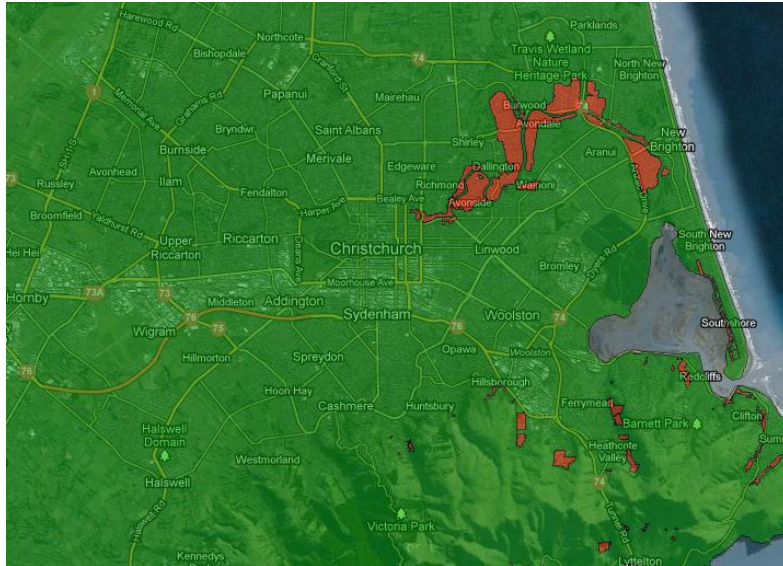
**Figure 9: Zoning Map Timeline**



22 June 2011



28 October 2011



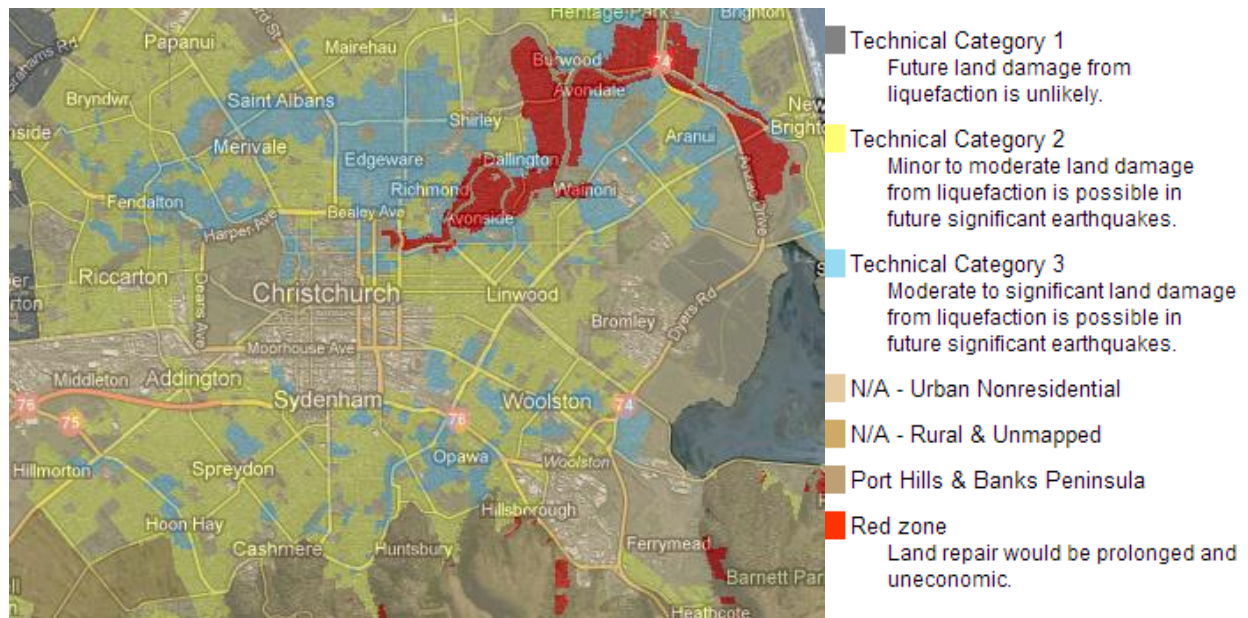
31 October 2012

(Government of New Zealand , 2013)

The vast majority of residential properties, or over 100,000, were zoned green, meaning they could be repaired and rebuilt. However, in October 2011 the Department of Building and Housing announced a new series of technical sub-categories for the green zone. The purpose of these technical categories was to indicate the different levels of geotechnical investigation required, and the likely foundation requirements (CERA, 2013c). The additional classification was seen as necessary to address the wide spectrum of risk within the green zone, and to effectively triage engineering resources. This sub-categorization has created clarity for those in TC1 and TC2, but further uncertainty in terms of insurability and property values for those in TC3.



**Figure 10: Technical Categories Map**



(Government of New Zealand , 2013, Reprinted with permission from CERA)

The earthquake sequence has created major land damage throughout Canterbury. The dual system of EQC and private insurers created a frustrating situation for many homeowners, in which EQC had to be dealt with before a household could begin settling a claim with its private insurer. (Community A). As of April 2, 2012 EQC had received a total of 467,017 claims, of which 113,869 had been closed (EQC, 2013b).

In September of 2011, New Zealand's High Court issued a declaratory judgement stating that each separate earthquake constituted a separate event, and that EQC was liable, up to its cap, for each event separately (High Court of New Zealand , 2011 ) (EQC, 2013a). While creating clarity for all parties in terms of the process, and especially for private insurers and reinsurers in terms of their liabilities, the decision created further complications in the settlement of insurance claims. The decision made it necessary to apportion a dollar value of damage to each individual earthquake to determine if damage from that event had gone over the cap. During the interviews, the insurance industry acknowledged the complexity of this, especially because often inspections could not be conducted in between the different earthquakes. At the time of the interviews, the insurance industry was developing an algorithm to automatically apportion a dollar value of damage to each event based on house location and a number of other variables (Insurance C).

Prior to the earthquake sequence EQC had approximately six billion NZD in reserves (EQC, 2010). As of April 2013, EQC had paid out approximately five billion NZD with total liabilities

estimated to be 12 billion NZD (EQC, 2013b). The costs of recapitalising EQC is expected take decades, and the cost of purchasing reinsurance in the interim is expected to be significant (Insurance C). Interviewees stressed that prior to the earthquakes, EQC premiums had likely been too low, and had been more of a levy than an accurate reflection of the risk faced by homeowners (Insurance C). Many interviewees believed that EQC rates would have to rise after the sequence to better reflect risk, and to assist in recapitalizing EQC.

The rebuild of Christchurch's infrastructure is being coordinated through the Stronger Christchurch Infrastructure Rebuild Team (SCIRT), a specialised contractual agreement or 'alliance' between CERA, City Council, the NZ Transport Agency, and several contractors (SCIRT, 2013). The agreement was formalised in September 2011 and the infrastructure rebuild plan was announced in December of 2011, with an estimated cost of \$2.2 Billion NZD (Christchurch City Council, 2011c). The cost and logistics of rebuilding Christchurch's infrastructure was not covered specifically in the interviews. One interviewee stressed that the creation of SCIRT was one of the most important decisions in allowing for the coordination of resources given the scale of the rebuild task.

The Cordon, and the future of the CBD became a major factor in the recovery of Christchurch. A large number of buildings have been demolished, and symbolically on 2 March 2012, it was announced that the Cathedral would be demolished to a height of 2-3 meters (The Press, 2012a). The Cathedral had become a contentious local issue, pitting heritage advocates against those concerned about the cost of rebuilding. A number of interviewees, particularly those in the Eastern Suburbs, stressed that the Cathedral should be a secondary concern while so many of Christchurch's citizens were still living in houses without working plumbing (Community A).

Prior to the earthquakes, Christchurch's downtown had been defined in part by the large number of Heritage buildings, including the Cathedral. Interviewees stressed that after the first earthquake, many building owners desired to repair and keep their buildings, however the successive aftershocks had worn down the buildings, and the resolve of their owners. Large numbers of heritage buildings across Christchurch have been lost, and creating city character was highlighted as one of the many challenges going forward.

