Earthquake Commission
1 March 2013

Insurance Liability Valuation
as at 31 December 2012

Final Report

MELVILLE JESSUP WEAVER
Towers Watson Alliance Partner
Released under the Official Information Act 1982
Contents

1 Executive Summary ................................................................................................................ 1
   1.1 Addressee .................................................................................................................. 1
   1.2 Report commissioned by ......................................................................................... 1
   1.3 Purpose ..................................................................................................................... 1
   1.4 Scope ......................................................................................................................... 1
   1.5 Effective valuation date ........................................................................................... 2
   1.6 Previous valuations .................................................................................................. 2
   1.7 Definitions of technical terms ................................................................................... 2
   1.8 Canterbury earthquake events ................................................................................... 2
   1.9 Developments since 30 June 2012 report ................................................................. 3
   1.10 Key results .............................................................................................................. 4
   1.11 Key uncertainties .................................................................................................... 12
   1.12 Data ......................................................................................................................... 13
   1.13 Key reliances .......................................................................................................... 14
   1.14 Key recommendations ............................................................................................ 14
   1.15 Limitations ............................................................................................................ 14
   1.16 MJW staff involved in the investigation .................................................................. 15
   1.17 Level of detail and additional information ............................................................ 15
   1.18 Professional standards ........................................................................................... 15
   1.19 Authors ................................................................................................................... 16

2 Background .......................................................................................................................... 16
   2.1 EQC structure and role ............................................................................................. 16
   2.2 Canterbury earthquakes and the implications of multiple events ......................... 16
   2.3 EQC operations outside those specified in the Act .................................................. 17
   2.4 EQC reinsurance ...................................................................................................... 18
   2.5 Canterbury land damage and EQC land claim liabilities ......................................... 18
   2.6 New Zealand economic environment ...................................................................... 24

3 Data and Information .......................................................................................................... 25
   3.1 Sources of data ......................................................................................................... 25
   3.2 Sources of information ............................................................................................. 26
   3.3 Validation of data ...................................................................................................... 27
   3.4 Reliances .................................................................................................................. 27
   3.5 Concerns and qualifications ..................................................................................... 27
   3.6 Recommendations ................................................................................................... 28
   3.7 Adequacy and Appropriateness ............................................................................... 28

4 Canterbury earthquake claims analysis ............................................................................ 29
   4.1 Actuarial Data Extract from ClaimCentre (31 December 2012) .............................. 29
   4.2 Special apportionments project ............................................................................... 33
   4.3 Fletcher construction and COMET data .................................................................. 34

5 Uncertainty ......................................................................................................................... 35
   5.1 General comment ..................................................................................................... 35
   5.2 General sources of valuation uncertainty ............................................................... 35
   5.3 Uncertainties arising from the Canterbury earthquakes .......................................... 35
   5.4 Implications of uncertainty ...................................................................................... 36

6 Outstanding Claims Liabilities – Valuation Methodologies ........................................... 37
   6.1 Liability components ............................................................................................... 37
   6.2 Valuation groupings ............................................................................................... 37
   6.3 Valuation methodology considerations ................................................................... 38
   6.4 Valuation methodology selected ............................................................................ 39
6.5 Previous valuation methodologies .............................................. 39
6.6 Gross incurred claims costs .................................................. 40
6.7 Non-reinsurance recoveries .................................................... 41
6.8 Claims handling expenses ..................................................... 41
6.9 Reinsurance recoveries .......................................................... 42
6.10 Risk margin ........................................................................ 42
6.11 Discounting for the time value of money .................................. 42

7 Outstanding Claims Liabilities – Valuation Assumptions .................. 43
7.1 Assumptions required .............................................................. 43
7.2 Actual vs. expected experience .............................................. 43
7.3 Changes in assumptions .......................................................... 43
7.4 Gross incurred claims costs .................................................... 43
7.5 Claims handling expenses ....................................................... 44
7.6 Reinsurance recoveries ............................................................ 45
7.7 Risk margin ........................................................................ 45
7.8 Discounting for the time value of money .................................. 45

8 Outstanding Claim Liabilities - Results ........................................ 46
8.1 Introductory comment .............................................................. 46
8.2 Estimated gross ultimate incurred cost of Canterbury claims .......... 46
8.3 Estimated net ultimate incurred cost of Canterbury claims .......... 47
8.4 Estimated OS claims liabilities – all claims ............................... 48
8.5 Distribution – estimated ultimate claim costs ............................... 50
8.6 Material implications of the results ........................................... 50
8.7 Key changes from results as at 30 June 2012 ............................ 50
8.8 Reconciliation of movement in outstanding claims liabilities ........ 50
8.9 Estimated future OSCL claims liability amortisation and cash flow patterns .... 56
8.10 Sensitivity and scenario testing ................................................. 57
8.11 Quality control processes ....................................................... 57

9 Premium Liabilities – Valuation Methodologies ............................... 58
9.1 Liability components .............................................................. 58
9.2 Valuation groupings ............................................................... 58
9.3 Valuation methodologies considered ....................................... 59
9.4 Valuation methodologies selected ............................................ 59
9.5 Changes in methodology ......................................................... 60
9.6 Cost of future claims .............................................................. 60
9.7 Policy administration expenses .............................................. 62
9.8 Claims administration expenses ............................................. 62
9.9 Future reinsurance costs ......................................................... 62
9.10 Risk margin ....................................................................... 62
9.11 Discounting for the time value of money ................................. 62

10 Premium Liabilities – Valuation Assumptions ................................. 63
10.1 Assumptions required ............................................................ 63
10.2 Changes in assumptions ......................................................... 63
10.3 Cost of future claims ............................................................. 63
10.4 Administration and future reinsurance costs ............................ 65
10.5 Discounting for the time value of money ................................ 66

11 Premium Liabilities – Valuation Results ....................................... 67
11.1 Results ............................................................................. 67
11.2 Material implications of the results ....................................... 67
11.3 Key changes from results as at 30 June 2012 ........................... 67
11.4 Quality control processes ..................................................... 67
# Appendices

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Canterbury Earthquakes – Background</td>
<td>70</td>
</tr>
<tr>
<td>B</td>
<td>EQC – Organisational Background</td>
<td>72</td>
</tr>
<tr>
<td>C</td>
<td>EQC Reinsurance</td>
<td>77</td>
</tr>
<tr>
<td>D</td>
<td>Information and Data – Further Detail</td>
<td>81</td>
</tr>
<tr>
<td>E</td>
<td>Data Validation</td>
<td>84</td>
</tr>
<tr>
<td>F</td>
<td>Expense Analysis</td>
<td>87</td>
</tr>
<tr>
<td>G</td>
<td>Outstanding Claims Liabilities – Detailed Methodology</td>
<td>91</td>
</tr>
<tr>
<td>H</td>
<td>Outstanding Claims Liabilities – Detailed Assumptions</td>
<td>95</td>
</tr>
<tr>
<td>I</td>
<td>Canterbury Earthquakes – Detailed Results</td>
<td>106</td>
</tr>
<tr>
<td>J</td>
<td>Discount Rates</td>
<td>109</td>
</tr>
<tr>
<td>K</td>
<td>Glossary</td>
<td>110</td>
</tr>
</tbody>
</table>
Released under the Official Information Act 1982
Executive Summary

1.1 Address

This report is addressed to the management of the Earthquake Commission (EQC).

1.2 Report commissioned by

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

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 reports as at 31 December 2012.
- The development of EQC's Canterbury earthquakes claims costs since 30 June 2012.

1.4 Scope

1.4.1 General comments

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

1.4.2 Insurance liabilities components

In summary, 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 31 December 2012.
- Premium liabilities – which relate to the future net claims costs and administration and reinsurance expenses for future claims arising from unexpired risks as at 31 December 2012.

