# Earthquake Commission

15 August 2016

## Insurance Liability Valuation as at 30 June 2016

## Final Report

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Towers Watson Alliance Partner

# Contents

## Appendices

# 1 Executive Summary

## 1.1 Addressee

This report is addressed to Ian Simpson, Chief Executive of the Earthquake Commission ('EQC').

## 1.2 Report commissioned by

This report was commissioned by Hugh Cowan, EQC's GM Reinsurance, Research and Education.

## 1.3 Purpose

This report was commissioned to provide information with regards to:

- EQC's insurance liabilities and reinsurance recoveries for use in the financial statements as at 30 June 2016.
- The development of EQC's Canterbury earthquakes claims costs since 31 December 2015.

## 1.4 Scope

### *1.4.1 Insurance liabilities components*

The insurance liabilities include:

- Outstanding (OS) claims liabilities – which relate to the future direct and indirect claims costs and reinsurance recoveries for claims incurred up to 30 June 2016.
- Premium liabilities – which relate to the future net claims costs and administration and reinsurance expenses for future claims arising from unexpired risks as at 30 June 2016.

The liabilities calculated include a risk margin and are discounted for the time value of money.

Premium liabilities are not included directly in the balance sheet but are used for the Liability Adequacy Test of the unearned premium liability provision.

A more detailed description of the nature and components of the insurance liabilities are set out in Section 1.10 as well as Sections 7 and 12.

## 1.5 Effective valuation date

The effective date of the valuation is 30 June 2016.

## 1.6 This report

Although this report includes considerable detail on all aspects of the actuarial investigations, in order to keep it to a manageable size a lot of the information has been summarised. Further details regarding the data, methods, assumptions, calculations and results underlying this report are available from the authors on request.

Unless otherwise indicated, all amounts in this report are stated in New Zealand dollars and are net of GST (i.e. they exclude GST).

## 1.7 Previous valuations

Melville Jessup Weaver ('MJW') has prepared valuations for EQC at six monthly intervals since 2010, when the Canterbury Earthquake Sequence began.

The most recent valuation for EQC, which is referenced in this report, is the Insurance Liability Valuation Report ('ILVR') as at 31 December 2015 (dated 10 February 2016).

## 1.8 Definitions of technical terms

We have tried to avoid unnecessary insurance jargon where possible. To help understand the technical terms which were used in this report we have included a glossary in Appendix J.

## 1.9 Event groups

### *1.9.1 Canterbury earthquake claim events*

A series of damaging earthquakes has affected the Canterbury region in general, and the city of Christchurch in particular, since the first event on 4 September 2010. These earthquakes have resulted in injury, loss of life, and billions of dollars of damage to infrastructure, commercial property and residential dwellings.

Details of the Canterbury earthquake events are set out in Appendix A.

For the purposes of valuing the outstanding claims, the Canterbury earthquake claims have been split into the following event groups:

- EQ1 – 4 September 2010 event
- EQ2 – 22 February 2011 event
- EQ3 – 13 June 2011 event (including 21 June 2011 event)*
- EQ4 – 23 December 2011 event
- Aftershocks ('AS') – the ten other events shown on the Business Information Unit ('BIU') Daily Report as well as 'Other Canterbury claims' included in the Daily Report totals. The logic used to identify these claims is based on the claim's Territorial Local Authority and loss cause and is consistent with the BIU's definition.

*EQC's reinsurance programme covers all incurred losses arising within 720 hours from an event. Consequently, losses arising from the 21 June 2011 aftershock are included in the EQ3 event definition.

### 1.9.2 *Other claim events*

Other outstanding EQC claims, including those arising from landslips, hydrothermal events, and from earthquakes outside Canterbury are categorised as 'BAU' (Business As Usual) claims.

### 1.9.3 *Components of premium liabilities*

For the purposes of valuing the premium liabilities, the following event categories were used:

- Business as Usual ('BAU') claims.
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury.
- Canterbury earthquake claims.

## 1.10 Operational Developments since the 31 December 2015 valuation

There were a number of operational developments that occurred in the first half of the 2015-2016 financial year which had an impact on the valuation models at 31 December 2015.

Since then, there have not been any material new developments but rather refinement in the operational process that has helped to guide the valuation process. These refinements relate to:

- Land model
  - ILV DoV rates
- Building model
  - Reopened claims

A description of these operational developments is shown below with detail on how each of these has affected the valuation being shown in Section 1.11.

### 1.10.1 *Canterbury earthquakes: land model*

#### *ILV DoV rates*

As at 31 December 2015 a draft set of DoV rates for ILV were available to inform the valuation process. Subsequently, a revised version of these rates was presented to the Board in May and finalised on 10 June 2016. The document:

- is focused on assessing DoV for properties where the house that existed before the Canterbury Earthquake Sequence is still in situ on the property,
- does not deal with properties with both IFV and ILV qualifying damage.

DoV payments on ILV affected properties have recently commenced.

### 1.10.2 *Canterbury earthquakes: building model*

#### *Reopened claims*

The valuation as at 31 December 2015 had provisions in respect of the remaining unresolved claims and in respect of claims that may reopen. The reopened claims provision was broadly divided into the following categories:

- Overcap claims
- Undercap EQR claims
- Undercap non-EQR claims

Since 31 December 2015 there has been further information in respect of the first two of these items. In respect of overcap claims, there have been initial conversations between EQC and some insurers as part of the Financial Completion (Insurer Washup). In respect of undercap EQR claims, there is now more visibility on the frequency and severity of remediation work and also of work required to repair damage to drains.

## 1.11 Valuation Developments since 31 December 2015

The operational developments noted above along with additional items of data have been factored into the valuation model. The sections below describe how this has occurred. Further information on all of the items below is found in Section 5 and Appendix G.

The impact of these changes is shown in Section 1.13.3.

### *1.11.1 Valuation vs operational approach*

The valuation methodology is intended to model the operational manner in which EQC is settling claims.

In many areas, the settlement process may utilise information which is not readily available for valuation purposes and so the valuation methodology must take a pragmatic approach. In some cases, the operational process has not been put into effect and in these cases we model a range of potential outcomes.

For these reasons the valuation approach may not mirror the intended operational process and this should be borne in mind when reading the following sections.

### *1.11.2 Canterbury earthquakes: land model*

***ILV land damage***

Qualification for ILV land damage is based on three criteria:

- Detailed analysis of land damage and subsidence information as well as geotechnical investigations and corresponding liquefaction vulnerability modelling have been considered to determine whether a property has material liquefaction vulnerability
- Whether there is a material change in liquefaction vulnerability as a result of the ground surface subsidence caused by the 2010-2011 earthquake sequence.
- Whether the increase in liquefaction vulnerability impacted the market value of the property.

EQC's policy in respect of settlement of ILV damaged land is set out in Section 2.5.5 and considers the ability and homeowner intent to repair the land, costs and the DoV that has been incurred.

Many of these criteria are not readily available (e.g. whether property has been sold, intent of homeowner to repair land) or in a form that is useable for valuation purposes. We have therefore based our valuation approach for ILV damage on whether the property appears to be a cleared site or has a house in-situ. Specifically, we have modelled the ILV policy in the following manner.

Cleared Site

In respect of cleared site land, the valuation approach will be a combination of:

- Repair costs applied to the land area that is reasonably required to reinstate a residential building. This land area is usually less than the Insured Land Area.
- DoV applied to the remainder of the Insured Land Area.

The estimated costs of indemnifying a home owner for ILV damage where the land is repaired are apportioned 100% to the first qualifying event.

Houses in-situ

In respect of properties with in-situ houses, the valuation approach will be on the basis of DoV applied to the Insured Land Area. The estimated costs of indemnifying a home owner through DoV for ILV damage have been apportioned amongst all qualifying events.

Uncertainty of eventual settlement outcomes

The uniqueness of ILV damage in Canterbury and therefore the lack of historical precedent presents a significant level of uncertainty around the eventual settlement outcome. There are a number of reasons for this but the principal one is the relative amounts produced by the two settlement paths.

For this reason, we have taken a prudent view of the settlement outcome for properties with a house in-situ, and have assumed that the ultimate settlement outcome will result in either; DoV (as intended), or as a repair cost on an equivalent cleared site.

***Silt removal***

Within the land model is a provision for the removal of silt, which will have largely been completed.

We have made enquiries as to how the relevant costs might have been accounted for and the responses we have got indicate that any silt removal costs incurred by EQC will likely have been recorded as either:

- EQR cost of remediation – and hence included in the dwelling model.
- Land damage category 1 – 7 cost.

In both these cases, the costs of silt removal will have been captured by other parts of the valuation model. There may yet be silt removal costs incurred outside these two avenues and we consider it appropriate to retain a provision (albeit reduced) for silt removal at this stage.

***Unclaimed damage***

Following the Ministerial Directions on unclaimed damage, we have investigated the extent to which properties with land damage may not have valid claims.

The flat land model is based on a list of all Canterbury properties that may have incurred land damage. Not all of these properties will have had insurance during the period of the Canterbury earthquakes, and of those that did have insurance, not all will have lodged a claim for every event to which land damage has been allocated.

For this valuation we have undertaken an exercise to match each of the properties in the flat land model to a property in the claims system where possible. Where we were unable to find a match at all, we have treated the flat land property as being uninsured and have assumed that EQC will not have any liability to pay for land damage which may have occurred.

Where we were able to match the flat land property to a property with at least one valid claim, we determined whether any of the allocated damage fell on events for which there was no valid claim. This has been treated as unclaimed damage. Under the Ministerial Direction, as noted in Section 2.2.6, unclaimed damage is to be covered by EQC. However, we have treated the unclaimed damage as unrecoverable from EQC's reinsurers.

We have estimated that there are

- 2,266 uninsured properties with land damage. The land costs associated with these properties sums to $27m for which we assume EQC is not liable.
- A number of properties with unclaimed damage totalling approximately $10 million which relates to the EQ1 event, for which reinsurance may therefore not be recoverable. Whilst there is unclaimed damage in respect of the other events, there is no reinsurance impact.

This treatment of uninsured damage and unclaimed damage is reflected in the tables shown throughout this report.

### *1.11.3 Canterbury earthquakes: building model*

***Reopened claims – overcap***

Since the valuation at 31 December 2015, we have had further discussions with EQC in respect of the Insurer Washup process. We understand there has been some further interaction between EQC and the private insurers.

As a result of these discussions we consider that we have no reason to change the estimated ultimate cost that was set as at the previous valuation.

***Reopened claims - EQR***

Through the repair work that EQC has undertaken through the Canterbury Home Repair Programme, it is expected that there will be a number of properties that experience materials failure, mis-scoping and/or workmanship issues.

We have had discussions with EQC staff that have been collating and reviewing information on the extent of the remedial work that may be required in respect of these issues.

We have also spoken to Master Builders Services ('MBS') who have visibility over a wider group of building practitioners and also over non-earthquake building work.

Based on these discussions, we have increased the provision held to address these costs.

***Reopened claims - drainage***

An additional item of work that has emerged relates to residential drains requiring remediation after initial dwelling remediation work has concluded.

It is very difficult to identify the proximate cause of drain failure, with earthquake damage being one of many possible reasons. In addition, the expected failure times for laterals could be five to seven years after an event. EQC's lateral policy provides claimants with a grace period up to 31 December 2016 where the 'benefit of the doubt' is granted. Where the circumstances are assessed to be consistent with earthquake damage by EQC's inspection programme, EQC will cover the repairs with no further proof required.

We estimate that there may be 6,000 properties requiring drainage remediation. For these properties we have applied an average remediation cost, based on some early trials.

***Unclaimed damage***

Following the Ministerial Directions on unclaimed dwelling damage, we have investigated the extent to which properties with dwelling damage may not have valid claims.

We have estimated that there is approximately $12 million of unclaimed dwelling damage related to the EQ1 event, for which reinsurance may therefore not be recoverable. Whilst there is unclaimed damage in respect of the other events, there is no reinsurance impact.

This is reflected in the tables shown throughout this report.

***Recoveries***

In a number of cases, claimants have returned or lost their settlement payments. In these cases, the returned / lost payment was recorded as a recovery and a new payment was issued. For these claims, the correct paid position should be the difference between the paid field (with two lots of payments) and the recoveries field (with the returned / lost cheque).

In addition to the above there are other categories of recovery which require more in-depth analysis.

EQC Finance have recently undertaken a project to ratify these records and have provided us with a list of those records where the recoveries amount should be netted off the paid amount. This adjustment has taken place and the results reflect the change.

***Fees***

Within the claims management system is a field called Fees. These direct fees are primarily in respect of dwelling sub-claims although some will relate to land sub-claims. There is no easy way to separate the fees into the appropriate sub-claim.

It was decided that a pragmatic approach to including them in the valuation was to include them in the dwelling model.

The total of the Fees amount was $7m.

### *1.11.4 Canterbury earthquakes: contents model*

No material changes to the model.

#### 1.11.5 *BAU model*

No material changes to the model.

#### 1.11.6 *Claims handling expenses (CHE) model*

No material changes to the model.

### 1.12 Principal areas of judgment

The valuation of the Canterbury earthquake claims costs requires judgment to be applied in many areas. Some of these areas have a material impact on the outcome and these are described below.

#### 1.12.1 *Land model*

The land model is based on information provided by T+T and EQC. A key part of this information is a scenario based model with detailed geotechnical and financial information on every flat land property that may be eligible for a land claim. We have then translated this into a stochastic land model and applied judgment in a number of key areas. The most material of these relate to:

- IFV DoV rates
- ILV DoV rates
- ILV Settlement path

***IFV DoV Rates***

Settlement on IFV damaged properties has begun with properties in the Green Zone that have IFV damage only being addressed first. These properties are considered easier to assess and therefore estimate settlement costs than combination IFV+ILV damaged properties or qualifying Red Zone properties.

It has been established that there is a strong correlation between the extent of the Exacerbated Flooding Coverage ('EFC'), as a percentage of the insured land area, and the DoV rates that have been applied. This relationship has been used to estimate DoV rates for the remaining IFV properties, given that the EFC has been assessed for those properties.

The remaining properties, particularly combination IFV+ILV damaged properties and Red Zone properties, have higher EFC than the properties that have been settled to date. We would therefore expect higher settlement amounts on average for the remaining properties.

We have considered that the relationship between EFC and DoV rate may break down for the more difficult remaining areas and to address this we have assumed higher DoV rates for the remaining Green Zone properties. The rates assumed for this valuation are the same as those as at 31 December 2015.

In respect of the Red Zone properties, we have left our DoV rate assumptions unchanged from 31 December 2015. These were based on engineering judgment at the time and will be re-assessed as more information is forthcoming.

***ILV DoV Rates***

The question of the appropriate ILV DoV rates to apply has been noted above in Section 1.11.2. The model supplied by T+T uses the final (house in-situ) DoV rates for all ILV affected properties. There are not as of yet DoV rates for combination IFV+ILV damaged properties or cleared site properties and so the house in-situ rates have been used.

There is a final DoV methodology document detailing how the DoV rates should be calculated. The document:

- Produces DoV rates for properties where the house that existed before the Canterbury Earthquake Sequence is still in situ on the property.
- Does not deal with properties with both IFV and ILV qualifying damage.

As discussed in Section 1.10.1 the draft DoV methodology in place as at 31 December 2015 has now been revised and presented to the Board. As at 30 June 2016 EQC have begun presenting settlement amounts to Green Zone claimants although this has only occurred in the last month.

The ILV operational process has not commenced to a material degree as at the date of the valuation. The eventual outcome is uncertain and reasons for this are noted in Section 1.11.2.

At 31 December 2015 we allowed for this uncertainty by adjusting the ILV DoV rates used in the model. For this valuation, given that the DoV methodology has now been presented to the Board, and that this document is intended to form the basis for any settlement amounts paid to claimants, and that the rates are slightly higher than that as at 31 December 2015, we have not applied any adjustment to the ILV DoV rates from the DoV methodology.

For this valuation, we have allowed for the uncertainty by modelling a range of potential settlement outcomes. As the outworkings of the operational process become clearer, the uncertainty (and range of modelled outcomes) will reduce.

***ILV Settlement path***

EQC's policy on settling ILV damaged land is detailed in Section 2.5.5. For qualifying properties, the settlement amount will be based on DoV unless a number of criteria are met, in which case the settlement amount will be based on repair cost.

Unfortunately, not all of the ILV criteria that will be used to inform the settlement path are readily available in a form fit for valuation purposes. We do have visibility on which properties are cleared sites (which is one of the criteria) and have prudently used this as the sole valuation criteria for determining the ILV settlement path.

***Scenario analysis***

We have carried out some scenario analysis around the ILV issues noted above. The results of this are shown in Section 8.3.

### *1.12.2 Building model*

Within the building model there is a provision for reopened claims for undercap EQR claims. This is discussed in Section 1.11.3.

Judgment has been applied to extrapolate from the small sample of completed remediations and the small sample of drainage claims.

***Remedial claims***

Through the repair work that EQC has undertaken through the Canterbury Home Repair Programme, it is expected that there will be a number of properties that experience materials failure, mis-scoping and/or workmanship issues.

This is due to the significant demands on the workforce and the demands of the insureds who, unsurprisingly, want their repairs carried out as quickly as possible. It is difficult to compare the rate of remedial works experienced by EQC and that of other industry experts due to the varying definition between parties of what broadly constitutes remedial works.

However, discussions with MBS have indicated that the rate at which EQC is incurring remedial costs is not inconsistent with that which might be expected in the wider industry.

EQC / EQR staff have carried out a triage process on the identified remedial claims and made assessments as to likely costs. In the absence of a number of fully completed test cases it is difficult to assess the adequacy of this cost assessment process. However, in our opinion the process used to estimate the costs was reasonable and we have taken this as a guide as to the ultimate costs of remediation.

***Drainage claims***

The situation in respect of drainage claims is slightly less robust as the reporting of these claims began more recently than the remedial work. It is expected that the rate of reporting for drainage failure will continue unabated until the end of 2016 with a reduced rate in 2017.

The average cost to remediate drain failure is based on a pilot study of 150 properties.

## 1.13 Key results – claims incurred

The gross incurred claims costs for all Canterbury EQ events, incurred to 30 June 2016, include:

- Claims costs paid to date
- Claims costs expected to be paid in future (the OS claims liability).

Claims costs paid to date are known, but those to be paid in the future are unknown and so must be estimated. The approach that we have taken is to estimate the ultimate incurred claims costs and then deduct payments made to 30 June 2016 in order to determine the estimated OS claims liability.

The ultimate incurred claims costs are calculated in respect of Canterbury earthquake events only as it is not useful (or practical) to include ultimate incurred claims costs from BAU events. No risk margins have been calculated and no discounting has been applied to the estimated ultimate incurred claims costs.

The outstanding claims liabilities are in respect of all outstanding EQC claims (Canterbury earthquakes plus BAU) and are discounted for the time value of money and include risk margins at the 85th percentile.

### 1.13.1 *Estimated ultimate claims costs – Canterbury earthquakes only*

The table below summarises the main components involved in estimating the ultimate cost of claims to EQC arising from the Canterbury earthquakes only as at 30 June 2016. A more detailed version of this table, including comparatives with the 31 December 2015 ILVR, is given in Section 7.5.

The estimated ultimate claims cost is built up from the following components:

- Claims costs paid to date
- Case estimates
- Actuarial determination
- Claims handling expenses (CHE).

**Canterbury earthquakes only**
**Ultimate claims costs, central estimate, undiscounted, including CHE - 30 June 2016 valuation**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| Claims paid to date* | 2,399 | 4,833 | 420 | 137 | 188 | 7,977 |
| Case estimates | (66) | (336) | 74 | 9 | 24 | (295) |
| Actuarial determination | 555 | 1,457 | 95 | 11 | (3) | 2,115 |
| Gross estimated ultimate incurred claims | 2,887 | 5,954 | 590 | 158 | 210 | 9,798 |
| Claims handling expenses (CHE) | | | | | | |
| Paid to date | 450 | 741 | 108 | 36 | 48 | 1,383 |
| Estimated future | 25 | 54 | 15 | 2 | 2 | 98 |
| Total | 475 | 796 | 123 | 38 | 50 | 1,481 |
| Gross ultimate incurred claims including CHE | 3,362 | 6,749 | 712 | 196 | 259 | 11,279 |
| Reinsurance recoveries | (1,821) | (2,477) | - | 0 | - | (4,298) |
| Net ultimate incurred claims including CHE | 1,541 | 4,272 | 712 | 196 | 259 | 6,981 |
| **31 December 2015 comparatives** | | | | | | |
| Gross ult incurred claims including CHE | 3,375 | 6,646 | 783 | 197 | 258 | 11,259 |
| Net ult incurred claims including CHE | 1,521 | 4,169 | 783 | 197 | 258 | 6,927 |
| **30 June 2015 comparatives** | | | | | | |
| Gross ult incurred claims including CHE | 3,341 | 6,675 | 790 | 199 | 244 | 11,249 |
| Net ult incurred claims including CHE | 1,520 | 4,197 | 790 | 199 | 244 | 6,950 |

*Includes Fletcher PMO direct costs of repair (excludes margin and infrastructure costs - included in CHE)

For the 4 September 2010 event (EQ1), the central estimate, undiscounted ultimate cost of claims including CHE and gross of reinsurance is $3.362b. The estimated reinsurance recoveries are $1.821b, giving a central estimate net of reinsurance of $1.541b.

By far the biggest single item is the $6.749b gross ultimate incurred claims (including CHE) arising from the 22 February 2011 event. This is $4.272b more than the $2.477b reinsurance available for that event.

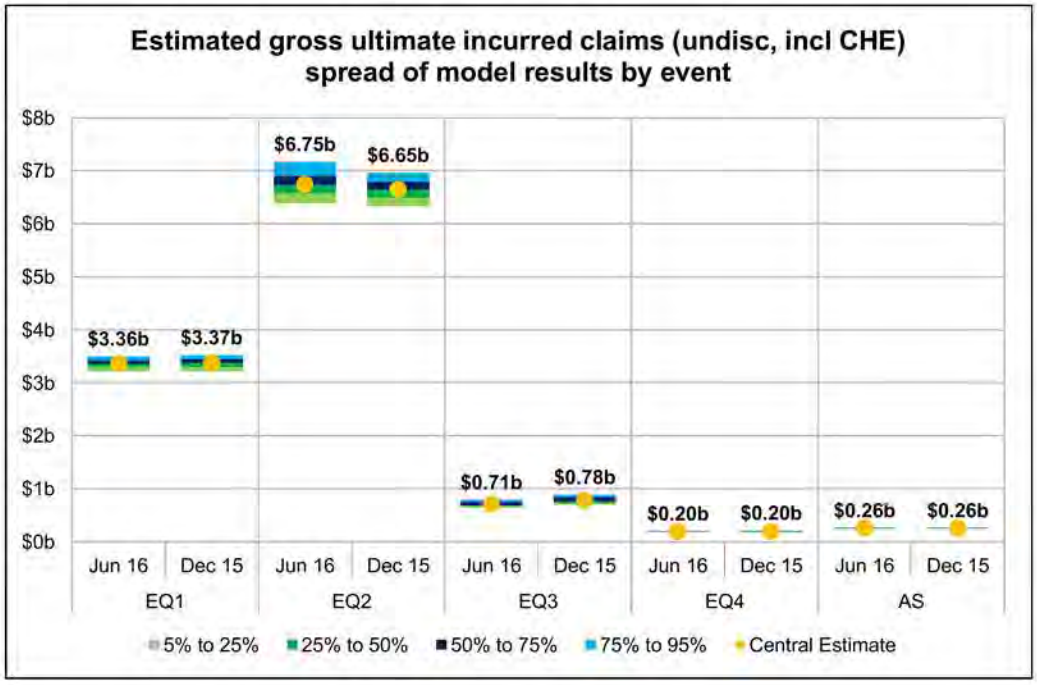
In respect of EQ3, the gross central estimate ultimate incurred claims cost is $0.712b. This falls below the retention point of $1b.

The actuarial determination for AS is shown as -$3m. A negative actuarial determination is due to the loading of total property damage estimates to the most recent claim, which tends to overstate the case estimates for AS (and understate for the other events).

Fletcher Earthquake Recovery (EQR) direct claim costs are included in the claims costs paid to date. Fletcher PMO margin and infrastructure costs are included in CHE.

### *1.13.2 Estimated ultimate claims costs – variability in modelled results*

The actual ultimate incurred claim costs arising from the Canterbury earthquake events will not be known until the last claim is settled. The figures shown in Section 1.13.1 are the central estimate (mean) of a distribution of modelled outcomes.




The chart above illustrates the variability in ultimate claims liabilities according to our valuation model, split by event. The numbers shown correspond to the central estimates.

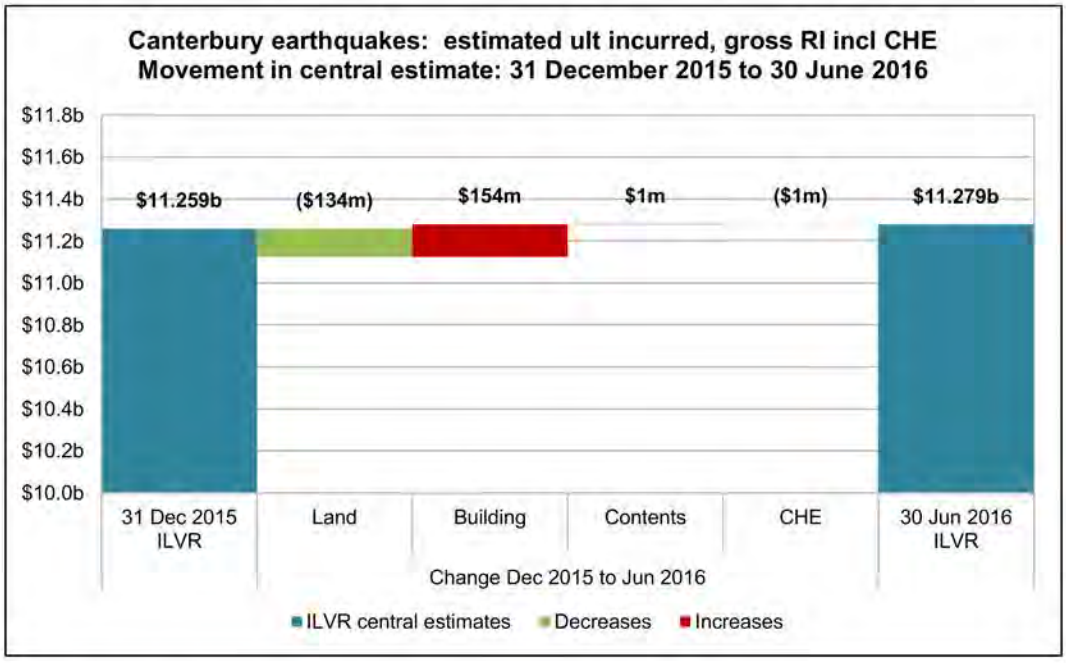
The numbers underlying the chart above are shown in the following table which gives figures at various percentiles. For example, the estimated 75th percentile loss for EQ2 is $6.907b.

**Estimated gross ultimate incurred cost incl CHE**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS |
|---|---|---|---|---|---|
| **30 June 2016 ILVR** | | | | | |
| 5% | $3.221b | $6.390b | $0.651b | $0.189b | $0.250b |
| 25% | $3.293b | $6.574b | $0.671b | $0.193b | $0.256b |
| 50% | $3.363b | $6.733b | $0.698b | $0.196b | $0.259b |
| 75% | $3.430b | $6.907b | $0.753b | $0.199b | $0.263b |
| 95% | $3.504b | $7.177b | $0.801b | $0.204b | $0.268b |
| Central Est | $3.362b | $6.749b | $0.712b | $0.196b | $0.259b |
| **31 December 2015 ILVR** | | | | | |
| 5% | $3.224b | $6.338b | $0.700b | $0.183b | $0.250b |
| 25% | $3.301b | $6.495b | $0.729b | $0.190b | $0.255b |
| 50% | $3.377b | $6.643b | $0.766b | $0.196b | $0.258b |
| 75% | $3.446b | $6.798b | $0.837b | $0.204b | $0.262b |
| 95% | $3.524b | $6.964b | $0.895b | $0.212b | $0.267b |
| Central Est | $3.375b | $6.646b | $0.783b | $0.197b | $0.258b |

### 1.13.3 *Estimated ultimate claims costs – movement since 31 December 2015*

The estimated ultimate gross claims cost for Canterbury earthquake events has moved from $11.259b as at 31 December 2015 to $11.279b as at 30 June 2016. Shown below is a graphical representation of the change in estimated ultimate incurred liabilities with a breakdown of this change below.