On March 2, 2012, CERA announced the creation of a new unit to drive the development of the CBD. The Christchurch Central Development Unit (CCDU) was to assume the task originally delegated to the City Council with the passing of the CER Act, and was given 100 days to create a blueprint for the new City. A full discussion of the plan and the agency is detailed in Chapter four. The CCDU was created to help build confidence in the downtown and the city. As of December 2012, the CBD Cordon has been reduced significantly, but a large core of the CBD remained closed (figure 7). Demolitions of major buildings were ongoing with no date for the CBD opening announced.

The population of Christchurch has stayed relatively stable, and it remains unclear to what extent this is driven by people choosing to stay, or new people such as workers arriving to replace those that have left (Implementers C). Between June 2010 and June 2011, the city population decreased by approximately 8,900 people or 2.2%, with CERA projecting an average of 0.5% growth out to 2031 (CERA, 2013a). Despite the tremendous impacts, the vast majority of Christchurch's businesses continue to operate around the city and economic activity has stayed consistent with other areas of New Zealand (Community H). The geographic impact of the earthquakes has varied widely, and recovery is proceeding at different rates across the city.

#### **4.4 The Most Important Decisions in Recovery**

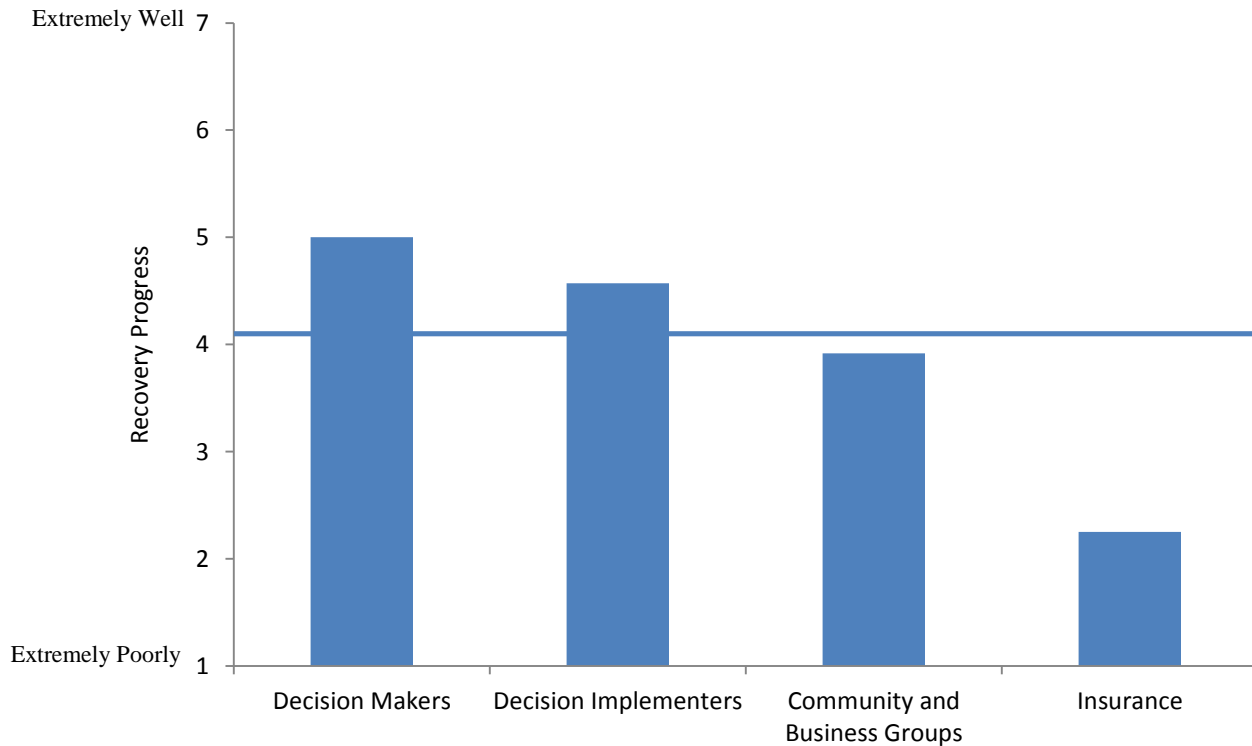
During the initial research, interviewees were asked to rate recovery progress to date. Interviewees were asked to rate how well Christchurch's recovery was proceeding overall on a scale of 1-7, with 1 being "extremely poor" and 7 being "extremely well". The average score was a 4.2, and most interviewees stressed that they believed the recovery was proceeding as well as it could, given the size of the event relative to the Gross Domestic Product (GDP) of New Zealand, and the number of earthquakes.

Respondents were grouped into categories based on their position in decision-making, as was outlined in section 3.2. The groups are:

- Decision Makers
- Decision Implementers
- Business and Community Groups
- Insurance

Several respondents highlighted the uneven impact of the earthquakes geographically, and suggested that how well recovery is proceeding "depends on where you live" (Community G).

**Figure 11: Recovery Progress by Interviewee Group**



(Taylor, Chang, Elwood, Seville, & Brunsdon, 2012)

In terms of the most important decisions in recovery, interviewees were asked to identify the three most important decisions overall in the recovery of Christchurch. Across the interviews, the decisions that were most often cited were the establishment of CERA (mentioned by 80%, or 18 of 23 interviews), the residential zoning (9 interviewees), and the CBD Cordon (5 interviewees).

## Chapter 5. Analysis

This section applies the framework to the three decisions in the recovery of Christchurch. Each decision is developed through a narrative based on data from the research, and then summarized through the diagram and conceptual framework.

The three decisions analyzed are:

- Establishing and maintaining the Cordon around the Central Business District (CBD)
- Establishing the Christchurch Central Development Unit (CCDU)
- Establishing a system of residential land zoning.

As noted earlier, these decisions are analyzed for two reasons. Firstly, these decisions were identified by interviewees as among the most important in recovery. Secondly, these decisions are strong examples of the government's role in managing uncertainty as a unique market actor.

### 5.1 Establishing and Maintaining the Cordon

This section will introduce maintaining the Cordon as a major decision in the recovery, and review the decision using the conceptual framework developed in Chapter Three. The key factor in Cordon reductions became the speed of demolitions, and this section will also review how demolitions were managed by CERA and the impact of this. This section will use the framework with the data collected to review the rationale and implications for maintaining the Cordon, the impact of the Cordon on different stakeholders, and the impact of Cordon in terms of managing uncertainty.

Damage to buildings in the Central Business District (CBD) was significant following the February Earthquake, and a patrolled Cordon was immediately established around the four avenues of the CBD (Figure 7). The Cordon was first established by the police, and management was then assumed by Civil Defence and the National Controller John Hamilton (Decision-Maker A). As the State of Emergency ended in May 2011, control of the Cordon was passed on to CERA who continued to manage the Cordon at the time of the interviews. The Cordon from the February earthquake was gradually reduced but would remain standing in some form at the time of this writing, over two years after its creation. The initial decision to establish the Cordon was universally seen as a necessity among interviewees. However, it was acknowledged during the interviews that removing the Cordon had "taken a lot longer than any of us would have expected" (Implementer F). This section will examine the decision to maintain the Cordon for an extended period of time while demolitions were completed. The following diagram shows the conceptual framework developed in Chapter three applied to the decision to maintain the Cordon.

Immediately following the February earthquake it was clear that damage was far greater than in the previous earthquakes. For the city as a whole, the level and concentration of damage created major uncertainty as to how the CBD would recover, and what it would look like as a commercial entity. The CBD had been in decline before the earthquake sequence, and its commercial health had further suffered from the initial earthquakes (Community D).

Interviewees reported that local businesses had been very resilient and at the time of the interviews 95% of businesses were still operating, despite 45% not having business interruption insurance (Community H). These businesses had survived by relocating around the city, including into houses in the suburbs, and the February earthquake created further uncertainty for the CBD. A Cordon had been established for a week following the September Earthquake, and the December Earthquake had taken place on New Zealand's busiest shopping day (Community D). These factors combined with the unprecedented damage within the CBD generated significant uncertainty in the short-term about the recovery of the CBD.