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

The 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 is set out in Section 1.10 as well as Sections 8 and 11.

1.4.3 Actuarial vs operational information

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

Some of these sources are not in a format that is useful for actuarial purposes. Comments to this effect should not be construed as implying that these data sources are not adequate for operational purposes.
It is readily acknowledged that claims management systems will (and should) use a combination of quantitative and qualitative information and the inability to use some of these data sources in a valuation does not detract from EQC’s ability to effectively settle claims.

1.5 Effective valuation date

The effective date of the valuation is 31 December 2012.

1.6 Previous valuations

Melville Jessup Weaver’s (M.J.W’s) most recent valuation for EQC was the Insurance Liability Valuation report (ILVR) carried out as at 30 June 2012, dated 13 September 2012.

1.7 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 (out of necessity) we have included a glossary in Appendix K.

1.8 Canterbury earthquake events

Since 4 September 2010, the Canterbury region in general, and the city of Christchurch in particular, has been shaken by sixteen damaging earthquakes including four major events (Sept 2010, and February, June and December 2011). The earthquakes have resulted in loss of life and injury, and billions of dollars of damage to infrastructure, commercial property and residential dwellings. Further details are set out in Appendix A.

1.8.1 Event groups

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

- Canterbury earthquakes:
  - EQ1 – 4 September 2010 event
  - EQ2 – 22 February 2011 event
  - EQ3 – 13 June 2011 events
  - EQ4 – 23 December 2011 events
  - AS – all other events/aftershocks e.g. 26 December 2010, 9 October 2011.
- “BAU” (Business As Usual) claims – including landslip claims, claims for hydrothermal events, claims from earthquakes outside Canterbury. BAU claims are also known as “attribution” or “working” claims.

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

- “BAU” (Business As Usual) claims
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury
- Canterbury earthquake claims.
1.9 Developments since 30 June 2012 report

The approach we have used to re-estimate EQC's outstanding claims liabilities as at 31 December 2012 has been developed by refining the methods used for the 30 June 2012 ILVR, particularly with regard to land claims. The methods used and changes made were as follows:

1.9.1 Canterbury earthquakes: building model

The building model continues to be based on the 2,000 properties where special apportionments were carried out in 2011 and 2012.

For this valuation, recently-generated data was supplied for some 23,000 properties where damage has been manually apportioned between earthquake events. The building model relies on a sampling technique which requires data for a set of properties which, taken as a group, provide a representative sample of all damaged properties in Christchurch. Given that the 23,000 properties in question were biased towards higher levels of damage (and therefore unrepresentative) it was not possible to use this data in the valuation model.

A change since 30 June 2012 is a move towards a property based model rather than a claim based model which was made possible with the availability of a new claim-to-property mapping.

1.9.2 Canterbury earthquakes: land model

The land model is now based on a property-by-property liability model developed by EQC's geotechnical engineering consultants Tonkin & Taylor. This model produces a liability estimate for Canterbury based on a number of inputs.

Following discussions with Tonkin & Taylor, the inputs were allowed to vary within suitable ranges so that a range of outcomes (i.e. a stochastic model) could be simulated.

The overall land liability has decreased significantly since 30 June 2012, primarily as a result of:

- The application of an incremental approach in assessing land damage caused by each earthquake event for Category 8 and 9 land damage.
- Application of newly developed science to determine liquefaction vulnerability to assess Category 8 land damage.
- Policy decisions to assess Category 8 and 9 land damage based on 100 year return period events.
- Bounding the enabling works estimate for properties with Category 8 and 9 land damage by deducting the dwelling damage repair costs already incurred.
- Correction of errors in the LiDAR surveys (affecting assessment of Category 8 and 9 land damage).
- Application of new repair methodologies for Category 8 land damage resulting in many properties with Category 8 land damage now being able to be repaired instead of being considered as total constructive losses.

1.9.3 Canterbury earthquakes: contents model

No material changes to the model.
1.9.4 BAU model
No material changes to the model.

1.9.5 CHE model
The claims handling expenses are based on a similar model to that used for 30 June 2012.

Further information on all of the above can be found in Section 6 and Appendix F.

1.10 Key results

1.10.1 Ultimate (Canterbury EQ only) vs. outstanding claims (all claims)

The gross incurred claims costs for all Canterbury EQ events, incurred to 31 December 2012 includes:

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

Claims 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 estimate the ultimate incurred claims costs and then deduct payments made to 31 December 2012 in order to determine the estimated OS claims liability.

The ultimate incurred claims costs are calculated in respect of Canterbury earthquake events and 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 75th percentile.
1.10.2 *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. A more detailed version of this table, including comparatives from the 30 June 2012 ILVR, is given in Section 8.7.

<table>
<thead>
<tr>
<th>Canterbury earthquakes only</th>
<th>Ultimate claims costs, central estimate, undiscounted, including CHE - 31 December 2012 valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EQ1</td>
</tr>
<tr>
<td>Claims paid to date*</td>
<td>1,506</td>
</tr>
<tr>
<td>Case estimates</td>
<td>725</td>
</tr>
<tr>
<td>Actuarial determination</td>
<td>549</td>
</tr>
<tr>
<td>Gross estimated ultimate incurred claims</td>
<td>2,780</td>
</tr>
<tr>
<td>Claims handling expenses (CHE)</td>
<td></td>
</tr>
<tr>
<td>Paid to date</td>
<td>238</td>
</tr>
<tr>
<td>Estimated future</td>
<td>139</td>
</tr>
<tr>
<td>Total</td>
<td>376</td>
</tr>
<tr>
<td>Gross ultimate incurred claims including CHE</td>
<td>3,157</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td>(1,638)</td>
</tr>
<tr>
<td>Net ultimate incurred claims including CHE</td>
<td>1,517</td>
</tr>
</tbody>
</table>

30 June 2012 comparatives

| Gross ult incurred claims including CHE | 3,455| 6,487| 1,371| 517  | 375| 12,205 |
| Net ult incurred claims including CHE  | 1,556| 4,010| 1,074| 517  | 375| 7,632 |

*Includes Fletcher PMO direct costs of repair (excludes 3.5% margin and infrastructure costs - included in CHE)

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).

For example, for the 4 September 2010 event (EQ1), the central estimate, undiscounted ultimate cost of claims including CHE and gross of (i.e. excluding) reinsurance is $3.157b. The estimated reinsurance recoveries are $1.639b, giving a central estimate net of reinsurance of $1.517b.

By far the biggest single item is the $6.398b of expected claims costs and CHE arising from the 22 February 2011 event. This is almost $4b more than the $2.5b reinsurance available for that event.

In respect of EQ3, the gross central estimate ultimate incurred claims cost is $1.118b. The net central estimate ultimate incurred claims cost is $0.996b. The net figure is less than the retention point of $1b as the distribution of possible outcomes includes scenarios where the gross liabilities are less than $1b.

Fletcher EQR direct claim costs are included in the claims costs paid to date. Fletcher PMO 3.5% margin and infrastructure costs are included in CHE.
The actuarial determination for AS is shown as -$52m. The reason why a negative actuarial determination has been applied is due to the loading of total property damage estimates to the most recent claim. This tends to overstate the case estimates for AS (and understate for the other events).

1.10.3 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 1.10.2 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.

Note that across all events, there has been a substantial reduction in the variability of ultimate costs compared to our 30 June 2012 valuation. This is mainly due to a more detailed model for land claims (based on Tonkin & Taylor calculations), giving a much narrower range of results for this component. This is illustrated further in Section 8.7.2.
Released under the Official Information Act 1982

The numbers underlying the chart above are shown in the following table which gives figures at various percentiles. For example, the estimated 95th percentile loss for EQ2 is $7.095b.