**Canterbury earthquakes only**
**Change in estimated ultimate incurred claims cost (undiscounted, incl CHE)**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| **Gross ultimate incurred claims including CHE - central estimate** | | | | | | |
| 31 December 2015 ILVR | 3,375 | 6,646 | 783 | 197 | 258 | 11,259 |
| **Change in:** | | | | | | |
| Land claim costs | -65 | -2 | -65 | -2 | -0 | -134 |
| Building claim costs | +48 | +97 | +6 | +3 | +0 | +154 |
| Contents claim costs | +0 | +1 | -0 | -0 | -0 | +1 |
| CHE | +4 | +8 | -11 | -2 | +1 | -1 |
| **Total change** | -13 | +103 | -71 | -1 | +1 | +20 |
| 30 June 2016 ILVR | 3,362 | 6,749 | 712 | 196 | 259 | 11,279 |
| **Net ultimate incurred claims including CHE - central estimate** | | | | | | |
| 31 December 2015 ILVR | 1,521 | 4,169 | 783 | 197 | 258 | 6,927 |
| **Movements** | | | | | | |
| Claims costs + CHE | -13 | +103 | -71 | -1 | +1 | +20 |
| Reinsurance recoveries | +34 | -0 | -0 | -0 | - | +34 |
| Total movements | +21 | +103 | -71 | -1 | +1 | +53 |
| 30 June 2016 ILVR | 1,541 | 4,272 | 712 | 196 | 259 | 6,981 |

The biggest changes are in respect of land claims and building claims.

Estimated costs for land claims have decreased by $134m. This is a combination of the using more informed land data, the changed approach to modelling the uncertainty around settling ILV claims and identifying properties which have valid claims (uninsured properties).

The estimated costs for building claims have increased by $154m. The increase in expected costs relates primarily to two workstreams addressing remediation work related to the EQR programme as well as drainage issues. These workstreams are at an early stage and the provisions for these issues are based on limited information. In addition, Direct Fees are now included in the dwelling model.

The other movements since 31 December 2015 are an increase in contents claims of $1m and a reduction in CHE of $1m.

In addition to the aggregate movements above, there has been a movement in expected claims costs towards EQ2 and away from EQ1 and EQ3. This is primarily as a result of the changes in the land model, see Section 1.13.5.

### *1.13.4 Historical progression of ultimate incurred*

The table below shows the progression of the estimated gross ultimate incurred claims costs at each valuation since 31 December 2010.

**Canterbury earthquakes only**

**Gross ultimate incurred claims costs, central estimate, undiscounted, including CHE**

| Valuation date | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| 31 December 2010 | 2,754 | - | - | - | - | 2,754 |
| Change in period | +494 | +6,536 | +1,382 | - | +514 | +8,925 |
| 30 June 2011 | 3,247 | 6,536 | 1,382 | - | 514 | 11,678 |
| Change in period | +210 | -22 | -13 | +448 | -139 | +485 |
| 31 December 2011 | 3,458 | 6,514 | 1,369 | 448 | 374 | 12,164 |
| Change in period | -3 | -27 | +2 | +69 | +0 | +42 |
| 30 June 2012 | 3,455 | 6,487 | 1,371 | 517 | 375 | 12,205 |
| Change in period | -298 | -89 | -253 | -1 | -8 | -649 |
| 31 December 2012 | 3,157 | 6,398 | 1,118 | 517 | 367 | 11,556 |
| Change in period | +101 | -28 | +13 | -38 | +15 | +63 |
| 30 June 2013 | 3,258 | 6,370 | 1,131 | 478 | 382 | 11,620 |
| Change in period | -46 | -111 | -75 | -75 | -28 | -335 |
| 31 December 2013 | 3,212 | 6,259 | 1,057 | 403 | 354 | 11,284 |
| Change in period | +66 | +242 | -42 | -2 | +3 | +267 |
| 30 June 2014 | 3,277 | 6,501 | 1,015 | 401 | 357 | 11,551 |
| Change in period | +41 | +231 | -156 | -90 | -33 | -8 |
| 31 December 2014 | 3,318 | 6,732 | 859 | 310 | 324 | 11,543 |
| Change in period | +23 | -57 | -69 | -112 | -80 | -294 |
| 30 June 2015 | 3,341 | 6,675 | 790 | 199 | 244 | 11,249 |
| Change in period | +34 | -29 | -7 | -2 | +14 | +10 |
| 31 December 2015 | 3,375 | 6,646 | 783 | 197 | 258 | 11,259 |
| Change in period | -13 | +103 | -71 | -1 | +1 | +20 |
| 30 June 2016 | 3,362 | 6,749 | 712 | 196 | 259 | 11,279 |

**Results used for accounts**

| Valuation date | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| 30 June 2013 (post-DoV adjustment) | 3,351 | 6,591 | 1,180 | 512 | 382 | 12,016 |
| Change in period | -66 | -108 | -124 | -90 | -28 | -415 |
| 31 December 2013 (post hard/soft) | 3,285 | 6,483 | 1,056 | 422 | 354 | 11,600 |
| Change in period | +58 | +110 | -28 | +2 | +3 | +146 |
| 30 June 2014 (post hard/soft) | 3,343 | 6,593 | 1,028 | 424 | 357 | 11,746 |

Key reasons for the movements:

- Dec 10: EQ1 only.
- Jun 11: EQ2 and EQ3 events occurred.
- Dec 11: EQ4 event. Aggregate Tonkin + Taylor ('T+T') land model.
- Dec 12: Introduction of T+T property based land model (introduced DoV).
- Jun 13: ILVR result ($11,620m) based on revised building model (ACE model introduced) and T+T property based model (with DoV on ILV and IFV). Board elected to book results without DoV ($12,016m).
- Dec 13: ILVR result ($11,284m) based on revised building model. Board elected to book only those gains that were hard / definitive ($11,600m).
- Jun 14: ILVR result ($11,551m) based on new land model (higher remediation costs for ILV and IFV) but offset by increasing dominance of ACE model (within the building claim model).
- Dec 14: ILVR result ($11,543m) based on revised land model (more properties eligible for ILV and IFV settlement and slightly revised ILV repair costs). Building model now more weighted to ACE model, includes statistical apportionment model for undercap properties and more refinement of classifying open claims.
- Jun 15: ILVR result ($11,249m) incorporates ILV settlement (DoV) policy.
- Dec 15: ILVR result ($11,259m) incorporates changed approach as a result of draft ILV DoV rates and a strengthened insurer washup provision.
- Jun 16: ILVR result ($11,279m) incorporates strengthening of reopened provision with changes in the modelling of uncertainty in the land model.

### *1.13.5 Estimated ultimate claims costs – land claims cost movement*

#### *Background*

The land claims cost is a highly uncertain and dynamic component of EQC's estimated ultimate claims costs. This component involves many complex engineering and legal issues and MJW relies on information provided by EQC and their engineering consultants, T+T.

The structure of the current land liability model is similar to the 31 December 2015 model although the parameters have been updated to reflect emerging knowledge.

The model development is described in Section 1.10.1.

***Movement in ultimate incurred cost***

The chart below illustrates the movement in estimated gross ultimate claims costs in respect of land sub-claims between 31 December 2015 ($1.60b) and 30 June 2016 ($1.46b). Note that the split between ILV and IFV is an estimation. The ILV/IFV split reflects the amount of land damage to a property which can be attributed to each damage type, prior to the application of EQC caps.

9(2)(j)

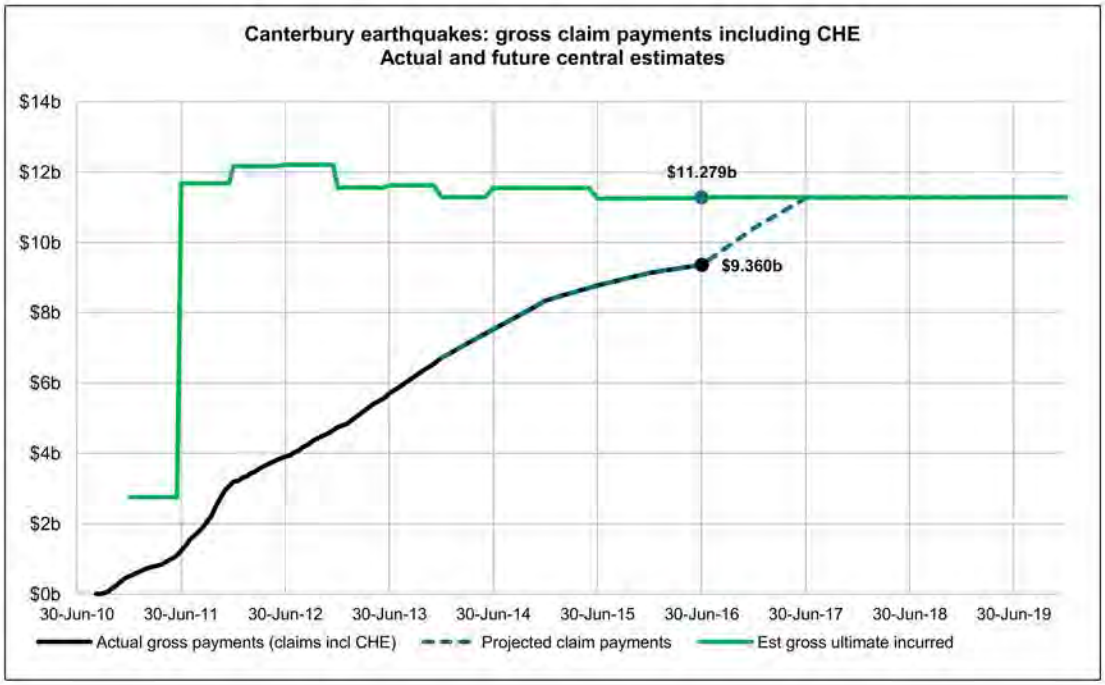
The movement of $140m can be attributed to four key areas:

- 9(2)(j)
- 9(2)(j)
- +$30m – With a change in way uncertainty has been modelled, this has a flow on impact to demand surge and the excesses applicable to settlement amounts.
- 9(2)(j)

### *1.13.6 Gross claim payments – comparison to previous estimates*

The following chart shows actual gross claim payments for Canterbury earthquakes to 30 June 2016 (including EQR payments and CHE) as the solid black line. Projected payments are shown as the blue broken line.

Future cashflow estimates underlying this chart can be found in Section 8.1, including a split by event.




The valuation reflects our understanding of anticipated future cashflows. CHE payments are assumed to continue until 30 June 2019. The final two years of CHE payments are assumed to be small and will be required for a variety of tail issues including managing warranty / rework and litigation.

### *1.13.7 Outstanding claims liabilities – all claims*

The table below summarises the key components of the outstanding claims liabilities ('OSCL') as at 30 June 2016. A more detailed breakdown is set out in Section 7.6.

The net discounted OSCL at a probability of adequacy of 85% is $1.801b. The largest component of the liabilities is in respect of EQ2. The BAU claims are dominated by the 14 February 2016 earthquake.

**All EQC claims**
**Estimated outstanding claims liabilities (OSCL) - 30 June 2016**

| | All EQC Claims | | | | | | |
|---|---|---|---|---|---|---|---|
| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | BAU $m | Total $m |
| **Gross outstanding claims liabilities - central estimate** | | | | | | | |
| Gross claims including CHE, undiscounted | 514 | 1,174 | 185 | 23 | 23 | 93 | 2,012 |
| Discounting | (5) | (12) | (2) | (0) | (0) | (1) | (21) |
| Gross claims including CHE, discounted | 508 | 1,162 | 183 | 23 | 23 | 92 | 1,991 |
| **Reinsurance recoveries - central estimate** | | | | | | | |
| Reinsurance recoveries, undiscounted | 492 | - | 0 | - | - | - | 492 |
| Discounting | (5) | - | (0) | - | - | - | (5) |
| Reinsurance recoveries, discounted | 487 | - | (0) | - | - | - | 487 |
| **Net outstanding claims liabilities - central estimate** | | | | | | | |
| Net claims excluding BAU CHE, undiscounted | 21 | 1,174 | 185 | 23 | 23 | 93 | 1,520 |
| Non-reinsurable CHE, undiscounted | - | - | - | - | - | - | - |
| Net claims including CHE, undiscounted | 21 | 1,174 | 185 | 23 | 23 | 93 | 1,520 |
| Discounting | (0) | (12) | (2) | (0) | (0) | (1) | (16) |
| Net claims including CHE, discounted | 21 | 1,162 | 183 | 23 | 23 | 92 | 1,504 |
| **Net outstanding claims liabilities - risk margin, 85% PoA** | | | | | | | |
| Net risk margin, diversified | 4 | 229 | 36 | 4 | 5 | 18 | 297 |
| **Net OSCL and risk margin 85% PoA, discounted** | 26 | 1,391 | 219 | 27 | 28 | 110 | 1,801 |

#### *14 February 2016 earthquake*

It is estimated that the ultimate claims costs arising from the 14 February 2016 earthquake are $76m of which $72m is outstanding.

### 1.13.8 *Outstanding claims liabilities – movement since 31 December 2015*

The net of reinsurance OSCL (85% probability of adequacy, discounted) has decreased from $1.805b at 31 December 2015 to $1.801b at 30 June 2016. A summary of the change is shown below with more detail in Section 7.5.

**All EQC claims**
**Reconciliation of change in outstanding claims liability from 31 December 2015 ILVR**

| | All Periods | | |
|---|---|---|---|
| | EQ $m | BAU $m | Total $m |
| **Net OSCL (85% PoA, discounted) as at 31 December 2015** | 1,795 | 9 | 1,805 |
| Remove net risk margin (85% PoA) | (307) | (2) | (309) |
| Net OSCL (central estimate, discounted) as at 31 December 2015 | 1,488 | 8 | 1,495 |
| Remove discounting | 38 | 0 | 38 |
| Net OSCL (central estimate, undiscounted) as at 31 December 201 | 1,526 | 8 | 1,534 |
| Estimated net paid over period | (152) | (4) | (156) |
| Change in net actuarial determination | 53 | 89 | 142 |
| Net OSCL (central estimate, undiscounted) as at 30 Jun 2016 | 1,427 | 93 | 1,520 |
| Add discounting | (15) | (1) | (16) |
| Net OSCL (central estimate, discounted) as at 30 June 2016 | 1,412 | 92 | 1,504 |
| Net diversified risk margin (85% PoA, discounted) | 278 | 18 | 297 |
| **Net OSCL (85% PoA, discounted) as at 30 June 2016** | 1,691 | 110 | 1,801 |

The principal drivers of the change in total claims liabilities in decreasing order of impact are:

- Claim payments; net payments since 31 December 2015 have amounted to $156m.
- Risk margin; this has decreased by $12m.
- Discounting; this has decreased by $22m.
- Actuarial determination; this has increased by $142m on a net of reinsurance basis. Section 1.13.3 details how the underlying claims models have moved over the period.

## 1.14 Key results – premium liabilities

### 1.14.1 *Premium liabilities*

The table below summarises the key results of the estimation of EQC's premium liabilities as at 30 June 2016. The premium liabilities will be used in the liability adequacy test.

The total value at 75% probability of adequacy is $216m. This is greater than the $146m unearned premium reserve. This means that an additional unexpired risk reserve will be required in the accounts as at 30 June 2016.

The largest component ($96m, as compared to $95m as at 31 December 2015) relates to projected costs of future claims arising from major events (other than those related to Canterbury earthquakes) during the period of the runoff of risks on the books as at 30 June 2016. These claims are modelled by Minerva.

The next largest component ($90m, as compared to $78m as at 31 December 2015) relates to projected costs of future claims arising from Canterbury earthquakes during the period of the runoff of existing risks as at 30 June 2016. This increased slightly as a result of increased probabilities of seismic activity as reported by GeoNet.

The other claims costs relate to future BAU (small) claims and the associated reinsurance and administration expenses.

The cost to EQC of reinsurance has increased considerably for cover negotiated since the Canterbury events. The future reinsurance costs for unexpired risks are $75m.

**Estimated Premium Liabilities - 30 June 2016**

| | BAU $m | Minerva $m | Cant EQ $m | Total $m |
|---|---|---|---|---|
| **Unearned premium reserve** | | | | 146 |
| **Cost of future claims from unexpired risks** | | | | |
| Gross claims, undiscounted - central estimate | 22 | 47 | 70 | 139 |
| **Administration and reinsurance costs for unexpired risks** | | | | |
| Claims administration expenses | 3 | 5 | 7 | 15 |
| Policy (non-claims) admin expenses for unexpired risks | 5 | 0 | 0 | 5 |
| Future reinsurance costs for unexpired risks | 0 | 57 | 19 | 75 |
| **Reinsurance recoveries** | | | | |
| Reinsurance recoveries, undiscounted | 0 | (11) | (4) | (15) |
| Net premium liabilties, undiscounted - central estimate | 30 | 97 | 92 | 219 |
| Discounting | (0) | (1) | (1) | (3) |
| Net premium liabilties, discounted - central estimate | 30 | 96 | 90 | 216 |
| Diversified risk margin, discounted - 75% PoA | | | | 0 |
| **Net premium liabilities, discounted - 75% PoA** | | | | 216 |

Note that the reason that the risk margin is $0 is because the distribution of potential claims is very skewed. The central estimate is the average of all possible outcomes; this includes some very low probability but high severity events. As a consequence, the central estimate (mean) outcome is greater than the 75$^{th}$ percentile.

The outcome of the liability adequacy test is often taken as a proxy for the adequacy of the levies (premium rates) that are charged. Consequently, the outcome above suggests that the current levy rates are less than sufficient to cover the expected costs of claims. However:

- The expected claims costs are currently inflated due to the heightened seismic conditions in Canterbury.
- The central estimate claims costs may not be the best decision making tool for setting levy rates for such a highly skewed distribution.
- EQC's considerations differ from private insurers and will include such factors as the Crown's appetite for managing earthquake risk including pre and post-funding.

## 1.15 Data

### *1.15.1 Sources*

The most important sources of data for the investigations were:

- Data extracts from the Claim Centre Claims Information Management System ('CIMS').
  - Data as at 13 June 2016 was used to inform the ultimate incurred claims costs.
  - Data as at 30 June 2016 was used to derive the net outstanding claims liabilities.
- ACE apportionment data from the BIU.
- Small PAT results
- EQR paid data.
- Claim-to-address mapping data from the BIU.
- Land cost calculations from EQC & T+T.
- Fletcher Construction completion cost data.
- Trial Balances as at 30 June 2016.
- A Minerva model run generated in January 2011.
- Discussions with EQC employees and contractors.

### *1.15.2 Adequacy and appropriateness*

The completion of this valuation report requires many sources of data.

The demanding operational aspects of the Canterbury earthquake response and recovery have meant that the provision of data and information suitable for actuarial analysis is but one priority among many – consequently the data available for actuarial analysis is limited in some respects.

However, as for previous investigations, we have sought alternative sources of data and chosen valuation methodologies that mitigate these data issues as much as possible.

## 1.16 Key uncertainties

### *1.16.1 General comment*

The actual ultimate incurred claim costs arising from the Canterbury earthquake events will not be known until the last claim is settled.

There is inherent uncertainty in any estimation of any insurance liabilities – estimates of liabilities are based on assumptions derived from analyses of past experience and deviations from estimates are normal and to be expected. The estimates are therefore a probability statement rather than an absolute judgment.

### *1.16.2 Exceptional uncertainties arising from the Canterbury earthquakes*

The Canterbury earthquakes have resulted in a high level of uncertainty. Some of the key sources of uncertainty are:

- The impact of multiple events on the allocation of damage, EQC coverage and EQC's reinsurance coverage.

- Severe land damage and a very complex land claims environment from engineering, valuation and legal perspectives.
- Claims development. There has been considerable progress within EQC in regard to the operational aspects of assessing and settling claims, especially in trying to process land claims. However, for a number of reasons, outcomes of that progress cannot be fully reflected in the information available for the valuation, and so there remains residual uncertainty in the valuation results.

Consequently, at this stage of claims development, there is still a degree of unavoidable uncertainty regarding the future claims costs.

As noted in our previous reports, as the claims are settled and as the reasonableness of the model and its assumptions are refined and tested against the emerging claims experience, the level of uncertainty will reduce.

Some practical outcomes of the uncertainty associated with the valuation are:

- The actual claims outcome will differ to some degree from the estimates.
- There are confidence ranges in the estimated liabilities for each event.
- Different practitioners could legitimately arrive at quite different estimates of claims cost.

A more detailed description of uncertainty associated with this valuation – in particular arising from the Canterbury earthquakes - is set out in Section 12.

### 1.17 Key reliances

In completing this report, considerable reliance has been placed on data and information supplied to MJW by EQC and its external advisors. The most important reliances were placed on the data sources listed in Section 1.15.

More details regarding data, information and reliances are set out in Section 3.

### 1.18 Quality control and risk management processes

The estimation of EQCs liabilities, particularly the building component, involves constructing multiple complex statistical models.

The data, methodology and results that drive, and are output from, these models undergo a variety of quality control and audit processes.

We undertake to ensure the robustness of these by:

- Internal peer review, including:
  - Detailed review of data, assumptions, methodology and results.
  - Periodic rotation of staff which allows, over time, a 'fresh set of eyes' over aspects of the valuation process.
- Data validation where possible to independent sources (e.g. management accounts, daily reports)
- Analysis of change in assumptions for reasonableness.
- Comparison of results to previous models and valuations.

- Comparing results to alternative models.
- External review, including
  - Discussions with EQC staff
  - Discussions with Deloitte at year end.

## 1.19 Key recommendations

### *1.19.1 Progress against previous recommendations*

Several recommendations were set out in the previous ILVR. The progress against these recommendations is as follows:

- In respect of settling the remaining land claims
  - Record the properties that have been sold. *Ongoing*
  - Improve the quality of the link between properties in the land model and properties in the ADE. *Stage 1 complete*

### *1.19.2 Current Recommendations*

The key recommendations, from an actuarial estimate perspective, arising from this investigation is:

- In respect of settling the remaining land claims
  - Record the properties that have been sold.
  - Improve the quality of the link between properties in the land model and properties in the ADE.

Further data recommendations are set out in Section 3.6.

## 1.20 Limitations

In this report we provide the results of our investigations together with an outline of the matters considered and the methods and assumptions applied to obtain these results. Opinions and estimates contained in this report constitute our judgment as at the date of the report.

This report must be read in its entirety. Individual sections of the report, including the Executive Summary, could be misleading if considered in isolation from each other.

This report is addressed to the management and Board of EQC and should not be provided to or used by any other party (except as specified below) without the express written permission of MJW. This limitation has been provided with the intention of preventing the use of the report for purposes for which the analysis was not intended. MJW will not be liable for the consequences of any third party acting upon or relying upon any information or conclusions contained within this report.

MJW has agreed to a request from EQC that this report may be provided to EQC's auditor (Deloitte), reinsurance broker (AON Benfield), reinsurers, legal counsel (Chapman Tripp), geotechnical engineers (Tonkin + Taylor) and the New Zealand Treasury. In agreeing to this request, we point out in particular that this report is addressed to EQC, and therefore we do not warrant or represent that any information, analysis or results set out in it are sufficient or appropriate for any other parties' purposes. This report cannot substitute for any investigations that any other party may wish to carry out for its own purposes, and the authors of this report and MJW will not accept any liability to any other party arising from the use of this report.

### *1.20.1 Official Information Act (OIA)*

It is also recognised that this report will be covered by the OIA and therefore may be released (subject to any redactions) to the public. It is noted however that we are advised that there are grounds for EQC to withhold the ILVR under the OIA.

The limitations above also apply to any other reader of this report.

## 1.21 MJW staff involved in the investigation

The following MJW staff members were involved in some capacity during the course of the investigation:

- Craig Lough — Principal
- Jeremy Holmes — Principal
- [redacted] — Analyst
- [redacted] — Analyst
- Mark Weaver — Principal (Peer review)

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9(2)(a)

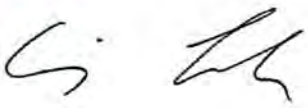
## 1.22 Level of detail and additional information

In writing this report we have tried to strike a reasonable balance between describing what has been done and why, and keeping the report to a manageable size. Because of this, a considerable amount of detail has been either summarised at a high level or omitted. Readers requiring more detailed information are invited to contact the authors of the report.

## 1.23 Professional standards

This report has been written to comply with Professional Standard No. 30 (Valuations of General Insurance Claims) of the New Zealand Society of Actuaries.

## 1.24 Authors



Craig Lough

Fellow of the NZ Society of Actuaries

Jeremy Holmes

Fellow of the NZ Society of Actuaries

Mark Weaver
Peer review
Fellow of the NZ Society of Actuaries

# 2 Background

## 2.1 EQC structure and role

EQC is a NZ Government-owned Crown entity whose origins stretch back to 1945 and is currently established under the Earthquake Commission Act 1993 ('the Act') and associated schedules and regulations.

EQC's role may be summarised as follows:

- To provide insurance against insured perils (see Appendix B).
- To administer the Natural Disaster Fund (NDF), including investments, and obtain reinsurance.
- To facilitate research and education about matters relevant to natural disaster damage and its mitigation.
- To undertake other functions as required by the Minister of Finance or the Minister of EQ Recovery and EQC.

A Government Guarantee ensures that EQC will be able to meet its financial obligations in all circumstances.

## 2.2 Canterbury earthquakes and the implications of multiple events

Since 4 September 2010, a series of damaging earthquakes has affected the Canterbury region in general and the city of Christchurch in particular.

Details of the Canterbury earthquake events are set out in Appendix A.

For the purposes of valuing the outstanding claims, the Canterbury earthquake claims have been split into the following event groups:

- EQ1 – 4 September 2010 event
- EQ2 – 22 February 2011 event
- EQ3 – 13 June 2011 event (including 21 June 2011 event)
- EQ4 – 23 December 2011 events
- AS – the ten other events shown on the Business Information Unit ('BIU') Daily Report as well as 'Other Canterbury claims' included in the Daily Report totals. The logic used to identify these claims is based on the claim's Territorial Local Authority and loss cause and is consistent with the BIU's definition.

Although there have been many earthquake events causing building damage, observable / measurable land damage is associated only with the four identified events (EQ1, EQ2, EQ3 and EQ4). The first two of these events caused enough damage in total to require EQC's reinsurance treaties to respond.

The phenomenon of multiple earthquake events in close succession (as opposed to a single, isolated event) has had many implications from both operational and valuation perspectives; these are considered in more detail below.

### 2.2.1 *More damage*

Each subsequent event adds to the existing damage and hinders the repair of already damaged structures. The impact of additional events on a single plot of land or building can be complex.

With buildings, the 'damage on damage' effect may limit ultimate repair costs to some extent, although some weakened buildings may suffer greater damage.

With land damage, the costs of repair can be exacerbated by later events, particularly for properties near waterways which were already vulnerable to the liquefaction hazards. Where these sites have materially subsided, the vulnerability of the land to the liquefaction and flooding hazards has considerably increased. This is most common in the residential red zone.

### 2.2.2 *Resource issues*

The additional damage creates additional demand for the professions and trades involved in the management of claims and rebuilding:

- Loss adjusters and assessors.
- Engineers.
- Valuers.
- Builders.

There will also be additional demand for rebuilding materials.

Finally there is the issue of Council resources for consents, inspections and code compliance certificates.

### 2.2.3 *Increased complexity in estimation and apportionment of costs*

Multiple events result in increased difficulty in:

- Estimating costs of repair.
- Apportionment of repair costs to different events/claims.
- Potential delays in repair of land and buildings as ongoing earthquakes cause problems in planning and securing resources.