The state of the CBD translated into significant uncertainty for individual businesses. Business owners had to make decisions about whether to permanently or temporarily relocate, or close down their business. These decisions had to be made within the context of the city-wide uncertainty in terms of what the CBD would look like as a commercial entity in the future, and how long it would take. Preliminary research has been published on the recovery challenges faced by businesses from the September Earthquake, and several interviewees pointed to the resiliency of local businesses in the face of uncertainty (Kachali, et al., 2012)(Community H).

The decision to maintain the Cordon was driven primarily by life-safety. However, maintaining the Cordon had important impacts and trade-offs in terms of managing uncertainty. On the one hand, local businesses did not have consistent access to the CBD, and the indefinite nature of the Cordon created uncertainty for individual market actors trying to make decisions and plan for the future. At the same time, the Cordon created certainty in terms of the Government's commitment to managing the recovery and protecting life safety. Demolitions became the key factor in getting the CBD re-opened, and the Cordon facilitated building demolitions both in terms of time and cost. Finally, the Cordon was critical in facilitating the creation of a comprehensive and organized recovery plan for the downtown as well as a government supported re-entry.

Initially the Cordon created significant uncertainty and frustration for local businesses. During the interviews, it was raised that while the status of the Cordon had changed over time, the "one constant is that unhindered access has never happened" (Implementers D). Business owners were unable to access stock critical to the operation of their businesses and several protests were organized with one instance of business owners "storming" the Cordon to retrieve items from their businesses (Otago Daily Times, 2011).

A business access program was organized, and a consensus emerged among interviewees that over time the pressure to open the Cordon gradually subsided (Implementer C). This happened as business owners were able to retrieve items, businesses re-opened in other parts of the city, and

residents adjusted to the CBD being closed. At the city level, the Cordon sent a clear message that the CBD would be closed until it could be made safe, and this message was reinforced during the June aftershock when a number of CERA staff working within the Cordon were put in danger from falling debris (Decision-Maker B).

The key factor in reducing the Cordon became building demolitions. The complexity of building demolitions, as well as the cost of keeping dangerous buildings standing had been a key area of learning from the September Earthquakes (Decision-Maker D). A tall building that was considered dangerous could create a fall zone many times its own footprint, rendering all the buildings within that zone unsafe to occupy. For example, following the September earthquake, Manchester Courts, a 7-storey unreinforced masonry building was closed down. This required the closing of 80 surrounding businesses which were within the fall zone (Decision-Maker D).

Demolitions were initially managed by engineers under Civil Defence with international assistance, and then under CERA (Implementer D). With the passing of the CER Act, CERA was given several powers with respect to building demolitions. Firstly, CERA was given the power to issue a notice to a building owner requiring a demolition or strengthening plan within 10 days with no right of appeal (Parliament of New Zealand, 2011) (Section 38)(Implementer C). Secondly, CERA was empowered to act as a project manager for building demolitions. This could be the case if the building owner did not want to manage the demolition process, or refused to do so. Within the CBD, CERA was able to set up specific rules requiring all contractors to be licensed, creating consistency and safety in the demolition process.

The Cordon also facilitated demolitions because the entire area within the Cordon was considered a construction site. This greatly reduced the cost and time required for building demolitions, and interviewees reported certain buildings were requesting to be kept within the Cordon (Implementer C). For example, contractors did not have to produce a traffic impact study for an individual building demolition. In interviews, CERA staff highlighted the importance of CERA expediting the demolition process in terms of getting the CBD re-opened due to the large number of demolitions (Implementer C). Specifically, it was suggested that expediting demolitions had been critical to creating momentum going forward, and allowing for the re-planning of the central city (Implementer C).

Finally, CERA management of demolitions brought consistency and certainty to the demolition process, both for building owners and contractors. Prior to the earthquake sequence, there were a limited number of experienced demolitions contractors, and immediately following the earthquakes, contractor services varied widely in terms of cost and quality of work. Because of CERA's size and expertise, the agency was able to expedite the creation of an organized and competitive market for demolitions. Furthermore, interviews from CERA highlighted that "CERA is Government, we pay our bills" – and this assurance was an important factor for demolitions contractors, allowing them to operate in an environment of greater certainty, and price jobs with less contingency (Implementer C).

The Cordon did create uncertainty for the business community in the short-term, however it created certainty in the sense that *none* of the businesses could move downtown. In the absence of this, it is possible a stop-start recovery could have developed in which businesses tried to move downtown while demolitions and aftershocks continued. Businesses may also have had to choose between establishing somewhere new, or trying to re-establish themselves in the CBD still suffering from aftershocks and demolitions.

One could argue that it is in the self-interest of each individual business to be part of a concentrated and vibrant commercial centre. However, it may not be in the interest of any one business to be the first to move back downtown and take the lead on establishing that centre. Each business would prefer for the others to go first and establish a critical mass of commercial activity. In this case, the private interest is not aligned with the collective business interest or the general public interest. This scenario would produce an outcome which is not optimal for the collective of businesses, or any one individual business. The Cordon represented a Government intervention which prevented this from playing out in the short-term and created the opportunity to develop a coordinated strategy for private business to move downtown.

While the Cordon did create some certainty as to the status of the CBD, the date of re-opening created major uncertainty for businesses trying to make decisions about the recovery. None of the interviewees were able to say when the Cordon would be taken down, and it was acknowledged that most people had not expected the Cordon to stay up as long as it did (Community F). Within the context of this model, knowing when the CBD would be re-opened is critical in reducing uncertainty and allowing businesses to make decisions about re-investment.

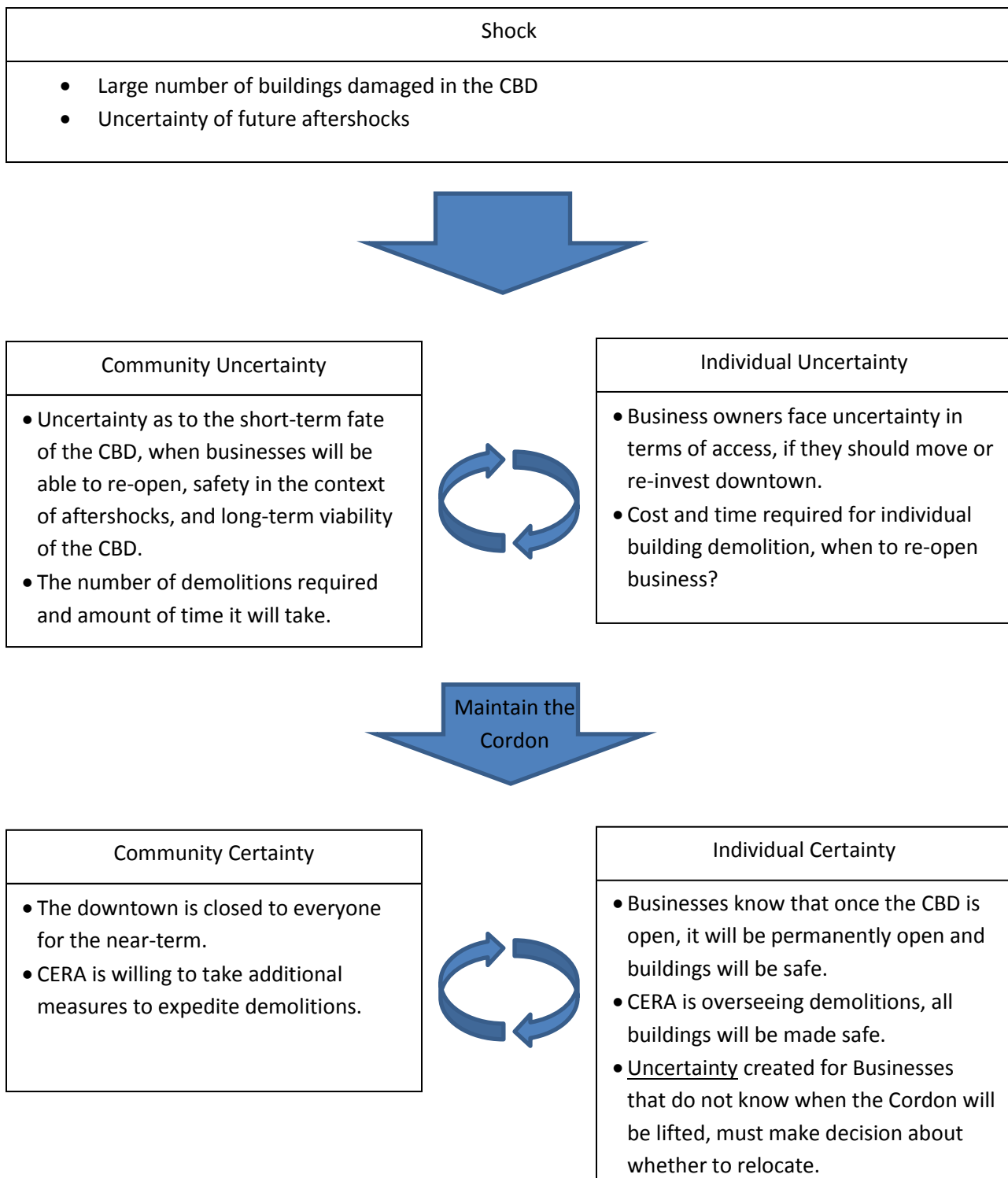
The Cordon created certainty at the city level in that the CBD was closed. The Cordon also sent the message that the Government was committed to seeing demolitions through, and the powers given to CERA demonstrated that the Government was willing to take extra measures to expedite the demolition process. This wider certainty created an environment for individual businesses in which it was clear the CBD would be re-opened at some point, and at that time it would be safe. A number of interviewees suggested that the Government had erred too far on the side of public safety (Community D). In terms of managing uncertainty, it is worth noting the implications if the Government had erred the other way, and the public as well as foreign investors did not believe the Government was willing or able to protect public safety. The value of certainty in terms of the Government's commitment to life safety could be an additional factor to explore and extend this model.