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQH</th>
<th>AS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>31 December 2012 ILVR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>$2.920b</td>
<td>$5.750b</td>
<td>$0.969b</td>
<td>$0.430b</td>
<td>$0.316b</td>
</tr>
<tr>
<td>25%</td>
<td>$3.044b</td>
<td>$6.096b</td>
<td>$1.055b</td>
<td>$0.478b</td>
<td>$0.346b</td>
</tr>
<tr>
<td>50%</td>
<td>$3.146b</td>
<td>$6.389b</td>
<td>$1.116b</td>
<td>$0.515b</td>
<td>$0.367b</td>
</tr>
<tr>
<td>75%</td>
<td>$3.264b</td>
<td>$6.687b</td>
<td>$1.161b</td>
<td>$0.554b</td>
<td>$0.388b</td>
</tr>
<tr>
<td>95%</td>
<td>$3.422b</td>
<td>$7.065b</td>
<td>$1.279b</td>
<td>$0.610b</td>
<td>$0.417b</td>
</tr>
<tr>
<td>Central Est.</td>
<td>$3.157b</td>
<td>$6.386b</td>
<td>$1.116b</td>
<td>$0.517b</td>
<td>$0.367b</td>
</tr>
<tr>
<td><strong>30 June 2012 ILVR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>$2.678b</td>
<td>$5.604b</td>
<td>$0.871b</td>
<td>$0.419b</td>
<td>$0.318b</td>
</tr>
<tr>
<td>25%</td>
<td>$3.115b</td>
<td>$6.016b</td>
<td>$1.043b</td>
<td>$0.466b</td>
<td>$0.352b</td>
</tr>
<tr>
<td>50%</td>
<td>$3.364b</td>
<td>$6.386b</td>
<td>$1.275b</td>
<td>$0.509b</td>
<td>$0.375b</td>
</tr>
<tr>
<td>75%</td>
<td>$3.732b</td>
<td>$6.911b</td>
<td>$1.659b</td>
<td>$0.556b</td>
<td>$0.397b</td>
</tr>
<tr>
<td>95%</td>
<td>$4.295b</td>
<td>$7.616b</td>
<td>$2.103b</td>
<td>$0.644b</td>
<td>$0.431b</td>
</tr>
<tr>
<td>Central Est.</td>
<td>$3.455b</td>
<td>$6.487b</td>
<td>$1.371b</td>
<td>$0.517b</td>
<td>$0.375b</td>
</tr>
</tbody>
</table>

1.10.4 Estimated ultimate claims costs – movement since 30 June 2012

The estimated ultimate incurred gross claims cost has decreased from $12.205b as at 30 June 2012 to $11.556b as at 31 December 2012. A breakdown of this change is shown in the following table.

Canterbury earthquakes only

<table>
<thead>
<tr>
<th>Change in estimated ultimate incurred claims cost (undiscounted, incl CHE)</th>
<th>EQ1 Sm</th>
<th>EQ2 Sm</th>
<th>EQ3 Sm</th>
<th>EQH Sm</th>
<th>AS Sm</th>
<th>Total Sm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>30 June 2012 ILVR</strong></td>
<td>3,455</td>
<td>6,487</td>
<td>1,371</td>
<td>517</td>
<td>375</td>
<td>12,205</td>
</tr>
<tr>
<td>Change In:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land claim costs</td>
<td>-274</td>
<td>-64</td>
<td>-264</td>
<td>+1</td>
<td>+0</td>
<td>-599</td>
</tr>
<tr>
<td>Building claim costs</td>
<td>-38</td>
<td>-38</td>
<td>-1</td>
<td>+1</td>
<td>-5</td>
<td>-78</td>
</tr>
<tr>
<td>Contents claim costs</td>
<td>-2</td>
<td>-9</td>
<td>-2</td>
<td>-1</td>
<td>-1</td>
<td>-16</td>
</tr>
<tr>
<td>CHE</td>
<td>+16</td>
<td>+22</td>
<td>+12</td>
<td>-5</td>
<td>-2</td>
<td>+44</td>
</tr>
<tr>
<td><strong>Total change</strong></td>
<td>-298</td>
<td>-89</td>
<td>-253</td>
<td>-1</td>
<td>-8</td>
<td>-649</td>
</tr>
<tr>
<td><strong>31 December 2012 ILVR</strong></td>
<td>3,157</td>
<td>6,398</td>
<td>1,118</td>
<td>517</td>
<td>367</td>
<td>11,556</td>
</tr>
</tbody>
</table>

**Net ultimate incurred claims including CHE - central estimate**

<table>
<thead>
<tr>
<th>Movement</th>
<th>EQ1 Sm</th>
<th>EQ2 Sm</th>
<th>EQ3 Sm</th>
<th>EQH Sm</th>
<th>AS Sm</th>
<th>Total Sm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>30 June 2012 ILVR</strong></td>
<td>1,556</td>
<td>4,010</td>
<td>1,074</td>
<td>517</td>
<td>375</td>
<td>7,532</td>
</tr>
<tr>
<td><strong>Movements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims costs + CHE</td>
<td>-298</td>
<td>-89</td>
<td>-253</td>
<td>-1</td>
<td>-8</td>
<td>-649</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td>+259</td>
<td>+0</td>
<td>+175</td>
<td>0</td>
<td>2</td>
<td>+434</td>
</tr>
<tr>
<td><strong>Total movements</strong></td>
<td>-39</td>
<td>-89</td>
<td>-78</td>
<td>-1</td>
<td>-8</td>
<td>-215</td>
</tr>
<tr>
<td><strong>31 December 2012 ILVR</strong></td>
<td>1,517</td>
<td>3,921</td>
<td>996</td>
<td>517</td>
<td>367</td>
<td>7,318</td>
</tr>
</tbody>
</table>

The principal reason for the change is the new land valuation methodology which now uses a model supplied by Tonkin & Taylor to estimate land repair costs. These calculations incorporate the latest EQC decisions regarding the determination of land liabilities. The impact is negative $599m. An explanation of the movement in the land liability is shown in Section 1.10.5.
On a gross basis the other movements since 30 June 2012 are:

- A reduction in building claims of $78m.
- A reduction in contents claims of $16m.
- An increase in CHE of $44m.

1.10.5 Estimated ultimate claims costs - land liability movement

Background

The land liability is a highly uncertain and dynamic component of EQC’s estimated ultimate liability. This component involves many complex engineering and legal issues and MJW relies heavily on information provided by EQC’s engineering consultants, Tonkin & Taylor (‘T&T’) and legal advisors, Chapman Tripp.

The land valuation model used for the 30 June 2012 valuation was first introduced for the 31 December 2011 valuation. This model was developed by MJW with input from T&T as to appropriate parameters. A key feature of the model was that it was an aggregate ‘top down’ model that used loss distributions for the entire damage across Canterbury (rather than a ‘bottom up’ individual property model).

The valuation model used for the 31 December 2012 valuation was developed by T&T and is based on individual property calculations. It explicitly allows for property level cost constraints e.g. building value and minimum lot size caps.

Movement in ultimate incurred cost

The chart below illustrates the change in estimated ultimate gross land liability from 30 June 2012 to 31 December 2012. Further detail is shown in Section 8.7.1.

Key components from the chart are:

- $632.6m. The reduction of estimated cost to damage categories 8-9.
$166.2m. The estimated ultimate incurred land liability has increased from changes in excess and nil claim recoveries. This increase is primarily driven from a lower overall estimated ultimate liability.

1.10.6 Gross claim payments — comparison to 30 June 2012 estimates

The following chart shows actual gross claim payments for Canterbury earthquakes to 31 December 2012 (solid black line) including EQR payments and CHE. Projected central estimate future payments from the current and previous valuations are also shown (broken lines).