### 2.2.4 *Increased complexity in determining cover – reinstatements*

The High Court's declaratory judgment on 2 September 2011 (EQC v the Insurance Council / Vero / IAG, and TOWER Insurance v EQC) clarified the issue of the reinstatement of EQC's cover after an event.

In summary, EQC is liable for up to $100k plus GST for each building claim and $20k plus GST for each contents claim; i.e. there is immediate reinstatement of cover after each natural disaster event as long as the contract of fire insurance is in force.

### 2.2.5 *Reinsurance*

The operation of EQC's reinsurance cover arrangements have been made much more complicated due to the multiple events. Cover in later events is contingent upon the reinsurance impacts of earlier events (Top and Drop).

More details are provided in 2.4 and Appendix C.

### 2.2.6 *Ministerial Directions*

Given the need to apportion the costs of the claims between the various earthquake events, there is the issue that damage is deemed to have occurred to events where no valid claim has been lodged.

In these cases, there is therefore a possibility that the insured may not be covered for all of the damage that has occurred due to a lack of claim lodgement for a particular event. As a consequence, there have been a number of Ministerial Directions to clarify the issue.

For the purposes of this ILVR, the relevant directions were given on:

- 29 October 2015. Relates to residential land and states that all apportioned residential land damage will be covered by EQC (subject to the land cap), so long as at least one valid claim has been made. Excesses will be deducted from all apportioned damage claim payments.
- 19 December 2012. Relates to residential building and states that all apportioned residential building damage will be covered by EQC, so long as at least one valid claim has been made for that residential building.
- 19 December 2013. An amendment to the previous residential building direction stating that no excess shall apply to apportioned damage where no valid claim was made.

These directions have consequences for the gross and net exposure of EQC in that all damage is covered by EQC (subject to there being at least one claim).

## 2.3 EQC operations outside those specified in the Act

EQC assumed, on behalf of Government, responsibility for a broader than usual range of activities related to the Canterbury earthquake recovery. However, the costs of these extra activities outside the Act were accounted for separately and funded from monies made available by the Crown specifically for these purposes.

Such activities include providing for:

- Emergency repairs (where outside EQC cover, for example for uninsured homes).
- Land strengthening at one locality (Spencerville) where the reinstatement of housing required engineering works that could not be facilitated under EQC cover rules and Government agreed to meet the cost.

## 2.4 EQC reinsurance

### 2.4.1 Cover


### 2.4.2 Premium accounting

Reinsurance premiums are paid quarterly in advance.

More details are provided in Appendix C.

### 2.4.3 Recoveries accounting

Reinsurance recoveries processes are described in Appendix C.

## 2.5 Canterbury land damage and EQC land claim liabilities

This section of the report sets out a high level summary of the situation regarding the land damage caused by the Canterbury earthquakes and the land claim cost implications for EQC. The principal sources of information for this section were Tonkin + Taylor and EQC.

The notes in the remainder of this section should not be considered to be exhaustive – they are merely a high level summary of some of the issues.

### 2.5.1 Land cover

Section 19 of the Earthquake Commission Act 1993 details what is legally covered by EQC in respect of land damage. In summary, EQC's maximum liability for each event is the sum of:

- the indemnity value of bridges, culverts and retaining walls that are lost or damaged, and
- the minimum of:
  - the value of the land damaged,
  - the value at the site of the damage of an area of 4000m2, or
  - the value of a parcel of land that is the minimum lot size under the District Plan of land used for that purpose.

This calculation is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.

### 2.5.2 *Land claims*

#### *Background*

In terms of eligibility, EQC land cover is only given where:

- There is a residential building lawfully situated on the land, and
- The residential building is covered by insurance with a private insurer against fire (although sometimes the cover may have been arranged directly with EQC).

Refer to Appendix B.1 for details.

#### *Canterbury land claims liabilities*

The situation regarding EQC's land claims is complex from several perspectives:

- The nature of the damage caused.
- The engineering solutions to repair the damage (if feasible).
- The valuation of the Insured Land Area and the Diminution of Value.
- The legal issues surrounding the extent of cover provided by EQC in the context of multiple events.

A great deal of work has been done by T+T over the past several years and this has been incorporated into this valuation. However, it should be recognised that there remains uncertainty regarding certain components of the land claims cost estimates.

### 2.5.3 *Land damage recognised by EQC*

#### Flat Land

Land damage has occurred on the flat land as a result of soil layers below the ground surface liquefying, deforming the ground surface and inundating the properties with ejected water, silt and sand.

The flat land in eastern Christchurch is underlain by a series of soil layers of fine-grained alluvial sediments with varying composition and density. Each soil layer has a different liquefaction resistance which means that some soil layers are able to liquefy at lower shaking intensities while other soil layers are only able to liquefy at higher shaking intensities. Generally the more soil layers that liquefy beneath a property, the more liquefaction induced damage that can be expected at the ground surface.

Each of the four main earthquake events had shaking intensities that were strong enough to trigger liquefaction of soil layers in Christchurch. The shaking intensity from EQ1 was only strong enough to cause consequential (damaging) liquefaction in the most vulnerable parts of Christchurch (these areas generally now comprise the residential red zone). The shaking intensity from EQ1 may have triggered liquefaction in isolated soil layers throughout other parts of Christchurch but with minor to no consequential effects at the ground surface. The shaking intensity from EQ2 was considerably stronger in eastern Christchurch causing more soil layers to liquefy, increasing the extent and severity of liquefaction induced damage at the ground surface. However, the shaking intensity from EQ2 was considerably lower in the western and northern parts of Christchurch resulting in no to minor consequential effects at the ground surface. The shaking intensities from EQ3 and EQ4 were less than EQ2 and were generally more localised, causing less extensive liquefaction damage compared with EQ2.

For the more vulnerable properties where severe liquefaction damage occurred, a lot of silt and sand was ejected also resulting in considerable ground surface subsidence. For these vulnerable properties, subsequent earthquake events have caused increasing amounts of land damage and associated repair cost.

The land damage may be divided into two broad groups – visible surface damage (Categories 1 to 7 land damage listed in the table below) and increased vulnerability to liquefaction and to flooding (Categories 8 and 9 respectively, listed in the table below).

| Category | Description |
|---|---|
| 1 Cracking caused by lateral spreading | Lateral spreading is the lateral movement of land, typically toward watercourses or other unconfined faces. Blocks of the crust raft laterally over liquefied soils toward an area of lower elevation. Surface manifestation of damage can range from minor to major cracks in the land, tilting of crust blocks and associated distortions to structures. |
| 2 Cracking caused by oscillation movements | Cracks in land have resulted from oscillation type land movements. This category of land damage refers only to oscillation induced cracking. The cracks produced from this phenomenon are typically minor and isolated. |
| 3 Undulating Ground | Undulating ground is caused by the differential ground settlement as a result of lateral spreading and the ejection of sand and silt and, to a lesser extent, the uneven settlement of the liquefied soils. |
| 4 Local ponding | The local settlement or lowering of the ground at some sites has resulted in water ponding on the ground surface in locations where it did not pond before the earthquake |
| 5 Local settlement causing drainage issues | At various sites land on an individual residential property has settled more than land on the adjacent road or land below which public services are located. In some situations this has resulted in drains that formerly flowed toward public services now flowing back toward the dwelling. |
| 6 Groundwater springs | Formation of new groundwater springs now being emitted at the ground surface usually from a specific location on a site. |
| 7 Inundation of ejected sand and silt | This includes the ejection of sand and silt to the ground surface from the zone below the water table through cracks in the crust. The ejected sand and silt can be deposited in isolated mounds, under dwellings or over the entire site. |

| | | |
|---|---|---|
| 8 | Increased Liquefaction Vulnerability | The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes. |
| 9 | Increased Flooding Vulnerability | The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events. |

**Port Hills**

The Port Hills also sustained land damage although this was of a more traditional nature, and included rock falls, slips and damage to retaining walls.

The Port Hills now has properties zoned as red following a zoning review completed December 2013. These are properties where either:

- The property has been affected by cliff collapse and there is deemed to be an immediate risk to life, or
- The property has been affected by rock roll resulting in an unacceptable risk to life and an area-wide engineering solution to remediate the issue has been determined not to be practicable.

Some areas of Port Hills land have been recognised as susceptible to risks of 'Toe Slumping'. Toe Slumping is the characteristic whereby sloped land is at risk of mass land movement.

### *2.5.4 Rebuilding and land zones*

The Canterbury Earthquake Recovery Authority (CERA) divided the land in greater Christchurch and in the Waimakariri District into two zones - red, and green. The zone definitions are:

- Green (Go Zone): repair / rebuild process can begin.
- Red (No Go Zone): land repair would be prolonged and uneconomic.

The green zone land is broken down further into commercial zoned land, Port Hills land, rural land, and three residential flat land categories. The three residential flat land categories describe how the land is expected to perform in future earthquakes, and also describe the foundation systems most likely to be required in the corresponding areas. These are defined as:

- Technical Category 1 (TC1) – future land damage from liquefaction unlikely.
- Technical Category 2 (TC2) – minor to moderate land damage from liquefaction is possible in future large earthquakes.
- Technical Category 3 (TC3) – moderate to significant land damage from liquefaction is possible in future large earthquakes.

### *2.5.5 Remediation of land claim damage*

Shown below is the manner in which EQC is settling the various land claim categories. The land damage may be broken down into 4 broad groups as discussed below.

- Repair of damage categories 1 – 7 on the flat.

- Repair of, or compensation for, ILV damage on the flat (formerly known as category 8 damage).
- Repair of, or compensation for, IFV damage on the flat (formerly known as category 9 damage).
- Repair of damage on the Port Hills.

***Damage categories 1 – 7 on the flat***

The land damage reinstatement costs have been calculated for each property on an individual property basis.

In the same way that the land damage effects may overlap, so may the reinstatement process and hence tend to reduce the overall cost, i.e. a single repair process may reinstate several categories of damage for several events.

***Diminution of value***

Diminution of Value ('DoV') measures the reduction in a property's market value which has been caused by IFV or ILV land damage.

This is consistent with the indemnity principle of insurance and is being used by EQC (amongst other options) to settle land claims.

ILV and IFV land damage (defined in Section 2.5.3) is a result of the ground surface subsidence caused by the four main earthquakes. There may not be any visible signs of the damage and the land may function in a perfectly reasonable state.

For the properties where the houses were not damaged beyond economic repair, remedying IFV or ILV damage by physically repairing the land would incur the combined costs of the (highly intrusive) land reinstatement and possibly the (also intrusive and often inappropriate) enabling costs associated with the demolition or temporary relocation of a building that is otherwise in reasonable condition. In any case, the combined costs for a property would be limited to the maximum level of cover, which is most often (but not always) the minimum lot value (MLV).

Furthermore, in the case of IFV land damage, it may not be possible to identify an appropriate repair for IFV land damage. For example, this may be because:

- It is not feasible to carry out a repair of the IFV land damage. This may be the case if the house has to be removed in order to do land repairs to address IFV damage under the house; or
- It is not possible to carry out the repair legally. For example, it may not be possible to get a resource consent required under the Resource Management Act for the land repairs to the IFV damage.

In these cases, EQC is not able to base the settlement on repair cost.

<u>Declaratory Judgment</u>

The Declaratory Judgment delivered on 10 December 2014 confirms that IFV and ILV are forms of natural disaster damage to residential land for the purposes of the Earthquake Commission Act ('the Act'), and that EQC may – and should – develop a policy to set out how it will settle claims involving IFV and ILV.

It also noted that the use of DoV as a measure of the amount of a settlement payment is lawful and proper in appropriate cases. At the date of the Declaratory Judgment, EQC had developed its IFV Policy but not the ILV Policy. The Declaratory Judgment confirms that use of DoV, in the circumstances set out in the IFV Policy, is lawful and proper; and the payment of claims out of the Natural Disaster Fund in accordance with the IFV Policy and the Act will be lawful.

Given this guidance, EQC has developed its ILV Policy to align with the principles endorsed by the court in relation to the IFV Policy.

Lastly, the Judgment held that individual claimants may contest EQC decisions (e.g. on qualification for, and the amount of, an IFV / ILV settlement) as an ordinary civil proceeding in the District Court or High Court rather than (as EQC contended) only judicial review.

***IFV damage on the flat***

Flooding encompasses both flooding from rivers which exceed their capacity during prolonged rainfall and also overflowed flow path stormwater run-off during shorter, more intense rainfall events.

Qualification for IFV land damage is based on three criteria.

- Detailed river flood modelling and overland flow path storm water modelling along with the subsidence information have been considered to determine whether a property is materially vulnerable to flooding
- Whether there is a material change in flooding vulnerability as a result of the ground surface subsidence of the insured land caused by each main earthquake.
- Whether the increase in flooding vulnerability impacted the market value of the property.

EQC's policy in respect of IFV damaged land considers the costs and ability to repair the land and the DoV that has been incurred.

We understand that there are a small number of properties (primarily rural) where land remediation may be possible.

***ILV damage on the flat***

Qualification for ILV land damage is based on three criteria:

- Detailed analysis of land damage and subsidence information as well as geotechnical investigations and corresponding liquefaction vulnerability modelling have been considered to determine whether a property has material liquefaction vulnerability
- Whether there is a material change in liquefaction vulnerability as a result of the ground surface subsidence caused by the 2010-2011 earthquake sequence.
- Whether the increase in liquefaction vulnerability impacted the market value of the property.

EQC's will settle the financial loss to the claimant arising from ILV based on the Diminution of Value of the property unless EQC is satisfied that:

- there is a repair methodology for the repair of the Increased Liquefaction Vulnerability of the land;
- the claimant intends to undertake the repair of the land within a reasonable period of time using that methodology;

- the residential land has not been sold by the claimant; and
- the repair cost is not disproportionate to the Diminution of Value of the property, having regard to the particular circumstances of the claimant (including his or her stated intentions in relation to repair of the land)

in which case EQC will settle the claim by payment of the repair costs, together with any residual Diminution of Value associated with any area of damaged land not remediated by the repair methodology.

***Repair of damage on the Port Hills***

Port Hills land damage is more conventional as there is no liquefaction. Compared to damage on the flat, it is more straightforward to assess on a case by case basis. However, it is more difficult to assess, estimate and/or reinstate on a grouped basis.

Port Hills land damage occurred predominantly during the EQ2 and EQ3 events and most related to the failure of retaining walls. There was also damage arising from landslides and rock fall. There was a lot of minor slope failure in general but it is not considered to be ongoing or to represent an ongoing risk. The overall land stability is the same and any future damage would require the occurrence of future major events. In general, repairs and reinstatement of the damage is possible.

***Apportionment of settlement costs***

For IFV and ILV settlement amounts that are based on DoV, the costs are apportioned amongst all qualifying events.

For settlement amounts based on repair cost (whether category 1-7, ILV, IFV and Port Hills), the costs are apportioned to the first event with qualifying damage.

***Silt removal***

One component of land damage has yet to be estimated in a detailed way, removal of ejected silt from underneath dwellings. It is estimated that approximately 5,000 properties (which are not included for ILV and IFV land damage) with silt inundation required silt to be removed from under the house.

## 2.6 New Zealand economic environment

### *2.6.1 Economic growth*

GDP increased 0.7% in the March 2016 quarter with annual growth of 2.4%.

### *2.6.2 Inflation*

Inflation has been very low with the June 2016 Consumer Price Index at 0.4% for the year. The CPI rose 0.4% for the June 2016 quarter.

### *2.6.3 Interest rates*

The Reserve Bank has recently decreased the OCR so that it is now 2.25% p.a.

The five-year government stock rate was 2.02% pa as at 30 June 2016 (3.00% as at 31 December 2015).

# 3 Data and Information

## 3.1 Sources of data

The main sources of data used for the investigation are set out below.

### *3.1.1 Actuarial Data Extract from ClaimCentre*

Weekly Actuarial Data Extracts (ADE) were taken from ClaimCentre and the key extracts used were dated 13 June 2016 and 30 June 2016.

The extract is structured as a single database table. Each record relates to a single claim (itself relating to up to three sub-claims) with many fields describing the claim's details.

More information on ClaimCentre can be found in Appendix B.

### *3.1.2 ACE damage data*

The ACE damage data (as at 2 May 2016) consisted of a table, provided by the BIU, showing apportioned damage estimates for a number of Christchurch properties. There were approximately 130,000 properties in the table although many of these had yet to be populated with apportionment information. There were 52,615 properties from this data set that were used in the building model. The table below details how the usable properties were derived from the total data set. It is in respect of all review statuses. A summary of the approved status information that was used is shown in Section 4.2.

**ACE data cleaning process**

| | Number of Properties | Sum of Raw ACE Estimates EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|---|
| Raw ACE Data | 128,236 | 1,611 | 4,812 | 237 | 28 | 48 | 6,736 |
| Remove: | | | | | | | |
| NAs | (75,520) | - | - | - | - | - | - |
| Duplicates | (46) | - | - | - | - | - | - |
| Property ID errors | (55) | (0) | (2) | (0) | - | (0) | (3) |
| Extremely large estimates (>$100m) | 0 | - | - | - | - | - | - |
| Data used in model | 52,615 | 1,611 | 4,810 | 237 | 28 | 48 | 6,733 |

The BIU supplied two additional tables of data:

- A supplementary table identifying multi-unit buildings (MuBs) and whether the MuB was comprised of dependent or independent dwellings.
- A claim-to-address mapping. Other address fields in the Actuarial Data Extract were unsuitable for this purpose as there were known issues within their records (e.g. they were free-form text fields).

### *3.1.3 EQR paid data*

The EQR paid data (as at 2 May 2016) consisted of a table, provided by the BIU, showing the amounts paid to substantively completed properties. There were 68,000 properties from this data set used in the model.

#### 3.1.4 *Tonkin + Taylor land data and assumptions*

The land valuation model has been constructed using information from T+T and supplemented with information from EQC and their advisors.

#### 3.1.5 *Output from the Minerva loss model*

Output from the Minerva model was the same as that used for the 30 June 2012 valuation. This output was provided by EQC in July 2011. No more recent outputs have been provided as there has been no input of revised parameters following the Christchurch events.

Details on the Minerva model are given in Appendix D.

### 3.2 Sources of information

The additional sources of information used for the investigation were:

- Draft accounts for the period ending 30 June 2016.
- Trial balance for the period ending 30 June 2016.
- Small PAT results.
- CHE Forecast 30 June 2016.
- Daily reports supplied by the BIU.
- Reports supplied by the Fletcher Construction EQR.
- T+T land claims cost model.
- Information from the Treasury website.
- Discussions and correspondence with various relevant EQC staff, contractors and advisors (more details are set out in Appendix D).

### 3.3 Validation of data

#### 3.3.1 *Actuarial data extract*

The first table in Appendix E illustrates a reconciliation of the 30 June 2016 Actuarial Data Extract system against the BIU's Daily Report for 30 June 2016.

Note that for BAU claims the information from the data extract is calculated on a loss date basis and so does not agree exactly with the accounting data. Overall the level of agreement is satisfactory for our purposes.

Further validation is provided via the claims analyses set out in Section 4.

#### 3.3.2 *Other data*

The other data sources were not able to be reconciled against the accounts but were reconciled against other sources where relevant and possible.

Further validation of the ACE data and Fletcher data is set out in Section 4.

## 3.4 Reliances

The key data and information upon which we have placed reliance are described in Sections 3.1 and 3.2 above.

## 3.5 Concerns and qualifications

### *3.5.1 General comments regarding the data held by EQC*

The main areas of concern with respect to the use of the data for actuarial purposes is that the Minerva model requires recalibration for new exposure, risk and damage levels, particularly land damage information and changes to building standards (e.g. enhanced foundations).

## 3.6 Recommendations

### *3.6.1 Progress against previous recommendations*

Several data-related recommendations were set out in Section 3.6 of the 31 December 2015 report. The progress against these recommendations is as follows:

- Minerva:
  - Review the model in the light of the recent events. *Ongoing*
  - Consider whether other catastrophe events besides earthquakes should be included. *Ongoing*

### *3.6.2 Current Recommendations*

The recommendations that were noted in the previous ILVR are outstanding although we note that EQC are planning to address these in the near future.

We recognise that our recommendations relate to actuarial data only. We also recognise the unique operational challenges EQC is facing and the need for EQC to prioritise process and systems changes according to the areas of greatest need.

As a consequence we have no additional recommendations to those noted above.

## 3.7 Adequacy and Appropriateness

The quality of the results in this report relies on the accuracy and completeness of the data and information supplied. Overall, and subject to the significant but unavoidable issues identified in Sections 3.5 and 3.6, we consider that the information provided to us was adequate and appropriate for the purposes of this valuation.

# 4 Canterbury Earthquake Claims Analysis

The figures in the following tables are based on an Actuarial Data Extract from ClaimCentre as at 30 June 2016.

## 4.1 Actuarial Data Extract from ClaimCentre (30 June 2016)

### *4.1.1 Number of notified claims*

**Number of notified claims (ClaimCentre)**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | Total |
|---|---|---|---|---|---|---|
| Closed | 82,977 | 73,971 | 31,453 | 36,636 | 28,653 | 253,690 |
| Open | 62,009 | 70,316 | 22,728 | 10,661 | 12,772 | 178,486 |
| Total | 144,986 | 144,287 | 54,181 | 47,297 | 41,425 | 432,176 |

**Number of notified claims (ClaimCentre) - all incl duplicates**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | Total |
|---|---|---|---|---|---|---|
| Closed | 94,458 | 86,766 | 33,672 | 38,108 | 29,949 | 282,953 |
| Open | 62,152 | 70,520 | 22,766 | 10,686 | 12,790 | 178,914 |
| Total | 156,610 | 157,286 | 56,438 | 48,794 | 42,739 | 461,867 |

- Duplicate claims are excluded from our tables (unless noted otherwise). Duplicate claims are included in the BIU daily report.
- The total number of claims on the daily report includes those from a number of other earthquake events which are not specifically identified. In this section we have included these claims in the AS group.

The following tables are based on sub-claims rather than claims. Each claim lodged with EQC includes up to three sub-claims (also known as 'exposures') corresponding to land, building or contents losses.

### 4.1.2 *Number of notified sub-claims*

**Number of notified sub-claims (ClaimCentre)**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | Total |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 39,583 | 54,512 | 15,791 | 11,781 | 4,456 | 126,123 |
| Open | 7,927 | 8,941 | 2,721 | 1,917 | 1,136 | 22,642 |
| Total | 47,510 | 63,453 | 18,512 | 13,698 | 5,592 | 148,765 |
| **Building sub-claims** | | | | | | |
| Closed | 86,711 | 74,919 | 32,492 | 36,462 | 28,494 | 259,078 |
| Open | 49,169 | 51,482 | 16,301 | 6,163 | 10,074 | 133,189 |
| Total | 135,880 | 126,401 | 48,793 | 42,625 | 38,568 | 392,267 |
| **Contents sub-claims** | | | | | | |
| Closed | 55,270 | 82,128 | 20,272 | 12,103 | 7,785 | 177,558 |
| Open | 17 | 84 | 8 | 5 | 11 | 125 |
| Total | 55,287 | 82,212 | 20,280 | 12,108 | 7,796 | 177,683 |
| **All sub-claims** | | | | | | |
| Closed | 181,564 | 211,559 | 68,555 | 60,346 | 40,735 | 562,759 |
| Open | 57,113 | 60,507 | 19,030 | 8,085 | 11,221 | 155,956 |
| Total | 238,677 | 272,066 | 87,585 | 68,431 | 51,956 | 718,715 |

- In respect of the Canterbury earthquake claims, there were 1.7 sub-claims per claim on average.
- 562,759 sub-claims (78% of the total) have been closed to date.
- It is worth noting that a significant portion of the 133k open building sub-claims are closed with EQR but are not recorded as such in ClaimCentre.
- Comparing EQ1 and EQ2 we see a similar number of building claims but a higher number of land and contents claims for EQ2.

The following table shows the number of sub-claims, including duplicates. The total matches closely to the BIU daily report as at 30 June 2016.

**Number of notified sub-claims (ClaimCentre) - all incl duplicates**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | Total |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 40,987 | 57,527 | 16,275 | 12,088 | 4,614 | 131,491 |
| Open | 7,946 | 8,956 | 2,722 | 1,922 | 1,136 | 22,682 |
| Total | 48,933 | 66,483 | 18,997 | 14,010 | 5,750 | 154,173 |
| **Building sub-claims** | | | | | | |
| Closed | 97,128 | 85,446 | 34,355 | 37,739 | 29,677 | 284,345 |
| Open | 49,229 | 51,557 | 16,319 | 6,174 | 10,082 | 133,361 |
| Total | 146,357 | 137,003 | 50,674 | 43,913 | 39,759 | 417,706 |
| **Contents sub-claims** | | | | | | |
| Closed | 57,747 | 87,481 | 20,965 | 12,472 | 7,998 | 186,663 |
| Open | 17 | 84 | 8 | 5 | 11 | 125 |
| Total | 57,764 | 87,565 | 20,973 | 12,477 | 8,009 | 186,788 |
| **All sub-claims** | | | | | | |
| Closed | 195,862 | 230,454 | 71,595 | 62,299 | 42,289 | 602,499 |
| Open | 57,192 | 60,597 | 19,049 | 8,101 | 11,229 | 156,168 |
| Total | 253,054 | 291,051 | 90,644 | 70,400 | 53,518 | 758,667 |

### 4.1.3 *Sub-claims paid to date*

**Sub-claims paid to date (ClaimCentre)**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 16.0 | 225.3 | 5.4 | 0.5 | 0.7 | 247.9 |
| Open | 3.5 | 5.5 | 0.1 | 0.1 | 0.0 | 9.1 |
| Total | 19.5 | 230.8 | 5.5 | 0.6 | 0.7 | 257.1 |
| **Building sub-claims** | | | | | | |
| Closed | 1,286.0 | 2,756.8 | 267.6 | 100.2 | 82.9 | 4,493.5 |
| Open | 86.3 | 204.2 | 34.3 | 6.1 | 8.0 | 338.9 |
| Total | 1,372.3 | 2,961.0 | 301.9 | 106.3 | 91.0 | 4,832.4 |
| **Contents sub-claims** | | | | | | |
| Closed | 125.1 | 298.8 | 28.7 | 12.4 | 7.5 | 472.5 |
| Open | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 |
| Total | 125.1 | 299.0 | 28.7 | 12.4 | 7.5 | 472.7 |
| **All sub-claims** | | | | | | |
| Closed | 1,427.1 | 3,280.9 | 301.8 | 113.1 | 91.1 | 5,213.9 |
| Open | 89.8 | 209.9 | 34.4 | 6.2 | 8.0 | 348.3 |
| Total | 1,516.8 | 3,490.8 | 336.1 | 119.3 | 99.2 | 5,562.2 |

*Includes duplicates & non-duplicates

- This table only includes claims paid to date as recorded in ClaimCentre.

- Claims costs attributable to Fletcher EQR are not in ClaimCentre and account for another $2,471m. Total building sub-claim payments equal $7,303m.
- EQ1 and EQ2 account for 90% of the total claims paid to date and building claims amount to 87% of the total paid.

### 4.1.4 *Reported incurred sub-claims*

**Reported incurred sub-claims (ClaimCentre & EQR)**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 16.0 | 225.3 | 5.4 | 0.5 | 0.7 | 247.9 |
| Open | 22.6 | 36.4 | 9.9 | 4.1 | 3.9 | 77.0 |
| Total | 38.6 | 261.7 | 15.4 | 4.6 | 4.6 | 324.9 |
| **Building sub-claims** | | | | | | |
| Closed | 1,285.9 | 2,757.2 | 268.7 | 96.6 | 82.9 | 4,491.5 |
| Open | 903.4 | 1,267.9 | 246.7 | 57.0 | 130.2 | 2,605.1 |
| Total | 2,189.3 | 4,025.1 | 515.4 | 153.7 | 213.1 | 7,096.6 |
| **Contents sub-claims** | | | | | | |
| Closed | 125.0 | 298.6 | 28.7 | 12.4 | 7.5 | 472.2 |
| Open | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.3 |
| Total | 125.1 | 298.8 | 28.7 | 12.4 | 7.5 | 472.5 |
| **All sub-claims** | | | | | | |
| Closed | 1,426.9 | 3,281.1 | 302.9 | 109.5 | 91.2 | 5,211.6 |
| Open | 926.0 | 1,304.6 | 256.6 | 61.1 | 134.1 | 2,682.4 |
| Total | 2,353.0 | 4,585.6 | 559.5 | 170.7 | 225.3 | 7,894.0 |

Reported claims incurred is the sum of claims paid to date plus the case estimates held as at 30 June 2016. To the extent that EQR claim payments may not be reflected in Claim Centre, the reported incurred will not be reflective of the actual position.