In terms of lessons learned, many interviewees stressed that it was too early to judge the full impact of the Cordon. Managing cordon access was raised as a critical issue for future planning, as well as having a plan in place to administer potential future cordons (Decision-Maker B). Allowing CERA to expedite demolitions and act as a contractor was also highlighted as a major positive lesson (Implementer D). Finally, the setting of public "stretch goals", or goals beyond



the traditional working capacity of a team, by the CERA leadership was highlighted as an important factor in driving elements of the recovery forward (Implementer D). For example, the local business community spearheaded the creation of a container mall in the CBD, or the “ReStart Mall”. In order for the Mall to open in time, the CERA engineering teams worked “twenty-four seven” to clear the Cordon (Implementer C). The Mall did open and was recognized by a number of interviewees as an important positive step in the recovery while creating a sense of progress (Decision-maker D, Implementer D).

**Figure 12: Maintaining the Cordon Diagram**



## **5.2 The Creation of the Christchurch Central Development Unit (CCDU)**

The Earthquake sequence and the Cordon created significant challenges for the Christchurch CBD. Rebuilding the CBD is a strong example in which there is a role for government to create confidence, and catalyze significant private investment into a positive feedback loop. If private actors believe in the plan, and they think that the other actors believe in the plan, then their incentive should be to invest in Christchurch. A parallel could be drawn to an individual depositor having confidence in the safety of their deposits, and believing that all other depositors have confidence as well, in this case no depositor faces the incentive to withdraw their money. In Christchurch, the Government has the opportunity to align the interest of a large number of self-interested actors with the public interest. A commercially robust CBD would create a better outcome for each individual business and investor, as well as the city as a whole and its citizens.

### **5.2.1 The CBD and the Central City Recovery Plan Developed by City Council**

Creating a recovery plan for the CBD was a task originally given to Christchurch City Council with the passing of the CER Act (Parliament of New Zealand, 2011). The City Council was tasked with developing a recovery plan to fit within the recovery strategy developed by CERA, and in May of 2011, an engagement campaign called “Share an Idea” was announced. Many interviewees saw the engagement process as positive, and the campaign attracted over 100,000 submissions from residents across Christchurch (CCDU, 2013b). A final plan was unveiled in December 2011, and submitted to Gerry Brownlee for review. The plan called for more green space, a smaller commercial footprint, mid-rise building typology, and the study of a Light Rapid Transit line (Christchurch City Council, 2011a).

A critical role for the Central City Plan was to create confidence in the downtown. At the time of the City Council plan submission, there remained significant uncertainty as to the future of the CBD. Interviewees highlighted a number of factors contributing to this:

- The Cordon had been up for over a year with a large number of demolitions to go and no confirmed opening date announced. Many businesses had moved to different areas in Christchurch and were beginning to become established in these new locations (Community H). The commercial centres of Christchurch and consumer patterns were being re-shaped.
- Before the earthquake sequence, the Christchurch CBD had been in a period of long-term decline with high commercial vacancy rates, low rents, and under-utilized space (Community F). Interviewees did highlight this as an opportunity to revitalize the downtown and replace the aging building stock.

- Downtown Christchurch had lost many of its heritage buildings including the iconic Cathedral. These buildings had been important to the CBD's character and the city's overall image, especially the tourism sector (Community H, Decision-Maker D).
- Capital flight was a major issue, and Christchurch competed with other cities in New Zealand, Australia, and Asia for investment. Generating competitive returns on capital investment was recognized as a major challenge (Community C).

These factors combined to create significant uncertainty at the city level in terms of the long terms shape and viability of the CBD. This had the potential to create a negative feedback loop with individual stakeholders including businesses and investors. In this case, individual market actors would not have confidence in the long-term viability of the CBD, or confidence that other market participants would.

### **5.2.2 The Establishment of the CCDU**

On April 18, 2012, CERA announced the creation of the CCDU, a new internal unit within CERA. The CCDU was tasked with developing a 'blueprint' for the central city in 100 days, starting from the day of the announcement (CCDU, 2013b). The CCDU was led by Warwick Isaacs, CERA's general manager of operations who had managed demolitions in the CBD. The CCDU was mandated to issue a tender for the blueprint, and worked with a team of consultants to create the final plan within its 100 day timeline.

In May of 2012, a number of interviewees highlighted the creation of the CCDU as a new and positive direction in terms of building confidence in the CBD. The initial CBD Recovery Plan from Christchurch City Council had been organized around the Share an Idea campaign, with an emphasis on local engagement and building momentum behind big ideas. The CCDU was within CERA, and the 100-day timeline was a prominent part of its mandate. Furthermore, the CCDU plan was recognized as being more grounded in the economic reality of the rebuild, and what would be required to attract investment back into the city (Decision-Maker C). During the interviews, members of the business community expressed concerns as to development rules in the City Council Plan. For example, the initial plan targeted significant road and parking reductions (Community D). It was seen that the CCDU would be more receptive to what was required to attract capital back into the city, and what would create a more business friendly recovery plan.

The CCDU was charged with making major decisions about the future of Christchurch, including investment which would eventually be estimated at 3 billion NZD (CCDU, 2013a). This included a new convention centre, a stadium, a new justice precinct, and large areas of parkland (Christchurch City Council, 2011a). A consulting team was selected within a few weeks of the initial announcement, and the final plan was released on July 30, 2012 (CCDU, 2013b). While

the team drew on the initial plan and the Share an Idea campaign, the CCDU did represent a change in the planning process away from local council and community consultation.