A comparison of payments over the last six months against what was predicted as at 30 June (darker portion of broken grey line) illustrates that actual payments were well below expected. This should be viewed as an indication that the assumed settlement pattern was too rapid, rather than an improvement in the underlying claims position.

The settlement pattern assumed for this valuation implies a quickening of claims payments for the second half of 2013.

Future cashflow estimates underlying this chart can be found in Section 8.9, including a split by event.
1.10.7 **Outstanding claims liabilities – all claims**

The table below summarises the key components of the OS claims liabilities as at 31 December 2012. A more detailed breakdown, including comparatives from the 30 June 2012 ILVR, is set out in Section 8.4.

The net discounted outstanding claims liability at a probability of adequacy of 75% is $4.110 b. The largest component of the liabilities is in respect of EQ2.

<table>
<thead>
<tr>
<th>All EQC claims</th>
<th>Estimated outstanding claims (OSCL) - 31 December 2012</th>
<th>All EQC Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$m</td>
<td>$m</td>
</tr>
<tr>
<td>Gross outstanding claims liabilities - central estimate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross claims excluding CHE, undiscounted</td>
<td>1,274</td>
<td>3,596</td>
</tr>
<tr>
<td>Reinsurable CHE, undiscounted</td>
<td>139</td>
<td>191</td>
</tr>
<tr>
<td>Non-reinsurable CHE, undiscounted</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gross claims including CHE, undiscounted</td>
<td>1,413</td>
<td>3,788</td>
</tr>
<tr>
<td>Discounting</td>
<td>(51)</td>
<td>(140)</td>
</tr>
<tr>
<td>Gross claims including CHE, discounted</td>
<td>1,362</td>
<td>3,649</td>
</tr>
<tr>
<td>Reinsurance recoveries - central estimate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>1,396</td>
<td>1,371</td>
</tr>
<tr>
<td>Discounting</td>
<td>(51)</td>
<td>(22)</td>
</tr>
<tr>
<td>Reinsurance recoveries, discounted</td>
<td>1,344</td>
<td>1,349</td>
</tr>
<tr>
<td>Net outstanding claims liabilities - central estimate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net claims excluding CHE, undiscounted</td>
<td>17</td>
<td>2,418</td>
</tr>
<tr>
<td>Non-reinsurable CHE, undiscounted</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Net claims including CHE, undiscounted</td>
<td>17</td>
<td>2,418</td>
</tr>
<tr>
<td>Discounting</td>
<td>(0)</td>
<td>(116)</td>
</tr>
<tr>
<td>Net claims including CHE, discounted</td>
<td>17</td>
<td>2,300</td>
</tr>
<tr>
<td>Net outstanding claims liabilities - risk margin, 75% PoA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net risk margin, diversified</td>
<td>1</td>
<td>185</td>
</tr>
<tr>
<td>Net OSCL and risk margin 75% PoA, discounted</td>
<td>19</td>
<td>2,495</td>
</tr>
</tbody>
</table>
1.10.8 Outstanding claims liabilities - movement since 30 June 2012

The net of reinsurance OSCL (75% probability of adequacy, discounted) has decreased from $4.882b at 30 June 2012 to $4.110b at 31 December 2012. A summary of the change is shown below with more detail in Section 8.7.

<table>
<thead>
<tr>
<th>All EQC claims</th>
<th>Reconciliation of change in outstanding claims liability - 30 June 2012 ILVR</th>
<th>All Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EQ $m</td>
<td>BAU $m</td>
</tr>
<tr>
<td>Net OSCL (75% PoA, discounted) as at 30 June 2012</td>
<td>4,869</td>
<td>13</td>
</tr>
<tr>
<td>Remove net risk margin (75% PoA)</td>
<td>(609)</td>
<td>(2)</td>
</tr>
<tr>
<td>Net OSCL (central estimate, discounted) as at 30 June 2012</td>
<td>4,260</td>
<td>11</td>
</tr>
<tr>
<td>Remove discounting</td>
<td>173</td>
<td>0</td>
</tr>
<tr>
<td>Net OSCL (central estimate, undiscounted) as at 30 June 2012</td>
<td>4,433</td>
<td>11</td>
</tr>
<tr>
<td>Estimated net paid over period</td>
<td>(292)</td>
<td>(30)</td>
</tr>
<tr>
<td>Change in net actuarial determination</td>
<td>(215)</td>
<td>48</td>
</tr>
<tr>
<td>Net OSCL (central estimate, undiscounted) as at 31 Dec 2012</td>
<td>3,926</td>
<td>29</td>
</tr>
<tr>
<td>Add discounting</td>
<td>(166)</td>
<td>(0)</td>
</tr>
<tr>
<td>Net OSCL (central estimate, discounted) as at 31 Dec 2012</td>
<td>3,760</td>
<td>29</td>
</tr>
<tr>
<td>Net diversified risk margin (75% PoA, discounted)</td>
<td>319</td>
<td>2</td>
</tr>
<tr>
<td>Net OSCL (75% PoA, discounted) as at 31 Dec 2012</td>
<td>4,078</td>
<td>31</td>
</tr>
</tbody>
</table>

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

- Risk margin; this has decreased from $610m to $321m.
- Claim payments; net payments since 30 June 2012 have amounted to $323m.
- Actuarial determination; this has been reduced by $166m on a net of reinsurance basis.

The reason for the reduced risk margin is the lower level of variability in modelled costs (primarily those for land) as illustrated in Section 1.10.3.

A reconciliation of outstanding liabilities from 30 June 2012 to 31 December 2012 is found in Section 8.8.

1.10.9 Premium liabilities

The table below summarises the key results of the estimation of EQC's premium liabilities as at 31 December 2012.

The total value at 75% probability of adequacy is $221m, considerably in excess of the $136m unearned premium reserve. This means that an additional unexpired risk reserve will be required in the accounts as at 31 December 2012. However this is slightly less than the $239m required as at 30 June 2012.

The largest component ($129m, as compared to $134m as at 30 June 2012) relates to projected costs of future claims arising from Canterbury earthquakes during the period of the runoff of risks on the books as at 30 June 2012. If earthquake activity in the Canterbury area continues to reduce, it is expected that this component will also reduce over the next
few years. The other claims costs relate to future BAU claims, major event claims as modelled by Minerva, and the associated reinsurance and administration expenses.

The cost to EQC of reinsurance has increased considerably for cover negotiated since the Canterbury events, and this is reflected in the calculations as shown below. The future reinsurance costs for unexpired risks are $71m (annual premium of $140m).

<table>
<thead>
<tr>
<th>Estimated Premium Liabilities - 31 December 2012</th>
<th>BAU Sm</th>
<th>Minerva Sm</th>
<th>Cant. EO Sm</th>
<th>Total Sm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unearned premium reserve</strong></td>
<td></td>
<td></td>
<td></td>
<td>139</td>
</tr>
<tr>
<td><strong>Cost of future claims from unexpired risks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross claims, undiscounted - central estimate</td>
<td>23</td>
<td>41</td>
<td>96</td>
<td>160</td>
</tr>
<tr>
<td><strong>Administration and reinsurance costs for unexpired risks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims administration expenses</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Policy (non-claims) admin expenses for unexpired risks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Future reinsurance costs for unexpired risks</td>
<td>0</td>
<td>30</td>
<td>41</td>
<td>71</td>
</tr>
<tr>
<td><strong>Reinsurance recoveries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>0</td>
<td>(9)</td>
<td>(12)</td>
<td>(21)</td>
</tr>
<tr>
<td><strong>Net premium liabilities, undiscounted - central estimate</strong></td>
<td>28</td>
<td>65</td>
<td>132</td>
<td>225</td>
</tr>
<tr>
<td><strong>Discounting</strong></td>
<td>(0)</td>
<td>(1)</td>
<td>(3)</td>
<td>(5)</td>
</tr>
<tr>
<td><strong>Net premium liabilities, discounted - central estimate</strong></td>
<td>28</td>
<td>64</td>
<td>129</td>
<td>221</td>
</tr>
<tr>
<td><strong>Diversified risk margin, discounted - 75% PoA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net premium liabilities, discounted - 75% PoA</strong></td>
<td></td>
<td></td>
<td></td>
<td>221</td>
</tr>
</tbody>
</table>

### 1.11 Key uncertainties

#### 1.11.1 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 judgement.

#### 1.11.2 Exceptional uncertainties arising from the Canterbury earthquakes

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 the allocation of damage, EQC coverage and EQC’s reinsurance coverage.
- Severe land damage and a very complex land claims environment from both engineering and legal perspectives.
Released under the Official Information Act 1982

- 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 very legitimate 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.
- The potential for construction cost inflation to exceed expectations.