Building claims closed by EQR may still be recorded as open claims within the ClaimCentre.

### 4.1.5 *Observed average sub-claims cost (reported incurred only)*

**Observed average sub-claim cost (ClaimCentre & EQR)**

| | EQ1 $ | EQ2 $ | EQ3 $ | EQ4 $ | AS $ | Total $ |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 404 | 4,132 | 344 | 42 | 165 | 1,966 |
| Open | 2,853 | 4,076 | 3,645 | 2,140 | 3,419 | 3,399 |
| Total | 813 | 4,124 | 829 | 335 | 826 | 2,184 |
| **Building sub-claims** | | | | | | |
| Closed | 14,830 | 36,803 | 8,270 | 2,651 | 2,911 | 17,336 |
| Open | 18,373 | 24,627 | 15,133 | 9,254 | 12,924 | 19,560 |
| Total | 16,112 | 31,844 | 10,563 | 3,605 | 5,526 | 18,091 |
| **Contents sub-claims** | | | | | | |
| Closed | 2,262 | 3,635 | 1,417 | 1,025 | 962 | 2,659 |
| Open | 2,398 | 3,131 | 461 | 0 | 2,095 | 2,644 |
| Total | 2,262 | 3,635 | 1,416 | 1,025 | 964 | 2,659 |

The land claim estimates held in ClaimCentre are not yet reliable. For an average sub-claim costs analysis based on ultimate incurred, see Section 7.2.1.

## 4.2 ACE data

The tables below show a summary of the ACE data (received as at 2 May 2016). Costs are shown only in respect of ACE approved properties. These figures relate to costs damage caused to a property rather than EQC liability arising.

### 4.2.1 *Costs*

9(2)(j)

[redacted]

The following conventions were used when determining average damage figures:

- In respect of the average damage, for each event and zone, the average is determined as the total apportioned damage divided by the number of properties in that zone.
- In respect of the EQ4 / AS events, the total damage has not been divided by the number of events that apply to the properties as the data did not allow this analysis.

### 4.2.2 *Percentages*

9(2)(j)

This table converts the damage costs (as determined in the table in 4.2.1) into percentages.

# 5 Outstanding Claims Liabilities – Valuation Methodologies

## 5.1 Liability components

EQC's outstanding (OS) claims liabilities to be included in its accounts for 30 June 2016 are, in summary, an estimate of the total value of liabilities arising from all claims incurred up to the valuation date of 30 June 2016.

Claims incurred will include both reported and unreported claims as at the valuation date. Liabilities are calculated both net and gross of reinsurance.

The OS claims liabilities include both claim payments that will be made after the valuation date and the associated claims handling expenses.

The direct claims payments have been calculated to include the valid claims costs payable to insureds, as defined by the Earthquake Commission Act 1993 ('the Act'). The claims handling costs include the administration costs and allocated overheads associated with the management of those claims.

Insurance accounting standards also require the OS claims liabilities to be discounted for the time value of money and to include the addition of a risk margin to increase the probability of adequacy of the provision.

Based on the comments above the key liability components are:

- Direct claims costs of reported, open claims; this part of the liability comprises:
  - Case estimates held within ClaimCentre.
  - An allowance for IBNER (incurred but not enough reported) claims costs where the case estimates are considered to be insufficient.
- Direct claims costs of reported, closed claims that reopen (Reopened).
- Non-reinsurance recoveries.
- Claims handling expenses.
- Reinsurance recoveries.
- Risk margins.
- Discounting for the time value of money.

## 5.2 Valuation groupings

The OS claims liabilities are subdivided by:

- Event.
- Sub-claim.

This subdivision is necessary because different cover and reinsurance rules apply to the different valuation groupings and the underlying data for the creation of assumptions also varies.

### 5.2.1 *Event valuation groupings*

The insurance liability components described in Section 5.1 have been further split into the costs arising from different, mutually exclusive, claim events.

As already noted in section 2.2, the event groups for valuation purposes are:

- 'BAU' (Business As Usual) claims e.g. landslip claims, claims for hydrothermal events, claims from smaller earthquakes outside Canterbury.
- Canterbury earthquakes:
  - EQ1 – 4 September 2010.
  - EQ2 – 22 February 2011.
  - EQ3 – 13 June 2011 event (including 21 June 2011 event)
  - EQ4 – 23 December 2011.
  - AS – all other events/aftershocks e.g. 26 December 2010, 9 October 2011.

The event groups are also split between prior period events and current period events.

A more detailed description of the different earthquake events is set out in Appendix A.

### 5.2.2 *Sub-claim valuation groupings*

Each claim lodged with EQC may result in repair and replacement costs arising from one or more sub-claims types (also known within EQC as 'exposures') and the OS claims liabilities components described above have been split into the costs arising from these groups.

The sub-claim valuation groups are:

- Land claims.
- Buildings claims.
- Contents (personal property) claims.

A detailed description of the cover provided by EQC is in Appendix B.

## 5.3 Valuation methodology considerations

The choice of a valuation methodology or methodologies is driven by a range of factors:

- The purpose of the valuation and outputs required.
- The nature, amount and quality of data available.
- The nature of the event(s) giving rise to the claims.
- The underlying claims process and characteristics.
- The degree of claims development.
- The degree of uncertainty underlying the claims process and assumptions.
- The time and resources available for the completion of the project.

The considerations relevant to this investigation are set out in Section 5.4.

## 5.4 Valuation methodology selected

In summary, the valuation model selected may be described as an aggregate stochastic frequency / severity model. The model itself runs in an MS-Excel spreadsheet and the R statistical package.

A number of alternative valuation methodologies were considered having regard to the criteria set out in Section 5.3. A list of methodologies considered and rejected can be found in our June 2012 ILVR.

The key considerations were:

- The liability components for an ILVR for financial statements were required – i.e. all the components set out in Section 5.1. We considered that a stochastic Monte Carlo approach was suited to the need for risk margins and modelling the operation of the catastrophe reinsurance treaties.
- Although there is a lot of claims-related data (from multiple sources and of variable quality) for building and contents sub-claims, transaction data setting out each individual payment and case-estimate movement is not available.
- Claims development. Although the building and contents sub-claim development is mature the land sub-claims development is relatively low.
- The estimates were required within financial reporting deadlines.

Finally, the high level of uncertainty regarding many of the assumptions and the claims process meant that a stochastic approach to estimate the aggregate claims distributions was required.

Our approach to the modelling has been to base our analysis on best estimate assumptions and reflect our uncertainty about claims assumptions in the size and shape of the variance around the best estimate assumption.

As the claims situation develops, the use of alternative valuation methodologies should be considered.

More details of the model's structure and operation are set out in Appendix G.

## 5.5 Previous valuation methodologies

The most recent valuation undertaken was as at an effective date of 31 December 2015. The valuation methodology is similar to that carried out for the most recent valuation.

## 5.6 Gross incurred claims costs

The costs paid to date are known with certainty, but those to be paid in the future are unknown and so must be estimated. The approach that we have taken is to first estimate the projected ultimate claims costs and then to deduct payments made to 30 June 2016 in order to determine the estimated OS claims liability.

### *5.6.1 High level description of the methodology*

As noted in Section 5.5, the methodology used for the estimation of the outstanding claims liabilities is essentially the same as that used at 31 December 2015.

The methodology adopted for the current valuation broadly follows five steps:

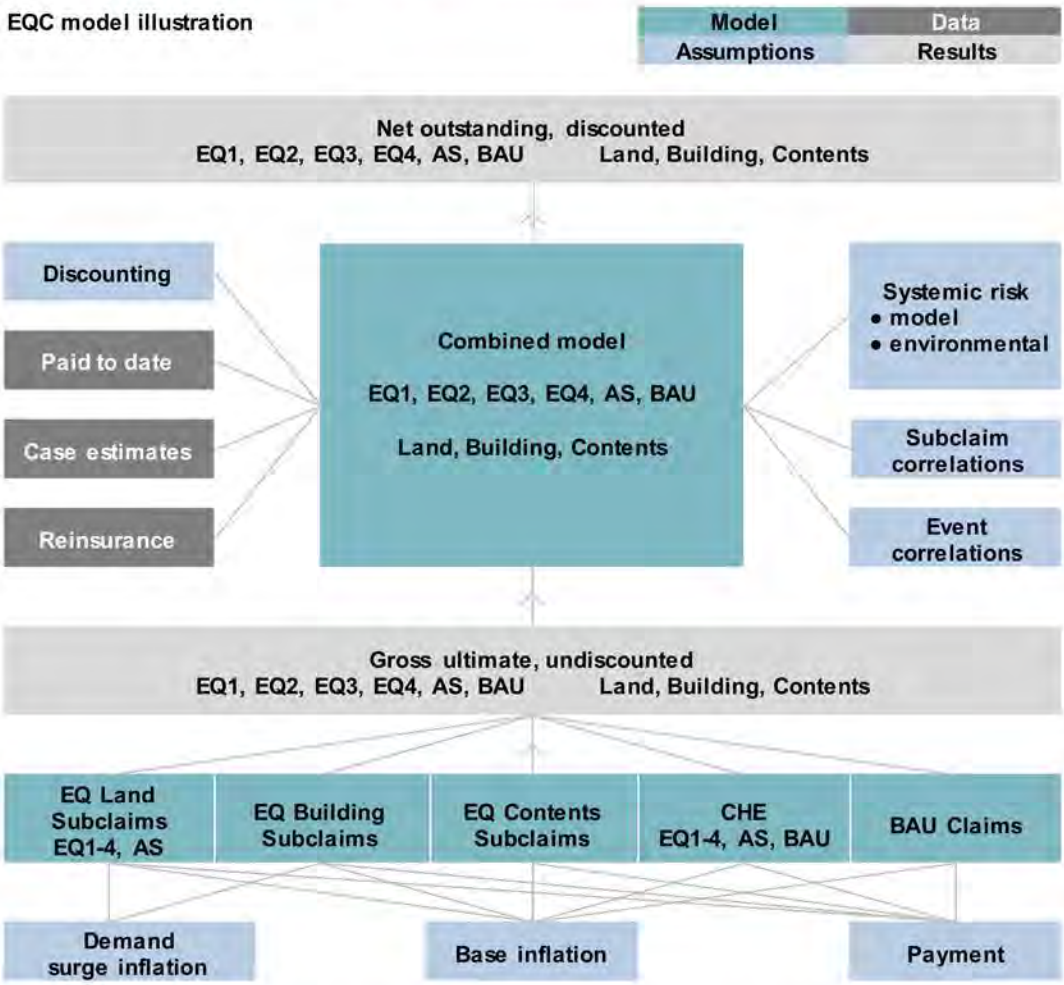
- The ultimate claims cost distribution (including an allowance for inflation) of each cost component for an event is estimated (i.e. land claims cost, building claims cost, contents claims cost and claims handling costs). At this stage each cost component is considered independently of all others. Each cost component distribution was derived using Monte Carlo simulation.
- The individual cost distributions are then combined (with specified dependency structures) into an aggregate distribution forming a single ultimate cost distribution for each event (EQ1, EQ2, EQ3, EQ4, AS, BAU current, BAU prior periods).
- Reinsurance recoveries are applied to each gross distribution to obtain net distributions for each event.
- The event distributions (both gross and net) are then further combined into a total aggregate cost distribution (again with specified dependency structures) for EQC at the entity level. Model and environmental systemic risk were also added at this time.
- Payments are then deducted from the estimated gross and net ultimate distributions to create corresponding outstanding distributions. An estimated payment pattern is then applied to these distributions and they are discounted for the time value of money.

A more detailed description is given in Appendix G.

### 5.6.2 *Diagrammatic illustration of the valuation model*

The diagram below illustrates the components and overall structure of the valuation model.

The structure represents the process for a single run of the model. Each event will have its own unique set of assumptions but needs to be run in parallel in the model as it is the aggregate claims position across the whole entity that must be captured.




The model is run 10,000 times and the output (which is subdivided by the valuation groups described earlier) from each run is collected to form an aggregate gross claims distribution. The central estimate claims cost is found by taking the mean value of the distribution and the 85% probability of adequacy estimate is found by taking the 85th percentile of the distribution.

## 5.7 Non-reinsurance recoveries

Non-reinsurance recoveries are not explicitly modelled as they are not considered to be material. They are dealt with implicitly to the extent that they are present in the reported incurred claims experience (as negative payments).

## 5.8 Claims handling expenses

Claims handling expenses are subdivided into the event groups and are further subdivided into reinsurable and non-reinsurable components.

Future claims handling expenses are modelled on a per-claim basis using per-claim cost assumptions derived from the expense analysis described in Appendix F. The allocation of past claims handling expenses to the different valuation groups is determined using the same model.

Fletcher EQR direct claim costs are included in the claims costs paid to date. Fletcher PMO margin and infrastructure costs are included in CHE.

Risk margins are also applied to the claims handling expenses.

## 5.9 Reinsurance recoveries

The catastrophe reinsurance cover and corresponding reinsurance recoveries are modelled explicitly by the valuation model. The application of the reinsurance rules is complex as the reinsurance cover applied for any event is contingent upon the severity of earlier events. The use of a stochastic model allows the incorporation of this aspect of the cover.

We have not considered adjustment for reinsurance credit risk for this report. The estimated reinsurance recoveries are in respect of future gross payments only.

A detailed description of the reinsurance programme is set out in Appendix C.

### *5.9.1 Unclaimed damage*

The Ministerial Directions in respect of dwelling costs and land costs apply to EQC's obligations only. It does not apply to the obligations of the catastrophe reinsurance programme.

That is, insured damage in respect of events that do not have a valid claim (unclaimed damage), will incur gross costs for EQC but will not accrue reinsurance recoveries.

As at the valuation date, this has an impact for EQ1 only as the estimated ultimate costs for this event lie within the reinsurance programme.

## 5.10 Risk margin

The gross and net risk margins are direct products of the determination of the 85th percentile of the generated gross and net of reinsurance claims distributions. The dollar value of the risk margin for a valuation group is determined by deducting the value of the central estimate of the relevant distribution from the 85th percentile – this may be negative at the valuation group level.

At the entity level, accounting rules require that the OS claims liability is the greater of the central estimate and the chosen percentile (currently 85%). That is, the risk margin cannot be negative at the entity level.

The statistical properties associated with combining aggregate claims portfolios means that the risk margin for a combined portfolio will – depending on the degree of covariance (non-independence) between the two distributions – generally result in a lower risk margin than a simple sum of the margins associated with the two separate distributions. We have assumed various dependency structures between the sub-claim and event distributions due to the proximity of the events in time and location, and the broadly similar mix of risks covered, for more information see Appendix G.

## 5.11 Discounting for the time value of money

Discounting for the time value of money was achieved by the application of forward interest rates to projected future claims cash flows. The projection of cash flow timings over future years was also 'randomised' in order to reflect uncertainty about the timing.

The discount rates used were those specified by Treasury and can be found in Appendix I.

# 6 Outstanding Claims Liabilities – Valuation Assumptions

## 6.1 Assumptions required

The assumptions required are driven by the structure of the valuation model as described in Section 5. In the sections that follow we set out the assumptions used in this valuation for each combination of liability component, event group and sub-claim group and provide some background to the assumptions and how they are derived.

A more detailed description of the data and analysis underlying the derivation of the assumptions is set out in Appendix H.

## 6.2 Actual vs. expected experience

A comparison between the current results and those determined as at 31 December 2015 is illustrated in Section 7.5.

## 6.3 Changes in assumptions

Due to the number of assumptions that are used in the models, a detailed analysis of all changes in assumptions would be of limited utility and potentially misleading.

However, the sensitivity analysis in Section 8.2 does identify the variations in claims liabilities from changes in key assumptions.

### *6.3.1 Land assumptions*

In respect of the land model, there has been revision in the model for this valuation which has seen a number of new assumptions. The new model's assumptions are described in detail in Appendix H.1.1 or may be available from the authors upon request.

### *6.3.2 Building assumptions*

In respect of the building model, there have been some changes to the assumptions underlying the model. The new model's assumptions are described in detail in Appendix H.1.2.

## 6.4 Gross incurred claims costs

The estimation of gross incurred claims costs is the most assumption-intensive part of the valuation model.

In this section we provide a summary of the main assumptions for the land, building and contents sub-claims split by event group.

### *6.4.1 Base inflation and demand surge*

The best estimates for base inflation of costs of land, building and contents sub-claims have been set to the CPI inflation forecast suggested by the NZ Treasury.

Regarding the potentially highly complex issue of demand surge in construction costs (largely relating to labour and accommodation); we have set the best estimate assumption after discussions with the EQR manager and other sources. This assumption was allowed to vary to reflect the inherent uncertainty. It will be reviewed in future in the light of experience and developments.

#### 6.4.2 *Sub-claim transition cost as a proportion of paid*

Analysis of the claims data indicated that in some cases claims that had a building sub-claim only subsequently generated a contents sub-claim, effectively making contents sub-claims a form of IBNR.

The assumptions reflect the fact that sub-claims generated via this mechanism are on average smaller than sub-claims generated at the time a claim is notified.

#### 6.4.3 *Average claim size*

The average claim sizes are typically an output from the valuation models with only the contents claim model using this as an input.

#### 6.4.4 *Number of sub-claims*

As the number of reported sub-claims incurred is known for EQ1, EQ2, EQ3 and EQ4, the only assumption in respect of this quantity is the number of sub-claim transitions.

#### 6.4.5 *Reinstatements*

It is not necessary to make assumptions regarding the reinstatement status of EQC coverage. This is in accord with a high court judgment which ruled residential building cover is fully reinstated immediately after an event. See Appendix B.1.2.

### 6.5 Claims handling expenses

The future claims handling expenses assumptions are set on a per-claim basis having regard to the progress of claims through the claims process. The figures are derived from the EQC finance budget, described in Appendix F.

### 6.6 Reinsurance recoveries

Reinsurance recoveries are determined by the actual parameters of the reinsurance programme cover as applied to the gross claims incurred plus the associated reinsurance recoverable component of the claims handling expenses.

A detailed description of the reinsurance programme is set out in Appendix C.

### 6.7 Risk margin

The gross or net of reinsurance risk margin for a particular combination of event and sub-claim is derived directly from the gross or net of reinsurance aggregate claims distribution from the incurred claims costs model.

In order to determine the degree of variance and hence the appropriate risk margins at higher aggregated levels (for example at event level or at the level of the whole OS claims liability distribution) the variances of each component distribution are combined. The correlation table below sets out our subjectively chosen correlation coefficients for the sub-claim and event dependencies.

| | Land | Building | Contents | CHE |
|---|---|---|---|---|
| Land | 100% | 50% | 25% | 25% |
| Building | 50% | 100% | 50% | 25% |
| Contents | 25% | 50% | 100% | 25% |
| CHE | 25% | 25% | 25% | 100% |

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | BAU | BAU PP |
|---|---|---|---|---|---|---|---|
| EQ1 | 100% | 50% | 50% | 50% | 50% | 0% | 0% |
| EQ2 | 50% | 100% | 50% | 50% | 50% | 0% | 0% |
| EQ3 | 50% | 50% | 100% | 50% | 50% | 0% | 0% |
| EQ4 | 50% | 50% | 50% | 100% | 50% | 0% | 0% |
| AS | 50% | 50% | 50% | 50% | 100% | 0% | 0% |
| BAU | 0% | 0% | 0% | 0% | 0% | 100% | 50% |
| BAU PP | 0% | 0% | 0% | 0% | 0% | 50% | 100% |

Note that these correlations are not applied to the Christchurch land and building sub-claim models.

## 6.8 Discounting for the time value of money

Projected future cash flows were discounted for the time value of money using Treasury's forward rates as at 30 June 2016. These rates are set out in Appendix I.

# 7 Outstanding Claim Liabilities - Results

## 7.1 Introductory comment

The tables in the following pages provide a summary of the results produced by the valuation model.

As discussed elsewhere in this report there is considerable uncertainty associated with the estimate of liabilities arising from the Canterbury earthquake events, and consequently there is a need for a large risk margin and wide claims costs distributions.

It is important to recognise that there is a real possibility that the liabilities could shift either up or down by material amounts for future valuations. This situation is an unavoidable consequence of the inherent estimation uncertainties which are outlined further in Section 12.

## 7.2 Estimated gross ultimate incurred cost of Canterbury claims

The table below shows the estimated ultimate incurred cost of claims for the Canterbury earthquake events split by event and sub-claim, excluding CHE.

**Canterbury earthquakes only**
**Estimated ultimate claims costs (undiscounted, excluding CHE) - 30 June 2016 valuation**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| **Claims costs paid to date *** | | | | | | |
| Land | 20 | 230 | 6 | 1 | 1 | 257 |
| Building | 2,254 | 4,305 | 385 | 124 | 180 | 7,248 |
| Contents | 125 | 299 | 29 | 12 | 7 | 472 |
| Total | 2,399 | 4,833 | 420 | 137 | 188 | 7,977 |
| **Case estimates** | | | | | | |
| Land | 19 | 33 | 10 | 4 | 4 | 70 |
| Building | (86) | (370) | 64 | 5 | 20 | (366) |
| Contents | 0 | 1 | 0 | 0 | 0 | 1 |
| Total | (66) | (336) | 74 | 9 | 24 | (295) |
| **Actuarial determination - central estimate** | | | | | | |
| Land | 249 | 774 | 115 | 1 | (4) | 1,134 |
| Building | 305 | 682 | (19) | 10 | 1 | 980 |
| Contents | 1 | 1 | 0 | (0) | 0 | 2 |
| Total | 555 | 1,457 | 95 | 11 | (3) | 2,115 |
| **Gross ultimate incurred claims cost - central estimate** | | | | | | |
| Land | 288 | 1,037 | 130 | 6 | 1 | 1,461 |
| Building | 2,473 | 4,616 | 431 | 140 | 201 | 7,862 |
| Contents | 126 | 300 | 29 | 12 | 8 | 475 |
| Total | 2,887 | 5,954 | 590 | 158 | 210 | 9,798 |
| **31 December 2015 comparative** | | | | | | |
| Gross ult inc claims cost - cent est | 2,904 | 5,858 | 649 | 157 | 210 | 9,777 |
| **30 June 2015 comparatives** | | | | | | |
| Gross ult inc claims cost - cent est | 2,861 | 5,904 | 663 | 151 | 189 | 9,768 |

*Includes Fletcher PMO direct costs of repair (excludes margin and infrastructure costs)

### 7.2.1 *Average sub-claim cost*

The table below shows the average estimate ultimate gross cost per sub-claim (excluding duplicates). The number of sub-claims can be found in Section 4.1.2. For the purposes of the analysis, the closed sub-claims are based on reported incurred figures and all actuarial adjustment is attributed to the open sub-claim.

**Estimated ultimate average sub-claim cost**

| | EQ1 $ | EQ2 $ | EQ3 $ | EQ4 $ | AS $ | Total $ |
|---|---|---|---|---|---|---|
| **Land sub-claims** | | | | | | |
| Closed | 404 | 4,132 | 344 | 42 | 165 | 1,966 |
| Open | 34,275 | 90,829 | 45,799 | 2,623 | 2 | 53,593 |
| Total | 6,056 | 16,349 | 7,025 | 403 | 132 | 9,823 |
| **Building sub-claims** | | | | | | |
| Closed | 14,830 | 36,803 | 8,270 | 2,651 | 2,911 | 17,336 |
| Open | 24,153 | 36,114 | 9,929 | 7,016 | 11,746 | 25,304 |
| Total | 18,203 | 36,522 | 8,824 | 3,282 | 5,218 | 20,042 |
| **Contents sub-claims** | | | | | | |
| Closed | 2,262 | 3,635 | 1,417 | 1,025 | 962 | 2,659 |
| Open | 57,780 | 13,479 | 27,257 | 383 | 4,046 | 19,032 |
| Total | 2,279 | 3,645 | 1,427 | 1,025 | 967 | 2,671 |

All of the actuarial determination assumed to relate to open subclaims.

## 7.3 Estimated net ultimate incurred cost of Canterbury claims

The table below shows the estimated ultimate incurred cost of claims for the Canterbury earthquake events split by event, including CHE and the impact of reinsurance.

**Canterbury earthquakes only**
**Ultimate claims costs, central estimate, undiscounted, including CHE - 30 June 2016 valuation**

| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | Total $m |
|---|---|---|---|---|---|---|
| Claims paid to date* | 2,399 | 4,833 | 420 | 137 | 188 | 7,977 |
| Case estimates | (66) | (336) | 74 | 9 | 24 | (295) |
| Actuarial determination | 555 | 1,457 | 95 | 11 | (3) | 2,115 |
| Gross estimated ultimate incurred claims | 2,887 | 5,954 | 590 | 158 | 210 | 9,798 |
| Claims handling expenses (CHE) | | | | | | |
| Paid to date | 450 | 741 | 108 | 36 | 48 | 1,383 |
| Estimated future | 25 | 54 | 15 | 2 | 2 | 98 |
| Total | 475 | 796 | 123 | 38 | 50 | 1,481 |
| Gross ultimate incurred claims including CHE | 3,362 | 6,749 | 712 | 196 | 259 | 11,279 |
| Reinsurance recoveries | (1,821) | (2,477) | - | 0 | - | (4,298) |
| Net ultimate incurred claims including CHE | 1,541 | 4,272 | 712 | 196 | 259 | 6,981 |
| **31 December 2015 comparatives** | | | | | | |
| Gross ult incurred claims including CHE | 3,375 | 6,646 | 783 | 197 | 258 | 11,259 |
| Net ult incurred claims including CHE | 1,521 | 4,169 | 783 | 197 | 258 | 6,927 |
| **30 June 2015 comparatives** | | | | | | |
| Gross ult incurred claims including CHE | 3,341 | 6,675 | 790 | 199 | 244 | 11,249 |
| Net ult incurred claims including CHE | 1,520 | 4,197 | 790 | 199 | 244 | 6,950 |

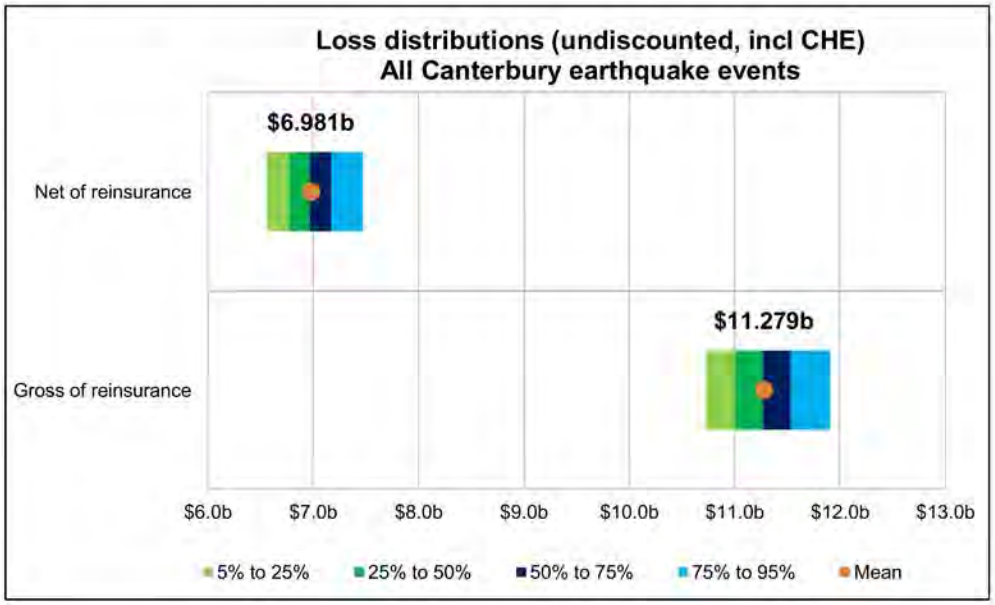
*Includes Fletcher PMO direct costs of repair (excludes margin and infrastructure costs - included in CHE)

## 7.4 Distribution – estimated ultimate claim costs

The chart below illustrates, for the Canterbury earthquake events, the spread of the estimated ultimate incurred claims cost distributions both gross and net of reinsurance.