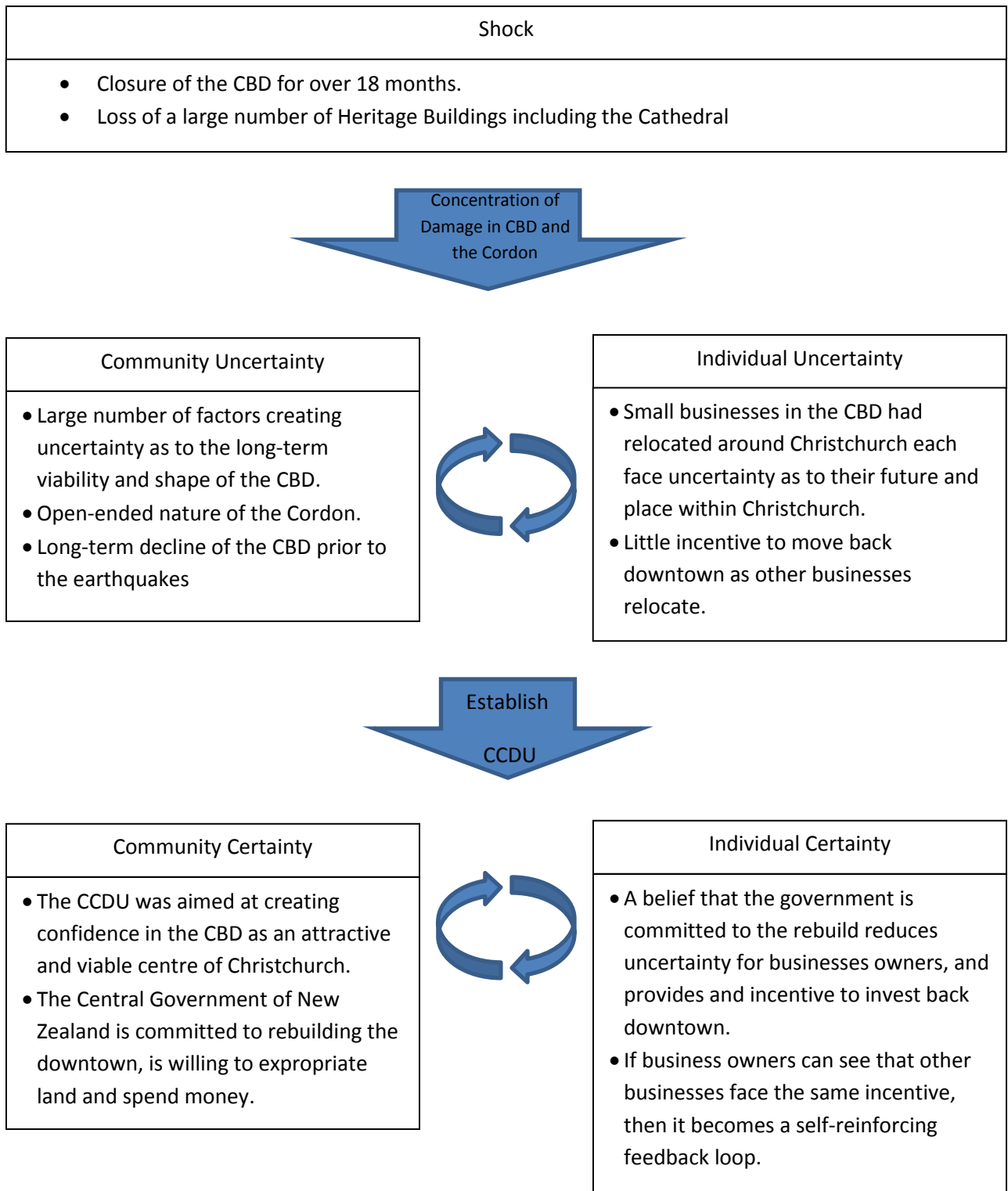
The CCDU plan created a major role for government in terms of shaping the new downtown, with significant expropriation required for land assembly. The plan called for a green ‘frame’ around the downtown, to concentrate development into a compact and active core. It also called for the creation of precincts including health, justice, and sports. A full analysis of the plan is beyond the scope of this thesis, but an overview of the blueprint is provided in figure XX.

At the time of the interviews, the CCDU plan had just been announced, and the contract to create the recovery plan was awarded during the final days of interviews. Data collected on the CCDU was on preliminary attitudes towards the creation and its mandate, and not on the plan that was ultimately produced. Following the interviews, the CCDU plan was released, calling for an ambitious green frame around the city, a number of major infrastructure projects, arts facilities, and significant land expropriation to re-organize the commercial downtown while making way for a new stadium and convention centre (CCDU, 2012).

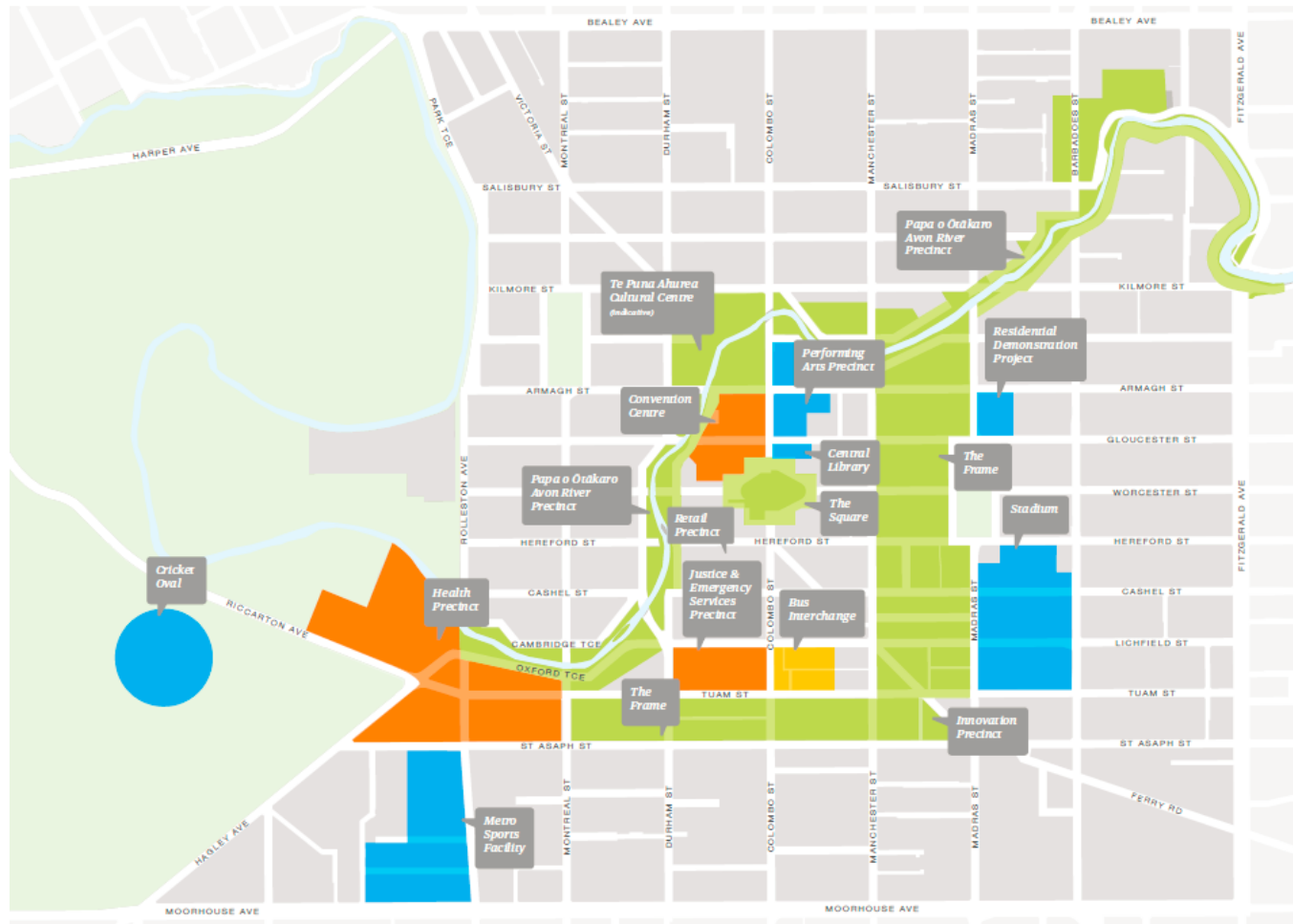
The CCDU represents an intervention designed to create certainty and confidence in the rebuild of Christchurch. The establishing of the CCDU demonstrated a commitment by the Government to invest, as well as to expropriate land necessary to create a coherent public realm and build large projects such as the convention centre. If the CCDU plan succeeds in creating investor confidence, it will have aligned the private interest (invest) with the public interest (attract investment) and will create a positive feedback loop between a large number of private market actors, and the wider vision and success of the city.