Consequently, at this stage of claims development, there is a degree of unavoidable uncertainty regarding the future claims costs. Over time, 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 wide confidence ranges in the estimated liabilities for each event.
- Different practitioners could legitimately arrive at quite different estimates of the cost of claims.

A more detailed description of uncertainty associated with this valuation – in particular arising from the earthquakes - is set out in Section 5.

1.12 Data

1.12.1 Sources

The most important sources of data for the investigations were:
- Data extracts from the ClaimCentre (CMS) claims administration system.
- Results of a special apportionments project carried out in 2011 and 2012 of 2,000 randomly sampled properties.
- Apportionment and claim-to-address mapping data from the BIU.
- Land cost calculations from EQC’s geotechnical engineering consultants, Tonkin & Taylor (T&T).
- Fletcher Construction completion cost data.
- Management accounts as at 30 June 2012 and 31 December 2012.
- Discussions with EQC employees and contractors.

1.12.2 Adequacy and appropriateness

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 has not been ideal. However, as for previous investigations, we have sought alternative sources of data and chosen valuation methodologies that mitigate these data shortcomings as much as possible.
1.13 Key reliances

In completing this report, considerable reliance has been placed on data and information supplied to MJW staff by EQC, Tonkin & Taylor and Chapman Tripp. The most important reliances were placed on the data sources listed in Section 1.12.1.

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

1.14 Key recommendations

1.14.1 Progress against previous recommendations

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

- Allocate a unique property ID to claims  
Completed.

- Improve the quality of land claims data  
Completed. Improved land claims calculations were supplied by Tonkin & Taylor for this valuation.

- Improve the quality of building claims data  
Ongoing.

1.14.2 Current Recommendations

The key recommendation, from an actuarial estimate perspective, arising from this investigation is continue to improve the quality of building claims data in ClaimCentre.

Further data recommendations are set out in Section 3.6.

1.15 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 judgement 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 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’s GGM, Reinsurance, Research and Education – Corporate Services 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 reinsurers’ or any other parties’ purposes. This report cannot substitute for any investigations that any reinsurer or other party may wish to carry out for its own purposes.
1.16 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
- Janet Lockett Actuary
- [Redacted] Analyst
- [Redacted] Analyst
- [Redacted] Analyst
- [Redacted] Analyst

Three people have been involved in all of MJW's Canterbury earthquake valuations.

1.17 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.

1.18 Professional standards

This report has been written to comply with Professional Standard No. 4.01 (Valuations of General Insurance Claims) of the New Zealand Society of Actuaries.

1.19 Authors

Craig Lough
Fellow of the NZ Society of Actuaries

Janet Lockett
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, Canterbury has been shaken by over 10,000 earthquakes including three which have caused enough damage to require EQC’s reinsurance treaties to respond and many other events for which claims for damage have been lodged.

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.
Earthquake Commission

Insurance Liability Valuation as at 31 December 2012

Released under the Official Information Act 1982

- 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

Following the High Court's declaratory judgement 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.

2.2.5 Reinsurance

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

More details are provided in Appendix C.

2.3 EQC operations outside those specified in the Act

EQC has 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 are 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.
- Repairs for damage caused by an event to a residential building, where the damage to the residential building has been apportioned to that event but no notice of any damage pertaining to that event was given by the claimant in the time limit. Conditions apply.
2.4 EQC reinsurance

2.4.1 Cover

EQC utilises catastrophe reinsurance to reduce net claims volatility. In summary, from 1 June 2010 EQC had reinsurance treaties in place providing cover per event above a $1.5b deductible up to an upper limit of $4.0b – i.e. maximum $2.5b reinsurance cover per event (less a small amount of coinsurance). This cover was placed in tranches and layers subject to different terms. On-going reinsurance cover after each event is complex as it depends on the usage of each layer and the reinstatement, replacement or renewal of each tranche and/or layer as relevant.

From 1 June 2012, EQC’s reinsurance cover has a 100% deductible per event to $1.5b and a 75% deductible per event between $1.5b and $1.75b. From $1.75b, 100% of a loss is covered, in layers to $4b. There is a final (4th) layer between $4b and $5b although only 60% is covered.

More details are provided in Appendix C.

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 Senior Geotechnical Engineer at T&T and Dr Hugh Cowan, GM Reinsurance, Research and Education at 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 Background

Land cover

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).

EQC land cover:

- 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...
Released under the Official Information Act 1982

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 of the value of the land damaged (further limited to the lower of
  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).

- 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.

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 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 since the 30 June 2012 valuation and this has
been incorporated into this valuation. However, it should be recognised that there remains
uncertainty regarding certain components of the land liability estimates.

2.5.2 Land damage

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.

Consequently, the level of building damage has been much larger than might be expected for earthquake events of this size because of the combination of land response with dwellings of a particular concrete-pad/brick/tile construction.
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 (Categories 8 and 9 land damage listed in the table below).

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cracking caused by lateral spreading</td>
</tr>
<tr>
<td>2</td>
<td>Cracking caused by oscillation movements</td>
</tr>
<tr>
<td>3</td>
<td>Undulating Ground</td>
</tr>
<tr>
<td>4</td>
<td>Local ponding</td>
</tr>
<tr>
<td>5</td>
<td>Local settlement causing drainage issues</td>
</tr>
<tr>
<td>6</td>
<td>Groundwater springs</td>
</tr>
<tr>
<td>7</td>
<td>Inundation of ejected sand and silt</td>
</tr>
<tr>
<td>8</td>
<td>Increased vulnerability - Liqufaction</td>
</tr>
<tr>
<td>9</td>
<td>Increased vulnerability - Flooding</td>
</tr>
</tbody>
</table>

Port Hills

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

2.5.3 Rebuilding and land zones

The land in greater Christchurch and in the Waimakariri District has been divided 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 three residential flat land categories, commercial zoned land, Port Hills land, and rural land. The three residential flat land categories 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.

2.5.4 Land claim cost estimates

The cost of a valid land claim is a function of a combination of the assessed land damage and the application of EQC’s land cover rules.

Although there have been many earthquake events causing building damage, there have been only 4 events that have resulted in observable/measurable land damage – 4 September 2010 (EQ1), 22 February 2011 (EQ2), 13 June 2011 (EQ3) and 23 December 2011 (EQ4) – and it is only for these events that there will be valid land claims.

The estimation of EQC’s land claims liabilities has been undertaken by T&T with legal input from EQC’s legal advisers, Chapman Tripp. The work undertaken to understand the nature and extent of land damage and to translate that into estimated land claims costs has been considerable, and at this time may be regarded as the best information available.

The costing of the damage repair may be broken down into 3 broad groups:

- Repair of damage categories 1 – 7 on the flat.
- Repair of damage categories 8 – 9 on the flat.
- 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 based on the cumulative damage state after each of the events.