Each coloured block corresponds to different percentile ranges from the distributions. For example, the pale green area corresponds to the 5th percentile to the 25th percentile of results. The orange dots and figures shown are the distribution means.

The top distribution is shown on a net of reinsurance basis, hence the lower overall values and the narrower range. Both distributions are positively skewed (i.e. stretching to the right) which is unsurprising given the degree of uncertainty and the nature of the claims process.




A similar chart relating to the outstanding (as opposed to incurred) claims distribution would look similar this one. The relevant figures from the above chart are shown below.

**Estimated ultimate incurred cost incl CHE**

| | Net | Gross |
|---|---|---|
| **30 Jun 2016 ILVR** | | |
| 5% | $6.561b | $10.728b |
| 25% | $6.771b | $11.004b |
| 50% | $6.964b | $11.266b |
| 75% | $7.172b | $11.535b |
| 95% | $7.471b | $11.906b |
| Central estimate | $6.981b | $11.279b |

## 7.5 Canterbury earthquake – derivation of outstanding claims liabilities

The table below details the derivation of the outstanding claims liabilities from the ultimate incurred claims costs. It also compares these results to the position from the 31 December 2015 valuation.

**Canterbury earthquakes only**
**Comparison to 31 December 2015 ILVR Results**

| | EQ1 | | | EQ2 | | | EQ3 | | | EQ4 | | | AS | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jun 16 $m | Dec 15 $m | Change $m | Jun 16 $m | Dec 15 $m | Change $m | Jun 16 $m | Dec 15 $m | Change $m | Jun 16 $m | Dec 15 $m | Change $m | Jun 16 $m | Dec 15 $m | Change $m | Jun 16 $m | Dec 15 $m | Change $m |
| **Gross ultimate claims excl CHE, undiscounted - central estimate** | | | | | | | | | | | | | | | | | | |
| Land | 288 | 353 | **-65** | 1,037 | 1,040 | **-2** | 130 | 195 | **-65** | 6 | 7 | **-2** | 1 | 1 | **-0** | 1,461 | 1,595 | **-134** |
| Building | 2,473 | 2,425 | **+48** | 4,616 | 4,520 | **+97** | 431 | 425 | **+6** | 140 | 137 | **+3** | 201 | 201 | **+0** | 7,862 | 7,708 | **+154** |
| Contents | 126 | 126 | **+0** | 300 | 299 | **+1** | 29 | 29 | **-0** | 12 | 12 | **-0** | 8 | 8 | **-0** | 475 | 474 | **+1** |
| Total | 2,887 | 2,904 | **-17** | 5,954 | 5,858 | **+95** | 590 | 649 | **-59** | 158 | 157 | **+1** | 210 | 210 | **-0** | 9,798 | 9,777 | **+20** |
| **Claims handling expenses (CHE)** | | | | | | | | | | | | | | | | | | |
| Paid | 450 | 424 | **+26** | 741 | 690 | **+52** | 108 | 108 | **+0** | 36 | 35 | **+1** | 48 | 45 | **+3** | 1,383 | 1,302 | **+81** |
| Future | 25 | 47 | **-22** | 54 | 98 | **-44** | 15 | 26 | **-12** | 2 | 5 | **-3** | 2 | 4 | **-2** | 98 | 180 | **-82** |
| Total | 475 | 471 | **+4** | 796 | 788 | **+8** | 123 | 134 | **-11** | 38 | 40 | **-2** | 50 | 49 | **+1** | 1,481 | 1,482 | **-1** |
| **Gross ult claims incl CHE, undisc - central est** | 3,362 | 3,375 | **-13** | 6,749 | 6,646 | **+103** | 712 | 783 | **-71** | 196 | 197 | **-1** | 259 | 258 | **+1** | 11,279 | 11,259 | **+20** |
| **Reconciliation to gross outstanding (OS)** | | | | | | | | | | | | | | | | | | |
| Gross ult cost incl CHE, undisc - central est | 3,362 | 3,375 | **-13** | 6,749 | 6,646 | **+103** | 712 | 783 | **-71** | 196 | 197 | **-1** | 259 | 258 | **+1** | 11,279 | 11,259 | **+20** |
| Paid claims costs excl CHE | (2,399) | (2,344) | **-54** | (4,833) | (4,800) | **-34** | (420) | (385) | **-35** | (137) | (116) | **-21** | (188) | (189) | **+1** | (7,977) | (7,834) | **-143** |
| Paid CHE | (450) | (424) | **-26** | (741) | (690) | **-52** | (108) | (108) | **-0** | (36) | (35) | **-1** | (48) | (45) | **-3** | (1,383) | (1,302) | **-81** |
| **Gross OS incl CHE, undisc - central est** | 514 | 607 | **-93** | 1,174 | 1,157 | **+18** | 185 | 290 | **-106** | 23 | 46 | **-23** | 23 | 24 | **-1** | 1,919 | 2,123 | **-204** |
| **Reinsurance recoveries, undiscounted - central estimate** | | | | | | | | | | | | | | | | | | |
| Past payments recoveries | (1,329) | (1,257) | **-72** | (2,478) | (2,478) | **+0** | - | - | **-** | - | - | **-** | - | - | **-** | (3,806) | (3,734) | **-72** |
| Future payments recoveries | (492) | (597) | **+105** | 0 | 0 | **-0** | 0 | 0 | **-0** | 0 | 0 | **(0)** | - | - | **-** | (492) | (597) | **+105** |
| Total expected recoveries | (1,821) | (1,854) | **+34** | (2,477) | (2,477) | **-0** | 0 | 0 | **-0** | 0 | 0 | **(0)** | - | - | **-** | (4,298) | (4,332) | **+34** |
| **Net ult inc claims incl CHE, undisc - central est** | 1,541 | 1,521 | **+21** | 4,272 | 4,169 | **+103** | 712 | 783 | **-71** | 196 | 197 | **-1** | 259 | 258 | **+1** | 6,981 | 6,927 | **+53** |
| **Reconciliation to net outstanding** | | | | | | | | | | | | | | | | | | |
| Gross OS incl CHE, undisc - central est | 514 | 607 | **-93** | 1,174 | 1,157 | **+18** | 185 | 290 | **-106** | 23 | 46 | **-23** | 23 | 24 | **-1** | 1,919 | 2,123 | **-204** |
| Future payments recoveries | (492) | (597) | **+105** | 0 | 0 | **-0** | 0 | 0 | **-0** | 0 | 0 | **-0** | - | - | **+0** | (492) | (597) | **+105** |
| **Net OS including CHE, undisc - central est** | 21 | 9 | **+12** | 1,174 | 1,157 | **+18** | 185 | 290 | **-106** | 23 | 46 | **-23** | 23 | 24 | **-1** | 1,427 | 1,526 | **-99** |
| Discounting | (0) | (0) | **-0** | (12) | (30) | **+17** | (2) | (7) | **+5** | (0) | (1) | **+1** | (0) | (0) | **+0** | (15) | (38) | **+23** |
| **Net OS including CHE, disc - central est** | 21 | 9 | **+12** | 1,162 | 1,127 | **+35** | 183 | 283 | **-100** | 23 | 45 | **-22** | 23 | 24 | **-1** | 1,412 | 1,488 | **-75** |
| Net risk margin, diversified, 85% PoA | 4 | 2 | **+2** | 229 | 233 | **-4** | 36 | 58 | **-22** | 4 | 9 | **-5** | 5 | 5 | **-0** | 278 | 307 | **-29** |
| **Net OS including CHE, disc - 85% PoA** | 26 | 11 | **+15** | 1,391 | 1,360 | **+31** | 219 | 341 | **-123** | 27 | 54 | **-27** | 28 | 29 | **-1** | 1,691 | 1,795 | **-104** |

The estimated net ultimate claims cost (central estimate, undiscounted, including CHE) arising from Canterbury earthquake events has changed from $6.927b at 31 December 2015 to $6.981b at 30 June 2016. The increase of $53m is driven by the following:

- Decreased land cost estimates of $134m.
- Increased building cost estimates of $154m.
- Increased contents cost estimates of $1m.
- Decreased CHE cost estimates of $1m.
- Reinsurance recoveries have increased the net ultimate incurred liabilities by $34m.

Reasons for the changes in the ultimate costs estimates are given in Section 1.13.3. A reconciliation of movement in the outstanding claims liability is shown in Section 8.

## 7.6 Estimated OS claims liabilities – all claims

In summary, the OS claims liabilities are calculated as the estimated ultimate liabilities less the claims paid to date (both direct claims costs and claims handling expenses).

The following table illustrates how the different components of the liabilities are first built up to generate gross outstanding claims liabilities at 85% probability of adequacy and then are reduced by the application of reinsurance. The unreinsurable component of claims handling expenses is deducted before the reinsurance calculations and then added back.

**All EQC claims**
**Estimated outstanding claims liabilities (OSCL) - 30 June 2016**

| | Prior Periods (to 30 Jun 2015) | | | | | | | Current period | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | BAU PP $m | Total $m | BAU $m | Total $m | Jun 16 $m | Dec 15 $m | Current $m | Non-Current $m |
| **Gross outstanding claims liabilities - central estimate** | | | | | | | | | | | | | |
| Gross claims including CHE, undiscounted | 514 | 1,174 | 185 | 23 | 23 | 8 | 1,927 | 85 | 85 | 2,012 | 2,131 | | |
| Discounting | (5) | (12) | (2) | (0) | (0) | (0) | (20) | (1) | (1) | (21) | (53) | | |
| Gross claims including CHE, discounted | 508 | 1,162 | 183 | 23 | 23 | 8 | 1,907 | 84 | 84 | 1,991 | 2,078 | 1,966 | 25 |
| **Reinsurance recoveries - central estimate** | | | | | | | | | | | | | |
| Reinsurance recoveries, undiscounted | 492 | - | 0 | - | 0 | (0) | 492 | (0) | (0) | 492 | 597 | | |
| Discounting | (5) | - | (0) | - | 0 | 0 | (5) | 0 | 0 | (5) | (15) | | |
| Reinsurance recoveries, discounted | 487 | - | (0) | - | 0 | - | 487 | - | - | 487 | 583 | | |
| **Net outstanding claims liabilities - central estimate** | | | | | | | | | | | | | |
| Net claims excluding CHE, undiscounted | 21 | 1,174 | 185 | 23 | 23 | 8 | 1,435 | 85 | 85 | 1,520 | 1,534 | | |
| Non-reinsurable CHE, undiscounted | - | - | - | - | - | - | - | - | - | - | - | | |
| Net claims including CHE, undiscounted | 21 | 1,174 | 185 | 23 | 23 | 8 | 1,435 | 85 | 85 | 1,520 | 1,534 | | |
| Discounting | (0) | (12) | (2) | (0) | (0) | (0) | (15) | (1) | (1) | (16) | (38) | | |
| Net claims including CHE, discounted | 21 | 1,162 | 183 | 23 | 23 | 8 | 1,420 | 84 | 84 | 1,504 | 1,495 | 1,484 | 20 |
| **Net outstanding claims liabilities - risk margin, 85% PoA** | | | | | | | | | | | | | |
| Net risk margin, diversified | 4 | 229 | 36 | 4 | 5 | 2 | n.a | 17 | n.a | 297 | 309 | 294 | 3 |
| **Net OSCL and risk margin 85% PoA, discounted** | 26 | 1,391 | 219 | 27 | 28 | 9 | n.a | 101 | n.a | 1,801 | 1,805 | 1,777 | 23 |

# 8 Reconciliation of movement in outstanding claims liabilities

The net OSCL (85% probability of adequacy, discounted) has decreased from $1.805b as at 31 December 2015 to $1.801b as at 30 June 2016.

The principal drivers of the change in total claims liabilities in decreasing order of impact are:

- Claim payments; net payments since 31 December 2015 have amounted to $156m.
- Risk margin; the risk margin has decreased by $12m.
- Discounting; the net provision has decreased by $22m.
- Actuarial determination; this has increased by $142m on a net of reinsurance basis – although this contains BAU which has increased by $89m ($72m as a result of the 14 February 2016 earthquake).

The following table provides a reconciliation and explanation of the movement in outstanding claims liabilities, by event.

**All EQC claims**
**Reconciliation of change in outstanding claims liability from 31 December 2015 ILVR**

| | Prior Periods (to 31 December 2015) | | | | | | | Current | All Periods | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | EQ1 $m | EQ2 $m | EQ3 $m | EQ4 $m | AS $m | BAU $m | Subtotal $m | BAU $m | EQ $m | BAU $m | Total $m |
| **Net OSCL (85% PoA, discounted) as at 31 December 2015** | 11 | 1,360 | 341 | 54 | 29 | 4 | n.a | 5 | 1,795 | 9 | 1,805 |
| Remove net risk margin (85% PoA) | (2) | (233) | (58) | (9) | (5) | (1) | n.a | (1) | (307) | (2) | (309) |
| Net OSCL (central estimate, discounted) as at 31 December 2015 | 9 | 1,127 | 283 | 45 | 24 | 3 | 1,491 | 4 | 1,488 | 8 | 1,495 |
| Remove discounting | 0 | 30 | 7 | 1 | 0 | 0 | 38 | 0 | 38 | 0 | 38 |
| Net OSCL (central estimate, undiscounted) as at 31 December 201 | 9 | 1,157 | 290 | 46 | 24 | 3 | 1,529 | 4 | 1,526 | 8 | 1,534 |
| Estimated net paid over period | (8) | (85) | (35) | (22) | (2) | (1) | (153) | (3) | (152) | (4) | (156) |
| Change in net actuarial determination | 21 | 103 | (71) | (1) | 1 | 6 | 59 | 83 | 53 | 89 | 142 |
| Net OSCL (central estimate, undiscounted) as at 30 Jun 2016 | 21 | 1,174 | 185 | 23 | 23 | 8 | 1,435 | 85 | 1,427 | 93 | 1,520 |
| Add discounting | (0) | (12) | (2) | (0) | (0) | (0) | (15) | (1) | (15) | (1) | (16) |
| Net OSCL (central estimate, discounted) as at 30 June 2016 | 21 | 1,162 | 183 | 23 | 23 | 8 | 1,420 | 84 | 1,412 | 92 | 1,504 |
| Net diversified risk margin (85% PoA, discounted) | 4 | 229 | 36 | 4 | 5 | 2 | n.a | 17 | 278 | 18 | 297 |
| **Net OSCL (85% PoA, discounted) as at 30 June 2016** | 26 | 1,391 | 219 | 27 | 28 | 9 | n.a | 101 | 1,691 | 110 | 1,801 |

## 8.1 Estimated future OSCL claims liability amortisation and cash flow patterns

The tables below show the projected outstanding claims liabilities (including CHE) and the associated cash flows. These are shown gross and net of reinsurance.

**All EQC claims**
**Outstanding claims liability (including CHE) - estimated amortisation**

| Half-year ending | 30 Jun 16 | 31 Dec 16 | 30 Jun 17 | 31 Dec 17 | 30 Jun 18 | 31 Dec 18 | 30 Jun 19 | 31 Dec 19 |
|---|---|---|---|---|---|---|---|---|
| | $m | $m | $m | $m | $m | $m | $m | $m |
| **Gross OSCL amortisation, discounted** | | | | | | | | |
| Central estimate | 1,991 | 881 | 26 | 16 | 5 | 4 | 1 | 0 |
| **Reinsurance asset amortisation, discounted** | | | | | | | | |
| Central estimate | 487 | 217 | 5 | 3 | 1 | 1 | 0 | 0 |
| **Net OSCL amortisation, discounted** | | | | | | | | |
| Central estimate | 1,504 | 664 | 21 | 13 | 5 | 3 | 1 | 0 |
| Risk margin (85% PoA) | 297 | 138 | 3 | 2 | 1 | 0 | 0 | 0 |

**All EQC claims**
**Undiscounted cashflows - central estimate**

| From | 1 Jul 16 | 1 Jan 17 | 1 Jul 17 | 1 Jan 18 | 1 Jul 18 | 1 Jan 19 | 1 Jul 19 | 1 Jan 20 | 1 Jul 16 |
|---|---|---|---|---|---|---|---|---|---|
| To | 31 Dec 16 | 30 Jun 17 | 31 Dec 17 | 30 Jun 18 | 31 Dec 18 | 30 Jun 19 | 31 Dec 19 | 30 Jun 20 | 30 Jun 20 |
| **Gross OSCL payments including CHE ($m)** | | | | | | | | | |
| EQ1 | 295 | 214 | 2 | 2 | - | 1 | - | 0 | 514 |
| EQ2 | 626 | 539 | 3 | 5 | - | 1 | - | - | 1,174 |
| EQ3 | 97 | 86 | 0 | 1 | - | 0 | - | 0 | 185 |
| EQ4 | 14 | 8 | 0 | 0 | - | 0 | - | - | 23 |
| AS | 16 | 7 | 0 | 0 | - | 0 | - | - | 23 |
| BAU PP | 8 | 0 | 0 | 0 | 0 | 0 | 0 | - | 8 |
| BAU | 70 | 7 | 4 | 2 | 1 | 1 | 1 | - | 85 |
| Total | 1,126 | 860 | 10 | 11 | 1 | 3 | 1 | 0 | 2,012 |
| **Reinsurance recovery payments ($m)** | | | | | | | | | |
| EQ1 | 273 | 214 | 2 | 2 | - | 1 | - | 0 | 492 |
| EQ2 | - | - | - | - | - | - | - | - | - |
| EQ3 | - | - | - | - | - | (0) | (0) | 0 | (0) |
| Total | 273 | 214 | 2 | 2 | - | 1 | (0) | 0 | 492 |

## 8.2 Sensitivity testing

The table below illustrates the impact on expected ultimate incurred and outstanding claims liabilities of varying key assumptions as at 30 June 2016.

The largest impact is caused by a lengthening of the term to settlement.

It is assumed that an increase in term to settlement incurs further claims handling expenses while a shortening of term to settlement will not decrease the level of claims handling expenses.

**Sensitivity analysis**

| | | Est ultimate incurred, gross undiscounted including CHE (excluding BAU) | Est outstanding, net, discounted, including CHE (including BAU) | Difference: Est outstanding, net, discounted, including CHE (including BAU) | Difference: Est outstanding, net, discounted, including CHE (including BAU) |
|---|---|---|---|---|---|
| | | Central estimate | 85% PoA | 85% PoA - Base | 85% PoA - Base |
| | | $m | $m | $m | % |
| **Results: base assumptions** | | 11,279 | 1,801 | 0 | 0% |
| **Results: sensitivity analysis** | | | | | |
| Discount rate | +1% p.a. | 11,279 | 1,792 | (8) | (0.5%) |
| | -1% p.a. | 11,279 | 1,810 | 9 | 0.5% |
| Base inflation | +1% p.a. | 11,284 | 1,804 | 3 | 0.2% |
| | -1% p.a. | 11,266 | 1,793 | (8) | (0.5%) |
| Demand surge: probability of surge event | x 1.5 | 11,294 | 1,805 | 4 | 0.2% |
| Demand surge: surge severity | x 1.5 | 11,320 | 1,814 | 13 | 0.7% |
| Risk margin as % of central estimate net OS | +1% | 11,279 | 1,816 | 15 | 0.8% |
| | -1% | 11,279 | 1,786 | (15) | (0.8%) |
| Future claims handling expense ratio | +1% | 11,290 | 1,807 | 6 | 0.4% |
| | -1% | 11,267 | 1,791 | (10) | (0.6%) |
| Term to settlement | + ½ year | 11,313 | 1,805 | 4 | 0.2% |
| | - ½ year | 11,272 | 1,809 | 8 | 0.4% |

## 8.3 Scenario Analysis

We have carried out some scenario analysis on key areas of judgment for the settlement of ILV damaged properties. These are shown below.

**Scenario analysis**

**Estimated ultimate incurred, gross of reinsurance, undiscounted, including CHE (excluding BAU)**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | Total | Difference | Difference |
|---|---|---|---|---|---|---|---|---|
| | | $m | $m | $m | $m | $m | $m | % |
| 9(2)(j) | [redacted] | | | | | | | |

The analysis illustrates the significant impact these areas have on the overall claims cost.

## 8.4 Quality control processes

The valuation was subject to internal peer review. In addition, all results were compared to those of the previous valuations.

# 9 Premium Liabilities – Valuation Methodologies

## 9.1 Liability components

In summary, EQC's premium liabilities are an estimate of the total value of net liabilities associated with the run-off of EQC's unexpired risks as at 30 June 2016. The focus is therefore on claims incurred as a result of events after the 30 June 2016 valuation date, i.e. future claims. This is in contrast to the OS claims liabilities, which relate to claims incurred up to 30 June 2016, i.e. past claims.

The premium liabilities comprise several components:

- The cost of future claims (net of reinsurance) arising from the unexpired risks.
- The claims handling expenses for the future claims arising from the unexpired risks.
- The cost of policy administration for the run-off of the unexpired risks.
- The cost of the reinsurance cover for the unexpired risks.

The estimate is set at a 75% probability of adequacy and discounted for the time value of money.

The premium liabilities are not included in EQC's balance sheet but will be used for the Liability Adequacy Test (LAT) of the unearned premium reserves (UPR). If the premium liabilities exceed the unearned premium reserves then an additional unexpired risk reserve is required to make up the extent of shortfall. If the premium liabilities are less than the UPR then the UPR remains unchanged.

## 9.2 Valuation groupings

Because the focus of the premium liabilities is on future claims – for which, by definition, there can be no claims data held by EQC - the valuation groupings used for the premium liabilities are very different from those used for the OS claims liabilities.

### *9.2.1 Event valuation groupings*

As we are now dealing with future claims it is not possible to categorise claims by event dates, however we must consider the sources from which future claims may arise. At the time of writing this report these are:

- 'BAU' (Business As Usual) claims
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury
- Canterbury earthquake claims – claims arising from future earthquakes in the Canterbury earthquake sequence.

The first two event groups above are traditional ones for the estimation of EQC's premium liabilities. The last one is temporary and once the Canterbury earthquakes sequence ceases this component will be removed.

### *9.2.2 Sub-claim valuation groupings*

Sub-claim valuation groupings are not produced for the Minerva component of the premium liabilities model because land sub-claims are not modelled by Minerva.

Sub-claims groupings are modelled for the BAU and Canterbury earthquakes but are not presented in the results.

## 9.3 Valuation methodologies considered

The choice of valuation methodology for premium liabilities is driven by the same factors set out in Section 5.3 for the OS claims liabilities.

For the future claims costs components of the premium liabilities the two main decisions are:

- Loss ratio basis or frequency / severity approach.
- Deterministic or stochastic approach.

For the other liability components the figures are usually developed from a consideration of budget figures and the expense analysis.

## 9.4 Valuation methodologies selected

Although several methodologies would have been reasonable, we decided to use a stochastic approach as it facilitated the determination of the risk margin and allowed us to directly model the effects of the catastrophe reinsurance.

This is consistent with the approach used for components of the OS claims liabilities so some of the assumptions developed for that work have been used.

The valuation methodologies selected for each event valuation grouping were:

- BAU: an aggregate stochastic frequency / severity model.
- Minerva claims: a stochastic model based on the supplied return period curve.
- Canterbury earthquakes: an aggregate stochastic frequency / severity model.

### 9.4.1 *Diagrammatic illustration of the valuation methodology*

**Notation (for the following diagram):**

| | |
|---|---|
| $Policies\ in\ force_{BA\ /\ Cant\ EQ\ /\ MINERVA}$ | Proportion of current unexpired policies still in force when a future event occurs (decreases uniformly over the year). |
| $Sub\text{-}claims_{BA\ /\ Cant\ EQ}$ | Predicted number of sub-claims (depends on event severity). |
| $\bar{x}_{BAU\ /\ Cant\ EQ}$ | Assumed average sub-claim size (varies by sub-claim type and combination). |
| *Resilience* | Resilience factor (assumed for building and contents sub-claims only to model the fact that subsequent future aftershocks are less damaging than previous ones). |
| $CCE_{BAU\ /\ Cant\ EQ}$ | Assumed claims cost escalation (inflation) |
| *Estimated Event Cost* | Output from the Minerva Model which simulates the cost of future events (depends on event severity). |

**Land** **Building** **Contents**

↓ ↓ ↓

**Future Business As Usual (BAU) Sub-claims**

$$\sum_{\substack{\text{Future}\\ \text{Events}}} \text{Policies in force}_{BAU} \times \text{Sub-claims}_{BAU} \times \bar{x}_{BAU} \times (1 + CCE_{BAU})$$

+

**Future Canterbury Earthquake Sub-claims**

$$\sum_{\substack{\text{Future}\\ \text{Events}}} \text{Policies in force}_{Cant\ EQ} \times \text{Sub-claims}_{Cant\ EQ} \times \bar{x}_{Cant\ EQ} \times \text{Resilience} \times (1 + CCE_{Cant\ EQ})$$

+

**Minerva Future Claims**

$$\text{Policies in force}_{MINERVA} \times \text{Estimated Event Cost}$$

## 9.5 Changes in methodology

The valuation methodology used is the same as that used for 31 December 2015 and prior valuations.

## 9.6 Cost of future claims

### *9.6.1 BAU*

The BAU model structure is an aggregate stochastic frequency / severity model:

- The number of sub-claims for the year is estimated.
- The average claim size is estimated.
- A claims cost escalation factor is applied in the same way as for the OSC model for BAU claims.
- The mean and variance of the aggregate claims cost are estimated as the number of claims multiplied by the average claims cost and the claims cost escalation.
- Claims handling costs are added and assumed to be stochastic.
- No reinsurance adjustment is applied as the aggregate cost distribution does not approach the reinsurance deductible.
- Discounting for the time value of money is applied to all claim payments.
- The model is run many times to develop an aggregate claims distribution and this is used to derive the risk margin.

### 9.6.2 *Minerva*

MJW was supplied with output from the Minerva model which provides simulated loss data based on property exposures and return periods for events across New Zealand (but excluding the Christchurch area, which is considered separately).

The model process is as follows:

- Each run of the MJW model (which operates based on the Minerva output) simulates an event and registers the appropriate cost to EQC should all policies be on risk at the time of the event.
- The timing of the event is simulated and the associated number of policies still unexpired is estimated.
- The proportion of policies on risk at the time of the event is multiplied by the estimated total cost.
- Claims handling costs are added and assumed to be stochastic.
- Reinsurance cover rules are applied.
- Net of reinsurance payments are discounted for the time value of money.
- The model is run many times to develop an aggregate claims distribution and hence a risk margin.

### 9.6.3 *Canterbury earthquakes*

The Canterbury earthquakes model structure is an aggregate stochastic frequency / severity model:

- The number of events to occur over the year (to 30 June 2016) is estimated.
- The number of claims arising from each event if all policies were on risk is estimated.
- The timing of the event is simulated and the associated number of policies still unexpired is estimated.
- The average claim size is estimated.
- A resilience effect was assumed for building and contents sub-claims, whereby each subsequent aftershock is less damaging than the previous one, so that the average claim size is reduced based on the previous number of events.
- A claims cost escalation factor is applied in the same way as in the OSC model for Christchurch earthquake claims.
- The actual cost is estimated by multiplying:
  - The number of claims arising from events if all policies were on risk.
  - The proportion of policies still on risk at the time of the event.
  - The estimated cost, the resilience effect, and the claims cost escalation.
- Claims handling costs are added and are assumed to be stochastic.
- Reinsurance cover rules are applied.
- Net of reinsurance payments are discounted for the time value of money.
- The model is run many times to develop an aggregate claims distribution and this is used to derive the net risk margin.

### 9.7 Policy administration expenses

Policy administration expenses were estimated based on the expense analysis described in Appendix F.

### 9.8 Claims administration expenses

Claims administration expenses were estimated based on an expense analysis as described in the expense analysis in Appendix F.

### 9.9 Future reinsurance costs

Future reinsurance costs were derived directly from budgets having regard to the fraction of future claims costs expected to arise from unexpired risks as at 30 June 2016.