The CCDU vision represents an outcome that is not only better for the city as a whole, but also for each individual business. In the absence of a strong and visible Government commitment it is possible that businesses would see it as too risky to move back into the CBD, and would have accepted the outcome of a much-diminished downtown. In the bank insurance scenario, this could be considered analogous to a situation where all the depositors choose to withdraw their money, even though it means losing a portion of savings, because that would be better than risking everything. The success of the CCDU plan will depend on a number of factors, but a key element going forward will be continued confidence in the Government’s visible commitment to the plan, both political and financially. If the CCDU plan works, it will create confidence in the CBD and investment that is potentially far beyond the Government’s expenditure. However, it will do so still at great cost to the taxpayers of New Zealand. The value in deposit insurance is that in theory it is creating something for nothing. While the CCDU plan could be a good deal for the taxpayers of New Zealand in the long-term, it still requires major upfront spending with no guarantee on return.

**Figure 13: Establishing the CCDU Diagram**



**Figure 14: CCDU Blueprint**



(CCDU, 2013a, Reprinted with permission from CERA)

### **5.3 Establishing a System for Zoning Residential Properties**

Land damage and liquefaction became a major factor in the recovery of Christchurch. Liquefaction was most severe in the Eastern Suburbs, a lower income area that had been known to be vulnerable to natural hazards, including flooding (Decision-Maker C). In addition to the Eastern Suburbs, land damage was also concentrated in the Port Hills area to the south of the central city. This area experienced land slip and rock fall, and land was classified as an unmapped ‘white zone’ until geotechnical work could be done to classify land as either red or green (CERA, 2012).

This section focuses on residential zoning decisions within the suburban areas, with an emphasis on the Eastern Suburbs. While there were similarities between the Eastern Suburbs and the Port Hills, the issues faced in zoning decisions were different in several key ways. Firstly, the possibility of further rock fall and landslip in the Port Hill meant that life safety risk had to be considered in those decisions (Implementer F). The Eastern Suburbs and Port Hills were also in different socio-economic terms, with the Port Hills being a higher income area. Data collected during the interviews in the category of land zoning largely focused on the Eastern Suburbs, both from the perspective of community groups as well as CERA staff.

#### **5.3.1 Land Damage and Uncertainty**

Liquefaction and land damage created major disruption for residents in the Eastern Suburbs. Firstly, the future of their physical neighbourhoods and social networks was uncertain as it was clear at least some land would not be suitable for rebuilding. Secondly, the future value of resident’s property, and their ability to buy back into the property market was unknown, as well as the future cost of insurance. Thirdly, local services such as sewer were cut-off or intermittent, creating a day-to-day stress and uncertainty. Together these elements represented a major disruption in a resident’s life in terms of social and economic grounding, and created significant stress for individuals and families (Community G).

At the wider level, this translated into uncertainty in the Christchurch land market, both in terms of land values and insurability (Insurance A). Market actors such as property owners or insurance companies were unable to consistently assess the damage or future risk of properties. Liquefaction damage and the future risk of further liquefaction effectively shut down the property market in Christchurch (Insurance B).

Having a functioning land market at the city level was critical for individual actors to make decisions and move forward in the recovery. Without confidence in the value of land, households and businesses would not be able to invest in Christchurch or the recovery. Furthermore, without



a clear sense of liabilities, it would be difficult for insurance companies to begin settling claims and issuing new policies.

### **5.3.2 The Creation of a System of Land Zoning**

Liquefaction damage from the February earthquake was widespread, with further damage from the June earthquake, and on June 22, 2011, CERA announced a system of land zoning. The decision to buy-out residents in the worst affected land was seen as an act of leadership by the Government, and was regarded almost universally as positive (Community A,G, Decision-Maker C). Zoning was seen as a bold act of leadership by the government to reach out to those who had been worst impacted by the earthquakes. Households were zoned into Red, Green, or Orange categories with red properties to be bought out by the government. In the first announcement, 5,000 residential properties were zoned red, 10,000 were zoned orange, and over 100,000 were zoned green (The Press, 2011) (CERA, 2011b).

Zoning decisions were ultimately made at the ministerial level, based on technical reports prepared by CERA staff. Repairing the land was considered in all cases, and decisions on red zones were made based on the level of disruption caused to the residents by the remediation (Implementer F). In general, properties were zoned red because they required remediation beyond the scale of a single property. For example, this could involve removing and replacing all the soil and infrastructure for a group of houses. While repairing the land could be feasible in engineering terms, it could mean five years of highly disruptive heavy construction work, and in these cases, the land was zoned red based on the impact to residents (Implementer F).

The government purchase offer was seen as critical in assisting those in the suburban areas, and allowed households to begin making decisions to move the recovery forward (Decision-Maker C). The zoning decisions were also seen as key in providing confidence to the wider land market by taking the worst land out of circulation (Implementer F). However, the zoning system ultimately created further complications and impacts which, according to one community group representative, “no one could ever guess” (Community A).

At the time of the interviews, this was recognized as the second most important decision to date in the recovery, following the creation of CERA (Taylor, Chang, Elwood, Seville, & Brunsdon, 2012). Zoning created certainty for those in red and green zones, and gave households in the red zone an exit option. Zoning did create a period of prolonged uncertainty for those in the orange zone, and it was acknowledged that the process of classifying land into red and green zones took far longer than had initially been imagined. The final zoning decisions were not completed until October 2012, meaning that some households had to wait in “holding pattern” for almost a year and a half (Decision Maker C). While the large majority of households were zoned red or green by November 2011, a number did face a prolonged and stressful period of uncertainty. While

awaiting a final zoning classification these households were unable to sell their house, or make repairs, they simply had to wait (sometimes in damaged houses) for a final decision.

At the city level, level zoning provided significant clarity in terms of the spectrum of land damage. This was critical to getting the property market function again, as well triaging engineering resources. By creating the system of zoning, the Government developed a system to create clarity and consistency in the market, and create a positive feedback loop of confidence.

In October of 2011, CERA announced a further system of land zoning, or a subdivision of the green zone into technical categories. It was seen that private parties were already beginning to assess risk levels within the green zone, and a universal system was required to address the spectrum of land risk within the green zone as well as triage geotechnical engineering resources (Implementer H). Properties within the green zone were divided into three technical categories based on foundation strengthening required for each property. The green zone was sub-divided in Technical Category 1, Technical Category 2, and Technical Category 3 (TC1, TC2, and TC3). TC1 and TC2 properties required standard foundations. However, TC3 required site-specific engineering solutions with no standardized solutions at the time of the announcement (CERA, 2011).

The decision had the greatest impact on those zoned Technical Category 3 as many green zone residents had taken the original zoning as “green meant go” (Implementer H). The further classification meant that their properties required site specific engineering work, creating further uncertainty in terms of insurability and property values (Decision-Maker B). Interviewees involved in the creation of technical categories stressed that the categories were about providing households with information, which would allow them to make decisions about their property as well as to bring clarity into the land market (Implementer H). Interviewees also stressed that third parties were already beginning to assess the spectrum of land damage within the green zone without the Government, and that a system was needed to create certainty and consistency (Implementer H). Similar to the original zoning decisions, the technical categories provided greater certainty to land market as a whole. The uncertainty created for TC3 residents was seen as an unfortunate but necessary consequence, and interviewees throughout CERA stressed assisting TC3 residents as one of their top priorities (Decision-Maker B).