In summary, the cost apportionment method is based on assigning the marginal increase in repair cost to each event based on the total repair cost of the cumulative damage. In the same way that the land damage effects may overlap, so may the reinstatement and hence tend to reduce the overall cost, i.e. a single repair process may reinstate several categories of damage for several events.

**Damage categories 8 – 9 on the flat**

The damage assessment approach is based on an incremental assessment based on the subsidence caused by each individual earthquake event. However, for each event for which the incremental ground surface subsidence qualifies as damage, the cost estimate approach is similar to that for properties on the flat although using different repair techniques.

Category 8-9 damage repair cost is based on the assumption of “clear land” whereas in fact in some dwellings (an unknown number) would have to be moved via “enabling works” in order to repair the land – this is discussed further below.
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, but it is more difficult to assess, estimate and/or reinstate on a grouped basis.

Port Hills land damage generally only occurred during the EQ2 and EQ3 events and most related to the failure of retaining walls. There was also damage arising from landslides and major inundation from rockfall. There was a lot of minor slope failure in general but it is not considered to be on-going or to represent an ongoing risk. The land stability is the same and any future damage would require the occurrence of future major events. Where the land has stabilised it is possible to undertake reinstatement.

Damage not yet estimated

The following components of land damage have not yet been estimated in a detailed way:

- The potential for the impact of enabling costs to be reduced by the application of the “diminution of value” approach to assessing land damage; this is discussed further below.
- Removal of ejected silt from underneath dwellings; it is estimated that approximately 5,000 of properties (which are not included for Category 8 and 9 land damage) with silt inundation will require silt to be removed from under the house.
- Port Hills land damage

Enabling works

The estimated cost for category 8 and 9 land damage is based on the assumption that there is a vacant property. In some cases, where there was no dwelling or the dwelling has been demolished, this is a reasonable assumption. However, in some cases there are “in-situ” dwellings that are not significantly damaged, and therefore would not otherwise be considered as needing to be demolished, so that the land remediation task becomes more difficult.

The costs of demolishing or moving these undamaged or partially damaged dwellings are known as “enabling costs” and these could be considerable. The situation is further complicated as in many cases there may be no readily apparent damage to the land, even though a material loss of amenity for residential housing is judged to have occurred and so, on that basis, it may not make sense to undertake extensive land remediation work. In these cases an alternative view of the land damage cost can be contemplated based on a “diminution of value” indemnity approach and this is discussed further below.

Diminution of value

For category 8 or 9 land damage properties, where the land condition and building condition permits, the indemnity principle will sometimes imply that EQC’s liability is better reflected by the diminution in the market value of the property (DOV) due to the unrepaid ground surface subsidence rather than the combined costs of the (highly intrusive) land reinstatement and 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 generally (but not always) the minimum lot value (MLV).
This means that the homeowner will get:

- Cost of land reinstatement (including enabling costs if required), or
- DOV (if the cost of repair is not appropriate).

But in no event will the amount paid be greater than the MLV.

At this time the determination of the dollar amount of a property’s DOV is a difficult concept and is still in the early stages of its development and application. The potential reduction in costs is thought to be up to 90% of the estimated value of the enabling works but this is highly uncertain. More accurate estimation will require valuer input and further information from EQC regarding the actual condition of each property. The application of the DOV offset is described in Appendix H.

2.5.5 Information / data

The land claim estimates held within ClaimCentre are not yet at a level of reliability to be used for actuarial analysis. Instead, a valuation model was obtained from T&T to value the land claims.

2.5.6Estimated EQC land claim liabilities and associated uncertainty

An illustration of land claim costs and their potential variability can be found in Section 8.7.2.

2.6 New Zealand economic environment

2.6.1 Economic growth

GDP increased 0.2% in the September 2012 quarter with annual growth of 2.6%.

2.6.2 Inflation

The Consumer Price Index rose 0.9% in the twelve months to 31 December 2012. The Statistics NZ Labour Cost Index rose 1.9% for the twelve months to 30 September 2012.

2.6.3 Interest rates

The Reserve Bank last decreased interest rates on 10 March 2011 to 2.50%. Since then the Bank has continued to hold rates at this level in light of unsettled conditions affecting global markets and delays to the Canterbury rebuild. Over the year to 30 September 2012, 5 year government bond yields fell from 3.3% to 2.9%.
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 two key extracts used were dated:

- 30 November 2012
- 31 December 2012.

These extracts are 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 Special apportionments project

For a number of reasons, including those mentioned in Section 2.2, the estimates held for each claim in ClaimCentre were not able to be used for the valuation.

As an interim solution, until all building claims estimates in ClaimCentre are able to be calculated according to the dwelling reserve apportionment guidelines introduced from 5 December 2011, a special apportionments survey was undertaken in 2011 and 2012 by the Canterbury Event Field Office, overseen by EQC consultants and statistician.

The survey was based on a sample of Canterbury region properties stratified by land zones (i.e. Red, TC3 etc.) and suburb grouping (12 groupings were used). The properties from which the sample was drawn were derived from claims lodged in ClaimCentre. Land zones were allocated via a link to T&T Orbit data and the suburb groupings were the same as for the report undertaken during 2011. Eight samples of 500 properties were taken along with some randomly selected alternative properties to be used in case of problems with the original samples.

Four samples of 500 were completed with damage being allocated to events in accordance with the dwelling reserve apportionment guidelines.

The following data for each sampled property was provided:

- Property location data.
- Land zone.
- Suburb group.
- EQC building estimates for EQ1, EQ2, EQ3, EQ4, AS.
- Claim numbers and notification dates for all claims notified from the property.
- Assessed damage for EQ1, EQ2, EQ3, EQ4, AS.
- EQC liabilities for EQ1, EQ2, EQ3, EQ4, AS.
- Emergency works for EQ1, EQ2, EQ3, EQ4, AS.
3.1.3 **Apportionment and claim-to-address mapping data from the BIU.**

The BIU supplied two additional tables of data:

- Apportionment data relating to approximately 23,000 properties where claim handlers have apportioned total damage between events.
- 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).

The second item did not exist for previous valuations. We have applied this mapping to our building model which is now property-based rather than claim-based.

3.1.4 **Output from the Minerva loss model**

Output from the Minerva model was the same as that used for the 30 June 2011 and 31 December 2011 valuation reports. 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.

3.1.5 **Fletcher Construction completion cost data**

Data extracts regarding completion cost data for completed substantive assignments were taken from Fletcher Construction’s Operational Management System (ECM) and provided to MJW on 16 January 2013.

The data extract included for each completed property:

- A claim number.
- Property location data.
- EQC estimate.
- FCC budget data.
- FCC certified cost data.

Included was information on costs relating to emergency repairs, winter heat work and substantive repairs.

In addition to the above, information relating to all EQR payments to 31 December 2012 was received on 18 January 2013.

3.2 **Sources of information**

The main sources of information used for the investigation were:

- Accounts for the year ending 30 June 2012 and half year ending 31 December 2012.
- Daily reports supplied by the BIU.
- Reports supplied by the Fletcher Construction EQR.
- T&T land liability model.
- Information from EQC and government websites.
3.3 Validation of data

3.3.1 Actuarial data extract

The first table in Appendix E illustrates a reconciliation of the 31 December 2012 Actuarial Data Extract system against the BIU’s Daily Report for 7 January 2013 (the first available report of the new year) and the Claims Paid figures from the 31 December 2012 accounts (Event loss summary).

Note that for BAU claims the information from the data extract is calculated on a loss date basis and so does not accord 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 special apportionments project 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 are:

- The need to improve the quality of the building claim incurred figures held in ClaimCentre; at the moment it is not possible to know whether or not the incurred claims for a particular claim have been completed according to the dwelling reserve apportionment guidelines.