### 9.10 Risk margin

The risk margin was a direct outcome (75th percentile less the mean) of the generated net aggregate claims distribution.

### 9.11 Discounting for the time value of money

Projected cash flows arising from future claims were discounted for the time of money using Treasury's forward rates as at 30 June 2016. These rates are set out in Appendix I.

# 10 Premium Liabilities – Valuation Assumptions

## 10.1 Assumptions required

The assumptions are driven by the valuation methodology. In the following sections we set out the assumptions for each event group and provide some background to the assumption and how it was derived.

## 10.2 Changes in assumptions

Given the underlying claims process and the valuation methodology, the assumptions are largely based on those used for the 31 December 2015 valuation. The principal exception to this is the Canterbury earthquakes component which was updated for the latest GeoNet forecasts released on 24 March 2016. We have also updated some of the expense assumptions.

## 10.3 Cost of future claims

### *10.3.1 BAU*

The following table and graph illustrate the number of claims projected to be incurred over the 2016 financial year. The standard deviation of this projection is also shown. For each run of the model a randomised number of claims is generated based on these parameters.

**Predicted number of claims by sub-claim profile**

| Profile | Mean | Std dev |
|---|---|---|
| -B- | 2,663 | 1,539 |
| -BC | 258 | 521 |
| –C | 197 | 302 |
| L– | 627 | 211 |
| LB- | 483 | 138 |
| LBC | 45 | 25 |
| L-C | 2 | 2 |

The assumptions above were obtained by the application of a Holt Winters smoothing technique to historical claims data.

The average claim sizes for this component are derived from the same generalised linear model (GLM) used to estimate BAU computer estimate claims for the outstanding claims component.

Assumptions for payment patterns, inflation and discounting are consistent with the BAU claims in the OSC model.

### *10.3.2 Minerva*

In using the output from the Minerva model (excluding Canterbury) we assume the following:

- The probability of an event is uniform over the year.
- The rundown in number of policies remaining unexpired is uniform over the year.
- Claims handling costs are 10% of the estimated ultimate gross cost of claims.
- The current reinsurance deductible is applied.

- Discounting follows the same pattern as for the continuing Christchurch earthquakes outstanding claims component as at 31 December 2015.

### *10.3.3 Canterbury Earthquakes*

The probability of certain size events was taken from the GeoNet website. The expected average number of events was assumed to be the parameter for a Poisson distribution (the natural distribution for a counting process). The maximum number of events that could be simulated by the Poisson distribution was limited to that shown in the following table.

Assumptions for discounting are the same as for the Canterbury earthquake claims in the OSC model.

**Geonet forecasts - Canterbury region long-term probabilities**
**One year: 24 March 2016 - 23 March 2017**

| Magnitude lower | Magnitude upper | Midpoint | Expected Avge (yr) | Expected max events |
|---|---|---|---|---|
| 5.0 | 6.0 | 5.50 | 0.84 | 3 |
| 6.0 | 7.0 | 6.50 | 0.07 | 1 |
| 7.0 | 8.0 | 7.50 | 0.006 | 1 |

Analysis indicates that the number of sub-claims arising from an event is correlated to the magnitude of the event. This relationship is used as the sole risk factor in the simulation of the number of claims from an event. The following table illustrates the number of sub-claims assumed for an event of a given magnitude.

**Number of claims by magnitude**

| Magnitude | Land | | Building | | Contents | |
|---|---|---|---|---|---|---|
| | Mean | Std Dev | Mean | Std Dev | Mean | Std Dev |
| 5.5 | 1,874 | 4,990 | 14,867 | 39,379 | 317 | 839 |
| 6.5 | 12,230 | 32,569 | 84,247 | 223,147 | 4,067 | 10,773 |
| 7.5 | 25,000 | 66,578 | 120,000 | 317,848 | 55,000 | 145,680 |

The number of sub-claims generated assumes all policies are on risk at the time of the event. The proportion of policies predicted to be still unexpired is simulated and the number of sub-claims adjusted accordingly. The risk of an event and the rundown in the number of policies is assumed to be uniform over the year.

The average claim size was also found to be correlated to the magnitude of the event. The average claim size used in this analysis was the estimated ultimate average generated by the OSC model. The following table illustrates the average claim size assumed for an event of a given magnitude.

**Assumed claim size**

| Magnitude | Land | Building | Contents |
|---|---|---|---|
| 5.5 | 23,355 | 10,000 | 2,000 |
| 6.5 | 23,355 | 15,000 | 2,000 |
| 7.5 | 42,854 | 40,000 | 3,000 |

The following resilience factors were applied to each average claim size depending on the number of events before it. For example, the first future event's building sub-claim average will be 100% of the basic assumption and the 5th event's building sub-claim average would be 24% of that figure. The resilience assumption attempts to capture the impact of 'damage on damage' effects arising from consecutive earthquakes and, in the absence of established data, the assumptions were chosen subjectively.

**Assumed resilience by event order**

| Event | Land | Buliding | Contents |
|---|---|---|---|
| 1 | 1.00 | 1.00 | 1.00 |
| 2 | 1.00 | 0.70 | 0.85 |
| 3 | 1.00 | 0.49 | 0.72 |
| 4 | 1.00 | 0.34 | 0.61 |
| 5 | 1.00 | 0.24 | 0.52 |
| 6 | 1.00 | 0.17 | 0.44 |
| 7 | 1.00 | 0.12 | 0.38 |
| 8 | 1.00 | 0.08 | 0.32 |
| 9 | 1.00 | 0.06 | 0.27 |
| 10 | 1.00 | 0.04 | 0.23 |

Claims handling costs were assumed to be 10% of the estimated ultimate gross cost of claims. The current reinsurance deductible was applied.

Assumptions in regard to payment patterns, inflation and discounting are broadly consistent with the Christchurch earthquake claims in the OSC model.

## 10.4 Administration and future reinsurance costs

The table below illustrates the key components in the determination of the costs of administering and reinsuring unexpired risks. These will be updated as at 30 June 2016.

| **Premium liabilities - unexpired risks assumptions - reinsurance / policy administration expenses** | |
|---|---|
| **Figures from accounts and budget** | **$000's** |
| Unearned premium reserve as at 30 June 2016 | 145,840 |
| Actual earned premiums over six months to 30 June 2016 | 148,377 |
| Actual reinsurance costs over year to 30 June 2016 | 150,402 |
| Budget non-Canterbury policy administration expenses over year to 30 June 2016 | 10,000 |
| Percentage of annual costs relating to unexpired risks as at 30 June 2016 | 50.0% |
| **Unexpired risks assumptions as at 30 June 2016** | **$000's** |
| Reinsurance expenses for unexpired risks | 75,201 |
| Policy administration expenses for unexpired risks | 5,000 |

## 10.5 Discounting for the time value of money

Projected cash flows arising from future claims were discounted for the time of money using Treasury's forward rates as at 30 June 2016. These rates are set out in Appendix I.

# 11 Premium Liabilities – Valuation Results

## 11.1 Results

**Estimated Premium Liabilities - 30 June 2016**

| | BAU $m | Minerva $m | Cant EQ $m | Total $m |
|---|---|---|---|---|
| **Unearned premium reserve** | | | | 146 |
| **Cost of future claims from unexpired risks** | | | | |
| Gross claims, undiscounted - central estimate | 22 | 47 | 70 | 139 |
| **Administration and reinsurance costs for unexpired risks** | | | | |
| Claims administration expenses | 3 | 5 | 7 | 15 |
| Policy (non-claims) admin expenses for unexpired risks | 5 | 0 | 0 | 5 |
| Future reinsurance costs for unexpired risks | 0 | 57 | 19 | 75 |
| **Reinsurance recoveries** | | | | |
| Reinsurance recoveries, undiscounted | 0 | (11) | (4) | (15) |
| Net premium liabilties, undiscounted - central estimate | 30 | 97 | 92 | 219 |
| Discounting | (0) | (1) | (1) | (3) |
| Net premium liabilties, discounted - central estimate | 30 | 96 | 90 | 216 |
| Diversified risk margin, discounted - 75% PoA | | | | 0 |
| **Net premium liabilities, discounted - 75% PoA** | | | | 216 |

The future reinsurance costs for unexpired risks do not take into account any unearned reinsurance premium asset that may be held on EQC's balance sheet and this should be considered when carrying out the Liability Adequacy Test.

The risk margin for premium liabilities is nil as the central estimate of the net premium liabilities is greater than the 75th percentile.

## 11.2 Material implications of the results

As the net discounted premium liability at 75% probability of adequacy exceeds the unearned premium reserve it will be necessary to hold an additional unexpired risk reserve.

## 11.3 Key changes from results as at 31 December 2015

The net discounted premium liabilities at the 75th probability of adequacy have increased from $196m as at 31 December 2015 to $216m as at 30 June 2016. The increase is driven by slightly increased probabilities of the likelihood of future Canterbury earthquake events as per the GeoNet website. This was driven by the 14 February 2016 earthquake event. We have also updated some of the attritional claims and expense assumptions.

## 11.4 Quality control processes

The valuation was subject to internal peer review and the results were compared to those from previous ILVRs.

### *11.4.1 Actual vs. expected experience*

The current data does not support an exact analysis of actual claims experience against that expected from the 31 December 2015 premium liabilities calculations. This is because there is no way of identifying incurred claims costs arising from unexpired risks as at 31 December 2015. However, it is still interesting to compare the estimated cost of claims incurred in the current period with the undiscounted central estimate future claims costs from 31 December 2015.

The undiscounted net central estimate cost of future claims as at 31 December 2015 was $195m.

# 12 Uncertainty

## 12.1 General comment

There is inherent uncertainty in any estimation of insurance liabilities – estimates of liabilities are based on assumptions and deviations from estimates are normal and to be expected. The estimates are therefore a probability statement rather than an absolute judgment.

## 12.2 General sources of valuation uncertainty

The general sources of error in the estimation of liabilities include:

- Normal variation that is inherent in any random process.
- The valuation model being a poor representation of reality.
- Incorrect valuation assumptions arising from:
  - Assumptions being derived from an unrepresentative sample.
  - Underlying experience drifting over time and chosen assumptions failing to accurately follow the 'drift' – this could be due to internal factors such as changes in the claims process or external factors such as changes in the legal environment, cost inflation etc.
- Incomplete or poor quality data.
- Errors in calculations.

All of these sources of error are potentially present in this investigation.

## 12.3 Uncertainties arising from the Canterbury earthquakes

### *12.3.1 Background*

The Canterbury earthquakes have resulted in a higher than usual level of uncertainty associated with this valuation.

Some of the key sources of uncertainty are:

- The impact of multiple events on EQC coverage and reinsurance coverage.
- Severe damage resulting from liquefaction and a complex land claims environment from both engineering, valuation and legal perspectives.
- The potential for construction cost inflation to exceed expectations.

Consequently, at this stage of claims development, there is still a degree of unavoidable uncertainty regarding the future claims costs. Over time, as claims are settled, and as the reasonableness of the model and its assumptions can be tested against the emerging claims experience, the level of uncertainty will further reduce.

### *12.3.2 Land valuation uncertainties*

The list below sets out some specific sources of uncertainty regarding the estimation of EQC's land liabilities. These sources include, but are not limited to:

- The extent to which properties have valid claims.

- The impact of the 'diminution of value' cover interpretation.
- The assumed market value cap for a number of properties in Canterbury.
- The implementation of the IFV and ILV settlement methodologies.
- The possible impact of demand surge due to labour shortages.
- Legal, valuation and engineering challenge and different interpretation of the land cover provisions in the EQC Act.

## 12.4 Implications of uncertainty

Some practical outcomes of the uncertainty associated with the valuation are:

- The actual claims outcome will differ to some degree from the estimates.
- There are wide confidence ranges in the estimated liabilities for each event.
- Different practitioners could legitimately arrive at quite different estimates of the cost of claims.

# Earthquake Commission

15 August 2016

## Insurance Liability Valuation as at 30 June 2016

## Appendices

MELVILLE JESSUP WEAVER

Towers Watson Alliance Partner

# A Canterbury Earthquakes – Background

Since 4 September 2010, Canterbury has been shaken by over 10,000 earthquakes including three which have required the catastrophe treaties to respond.

GNS Science has noted that there are various particular features of the seismic activity in the Canterbury region that have led to the unusually high levels of damage recently experienced. These include:

- A high 'stress drop' and/or strong focusing of the February 2011 fault rupture toward Christchurch, associated with the orientation and breaking of strong faults, resulting in higher intensities of shaking.
- Extremely high peak horizontal and vertical ground accelerations were recorded close to the epicentres of the February and June 2011 earthquakes.
- The presence of several hundred metres of soft alluvial sediments beneath Christchurch city amplified the ground motion at certain frequencies.
- The hard volcanic rock comprising Banks Peninsula may have compounded the effect of the earthquakes by reflecting the seismic energy back into the soft sediments beneath Christchurch.
- High water tables and the presence of soft soils beneath parts of eastern Christchurch contributed to more severe liquefaction effects at the surface.

## A.1 Main events

The four largest events, to which the bulk of property damage is attributable, were:

### *A.1.1 EQ1 – 4 September 2010*

On 4 September 2010, an earthquake of magnitude 7.1 on the Richter scale occurred, centred at Darfield, 40km west of Christchurch City, at a depth of 11km. It caused significant non-structural damage to residential and commercial property across the region. Particular features of this event were the peak ground acceleration and the many residential areas of eastern Christchurch and to the north (Kaiapoi) that suffered liquefaction and lateral spreading along river banks.

### *A.1.2 EQ2 – 22 February 2011*

On 22 February 2011 there was an earthquake of magnitude 6.3, centred 5km SE of Lyttelton, at a depth of only 5km, affecting the CBD and suburbs to the South and East of the city. Many significant buildings in the CBD were severely damaged with 185 deaths and many injuries, and there extensive and severe liquefaction damage in vulnerable areas as well as some landslides and rock falls from cliffs in the Port Hills.

### *A.1.3 EQ3 – 13 June 2011 (including 21 June 2011 earthquake)*

On 13 June 2011 there were two earthquakes of magnitude 5.6 and 6.3 at shallow depth, both centred close to Sumner. The shaking was sufficient to cause further significant damage to already weakened buildings. There was again lateral spreading adjacent to the rivers and a great deal more liquefaction damage in areas previously affected by the February event.

### *A.1.4 EQ4 – 23 December 2011*

On 23 December 2011 there were several earthquakes, the largest of magnitude 6.0 at a depth of 7km, centred close to South New Brighton Beach. Being centred off the coast, the effects have been generally less damaging to structures than the other main events, but vulnerable buildings and the same areas of land again suffered further damage.

## A.2 Future events

The understanding of the active fault system in the Christchurch area is evolving but analysis of the series of events to date indicates a progressive 'unlocking' towards the east. If continued this would imply that future events may be centred offshore and further away from the city.

As at 24 March 2016 the GeoNet website stated that their latest computer modelling showed a 7% - 8% chance of a magnitude 6 of greater earthquake occurring within the wider Canterbury aftershock region in the course of the next year. The extent of the area of the earth's crust that has experienced a stress change indicates that aftershocks can be expected to continue (at reducing levels) for decades. It is noted that the percentage chance of a magnitude 6 event is for the greater Canterbury region. The percentage chance of another magnitude 6 event within a 20km window of urban Christchurch is considerably smaller.

# B EQC – Organisational Background

## B.1 EQC cover

EQC pays out on claims from insured New Zealand residential property owners for damage to the residential building and the land on which that building is situated and damage to personal possessions caused by earthquake, natural landslip, volcanic eruption, hydrothermal activity, tsunami and fire caused by any of these. In the case only of residential land there is also cover for storm or flood damage. Claim payments are subject to limits and excesses.

Each claim lodged with EQC may result in repair and/or replacement costs arising from one or more of the following claims types (also known as 'sub-claims' or 'exposures'):

- Land claims (S19 of the Act) to a maximum liability of the indemnity value of bridges, culverts and retaining walls that are lost or damaged plus the lesser of:
  - the value of the land damaged,
  - the value at the site of the damage of an area of 4000m$^2$, or
  - the value of a parcel of land that is the minimum lot size under the District Plan of land used for that purpose.
  - This calculation is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.
- Building claims (to a maximum of $100k plus GST).
- Personal property (contents) claims (to a maximum of $20k plus GST).

Cover is only given in relation to land where there is a residential building lawfully situated on the land.

Cover can only be given in relation to a residential building where among other things, there are self-contained premises which are a home or a holiday home or capable of being or are intended by the owner to be a home or a holiday home.

For there to be residential building, or residential land cover, the residential building must be covered by insurance with a private insurer against fire (although sometimes the cover may have been arranged directly with EQC).

- Cover can only be given in relation to contents where there is insurance with a private insurer in respect of the contents (although sometimes the cover may have been arranged directly with EQC).

General exclusions are:

- Motor vehicles and vessels (boats).
- Plants and landscaping.
- Dams, breakwaters, fences, walls etc. not integral to the residential building.
- Reservoirs, swimming and spa pools, tanks etc. that are not integral to and within the building; or that do not form part of the storage or (in the case of tanks) water supply system.
- Jetties etc.

- Any paved or other artificial surface (including the surface of the access way).
- Certain specified types of valuables (including jewellery, stamps, works of art, securities etc.).

### B.1.1 *Property covered (including excess and limits)*

***Land***

- Applies to land on which the residential building stands; land within 8m of the building or outbuildings; land that is part of or supports the main access way up to 60m of the building; bridges and culverts within 8m of the residential building, or on land within 60m of the building that is part of or supports the main access way; and retaining walls and support systems within 60m of the building that are necessary to support or protect the building or insured land (including the main access way).
- Does not extend to plants or landscaping; fences and walls that are not integral to the building; or paved or artificial surfaces.
- Is based on:
  - the indemnity value of any bridges, culverts, and retaining walls and their support systems that are covered, plus
  - the cost to repair land that is physically damaged or lost in the earthquake (or in some circumstances the reduction in the value of the damaged land, where repair is not possible or unlikely to occur for practical reasons).
- Is subject to a maximum per event of the indemnity value of bridges, culverts and retaining walls that are lost or damaged plus the lesser of:
  - the value of the land damaged,
  - the value at the site of the damage of an area of 4000m$^2$, or
  - the value of a parcel of land that is the minimum lot size under the District Plan of land used for that purpose.
  - This calculation is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.
- Is subject to an excess calculated as: the greater of $500 per dwelling or 10% of land value, subject to $5,000 maximum per claim.
- In some cases, whether or not certain land damage results in a valid land claim can be a complex matter requiring specialised legal and engineering advice.

***Residential Buildings***

- Eligibility and Exclusions: as above. Any exclusions under the policy with the private insurer apply also to EQC coverage. There is no EQC cover for temporary accommodation costs.
- Cover includes all water supply, drainage, sewerage, gas, electrical and telephone services serving the dwelling, within 60m of the dwelling and owned by the owner of the land or dwelling.
- Cover is limited to replacement value and is subject to a maximum of the lesser of the replacement sum specified under the private insurance policy; the sum specified for insurance under the EQC Act; or $100k plus GST per dwelling (see discussion of conditions for reinstatement of this dollar amount for second and subsequent events).
- Excess: 1% of amount payable under Act with a minimum of $200 per dwelling.

***Contents (Personal Property)***

- Eligibility and Exclusions: as above. Any exclusions under the policy with the private insurer apply also to EQC coverage.
- Cover is on a Replacement value basis (unless the private insurance is on a less favourable basis) and is limited to the lesser of the sum insured under the private insurance policy or $20k plus GST.
- Excess: $200 deducted from claim for contents only (otherwise the excess noted above for a building claim will apply for a claim for building and contents).

### *B.1.2 Reinstatement of cover limits*

Following the High Court's declaratory judgment on 2 September 2011 (EQC v the Insurance Council / Vero / IAG; and Tower Insurance v EQC) the issue of the reinstatement of EQC's cover after an event has now been clarified.

In summary, EQC is liable for up to $100k plus GST for each building claim and $20k plus GST for each contents claim; i.e. there is immediate reinstatement of cover after each natural disaster event as long as the contract of fire insurance is in force.

## B.2 EQC levies

EQC levies are collected via the insurance premiums on all domestic home and domestic contents policies issued by private insurers.

Prior to 1 February 2012, domestic home and contents policyholders paid 5c per $100 of insurance cover, up to a maximum of $69 per year.

From 1 February 2012 the levy increased for contracts entered into on or after that date to 15c per $100 of insurance cover, up to a maximum of $207 per year.

The purpose of the increase (as noted in the Minister of Finance's press release dated 11 October 2011) was to:

- Provide revenue to meet EQC's operating costs, which for many years have been subsidised by NDF investment income, and to cover higher reinsurance costs.
- Enable EQC to rebuild the NDF to its pre-earthquake level of $6 billion in about 30 years.
- Reduce EQC's estimated $1.2 billion cash shortfall to $490 million, reducing the amount the Government may have to provide under EQC's Crown guarantee.

## B.3 EQC market and distribution

As the provision of EQC cover is compulsory for all domestic home and domestic contents policyholders (insured through private insurers) EQC does not have distribution activities. As a single, flat-rate levy is applied throughout New Zealand, there is no underwriting carried out by EQC.

An amount equal to 2.5% of EQC levy commission is paid to the private insurer. This is intended to cover the insurer's costs of collecting and remitting the levy to EQC.

## B.4 EQC operations

EQC's head office is based in Wellington.

EQC's normal activities include:

- Collection of levies, placement of reinsurance and management of the NDF.
- Claims management.
- Research facilitation.
- Education.

New (non-Canterbury) natural disaster claims are managed out of the Wellington and Hamilton Processing Centre. When there is a significant disaster and EQC declares an event, a field office is set up in a suitable location near where the damage occurs.

Fletcher Earthquake Recovery or EQR (also known as the Project Management Office or PMO) acting as an agent of EQC for repair of damaged houses had established 20 hubs in the Christchurch area. This has now reduced to just one hub as the Christchurch Home Repair Programme enters the final phase.

## B.5 EQC claims handling process

The key points of EQC's Canterbury earthquake claim process may be summarised as follows:

- A claimant lodges a notice of damage via EQC's 0800 claims freephone number or website. Claimants have three months following each event in which to lodge a notice.
- EQC allocates to each claim an initial triage status and estimated cost based on the lodgement information.
- Building and land claims are assessed on site by a loss adjuster and a builder, supported by an engineer as required and a new estimate is produced via the COMET-based iPad system. Based on the assessment, one of the following actions occurs:
  - Some claims are settled via payment in cash:
    - Small claims for contents, minor damage and emergency repairs.
    - Claims over EQC 'claims cap'.
  - For claims not paid in cash, settlement via repair will usually be undertaken by the EQR but the claimant can elect to use another repairer under certain conditions.
- Contents claims are managed in Wellington, Christchurch and Hamilton.
- BAU claims are managed in Wellington and Hamilton.

## B.6 EQC systems

EQC operates a number of systems. Those most relevant to the current investigation include:

- The CLAIMS (Claims Lodgement, Allocation, Information and Management System) which comprises:
  - The ClaimCentre CIMS (Claims Information Management System) system.
  - The GIS (Geographical Information System) system.

- The Alchemy COMET systems (A & B) that manage the iPad-based field assessments.
- The ACE (Apportioned Cost Estimate) database.
- The DataWarehouse.
- The Minerva risk model application.

The claims data which forms part of the basis for this investigation comes primarily from the ClaimCentre and COMET systems. The Minerva model provided output for use in the estimation of a component of the premium liabilities.

# C EQC Reinsurance

## C.1 Reinsurance periods

EQC reinsurance periods commence 1 June (and so do not correspond with EQC financial year that commences 1 July.) Reinsurance is a mix of annual and 3 year contracts.

EQC has had several different reinsurance situations over the period from 1 June 2010. The situations are complex as each depends on the level of costs incurred by EQC for the various events that have occurred and the layers of reinsurance that are ultimately triggered by each event, as these affect the ongoing cover provided by the reinsurance treaties in place.

## C.2 Reinsurance event definition

In EQC reinsurance treaties, there are two sections within the clauses dealing with reinsurance 'event' definition, the vital points being:

- Losses incurred within 720 hours of the nominated event start time but also
- All additional losses, as a result of earthquakes/aftershocks occurring within 250km radius of the originally nominated earthquake.

Further, the reinsurance is limited to coverage of losses as set out in the Earthquake Commission Act.

## C.3 Reinsurance events occurring in the financial year 1 July 2010 – 30 June 2011

Of the earthquake events that have given rise to claims on EQC over the financial year ended 30 June 2011, it is clear that two will trigger the reinsurance.

- EQ1 on 4 September 2010,
- EQ2 on 22 February 2011,

A third is possible - EQ3 on 13 June 2011 - although the estimate remains subject to uncertainty until the land settlement framework and apportionment is confirmed. At this stage, the estimated ultimate incurred costs suggest that the top and drop layer may not be required to respond.

For reinsurance purposes, all other earthquake claims can be regarded as 'other earthquake' claims.

## C.4 Reinsurance events occurring in the financial year 1 July 2011 – 30 June 2012

There have been further aftershocks since 1 July 2011 that have given rise to claims on EQC, including EQ4 on 23 December 2011. However, it is not expected that these will trigger the reinsurance.

## C.5 Reinsurance protection in place for EQC for the period 1 June 2010 – 31 May 2011

As from 1 June 2010, and effective for EQ1, EQC reinsurance programme was made up of three layers, providing a total of NZD 2.4775b* cover excess of NZD 1.5b first loss deductible:

- Layer 1: NZD $500m xs NZD $1,500m
- Layer 2: NZD $1,500m xs NZD $2,000m
- Layer 3: NZD $500m xs NZD $3,500m

*Note that EQC co-insured 1.5% or NZD 22,500,000 of Layer 2 (on the 2009 3-year placement).

Layers 1 and 2 were made up from four equal tranches, with 3 of the tranches placed on 3-year contracts and the fourth tranche as an annual contract. The 3-year contracts for these layers have annual re-signing. (This structure had been used for some years so that 50% of Layers 1 and 2 were renewed each year.) Both these layers had one automatic reinstatement. After EQ1 a back-up cover for Layer 1 was purchased.

Layer 3 was placed 100% on a 3-year contract in 2009 and had one automatic reinstatement after a loss over the period of the contract (3 years) with a 'Top and Drop' feature.

EQC reinsurance year ends on 31 May each year.

## C.6 Reinsurance protection in place for EQC for the period 1 June 2011 – 31 May 2012

From 1 June 2011, the reinsurance situation depended to some degree on the extent to which events during the previous year (EQ1 and EQ2) impacted on reinsurers.

The 2009 and 2010 3-year Layer 1 and 2 contracts were re-signed. As at 1 June 2011, new cover for 50% of Layers 1 and 2 was placed under annual contracts (no 3-year contract being available). The 2011/12 parts of Layers 1 and 2 allow for one reinstatement at 100%.

As noted above, EQC co-insured 1.5% or NZD 22,500,000 of Layer 2 (on the 2009 3-year placement), and it now also co-insures 0.719% (or NZD 10,785,000) of Layer 2 on the 2011/12 placement.

Layer 3 was placed 100% on a 3-year contract in 2009 and had one automatic reinstatement after a loss over the period of the contract (3 years) with a 'Top and Drop' feature. As there is a cap of NZD 1b on total recoveries under this contract, the extent of cover available after 1 June 2011 is dependent on the extent to which it has been impacted by earlier events.

Ongoing cover depends on the impact of EQ3, as well as on EQ1 and EQ2.

## C.7 Reinsurance protection in place for EQC for the period 1 June 2016 – 31 May 2017

## C.8 EQC reinsurance accounting

### *C.8.1 Reinsurance premiums*

Premiums on Layers 1, 2 and 3 are payable quarterly in advance on 1 June, 1 September, 1 December and 1 March.