The system of land zoning did create certainty for the market as a whole and for individuals, but created further uncertainty and negative impacts for certain groups. Interviewees reported high levels of stress and health related impacts for those in the affected areas, especially among senior citizens, and those that did not have family to assist them (Community A). Firstly was the amount of the purchase offer, and if it would be sufficient to allow a household to buy a house in Christchurch or elsewhere. The purchase offer was based on the 2007 value of homes on the basis that prices had peaked in that year (Community G). While on average, home prices had peaked in 2007, this was not universally the case and some interviewees interpreted it as half of residents were getting a good deal while the other half were not (Community G). Furthermore,

residents may have been making improvements to their properties without having the property values re-appraised (Decision-Maker B). Interviewees highlighted the different experiences of residents with the purchase offer on their houses. For example, the offer worked well for a retired person looking to leave their aging house and build a renovation into their son's or daughter's house. On the other hand, a retired couple with no kids was first left to negotiate the process by themselves. These households were not in a position to take on further debt, and it was unclear if the purchase offer would be sufficient to buy back into the property market (Community G).

Another major impact was on the social fabric of communities literally divided by zoning decisions. Splitting residents into red, green and orange had the effect of dividing them, and eroding the social support networks which had previously existed (Community A). Dividing the community into groups created disparate interests, jealousy in some cases, and reduced the ability of the community to unite and support itself (Community A). Inevitably, residents on one side of the line wished to be on the other and vice versa. Households who wished to stay in the community were forced to leave if they were classified into the red zone, and those who wanted to leave could be left with a property in a declining neighbourhood.

Finally, a large number of orange zone residents were left in a "holding pattern" for an extended period of time (Decision-Maker C). While a large number of households were classified out of the orange zone in October, these represented the low hanging fruit in the process, which became further drawn out as it went on. Some residents in the orange zone were living in damaged houses with no working toilets during this time, and several protests were organized by frustrated residents' groups (Rebuild Christchurch , 2011).

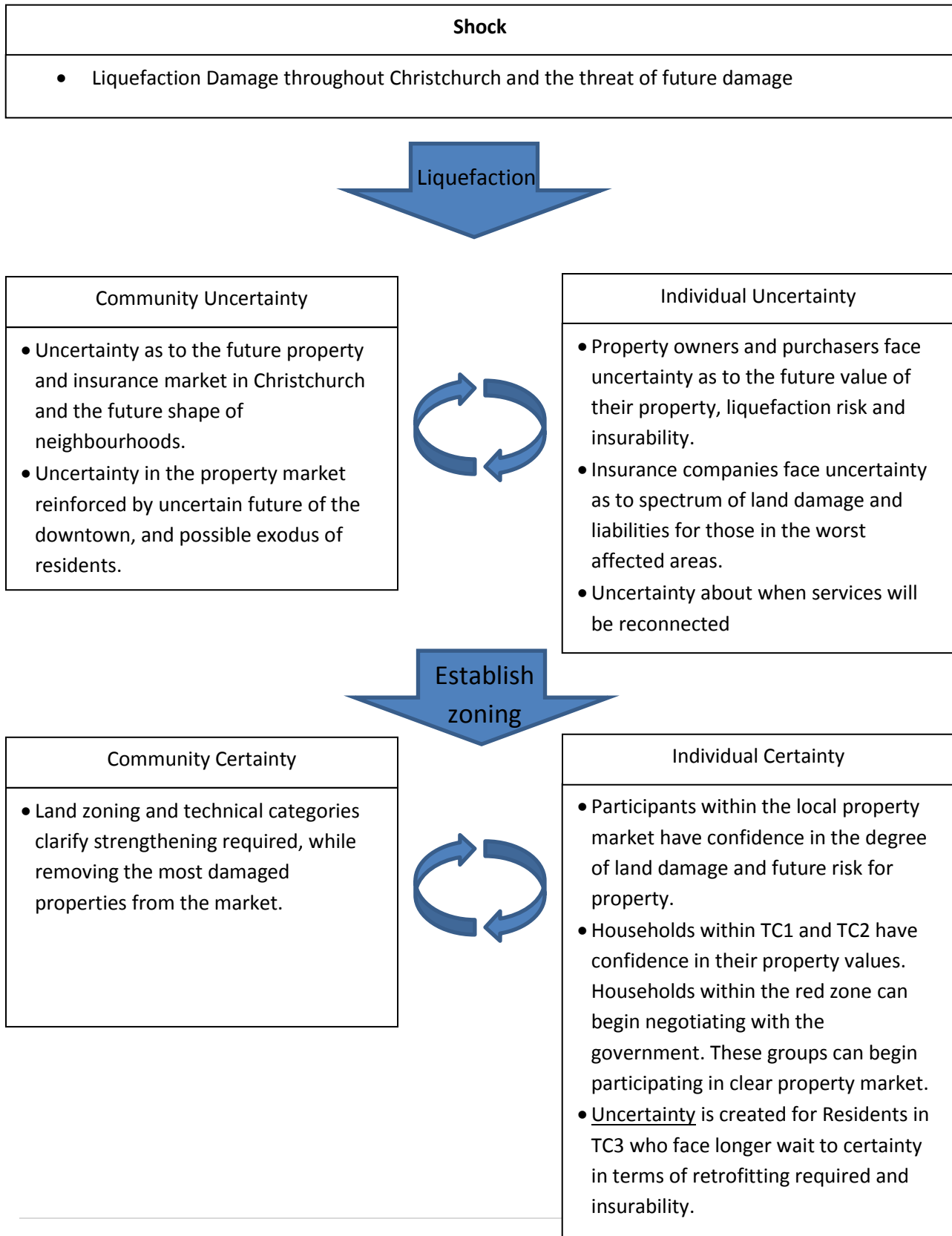
Ultimately, the zoning decisions did reduce uncertainty. Zoning was critical to creating confidence in the wider land market, but did necessitate drawn out uncertainty for those in the orange zone and TC3. At the same time, no viable alternative was raised during the interviews, and not having zoning would have created much greater uncertainty for everyone. Many interviewees did argue that the complexity of the zoning task had been underestimated, and that the implementation had created significant stress for residents, especially in the red zone. Despite this, the red zone did provide an exit option for residents in the red zone, and it is unclear what would have happened to these households otherwise.

The zoning decisions had to make up for a history of poor land-use decisions and settlements being constructed in hazard prone areas (Decision-Maker C). The zoning also created clarity in the land market for market actors, including property owners and insurance companies. This clarity was critical to create confidence, at least in TC1 and TC2 properties, and for the land market to function. At the time of the interviews, it was unclear what options would have existed if the Government had not chosen to establish the system of land zones. Numerous interviewees highlighted that at a minimum, taking the worst damaged land out of circulation was critical to providing confidence in the land market (Insurance A, Implementer F).

The zoning system represented a government intervention designed to create certainty, and then allow individuals to make their own decisions. If households and insurance companies believe the system is reliable, then they should be able to participate in the land market and invest in homes and property. This could create a positive feedback loop in which reassured market participants reinvest in local property, and contribute to a sense of overall confidence in the land market. In this case, the intervention will have generated a climate where individual homeowners are able to act in a way that generates a positive outcome at both the individual and community levels.

As in other areas, a key lesson was the importance of balancing external and objective ‘experts’ with local people who actually live in the community and identify with the land which is being zoned (Implementer D). Community groups raised a number of issues including the fact that on average most citizens do not deal with Government extensively, and many Government departments are not set-up to communicate with certain groups in the population. For example, initially in the recovery, government departments continued to produce long, technical documents which may not be accessible to all groups.

**Figure 15: Residential Zoning Diagram**



## **Chapter 6. Conclusion**

### **6.1 Summary**

The length of the Canterbury Earthquake sequence and the scale of damage relative to the city has created major structural changes and uncertainty for the city of Christchurch. The historic downtown core of the city has been largely destroyed, and over 7,000 properties have been taken out of the local property market or zoned as TC3. This has translated into significant disruption as well as social and economic uncertainty for individual citizens who continue to work through the recovery.

This thesis has sought to provide a new lens on understanding disaster recovery by looking at the role of uncertainty at different levels, and the potential for Government to intervene and create positive feedback loops of certainty and confidence. For example, the creation of the CCDU aimed to create confidence in the downtown with a strong vision and Government commitment. This in turn could catalyze a large number of private investors, and create further confidence in the future viability of the CBD. The system of residential zoning brought consistency to a highly uncertain land market. By removing the worst damaged land from the land market, the Government aimed to create confidence in the remaining ‘green’ properties, both for individual buyers and for the market as a whole.