- The need to improve the quality of land estimates held in ClaimCentre.

- 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 report of 13 September 2012. The progress against these recommendations is as follows:

- ClaimCentre:
  - Unique property ID. Complete. This has allowed a property based building model to be developed.
  - Improve the quality of land claims data. Complete. This has reduced volatility of claim estimates.
  - Improve the quality of building claims data. Ongoing
  - Data dictionary interpretation of data. Complete. Enables certainty around interpretation of data.
  - Clear identification where EQC cover rules have or have not been applied to estimates (a claim quality indicator). Outstanding

- Minerva:
  - Review the model Outstanding
  - Consider Non-EQ events Outstanding
  - Consider the inclusion of land damage. Outstanding

3.6.2 Current Recommendations

There are many potential recommendations regarding the data that could aid future investigations. Some of the key ones are:

- ClaimCentre:
  - Incorporate EQR claims data in the EQC claims database.
  - Improve the quality of building claims data.

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

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.

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 considered that the information provided to us was adequate and appropriate for the purposes of this valuation.
4 Canterbury earthquake claims analysis

4.1 Actuarial Data Extract from ClaimCentre (31 December 2012)

4.1.1 Number of notified claims

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>43,200</td>
<td>18,826</td>
<td>5,775</td>
<td>7,891</td>
<td>7,194</td>
<td>82,886</td>
</tr>
<tr>
<td>Open</td>
<td>102,236</td>
<td>126,771</td>
<td>46,464</td>
<td>39,829</td>
<td>35,273</td>
<td>350,570</td>
</tr>
<tr>
<td>Total</td>
<td>145,436</td>
<td>145,597</td>
<td>52,239</td>
<td>47,717</td>
<td>42,467</td>
<td>433,456</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>53,886</td>
<td>29,786</td>
<td>7,547</td>
<td>8,552</td>
<td>8,345</td>
<td>108,496</td>
</tr>
<tr>
<td>Open</td>
<td>102,342</td>
<td>126,956</td>
<td>46,502</td>
<td>36,875</td>
<td>35,302</td>
<td>350,979</td>
</tr>
<tr>
<td>Total</td>
<td>156,228</td>
<td>156,742</td>
<td>54,049</td>
<td>45,427</td>
<td>43,647</td>
<td>459,475</td>
</tr>
</tbody>
</table>

- The figures in the tables above and the following tables are based on an Actuarial Data Extract from ClaimCentre as at 31 December 2012.
- Duplicate claims are excluded from our tables (unless noted otherwise). Duplicate claims are included in the BIU daily report.

4.1.2 Number of notified sub-claims

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>11,241</td>
<td>8,151</td>
<td>2,657</td>
<td>907</td>
<td>1,370</td>
<td>24,326</td>
</tr>
<tr>
<td>Open</td>
<td>16,320</td>
<td>45,353</td>
<td>10,148</td>
<td>7,274</td>
<td>3,423</td>
<td>82,818</td>
</tr>
<tr>
<td>Total</td>
<td>27,561</td>
<td>53,504</td>
<td>12,805</td>
<td>8,181</td>
<td>4,793</td>
<td>106,844</td>
</tr>
<tr>
<td>Building sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>52,571</td>
<td>30,420</td>
<td>8,507</td>
<td>6,389</td>
<td>8,653</td>
<td>108,540</td>
</tr>
<tr>
<td>Open</td>
<td>83,563</td>
<td>96,864</td>
<td>38,362</td>
<td>34,501</td>
<td>30,834</td>
<td>284,134</td>
</tr>
<tr>
<td>Total</td>
<td>136,134</td>
<td>127,284</td>
<td>46,869</td>
<td>42,890</td>
<td>39,487</td>
<td>392,674</td>
</tr>
<tr>
<td>Contents sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>50,351</td>
<td>65,053</td>
<td>12,886</td>
<td>6,596</td>
<td>5,864</td>
<td>140,874</td>
</tr>
<tr>
<td>Open</td>
<td>4,458</td>
<td>16,546</td>
<td>6,539</td>
<td>5,316</td>
<td>2,010</td>
<td>34,869</td>
</tr>
<tr>
<td>Total</td>
<td>54,809</td>
<td>81,599</td>
<td>19,425</td>
<td>11,914</td>
<td>7,874</td>
<td>175,743</td>
</tr>
<tr>
<td>All sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>114,183</td>
<td>103,624</td>
<td>24,052</td>
<td>15,894</td>
<td>16,007</td>
<td>273,740</td>
</tr>
<tr>
<td>Open</td>
<td>104,331</td>
<td>158,753</td>
<td>55,046</td>
<td>47,091</td>
<td>36,257</td>
<td>401,521</td>
</tr>
<tr>
<td>Total</td>
<td>218,514</td>
<td>262,377</td>
<td>79,098</td>
<td>62,985</td>
<td>52,264</td>
<td>675,261</td>
</tr>
</tbody>
</table>

- This table and 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.
- In respect of the Canterbury earthquake claims, there were 1.5 sub-claims per claim on average.
273,740 sub-claims (40% of the total) have been settled to date.

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 nearly exactly with the BIU daily report.

<table>
<thead>
<tr>
<th>Number of notified sub-claims (ClaimsCentre) - all incl duplicates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td><strong>Land sub-claims</strong></td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>Contents sub-claims</strong></td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td><strong>All sub-claims</strong></td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
### 4.1.3 Sub-claims paid to date

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

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>2.6</td>
<td>18.9</td>
<td>1.1</td>
<td>0.0</td>
<td>0.3</td>
<td>23.1</td>
</tr>
<tr>
<td>Open</td>
<td>1.3</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>4.1</td>
<td>19.7</td>
<td>1.1</td>
<td>0.0</td>
<td>0.3</td>
<td>25.2</td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>693.5</td>
<td>1,339.2</td>
<td>94.9</td>
<td>6.0</td>
<td>35.6</td>
<td>2,395.2</td>
</tr>
<tr>
<td>Open</td>
<td>127.0</td>
<td>208.9</td>
<td>18.1</td>
<td>1.8</td>
<td>8.2</td>
<td>364.0</td>
</tr>
<tr>
<td>Total</td>
<td>1,020.6</td>
<td>1,548.1</td>
<td>113.0</td>
<td>7.8</td>
<td>43.8</td>
<td>2,733.2</td>
</tr>
<tr>
<td><strong>Contents sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>112.8</td>
<td>220.2</td>
<td>19.0</td>
<td>6.9</td>
<td>6.1</td>
<td>364.9</td>
</tr>
<tr>
<td>Open</td>
<td>1.4</td>
<td>10.9</td>
<td>0.9</td>
<td>0.7</td>
<td>0.1</td>
<td>13.9</td>
</tr>
<tr>
<td>Total</td>
<td>114.2</td>
<td>231.1</td>
<td>19.9</td>
<td>7.6</td>
<td>6.3</td>
<td>378.8</td>
</tr>
<tr>
<td><strong>All sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>1,090.0</td>
<td>1,578.3</td>
<td>115.0</td>
<td>13.0</td>
<td>42.0</td>
<td>2,757.2</td>
</tr>
<tr>
<td>Open</td>
<td>129.7</td>
<td>220.5</td>
<td>19.0</td>
<td>2.5</td>
<td>8.3</td>
<td>360.0</td>
</tr>
<tr>
<td>Total</td>
<td>1,138.7</td>
<td>1,798.8</td>
<td>133.9</td>
<td>15.4</td>
<td>50.3</td>
<td>3,137.2</td>
</tr>
</tbody>
</table>

- 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 $994m. Total building sub-claim payments equal $3,727m.
- EQ1 and EQ2 account for 94% of the total claims paid to date and building claims amount to 87% of the total paid.
4.1.4 Reported sub-claims incurred