***For 2010/11 reinsurance year:***

- Layers 1 and 2 were placed on the basis of one pre-paid (or 'free') reinstatement. The contracts therefore reinstate up to one limit of indemnity with no additional reinstatement premium payable. Back-up cover for Layer 1 was purchased for the period from 30 September 2010 to 31 May 2011.
- Layer 3 (the top and drop) was placed with one reinstatement at 100% additional premium. In the event of a loss the cover is reinstated up to one limit of indemnity for the payment of a premium that is pro rata as to the amount of the cover utilised but 100% as to time. The reinstatement premium is payable at the time of EQC requesting payment of the claim from reinsurers, that is only once claims from one event exceed the trigger point of $3.5 bn.

There was an asset representing the 'unearned' 2/3 of the reinsurance premiums paid at 1 June 2011 in EQC accounts as at 1 July 2011.

***For the 2011/12 reinsurance year:***

- The unexpired 3 year deals continue on the same basis as before, after annual resigning; i.e. premiums payable quarterly in advance and one pre-paid reinstatement for each of Layers 1 and 2.
- The 2011/12 annual placement is on the basis of one reinstatement at 100% additional premium.
- The situation in regard to Layer 3 (the top and drop) depends on the extent to which cover has been used by EQ1 and / or EQ2, as discussed in Appendix C. There was one reinstatement at 100% additional premium, but this is subject to the proviso that there may be limited cover to reinstate on this contract as the NZ$1bn total limit of indemnity applies across the 3-year term.

As noted above, reinstatement premiums are only payable once claim payments actually trigger the situation. Therefore, amounts that may become payable in future as a result of past events may be regarded as contingent liabilities in EQC accounts.

***For 2016/17 (current) reinsurance year:***

- The details for the current year are commercially sensitive.

## C.9 Reinsurance recoveries

Reinsurance recoveries become payable to EQC once gross payments (claims and associated claims handling expenses) exceed the relevant treaty retentions.

Pre-funding for any event can only be requested once an official incurred estimate exceeding the programme deductible has been issued.

# D Information and Data – Further Detail

## D.1 Minerva loss model

Minerva is a complex and powerful model built specifically for EQC to predict the cost of natural catastrophes. It was created to provide data on the potential cost of disasters and hypothetical disasters, and to assist in assessing the capital and reinsurance needs of EQC.

When calculating unexpired risk reserves for use in the Liability Adequacy Test, we have referred to Minerva output providing a probability distribution for potential major catastrophes occurring throughout New Zealand over a specified period of time (usually one year).

Minerva generates, according to the type of event, the nature and severity at which the event will impact on surrounding locations. Algorithms for levels of damage to each eligible property are applied, and hence the dollar amount arising from each EQC claim is projected.

The model takes into account the extent of EQC coverage provided (excesses and limits), and allows for assumed levels of non-insurance of eligible properties. The value of contents is related to the value of buildings, and expected claims are then projected based on severity. Variations about central values of severity and level of damage are incorporated in the calculations.

### *D.1.1 The model and its calibration*

9(2)(a) [redacted] a consultant, collects and inputs the data required by Minerva. In July 2011, MJW has discussed with him, in general terms, the nature of the data and aspects of the operation of Minerva. [redacted]

9(2)(ba)(i) [redacted] We summarise some of the points that were discussed below, in order to provide a suitable context for the results used.

With regards to properties covered by EQC (i.e. primarily domestic buildings), this data includes details of age, construction and size as well as current value. Data has been derived from a full set of information obtained from Quotable Value New Zealand, usually in the second half of each year.

Data on properties covered was last updated as at mid-2009 for calculations carried out in early 2010. [redacted]

9(2)(ba)(i) [redacted] Information relating to properties in Canterbury would have been significantly affected by earthquakes. This situation has to be taken into account when reviewing the output from Minerva after mid-2010.

9(2)(ba)(i) [redacted]

9(2)(ba)(i) [redacted]

### D.1.2 *Use of the model for this valuation*

As noted above, the data on Canterbury dwellings currently held in Minerva will need to be updated to reflect the current situation, including a review of the frequencies assumed to apply for earthquakes affecting Christchurch. Over the next year the probability of further earthquakes in the Canterbury area remains at a heightened level.

Also it is noted that data for the rest of New Zealand should be updated and that the Minerva model requires recalibration for new exposure, risk and damage levels, particularly land damage information. However, in the absence of other modelling, the Minerva output is considered to be the most suitable for this valuation.

As a result of the issues identified above we have adapted our premium liabilities modelling by referring to a Minerva run excluding Canterbury and adding a new component to the premium liabilities to allow for Canterbury earthquakes.

## D.2 People consulted

MJW has consulted a number of people in the course of preparing this valuation for EQC. The people noted below are those with whom we had had discussions recently to help in the production of this report.

### D.2.1 *EQC Executive*

Hugh Cowan – GM Reinsurance, Research and Education:

- Land issues.
- Apportionment issues.
- 'Big picture' issues.

Gillian Dudgeon – General Manager Shared Services:

- Financial statements.
- Claims handling expenses.

### D.2.2 *EQC Finance Team*

9(2)(a) [redacted] – Reinsurance Claims Manager:

- 'Big picture' issues.
- Accounts.
- Inflation and discounting.

- Apportionments.

9(2)(a) [redacted] – Financial Controller

- Accounts.
- Claims handling expenses

### D.2.3 EQC Canterbury Event Field Office

9(2)(a) [redacted] – Business Services Manager:

- Liaison to EQR.

9(2)(a) [redacted] – Head of Canterbury Land:

- Land issues.

### D.2.4 EQC Business Information Unit

9(2)(a) [redacted] – BIU Manager:

- ClaimCentre and Actuarial Data Extract.
- Background material.

### D.2.5 EQC legal team

9(2)(a) [redacted] – Chief Legal Advisor

9(2)(a) [redacted] – Legal Counsel (secondment)

- Legal issues

### D.2.6 EQC policy team

9(2)(a) [redacted] – Principal Policy Analyst

- EQC policy responses

### D.2.7 Tonkin + Taylor

9(2)(a) [redacted] – Senior Geotechnical Engineer:

- Land claims issues and costs.

9(2)(a) [redacted] – Geotechnical Engineer:

- Land claims issues and costs.

### D.2.8 Master Builder Services

9(2)(a) [redacted] – General Manager:

- Building remediation issues in Canterbury and wider afield.

# E Data Validation

### *E.1.1 Actuarial Data Extract vs Daily Report*

The table below shows a reconciliation of the 30 June 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit's Daily Report for 30 June 2016.

**Canterbury earthquakes only**
**Reconciliation of ADE to Daily Report**

| Event | Event Date | ADE - 30 Jun 2016 Number of Claims | Building $000s | Land $000s | Contents $000s | Paid $m | EQR Paid $m | Total Paid $m | Daily Report - 30 Jun 16 Number of Claims | Paid $m | Difference Number of Claims | Paid $m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EQ1 | 4-Sep-10 | 156,610 | 1,368,363 | 19,466 | 125,122 | 1,513 | 491 | 2,004 | 156,609 | 2,003 | (1) | (1) |
| AS | 19-Oct-10 | 3,637 | 8,376 | 74 | 467 | 9 | 8 | 17 | 3,637 | 17 | 0 | (0) |
| AS | 14-Nov-10 | 2,615 | 5,688 | 54 | 238 | 6 | 6 | 12 | 2,615 | 12 | 0 | (0) |
| AS | 26-Dec-10 | 19,041 | 37,406 | 281 | 3,410 | 41 | 41 | 82 | 19,041 | 82 | 0 | (0) |
| AS | 20-Jan-11 | 2,854 | 5,832 | 101 | 466 | 6 | 8 | 14 | 2,854 | 14 | 0 | (0) |
| AS | 4-Feb-11 | 636 | 2,471 | 45 | 347 | 3 | 3 | 6 | 636 | 6 | 0 | (0) |
| EQ2 | 22-Feb-11 | 157,286 | 2,956,359 | 238,908 | 298,969 | 3,494 | 1,313 | 4,807 | 157,286 | 4,806 | 0 | (2) |
| AS | 16-Apr-11 | 3,646 | 7,331 | 34 | 1,144 | 9 | 22 | 31 | 3,646 | 31 | 0 | (0) |
| AS | 30-Apr-11 | 192 | 454 | - | 33 | 0 | 1 | 2 | 192 | 2 | 0 | (0) |
| AS | 10-May-11 | 975 | 2,376 | 2 | 135 | 3 | 6 | 8 | 975 | 8 | 0 | (0) |
| AS | 6-Jun-11 | 2,291 | 6,368 | 63 | 449 | 7 | 14 | 21 | 2,291 | 21 | 0 | (0) |
| EQ3 | 13-Jun-11 | 54,203 | 293,271 | 5,285 | 28,219 | 327 | 480 | 807 | 54,203 | 807 | 0 | (1) |
| EQ3 | 21-Jun-11 | 2,235 | 8,622 | 213 | 517 | 9 | 19 | 29 | 2,235 | 29 | 0 | (0) |
| AS | 9-Oct-11 | 5,635 | 12,866 | 83 | 611 | 14 | 11 | 25 | 5,635 | 25 | 0 | (0) |
| EQ4 | 23-Dec-11 | 48,794 | 102,769 | 579 | 12,417 | 116 | 49 | 165 | 48,794 | 165 | 0 | (0) |
| Other Canterbury event* | | 1,217 | 2,208 | - | 176 | 2 | - | 2 | 8,791 | 21 | 7,574 | 18 |
| Total | | 461,867 | 4,820,759 | 265,188 | 472,719 | 5,559 | 2,471 | 8,032 | 469,440 | 8,047 | 7,573 | 15 |

*not shown separately on the Daily Report, but included in the total.

The level of agreement is satisfactory for valuation purposes.

The table below illustrates a reconciliation of the 30 June 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit's Daily Report for 30 June 2016.

**Validation of ClaimsCentre (CIMS) Actuarial Data Extract**
**Comparison to BIU Daily Report - Canterbury Earthquakes only**

| | ADE - 30 June 2016 | | | | | |
|---|---|---|---|---|---|---|
| | EQ1 | EQ2 | EQ3 | EQ4 | AS + Other Canterbury | Total |
| ***ADE and Fletcher - 30 June 2016*** | | | | | | |
| **Number of claims** | | | | | | |
| Open | 62,152 | 70,520 | 22,766 | 10,686 | 12,493 | 178,617 |
| Closed | 94,458 | 86,766 | 33,672 | 38,108 | 29,029 | 282,033 |
| Total | 156,610 | 157,286 | 56,438 | 48,794 | 41,522 | 460,650 |
| **Paid to Date ($000s)** | | | | | | |
| Total | 2,004,096 | 4,807,487 | 836,027 | 164,616 | 217,050 | 8,029,277 |
| **Number of subclaims** | | | | | | |
| Land | 48,933 | 66,483 | 18,997 | 14,010 | 5,591 | 154,014 |
| Building | 146,357 | 137,003 | 50,674 | 43,913 | 38,618 | 416,565 |
| Contents | 57,764 | 87,565 | 20,973 | 12,477 | 7,799 | 186,578 |
| Total | 253,054 | 291,051 | 90,644 | 70,400 | 52,008 | 757,157 |
| ***Daily Report - 30 June 2016*** | | | | | | |
| **Number of claims** | | | | | | |
| Open | 62,152 | 70,520 | 22,766 | 10,686 | 13,971 | 180,095 |
| Closed | 94,457 | 86,766 | 33,672 | 38,108 | 36,342 | 289,345 |
| Total | 156,609 | 157,286 | 56,438 | 48,794 | 50,313 | 469,440 |
| **Paid to Date ($000s)** | | | | | | |
| Total | 2,003,448 | 4,805,753 | 835,367 | 164,552 | 216,892 | 8,026,012 |
| **Number of subclaims** | | | | | | |
| Land | 48,932 | 66,483 | 18,997 | 14,010 | 6,386 | 154,808 |
| Building | 146,356 | 137,003 | 50,674 | 43,913 | 47,023 | 424,969 |
| Contents | 57,764 | 87,565 | 20,973 | 12,477 | 8,503 | 187,282 |
| Total | 253,052 | 291,051 | 90,644 | 70,400 | 61,912 | 767,059 |
| ***Difference*** | | | | | | |
| **Number of claims** | | | | | | |
| Open | - | - | - | - | (1,478) | (1,478) |
| Closed | 1 | - | - | - | (7,313) | (7,312) |
| Total | 1 | - | - | - | (8,791) | (8,790) |
| **Paid to Date ($000s)** | | | | | | |
| Total | 648 | 1,734 | 660 | 64 | 158 | 3,265 |
| **Number of subclaims** | | | | | | |
| Land | 1 | - | - | - | (795) | (794) |
| Building | 1 | - | - | - | (8,405) | (8,404) |
| Contents | - | - | - | - | (704) | (704) |
| Total | 2 | - | - | - | (9,904) | (9,902) |

# F Expense Analysis

EQC have provided a CHE forecast which summarises the indirect claims expenses paid to date and projects these forward for the remaining expected duration of the Canterbury earthquake settlement programme.

This forecast is seen as being the most credible source of claims handling expense information.

For this valuation we have reviewed the forecast and compared it to previous forecasts.

## F.1 Adopted approach

The CHE Forecast (provided by EQC finance) has been blended with an expense analysis to arrive at assumptions for the valuation.

The expense analysis apportions the total CHE costs between events.

Note that in Section 8.2 we have provided sensitivity analysis results for a lengthening of the settlement pattern with consequential impact on CHE.

## F.2 CHE event apportionment

CHE costs that can be identified as being wholly related to specific claim costs are separated from the remainder of the CHE. These related indirect expenses have been apportioned in relation to the underlying claim costs. The remaining unrelated indirect expenses have been apportioned in relation to sub-claim counts.

Specifically the methodology used is:

- CHE - paid to date
  - A trial balance is obtained from EQC and the expenses are summarised by cost centre.
  - Cost centres which relate wholly to a particular claim cost are tagged as *related indirect expenses* ('RIE'). An example of this is the costs associated with EQR.
    - There will be separate RIE for land, building, and contents.
  - The remaining costs are tagged as *unrelated indirect expenses* ('UIE'). An example of this might be head office salaries.
  - The sum of RIE and UIE will equal the CHE costs paid to date.
- CHE - future
  - The CHE forecast has been broken down by cost centres. In a similar manner to CHE – paid to date, future RIE have been identified and apportioned in line with the underlying claim costs. The remaining future CHE is assumed to UIE.
  - Future UIE is apportioned between events in relation to sub-claim counts.

## F.3 Conclusion

The results are shown below.

**Estimated undiscounted/uninflated Claims Handling Expenses (CHE) - all indirect costs**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | BAU* | Total |
|---|---|---|---|---|---|---|---|
| **Total Costs** | | | | | | | |
| Paid to date - reinsurable ($000s) | 449,095 | 740,731 | 107,837 | 35,812 | 47,909 | 0 | 1,381,384 |
| Paid to date - non reinsurable ($000s) | 558 | 694 | 171 | 77 | 83 | 0 | 1,582 |
| Paid to date - total ($000s) | 449,653 | 741,425 | 108,008 | 35,889 | 47,992 | 0 | 1,382,966 |
| 0 | | | | | | | |
| Estimated future - reinsurable ($000s) | 24,481 | 53,330 | 14,579 | 2,374 | 1,616 | 0 | 96,381 |
| Estimated future - non reinsurable ($000s) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total future - total ($000s) | 24,481 | 53,330 | 14,579 | 2,374 | 1,616 | 0 | 96,381 |
| Total ($000s) | 474,135 | 794,755 | 122,588 | 38,263 | 49,607 | 0 | 1,479,347 |

The BAU expenses assumptions have remained unchanged since 30 June 2015.

# G Outstanding Claims Liabilities – Detailed Methodology

## G.1 Construction of individual event / sub-claim distributions

The outstanding claim liabilities were estimated using separate models for each valuation group (i.e. by sub-claim and event). The models vary significantly for each sub-claim group with further variations included as required to adequately model each event. The output from each model produced an estimated ultimate claims cost distribution (including inflation and demand surge) for the relevant event / sub-claim group as well as CHE.

### *G.1.1 Land sub-claims cost distribution*

***Canterbury earthquakes***

The land sub claims cost distribution has been created with input from T+T. The model calculates property-by-property land costs using the following parameters, which were stochastic in nature:

- Category 1 – 7 damage
  - Cost per property
- IFV Damage
  - Qualification indicators
  - Indemnity value expressed as proportion of CV
- ILV damage
  - Qualification indicators
  - Indemnity value expressed as proportion of CV
  - Percentage of ILV area to be repaired
  - Remediation costs for vacant land
- Allowance for Port Hills land damage (aggregate)
- Allowance for removal of silt from beneath houses (aggregate)

The liability model was run 10,000 times with the inputs being allowed to vary each simulation.

The claims costs were then projected using an assumed payment pattern and base inflation and demand surge inflation were applied.

***BAU***

An aggregate frequency/severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was taken to be the number of claims recorded in ClaimCentre as well as an estimated number of future IBNR claims. These were then grouped by loss cause and sub-claim profile (i.e. which combination of sub-claims was notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for nil claims (e.g. declined).

The number of estimated non-nil claims for each event / location group was then multiplied by the claim profile group's average claim size (weighted by loss cause proportion). Variance for each claim profile group was added to create aggregate loss distributions – from which a loss was simulated. The simulations from each claim profile group were then aggregated to a single land aggregate distribution.

The above process was repeated 10,000 times to create an estimated claims cost distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

### *G.1.2 Building sub-claims cost distribution*

***Canterbury earthquakes***

The building sub-claim cost distribution uses the ACE apportionment data and EQR repair data to estimate the ultimate cost distribution.

The ACE model uses an individual property stochastic claims model to estimate the cost of Canterbury earthquake building sub-claims.

The model relies on two sets of data:

- ACE apportionment data
- EQR completed properties repair data

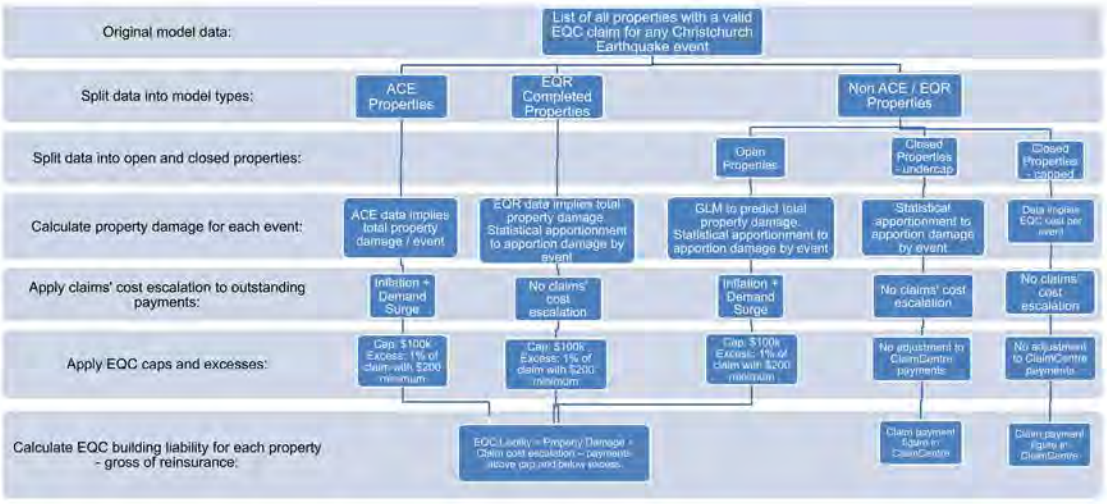
The model consists of three main components:

- Modelling the probability a building sub-claim will settle for nil cost. This is based on both ACE data and EQR data.
- Modelling average property damage estimates across all events for non-nil sub-claims. This is based on both ACE data and EQR completed repairs data
- Modelling event damage apportionment. This is based solely on ACE apportionment data.

The ACE data is biased towards highly damaged properties. Thus we expect the settled properties in the ACE database to be significantly different to the other damaged properties without an ACE estimate. The EQR data is also biased but towards properties with mid-range damage. Generalised Linear Models (GLMs) were used to account for biases in the ACE data and EQR data. The GLMs project average claim sizes and nil claim rates onto properties without an ACE or EQR estimate.

See Sections 3.1.2 and 4.2 for more details on the ACE apportionment data.

The following diagram illustrates how the ACE model estimates the ultimate building sub-claim cost.




### *Additional provisions*

The ACE model is based on the experience to date and will therefore tend to predict that the outstanding claims will behave in a manner similar to those already settled.

There will therefore need to be additional provisions to allow for tail deterioration and reopened claims.

- Tail deterioration is the expectation that the remaining properties are likely to be more difficult to settle than those that are already settled and will probably cost more.
- Reopened claims includes building warranty issues, complaints and insurer washup.
    - Building warranties apply to all properties that have been settled through the Fletcher EQR programme. There will be some proportion of these that require remediation.
    - Complaints may come from any undercap property. A proportion of these may result in a higher ultimate settlement.
    - Insurer washup is the process to ensure there is an appropriate allocation of costs by EQ event and by owner (EQC or insurer) for overcap dwelling claims.

Tail deterioration has been modelled within the GLMs in the ACE model. Residual open EQR claims incur a higher estimated settlement amount than the EQR properties that have closed to date. The Reopened Claims provisions are modelled using a frequency / severity model.

### *BAU*

The outstanding BAU building sub-claims were grossed up by a ratio to reflect future development. A ratio was applied to calculate both a mean and 85th percentile for the aggregate distribution – from which a distribution was inferred.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

### G.1.3 *Contents sub-claims cost distribution*

***Canterbury earthquakes***

An aggregate frequency/severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was a known value for all events, and was taken from ClaimCentre. These claims were grouped by event and sub-claim profile (i.e. which combination of sub-claims were notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for future nil claims (arising from duplicate claims and other reasons e.g. declined).

The number of estimated non-nil claims for each event / location group was then multiplied by the event / claim profile group's average claim size. Variance for each event / claim profile was added to create aggregate loss distributions by event – from which a loss was simulated. The simulations from each event / claim profile group were then aggregated to a single event distribution.

The above process was repeated 10,000 times to create an estimated claims cost distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

***BAU***

Outstanding contents BAU sub-claims were estimated using the same methodology as per land and building sub-claims.

### G.1.4 *Claims handling expenses distribution*

***Canterbury earthquakes & BAU***

The estimation of central estimate of CHE (before inflation) for each event was discussed in Appendix F. A cost distribution was then assumed around this central estimate.

The CHE costs were then projected using an assumed payment pattern and base inflation was applied.

## G.2 Construction of individual event distributions

The individual sub-claim event distributions derived above were combined to form aggregate gross claims cost distributions (including inflation) for each event. A multivariate copula was used to aggregate these individual distributions.

The variance of each event's aggregate claim cost distribution was adjusted to allow for model (internal systemic) risk and environmental (external systemic) risk. The details of the systemic risk adjustment are set out in Appendix H.2.2. The output of this is the final estimated gross claim cost distribution assumed for each event.

The impacts of reinsurance recoveries were applied to each event's gross distribution to obtain net distributions for each event.

Gross and net paid to date were deducted from the estimated gross and net ultimate distributions to create corresponding outstanding claims distributions.

Discounting for the time value of money was carried out after projecting the aggregate claims costs using an assumed payment pattern.

## G.3 Construction of the total EQC entity level distribution

The discounted outstanding net distributions for each event were then combined using a multivariate copula. This created a total aggregate outstanding claims liability distribution for EQC at the entity level from which the final outstanding central estimate and risk margin were obtained.

# H Outstanding Claims Liabilities – Detailed Assumptions

## H.1 Construction of individual event sub-claim distributions

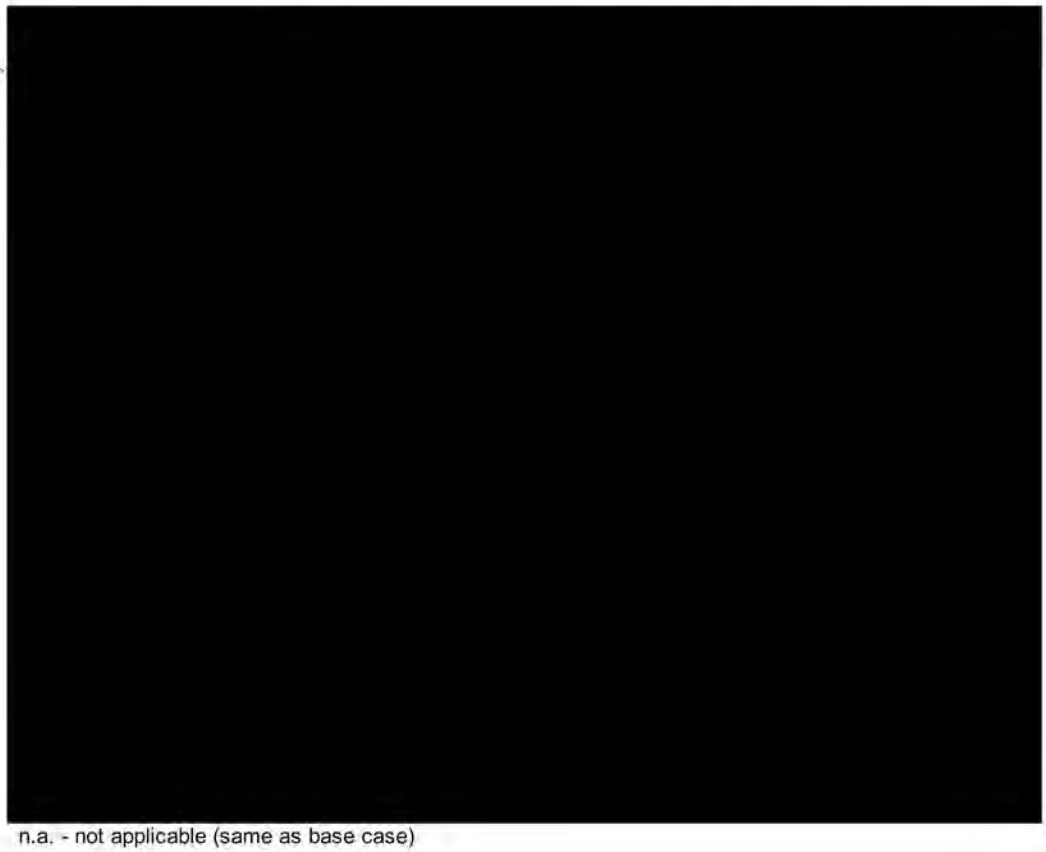
### *H.1.1 Land sub-claims cost distribution – Canterbury earthquakes*

***Cost component summary***

The land sub-claims model is based on the T+T land liability data and assumptions used to assess land damage. A number of these have been adjusted by MJW to produce the results in this report.

There are a number of detailed assumptions that drive this model, which are shown in the table below. Composite uniform distributions were derived for each parameter using the percentiles below. Non-numerical parameters were modelled on a scenario basis.

9(2)(j)



n.a. - not applicable (same as base case)

Please contact the authors for information on the ILV DoV percentage assumptions. LDI stands for Land Damage Indicator.

The percentiles for most parameters were based on scenarios provided by T+T. An assumed correlation matrix for these parameters is available on request.

***Offer & Payment pattern***

Estimates for the timing of offers and settlement were based on information provided by the EQC finance team. The table below summarises the assumed, uninflated payment pattern. From this, an estimated mean term to settlement was derived and this was allowed to vary in the model.

**Payment pattern**

| Quarter Ending | Cumulative Paid |
|---|---|
| 30/09/2016 | 24% |
| 31/12/2016 | 48% |
| 31/03/2017 | 74% |
| 30/06/2017 | 100% |
| 30/09/2017 | 100% |
| 31/12/2017 | 100% |
| 31/03/2018 | 100% |
| 30/06/2018 | 100% |

The term to settlement was not assumed to be independent of the cost distribution – on average an increase in total land sub-claim costs was associated with a longer settlement pattern. The payment pattern was used in the calculation of base inflation and demand surge.