### **6.2 Major Findings and Contributions**

The research found that uncertainty can play a major role in disaster recovery, and that it can create self-reinforcing feedback loops between the individual and community scales. Uncertainty can lead to significant stress for stakeholders, and can manifest into negative outcomes. For example, uncertainty related to land damage was extremely stressful for homeowners, and without a system of land zoning, threatened to disrupt the entire land market. Equally, confidence can play a critical role in enabling recovery and creating a positive cycle of investment and growth. The CCDU plan is perhaps the best example of working to create confidence, and the opportunity to create a positive feedback loop between individual businesses.

The research suggests that government is critical in creating confidence following a disaster, and that consideration of uncertainty and confidence should be explicitly considered in government decision-making. As in the example of deposit insurance, Government could explore options to use its credibility and size to influence large numbers of self-interested private actors, and potentially in such a way as to align their private interest with the overall group interest. However, the interventions in this thesis have all required significant public expenditure, and do not harness the same effect as deposit insurance.

### 6.3 Further Research and Policy Implications

Perhaps the most interesting aspect of Deposit Insurance is that in theory, it should cost the Government very little money to run. Simply by creating the program, depositors should be incentivized not to withdraw their money and banks can be regulated so they do not overextend themselves. On the one hand, the examples in this thesis could catalyze private investment, which is many times the government money spent. For example, by purchasing 7,000 residential properties the Government cleared over 100,000 properties to be traded in the property market. In this sense, this could be seen as relatively inexpensive interventions. At the same time, the interventions analyzed in this thesis, and disaster recovery in general, is extremely expensive. Paying for the CCDU plan and the infrastructure rebuild will be a significant burden on the taxpayers of New Zealand, and as of July 2013 the final bill was for the CCDU plan was estimated at around 3 billion NZD (CCDU, 2013a).

This thesis originally used the example of deposit insurance as an example because it was an intervention that could in theory have almost no cost to the government. None of the interventions analyzed in this thesis work quite in the same way in terms of getting something for nothing. However, in the case of deposit insurance, banks are required to meet certain levels of reserve ratios, etc., which reduce their risk of failure. Otherwise the scheme would expose taxpayers to risk, and could encourage banks to undertake risky behaviour. This also means that the government is guaranteeing money in banks which are fundamentally sound. Investors also know this, which creates more confidence in the bank.

In contrast, the same cannot be said for the Christchurch CBD or property market. One could argue that the opportunity to regulate (as in the bank example) has already passed, and the bank has failed. The government can now step in and create confidence by recapitalizing the bank, but it could be at a much higher cost.

If governments were able to play a more active role in mitigating disaster risk, such as they do in reducing the risk of bank failure, then further opportunities may be created for such interventions. For example, in Christchurch, as in many countries, buildings were designed to preserve life safety, rather than building functionality. In other words, the building are designed to protect the people inside and allow them to escape, although the building itself may then require demolition. In Christchurch, relatively few people were killed given the scale of damage, yet almost all of the tall buildings are being taken down, and the CBD has been closed for over two years. If buildings were designed to continue functioning through an earthquake, then it might allow the government to create confidence in buildings, and mean that the system wouldn't have to pay out.

There is an important difference in that bank runs are dependent on the behaviour of actors during the bank run itself, while the mitigation actions discussed above require action beforehand. However, the ability of the government to insure the bank while being fair to the tax

payers requires preventative action on behalf of the bank. In the same way, creating confidence in disaster prone areas will be continue to be expensive, and will likely require subsidies from those not living in hazard prone areas.

One area of further research could be how with greater upfront regulation to manage risk, the government could establish systems similar to deposit insurance which could greatly reduce the cost of recovery and build confidence following a natural disaster. This thesis research suggests that without further upfront regulation, it will be difficult for the government to create confidence without significant public expenditure as in the deposit insurance example. Further research could explore the power of regulation in earlier stages of the disaster cycle.

Another further area of research could be a follow up study in Christchurch to examine the implications and consequences of the decisions analyzed in this thesis; for example, how successful the CCDU plan was in creating confidence, and the geography of re-investment into the downtown. Additionally, a long term-study of the technical categories, and especially those in the TC-3 category, could inform future decision-makers dealing with liquefaction damage, or homes in other types of hazard zones.

Perhaps the most significant policy implication from the research is the importance of feedback loops created between individual and group actors; in particular, the power of uncertainty to create feedback loops, and the unique role government can play in building confidence.



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## **Appendix A: List of Interviewees by Category**

### **Decision Makers**

John Hamilton, National Controller: Ministry of Civil Defense

Steve McCarthy, Regulatory Services Manager: Christchurch City Council

Roger Sutton, Chief Executive: CERA

Diane Turner, General Manager- Strategy, Planning and Policy: CERA

### **Decision Implementers**

Paul Campbell, Team Leader Engineers: CERA

Carl Devereux, Lead Engineer, Significant Buildings Unit: CERA

John Hare, Principal Engineering Advisor: CERA; President: Structural Engineering Society NZ

David Hopkins, Chairman: Earthquake and Natural Hazards New Zealand

Jan Kupec, Chief Geotechnical Engineer: CERA

Kelvin Newman, Department Manager Building Inspections: Christchurch City Council

Mike Stannard, Chief Engineer: Department of Building and Housing

David Brunsten, Director: Kestrel Group and Lead Researcher Resilient Organisations

### **Business and Community Groups (Community)**

Kelvin Berryman, Director: Natural Hazards Research Platform, GNS Science

Liane Dalziel, Member of Parliament for Christchurch East

Jeff Field, Registrar: University of Canterbury

Paul Lonsdale, ReStart the Heart Trust Manager & Central City Manager: Business Association

Dave Margetts, Heritage Advisor Architecture & Conservation: New Zealand Historic Places Trust

Brian Parker, Communications Manager: CERN

Peter Townsend, Chief Executive: Canterbury Employers' Chamber of Commerce

John Vargo, Co-leader, Resilient Organisations Research Programme

Francis Wevers, Executive Director: Future Canterbury Network

## **Insurance**

Hugh Cowan, General Manager Research and Education: EQC

Martin Kreft, Regional Manager: MunichRe

John Lucas, Insurance Manager: Insurance Council of New Zealand



## Appendix B: Sample Interview Questions

### Learning from Christchurch: Technical Decisions and Societal Consequences in Post-Earthquake Recovery

#### Outline of Interview Questions (Generic Version)

##### Part 1: General Questions:

1. Please briefly describe the responsibilities of your position before and after the February 2011 earthquake. In what ways are/were you involved in the post-earthquake response, reconstruction and recovery?
2. In your view, on a scale of 1-7 (where 1=“extremely poorly” and 7=“extremely well”), how well is Christchurch’s recovery proceeding?
3. Overall, if you were to pick the three most important decisions influencing the recovery of Christchurch, made since February 2011, what would they be? *Example decisions might include: establishing CERA, land buyouts in Eastern Suburbs, not saving the Cathedral, etc.*

##### Part 2: Specific Questions for Decision Makers:

4. Specifically in terms of (*area of specialty*), if you were to pick the three most important government decisions in the recovery of Christchurch, made since February 2011, what would they be? Please tell us a little more about each of these decisions: when they were made; what organization made them; what was the basis for these decisions; if they were guided by any specific pre-planning (from either before the September 2010 earthquake, or the period between September 2010 and February 2011), if the outcomes were as anticipated; what alternatives were considered, etc.

##### Part 3: Sharing the Christchurch Experience

This will be a less-structured section to elaborate on some of the key lessons learned in your areas of expertise. Questions in this section might be follow-up questions from the first two parts, but could also include:

5. What do you see as the most important challenges for Christchurch’s recovery going forward?
6. What lessons has this disaster provided in terms of recovery-related decision-making? What lessons would you like to share with decision-makers in other earthquake-prone cities around the world?