***Base Inflation and Demand Surge***

The total costs were inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

Demand surge was simulated on a semi-annual basis – for each half year a demand surge event was simulated using a Bernoulli process and the percentage increase in cost (on top of base inflation) was also simulated. Any payments during that year were correspondingly grossed up. The following table summarises the demand surge assumption adopted.

| | 30 June 2016 | | |
|---|---|---|---|
| Quarter Ending | Demand Surge Probability | Demand Surge Mean | Demand Surge Sd |
| 30/09/2016 | 90.0% | 15.0% | 3.8% |
| 31/12/2016 | 90.0% | 15.0% | 3.8% |
| 31/03/2017 | 90.0% | 15.0% | 3.8% |
| 30/06/2017 | 90.0% | 15.0% | 3.8% |
| 30/09/2017 | 90.0% | 15.0% | 3.8% |
| 31/12/2017 | 90.0% | 15.0% | 3.8% |
| 31/03/2018 | 90.0% | 15.0% | 3.8% |
| 30/06/2018 | 90.0% | 15.0% | 3.8% |

### *H.1.2 Building sub-claims cost distribution – Canterbury earthquakes*

***Offer & Payment pattern***

Estimates for the timing of offers and settlement were based on information provided by the EQC finance team. The table below summarises the assumed, uninflated payment pattern. From this, an estimated mean term to settlement was derived and this was allowed to vary in the model.

| Quarter Ending | Cumulative paid |
|---|---|
| 30/09/2016 | 31% |
| 31/12/2016 | 62% |
| 31/03/2017 | 78% |
| 30/06/2017 | 94% |
| 30/09/2017 | 97% |
| 31/12/2017 | 100% |
| 31/03/2018 | 100% |
| 30/06/2018 | 100% |

***Nil claim rates***

Prior to the 31 December 2014 valuation Generalised Linear Models were used to calculate a nil claim rate for each property with a valid EQC claim.

Given the extent of the completed settlement process it is now considerably clearer which claims will settle for a non-nil amount. Identified nil claims are now removed from the data set prior to damage modelling. This results in a lower estimate of ultimate incurred claims liability.

***Claim size and event apportionment***

Generalised Linear Models were used to predict the damage each property incurred – both the mean and standard deviation of damage were estimated.

Apportionment was derived from the ACE apportioned cost estimates as well as the [redacted] 9(2)(a) [redacted] statistical apportionment model.

EQC excesses and limits were then applied to the estimates to calculate the average EQC liability per property for each event.

As a result of using GLMs, the raw assumptions are complex and are best given in a digital format, we are happy to supply these upon request.

GLM predicted damage amounts were only applied to the Non ACE or EQR properties. Average damage costs for ACE and EQR properties were given by their respective estimates.

Modelled damage apportionments were only applied to the Non ACE properties. Damage apportionment for ACE properties was given by their ACE apportionment estimates.

***Payment pattern***

The timing of cash flow payments was based on information initially provided by EQC finance.

***Base Inflation and Demand Surge***

The total costs were inflated according to when the payment was estimated to be made using the long-term Treasury rate of 2.5% p.a.

Demand surge was simulated on an semi-annual basis – for each half year a demand surge event was simulated using a Bernoulli process and the percentage increase in cost (on top of base inflation) was also simulated. Any payments during that year were correspondingly increased. The following table summarises the demand surge assumption adopted.

| | 30 June 2016 | | |
|---|---|---|---|
| Quarter Ending | Demand Surge Probability | Demand Surge Mean | Demand Surge Sd |
| 31/03/2016 | 90.0% | 15.0% | 3.8% |
| 30/09/2016 | 90.0% | 15.0% | 3.8% |
| 31/03/2017 | 90.0% | 15.0% | 3.8% |
| 30/09/2017 | 90.0% | 15.0% | 3.8% |
| 31/03/2018 | 90.0% | 15.0% | 3.8% |
| 30/09/2018 | 90.0% | 15.0% | 3.8% |
| 31/03/2019 | 90.0% | 15.0% | 3.8% |
| 30/09/2019 | 90.0% | 15.0% | 3.8% |

### *H.1.3 Contents sub-claims cost distribution – Canterbury earthquakes*

#### *Nil claim rates*

The nil claim rates for each event / sub-claim profile group were set to zero for the 30 June 2016 valuation. This assumption implies that all nil contents claims have been identified as such.

#### *Estimated claim size average and standard deviation*

The average claim size and variance for claims in each event / sub-claim profile group were estimated using closed contents sub-claims paid amounts.

**Average Claim Size**

| Profile | EQ1 | EQ2 | EQ3 | EQ4 | AS |
|---|---|---|---|---|---|
| -BC | 3,497 | 9,507 | 8,746 | 2,760 | 2,075 |
| –C | 6,822 | 6,654 | 3,398 | 1,953 | 1,940 |
| LBC | 10,336 | 12,275 | 4,578 | 3,818 | 3,397 |
| L-C | 2,298 | 4,597 | 4,485 | 3,569 | 1,705 |

**Claim Size Standard Deviation**

| Profile | EQ1 | EQ2 | EQ3 | EQ4 | AS |
|---|---|---|---|---|---|
| -BC | 5,517 | 11,855 | 12,710 | 4,355 | 3,326 |
| –C | 8,226 | 7,733 | 5,078 | 2,876 | 2,814 |
| LBC | 8,595 | 11,019 | 5,558 | 6,051 | 5,322 |
| L-C | 3,068 | 5,271 | 5,606 | 5,368 | 1,633 |

#### *Contents sub-claims aggregate distribution*

For each event / sub-claim profile group the number of non-nil claims was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a normal distribution was then fitted to these parameters.

#### *Payment pattern*

The payment pattern assumes 85% of all remaining contents claims settle within the next year, with the remaining tailing off at a slower rate.

| Month ending | Cumulative paid |
|---|---|
| 30-Jun-16 | - |
| 31-Jul-16 | 33% |
| 31-Aug-16 | 67% |
| 30-Sep-16 | 100% |
| 31-Oct-16 | 100% |
| 30-Nov-16 | 100% |
| 31-Dec-16 | 100% |

***Base Inflation and Demand Surge***

Costs were then inflated according to when the payment was estimated to be made using the recommended long-term Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for contents sub-claims.

### *H.1.4 Claims handling expenses – Canterbury earthquakes*

The central estimate of CHE (before inflation) was discussed in Section 5.8. A coefficient of variation of 20% was assumed and applied to the inflated CHE central estimate. For the purposes of estimating the CHE cost distribution, a normal distribution was fitted to these parameters.

***Payment pattern***

CHE payments arising from the Canterbury earthquake claims were assumed to follow a payment pattern which is consistent with the EQC budget projections.

| Half year ending | Cumualtive inflated paid |
|---|---|
| 31/12/2016 | 43% |
| 30/06/2017 | 86% |
| 31/12/2017 | 93% |
| 30/06/2018 | 97% |
| 31/12/2018 | 98% |
| 30/06/2019 | 100% |
| 31/12/2019 | 100% |
| 30/06/2020 | 100% |

***Base Inflation and Demand Surge***

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for CHE. It is noted that the duration of the rebuild programme will have a more material impact on the overall CHE costs than any margin for demand surge.

### *H.1.5 Land, Building & Contents sub-claims cost distributions – BAU & BAU Past Periods*

#### *Nil claim rates*

The nil claim rates for each sub-claim type and profile were set with regard to assumptions for the 30 June 2016 outstanding claims estimation. The number of non-nil contents sub-claims for the group was then simulated according to a binomial distribution. The probability of a nil claim for each event / sub-claim profile is set out below. The assumptions adopted for BAU and BAU Past Periods were the same.

**Nil claim probabiltiy**

| Profile | Land | Building | Contents |
|---|---|---|---|
| --- | 5.0% | 7.5% | 2.5% |
| -B- | 5.0% | 7.5% | 2.5% |
| -BC | 5.0% | 7.5% | 2.5% |
| --C | 5.0% | 7.5% | 2.5% |
| L-- | 5.0% | 7.5% | 2.5% |
| LB- | 5.0% | 7.5% | 2.5% |
| LBC | 5.0% | 7.5% | 2.5% |
| L-C | 5.0% | 7.5% | 2.5% |

#### *Sub-claim transitions (SCT)*

The rate of sub-claim transition (i.e. claims which will change their sub-claim profile before settling – in this case to add a contents sub-claim) for each sub-claim type and profile were set with regard to those set for 30 June 2016.

Claims with no contents sub-claim which are predicted to ultimately register a contents sub-claim are also expected to have a reduced average claim size. The following tables set out these assumptions for each sub-claim type and profile.

**Sub-claim transition probability**

| Profile | SCT | Land | Building | Contents |
|---|---|---|---|---|
| -B- | -BC | 12.5% | 12.5% | 12.5% |
| --C | -BC | 7.5% | 7.5% | 7.5% |

**Sub-claim transition cost**

| Profile | SCT | Land | Building | Contents |
|---|---|---|---|---|
| -B- | -BC | 50% | 50% | 50% |
| --C | -BC | 75% | 75% | 75% |

#### *Estimated claim size average and standard deviation*

The average claim size and variance for claims in each for each sub-claim type and profile were estimated using a GLM on all sub-claims which had loss adjuster estimates. However the GLM predicted claim sizes were only applied to open claims without a loss adjuster estimate.

The risk factors used in the GLM were:

- Loss date
- Loss cause
- Sub-claim profile
- Initial computer estimate

The following tables illustrate the final averages used in the model.

***BAU***

**Average Claim Size**

| Profile | Land | Building | Contents |
|---|---|---|---|
| --- | | | |
| -B- | | 3,888 | |
| -BC | | 6,373 | 1,489 |
| --C | | | 1,443 |
| L-- | 8,604 | | |
| LB- | 27,759 | 16,788 | |
| LBC | 59,160 | 36,609 | 4,676 |
| L-C | 14,936 | | 1,544 |

**Claim Size Standard Deviation**

| Profile | Land | Building | Contents |
|---|---|---|---|
| --- | | | |
| -B- | | 7,382 | |
| -BC | | 12,776 | 2,155 |
| --C | | | 2,147 |
| L-- | 19,046 | | |
| LB- | 50,114 | 26,408 | |
| LBC | 80,834 | 37,956 | 5,814 |
| L-C | 20,903 | | 2,077 |

***BAU PP***

**Average Claim Size**

| Profile | Land | Building | Contents |
|---|---|---|---|
| --- | | | |
| -B- | | 3,888 | |
| -BC | | 6,373 | 1,489 |
| --C | | | 1,443 |
| L-- | 8,604 | | |
| LB- | 27,759 | 16,788 | |
| LBC | 59,160 | 36,609 | 4,676 |
| L-C | 14,936 | | 1,544 |

**Claim Size Standard Deviation**

| Profile | Land | Building | Contents |
|---|---|---|---|
| --- | | | |
| -B- | | 7,382 | |
| -BC | | 12,776 | 2,155 |
| --C | | | 2,147 |
| L-- | 19,046 | | |
| LB- | 50,114 | 26,408 | |
| LBC | 80,834 | 37,956 | 5,814 |
| L-C | 20,903 | | 2,077 |

***Contents sub-claims aggregate distribution***

For each sub-claim type and profile group the number of non-nil claims and sub-claim transitions was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a lognormal distribution was then fitted to these parameters.

***Payment pattern***

An analysis of historical experience informed the choice of the following assumed payment pattern which is summarised below.

| Half year ending | Cumulative paid BAU | Cumulative paid BAU PP |
|---|---|---|
| 31 Dec 2017 | 82% | 99% |
| 30 Jun 2018 | 90% | 99% |
| 31 Dec 2018 | 94% | 100% |
| 30 Jun 2019 | 96% | 100% |
| 31 Dec 2019 | 98% | 100% |
| 30 Jun 2020 | 99% | 100% |

***Base Inflation and Demand Surge***

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for BAU sub-claims.

## H.2 Construction of individual event distributions

### *H.2.1 Sub-claim distribution aggregation*

The individual sub-claim distributions for each event were combined to a single event claim cost distribution. A Gaussian copula dependency structure was assumed between each sub-claim distribution with the following correlation matrix.

**Subclaim correlation**

| | Land | Building | Contents | CHE |
|---|---|---|---|---|
| Land | 100% | 50% | 25% | 25% |
| Building | 50% | 100% | 50% | 25% |
| Contents | 25% | 50% | 100% | 25% |
| CHE | 25% | 25% | 25% | 100% |

### *H.2.2 Systemic risk adjustment*

The following systemic risk assumptions were applied to each event distribution to recognise risks not allowed for in the stochastic nature of the model.

**Systemic risk assumptions**

| | Land | Building | Contents | CHE |
|---|---|---|---|---|
| **Coefficients of variation** | | | | |
| Model risk | 10.0% | 20.0% | 15.0% | 10.0% |
| Environmental risk | 10.0% | 15.0% | 2.5% | 5.0% |
| **Correlation matrices** | | | | |
| ***Model risk*** | | | | |
| Land | 100% | 0% | 0% | 25% |
| Building | 0% | 100% | 25% | 25% |
| Contents | 0% | 25% | 100% | 25% |
| CHE | 25% | 25% | 25% | 100% |
| ***Environmental risk*** | | | | |
| Land | 100% | 50% | 0% | 25% |
| Building | 50% | 100% | 0% | 25% |
| Contents | 0% | 0% | 100% | 0% |
| CHE | 25% | 25% | 0% | 100% |

### *H.2.3 Reinsurance*

The reinsurance rules assumed follow from the terms and conditions of the reinsurance in place for each event and are discussed in Appendix C.

### *H.2.4 Payment patterns*

In respect of each event, net payments to date were deducted from the estimated net ultimate distribution to create the corresponding estimated outstanding net claims cost distribution.

The net payment pattern mirrored the gross payment pattern subject to the application of the reinsurance layers. Net payments were zero during the reinsurance layers (subject to small amounts of co-insurance), and resume after gross payments exceeded the upper reinsurance retention limit.

Net payments made during the coinsurance layers were assumed to be made at the same time as the reinsurance deductible and thus are subject to less discounting than might be expected.

## H.3 Construction of the total EQC entity level distribution

The individual event distributions were combined to a single EQC entity claim cost distribution. A Gaussian copula dependency structure was assumed between each event distribution with the following correlation matrix.

**Event correlation**

| | EQ1 | EQ2 | EQ3 | EQ4 | AS | BAU | BAU PP |
|---|---|---|---|---|---|---|---|
| EQ1 | 100% | 50% | 50% | 50% | 50% | 0% | 0% |
| EQ2 | 50% | 100% | 50% | 50% | 50% | 0% | 0% |
| EQ3 | 50% | 50% | 100% | 50% | 50% | 0% | 0% |
| EQ4 | 50% | 50% | 50% | 100% | 50% | 0% | 0% |
| AS | 50% | 50% | 50% | 50% | 100% | 0% | 0% |
| BAU | 0% | 0% | 0% | 0% | 0% | 100% | 50% |
| BAU PP | 0% | 0% | 0% | 0% | 0% | 50% | 100% |

# I Discount Rates

Where cashflows have been discounted for the time value of money, the following discount rates were adopted as specified by Treasury. Discounts rates used for the 31 December 2015 valuation have been included for comparative purposes only.

**Treasury Discount rates**

| Valuation Year (for Annual Cash Flows to 30 June) | Forward Rate as at 30 June 2016 | Forward Rate as at 31 Dec 2015 |
|---|---|---|
| 2017 | 2.12% | 2.75% |
| 2018 | 1.95% | 2.99% |
| 2019 | 1.93% | 3.25% |
| 2020 | 2.03% | 3.49% |
| 2021 | 2.16% | 3.73% |
| 2022 | 2.31% | 3.95% |
| 2023 | 2.46% | 4.16% |
| 2024 | 2.63% | 4.36% |
| 2025 | 2.81% | 4.53% |
| 2026 | 2.98% | 4.68% |
| 2027 | 3.14% | 4.81% |
| 2028 | 3.27% | 4.92% |

The forward rates at various durations are appropriate to use in our model as we have projected future yearly cash flows which we then discount to the present.

All other things being equal, the reduction in discount rates would lead to an increase in EQC discounted claims liability.

# J Glossary

***Accounting standard***

In New Zealand, the accounting standards of the NZ Institute of Chartered Accountants apply. The standard most relevant to **insurance entities** is *NZ IFRS4 Insurance Contracts*.

***Actuarial Data Extract (ADE)***

A data extract used to facilitate an actuarial valuation. The data is typically sourced from the claims and policy administration systems.

***Actuary***

In general, in New Zealand an actuary is a Fellow or Accredited Member of the New Zealand Society of Actuaries or equivalent body.

***Aggregate excess of loss reinsurance***

See **catastrophe reinsurance.**

***Apportioned Cost Estimate (ACE) data***

A number of properties have had their dwelling damage apportioned between events in a manual fashion. This process uses all available information on that property (quantity surveyor reports, land damage information, neighbourhood damage, customer reports etc.) to inform the apportionment. These apportionments are called Apportioned Cost Estimates and will be included the ACE data set. The ACE data set includes all overcap properties and a number of undercap properties too.

***Attachment date***

See **inception date**.

***Best estimate***

In the context of scenarios, a best estimate means a realistic future scenario, rather than a deliberately pessimistic or optimistic one. Also see **central estimate**.

***Brokerage***

An alternative term for commission paid to a **broker**.

***Broker***

An intermediary who acts for an insured in negotiating their insurance. The broker usually receives payment by way of commission from the insurer with whom the business is placed.

***Business as Usual (BAU)***

A distinction has been drawn between claims that are related to the Canterbury earthquake events and those that are from other events (earthquake or other). These non-Canterbury earthquake events are referred to as Business as Usual (BAU) events.

***Canterbury Earthquake Sequence ('CES')***

The sequence of earthquakes and aftershocks in the Canterbury area from 4 September 2010 to the end of 2011. This included four main earthquakes on 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011.

***Case estimate***

The amount recorded by the insurer's claims personnel (including external claims assessors) as being the amount required to settle an open claim, based on the information available on that particular case. When a claim is first reported and recorded, a nominal placeholder estimate may be entered into the system. Estimates should be updated as extra information comes to light and adjusted to reflect any partial payments that may be made prior to final settlement.

***Catastrophe***

A catastrophe event for an insurer is generally considered to be a single event that results in one or more claims for very large amounts or in an aggregation of many claims collectively costing an extremely large amount. The nature and impact of potential catastrophe events will vary by insurer according to their business, amount of capital and risk management arrangements. Examples include earthquakes and terrorism.

***Catastrophe reinsurance***

Usually an aggregate excess of loss reinsurance arrangement providing cover to an insurer against very high losses arising from a **catastrophe** event, which meets the definition of 'catastrophe' as specified in the reinsurance policy. The nature and extent of the cover available / provided depends on the nature of the underlying insurer's business and the terms available for such protection. For some events, such as storm or earthquake, the reinsurer may impose a specified time limit on when claims may be covered under the catastrophe treaty.

***Cedant or ceding insurer***

An insurer who has ceded (passed on) all or part of the risks it has underwritten by way of reinsurance. Analogous to an insured who cedes risk to an insurer.

***Central Estimate***

An estimate that contains no deliberate or conscious over- or under-estimation. NZ Accounting standards define this to be the mean of the probability distribution of future outcomes. Also see **probability of adequacy**.

***Claim frequency***

The number of claims divided by exposure over a given time period. This could apply to **reported** or **incurred** claims.

***Claims handling expenses (CHE)***

The expenses involved in the processing and settlement of claims. Note that this term usually relates only to indirect claims expenses such as internal general administration claims costs. Expenses such as assessors' fees or legal costs, that arise in relation to specific claims, are termed direct expenses and are usually treated as part of the cost of those claims.

***Claims paid***

The amount paid in respect of claims.

***Claims provision and claims reserve***

These are both terms used to refer to the amount held or required to provide for future payments on outstanding claims. These terms are sometimes seen as being interchangeable. However, there are variations in the precise usage of both terms according to the context in which they appear.

A claims provision is often used to refer to the amount held in an insurer's accounts. In management accounts, claims reserve may refer to the total **case estimates**, possibly with an additional amount for **IBNR** claims. In actuarial contexts the technical terms are, respectively, **incurred claims liability** and **outstanding claims liability**. These amounts might also include allowances for **CHE**, **discounting**, **claims paid**, and a **risk margin**. Figures may be given **net** or **gross of reinsurance**.

***Closed claims***

Those claims for which records have been closed, because settlement has been made and no recoveries are expected. However, see **reopened** claims.

***Cover***

The extent and nature of protection provided by an insurance policy. This will be defined in the policy documentation.

***Deductible***

See **excess.**

***Demand surge***

The increase in the cost of insurance claims following a major loss event. The event puts pressure on the demand for labour and materials to pay for repairs which, in the absence of increased supply, increases the price of these costs.

***Discounting***

Discounting refers to the (absolute) reduction, for the time value of money, of any future cashflows. The extent of discounting is a consequence of two factors: length of time until payment and the discount rate with an increase in either of these increasing the impact of discounting. Cashflows which have been discounted are said to be *present values*.

Actuarial **professional standards** state that **risk-free discount rates** must be used to calculate present values.

***Effective date***

The effective date of an **ILVR** is the date to which the valuation calculations apply.

***Exacerbated Flooding Coverage ('EFC')***

Exacerbated Flooding Coverage ('EFC') is the area of a property that has had exacerbated flooding as a result of the Canterbury Earthquake Sequence. The exacerbated flooding is assessed for a 100 year return period event (as stated in the EQC IFV policy). In the report, 'EFC' is presented as a percentage of the EQC insured land area for a property. It has been used as a proxy to estimate the likely DoV rates for IFV properties which are yet to be assessed.

***Excess***

The amount of an insured loss that must be borne by the policyholder before the insurer becomes liable to make a claim payment. The amount of the excess will be set out in the policy documentation.

***Excess of loss reinsurance***

A non-proportional form of reinsurance whereby the insurer pays the cost of a claim up to a specified point (their **retention**) and the reinsurer pays the remainder of the cost. The amount payable by the reinsurer is usually subject to a specified maximum amount which may apply per claim or to the total amount. Also see **catastrophe reinsurance**.

***Experience***

The term used to describe the results of blocks of insurance business, particularly when the results are the subject of detailed analysis.

***Financial soundness***

A measure of the sufficiency of the assets of an insurer to support its continuing operation.

***Future Claim Liability (FCL)***

A term sometimes used to refer to the **premium liability** arising from unearned policies. It is the value of future claim payments and related **CHE**, arising from future events for which the insurer is liable.

***Gross***

Refers to the amounts of premiums, claims and expenses before allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

***Inception date***

Inception date is the date on which cover commences.

***Increased Flooding Vulnerability (IFV)***

The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events.

***Increased Liquefaction Vulnerability (ILV)***

The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes.

***Incurred***

A term relating to claims arising from events that occurring in a specified period.

There are differences in the precise usage of the term according to the context in which it appears. In some contexts it may refer to the group of claims *occurring* in the period (whether **reported** to the insurer or not) and their eventual cost. In accounting contexts, the term may refer to the amount of *claims payments made plus the change in outstanding claims provisions* from the start to the end of the period.

In an actuarial context, 'incurred' costs are taken to mean the claim costs cost which arise, or come to light) during the period. An alternative expression of this is: claim payments made plus outstanding estimates (inclusive of **IBNR** and **IBNER**).

Further differences may also apply in regard to the inclusion (or not) of **CHE** and **risk margins.** Clarification should be provided in the actuarial commentary as to the precise meaning applied. It should also be stated whether there has been allowance for **discounting** in the quantification of future payments to be made on these claims. Also see **discounting** and **ultimate cost**.

***Incurred but not reported (IBNR)***

Any claim or claim amount for which, at a particular point in time, the loss event has occurred but the insurer has not yet been notified and/or the claim entered into the claims system. Any **outstanding claims liability** must include an allowance for these claims.

***Incurred but not enough reported (IBNER)***

A monetary amount relating to **reported** claims. IBNER is defined as the ultimate cost of the claim less the current **case estimate** and could be positive or negative. The **outstanding claims liability** must include an allowance for this.

***Incurred claims***

Claims that were **incurred** during a specified time period.

***Incurred claims liability***

See **Outstanding Claims Liability**.

***Indirect claims handling expenses***

See **claims handling expenses**

***Insurance liability valuation report (ILVR)***

A report detailing a valuation by the **actuary** of the **insurance liabilities** of an insurer.

***Liability adequacy test (LAT)***

A test applied under the **accounting standard** which consists of a comparison of the **unearned premium**, less deferred acquisition costs (DAC), against the **premium liability**. If the test indicates a deficiency, the DAC must be written down by an appropriate amount in the entity's income statement. If the deficiency is greater than the DAC, a premium deficiency reserve must be set up.

***Material***

In the context of an actuarial report, an item is deemed material if it is significant in the professional judgment of the actuary. This may not necessarily correspond exactly with 'material' as applied in an accounting context.

***Net***

Refers to the amounts of premiums, claims and expenses after allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

***Net outstanding claims liability***

See **outstanding claims liability.**

***Non-reinsurance recoveries***

Non-reinsurance recoveries refer to the recoveries against claim payments that come from entities other than reinsurers. It includes amounts in respect of salvage and third parties. It doesn't refer to excesses and deductibles that are deducted from the claim.

***Open claims***

Those claims that have been **reported** to the insurer but are not regarded as finally settled as claim payments and/or recoveries associated with the claim, may occur in future.

***Outstanding Claims Liability (OCL)***

The expected value of future payments on claims that were **incurred** on or before the **effective valuation date**. This usually includes future **CHE** associated with those claims, allows for **discounting**, and includes a specified **risk margin**. It may be calculated **gross** or **net of reinsurance** and **non-reinsurance recoveries**.

***Outstanding Claims Provisions***

The amount in the insurer's accounts providing for **outstanding claims liabilities** at the accounting date.

***Premium Liabilities***

The value of future claim payments and related **CHE**, arising from future events for which the insurer is liable at the date of calculation.

***Probability of adequacy***

The statistical probability that a reserve or provision will ultimately prove to be adequate to provide for all relevant payments to be made.

***Professional Standard***

The form of professional guidance as issued by the New Zealand Society of Actuaries, or such other professional body as may be stated.

***Reinstatement premiums***

Premiums that become payable under reinsurance treaties, particularly catastrophe reinsurances, when all or part of a layer of cover has been 'used' by the insurer making a claim, but the insurer wishes to reinstate full coverage for the remaining term of the treaty. A 'free reinstatement' may sometimes be included in the original terms of a treaty.

***Reopened claims***

Claims that had been regarded as settled (i.e. no further claim payments or recoveries) but for which claims records have since been reopened because an additional payment or receipt has been made or is now expected to be made. The **Outstanding Claims Liability** must take the possibility of claims reopening in future into account.

***Reported***

Claims are said to be reported if the insurer has been notified of their existence. This is in contrast to **IBNR** claims.

***Retention***

The amount of risk retained by the direct insurer above which an excess of loss reinsurance will be triggered. Also see **excess**.

***Risk-free discount rates***

These are the rates of interest that would be available on a theoretical, riskless investment. In practice, they are the rates available on very secure investments, such as government bonds of suitable durations, which may be assumed to be free of default risk.

***Risk Margin***

The amount of extra provision over and above the **central estimate** which is intended to allow for the inherent uncertainty of insurance liabilities. The relevant **probability of adequacy** associated with the increased amount should be stated.

***Sensitivity***

The uncertainty in the calculation of insurance liabilities due to the assumptions involved. Accounting and **professional standards** require statements of the effects on the results to be illustrated by sensitivity tests. These involve reviewing the calculations after varying key assumptions.

***Uncertainty***

Where full, known information is not available, uncertainty exists as to the exact nature and extent of the ultimate outcome. In particular, there is inherent uncertainty in any estimation of insurance liabilities, which are necessarily based on assumptions, usually derived from analyses of past experience. Deviations from estimates are normal and are to be expected. See also **central estimate, probability of adequacy** and **sensitivity**.

***Unearned Premium***

The proportion of written premium that relates to the risk still to be covered after the balance date or effective date of the valuation. The calculation usually assumes that premium is earned evenly over the term of a policy, except for unusual types of risk where this is clearly not the case (for example, Contractors All Risks). Should a policy be cancelled, the unearned premium as at the cancellation date may be refunded to the policyholder, possibly after allowance for expenses incurred.

***Unearned Premium Reserve (UPR)***

The total amount of **unearned premiums** held, reflecting the periods of future cover to be provided under policies in force at the balance date or effective date of the valuation.

***Valuation date***

The **effective date** as at which a valuation has been made.