<table>
<thead>
<tr>
<th>Reported incurred sub-claims (ClaimsCentre &amp; EQR)</th>
<th>EQ1 $m</th>
<th>EQ2 $m</th>
<th>EQ3 $m</th>
<th>EQ4 $m</th>
<th>AS $m</th>
<th>Total $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>2.8</td>
<td>19.0</td>
<td>1.1</td>
<td>0.0</td>
<td>0.3</td>
<td>23.2</td>
</tr>
<tr>
<td>Open</td>
<td>125.7</td>
<td>194.9</td>
<td>66.7</td>
<td>23.3</td>
<td>12.2</td>
<td>414.8</td>
</tr>
<tr>
<td>Total</td>
<td>128.5</td>
<td>213.9</td>
<td>67.8</td>
<td>23.3</td>
<td>12.5</td>
<td>438.0</td>
</tr>
<tr>
<td>Building sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>804.1</td>
<td>1,340.5</td>
<td>96.2</td>
<td>6.0</td>
<td>35.6</td>
<td>2,372.3</td>
</tr>
<tr>
<td>Open</td>
<td>1,065.6</td>
<td>2,236.4</td>
<td>154.3</td>
<td>145.1</td>
<td>264.0</td>
<td>4,537.5</td>
</tr>
<tr>
<td>Total</td>
<td>1,879.7</td>
<td>3,576.9</td>
<td>252.5</td>
<td>151.1</td>
<td>299.5</td>
<td>6,909.8</td>
</tr>
<tr>
<td>Contents sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>112.6</td>
<td>220.2</td>
<td>19.0</td>
<td>6.9</td>
<td>6.1</td>
<td>384.9</td>
</tr>
<tr>
<td>Open</td>
<td>10.4</td>
<td>36.8</td>
<td>9.5</td>
<td>7.5</td>
<td>2.1</td>
<td>66.4</td>
</tr>
<tr>
<td>Total</td>
<td>123.1</td>
<td>257.0</td>
<td>28.5</td>
<td>14.4</td>
<td>8.3</td>
<td>431.3</td>
</tr>
<tr>
<td>All sub-claims</td>
<td>1,009.5</td>
<td>1,579.7</td>
<td>116.3</td>
<td>13.0</td>
<td>42.0</td>
<td>2,760.5</td>
</tr>
<tr>
<td>Open</td>
<td>1,221.9</td>
<td>2,468.1</td>
<td>874.4</td>
<td>175.9</td>
<td>278.3</td>
<td>5,018.7</td>
</tr>
<tr>
<td>Total</td>
<td>2,231.4</td>
<td>4,047.8</td>
<td>990.7</td>
<td>188.9</td>
<td>320.4</td>
<td>7,779.1</td>
</tr>
</tbody>
</table>

- This table includes claims paid to date as recorded in ClaimCentre and claims arising from Fletcher EQR. Reported claims incurred is the sum of claims paid to date plus the case estimates held as at 31 December 2012.

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

<table>
<thead>
<tr>
<th>Observed average sub-claims cost (ClaimsCentre &amp; EQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ1 $</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Land sub-claims</td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Building sub-claims</td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Contents sub-claims</td>
</tr>
<tr>
<td>Closed</td>
</tr>
<tr>
<td>Open</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

- The land claim estimates held in ClaimCentre are not yet reliable. For an average sub-claim costs analysis based on ultimate incurred, see Section 8.2.1.
4.2 Special apportionments project

The building model relies on information from the special apportionments project carried out by [redacted] and [redacted] to assist this valuation update. The apportionment data contains the estimated split of total damage between earthquake events and then applies EQC cover rules to determine EQC’s liability for each event.

Summary statistics from the special apportionments data is shown below, more information is available on request.

4.2.1 Costs

The average damage and liability figures in the table above have been determined as follows:

In respect of the damage apportionment, 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 is divided by the number of events that apply to the properties. A similar process has been applied to EQC liability figures.

The number of properties with valid apportionment from the two sets of data was less than 2,000 although this is not considered material.

4.2.2 Percentages

The percentages in the table above have been determined as follows:

- In respect of the damage apportionment, for each property, the percentage split of damage was determined irrespective of whether a claim had been lodged. The percentages were then averaged across all properties in the same zone. This approach applies equal weight to each property, regardless of both the damage incurred and the prevalence of claims.
In respect of EQC liability apportionment, for each property the percentage split of liability was determined, but only for events that had a claim. The percentages for a property were then rebased to sum to 100%. As for the damage apportionment approach, this approach ignores the overall amount of liability although it does take into account claim notifications and is considered reasonable for the valuation.

4.3 Fletcher construction and COMET data

We have received Fletcher EQR data in respect of 30,419 substantively completed home repairs. The data contained details on the properties, the costs paid to date and EQC reserve that applied to the property prior to the work beginning.

We also have been supplied with COMET data which was used (indirectly) as a basis for the building valuation model.

It was noted in the 30 June 2012 valuation report that there are reasons why the two datasets are not readily comparable for use in informing the degree of under or over reserving. These reasons still exist and MJW is working with EQC staff to establish alternative methods of monitoring how accurate building estimates are to the final building costs.
5 Uncertainty

5.1 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 judgement.

5.2 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.

5.3 Uncertainties arising from the Canterbury earthquakes

5.3.1 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 and legal perspectives.
- The potential for construction cost inflation to exceed expectations.
- Systemic cost issues such as the enhanced foundation costs affecting properties in TC3 and to a lesser extent, TC2.

Consequently, at this stage of claims development, there is a degree of unavoidable uncertainty regarding the future claims costs. However, it is noted that the degree of uncertainty has considerably decreased since the last valuation. 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.
5.3.2 Land valuation uncertainties

There is inherent uncertainty in any estimation process. 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.
- Enabling costs associated with category 8 – 9 damage repairs.
- The impact of the “diminution of value” cover interpretation.
- The possible impact of alternative repair methodologies.
- The number of buildings requiring silt removal from beneath them.
- The possible impact of demand surge due to labour shortages.
- Legal challenge and different interpretation of the land cover provisions in the EQC Act.

5.4 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.
6 Outstanding Claims Liabilities – Valuation Methodologies

6.1 Liability components

EQC’s outstanding (OS) claims liabilities to be included in its accounts for 31 December 2012 are, in summary, an estimate of the total value of liabilities arising from all claims incurred up to the valuation date of 31 December 2012.

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.

6.2 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.
6.2.1 Event valuation groupings

The insurance liability components described in Section 6.1 have been further split into the costs arising from different, mutually exclusive, claim events.

The event groups are:

- "BAU" (Business As Usual) claims, also known as "attritional" or "working" 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.
  - 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.

6.2.2 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.
- Personal property (contents) claims.

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

6.3 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 6.4.
6.4 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 6.3. 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 6.1. 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, while more advanced than for the 30 June 2012 investigation, the valuation data is still relatively immature for land and buildings sub-claims.

- 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.

6.5 Previous valuation methodologies

The most recent valuation undertaken was as at an effective date of 30 June 2012.

The evaluation methodology is similar to that carried out for the most recent valuation with the exception of:

- Building model: The building sub claim model is now carried out on a property by property basis (as opposed to a claim by claim basis for 30 June 2012).

- Land model. The land sub-claim model is based on a land liability model prepared by Tonkin and Taylor. As at 30 June 2012 the land sub-claim model was developed by MJW based on information provided by Tonkin & Taylor.

Significantly different approaches were used for the investigations carried out prior to December 2011.
6.6 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 31 December 2012 in order to determine the estimated OS claims liability.

6.6.1 High level description of the methodology

As noted in Section 6.5, the methodology used for the estimation of the outstanding claims liabilities is different from that used at 30 June 2012 — to the extent that the sub-claim models are different.

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.

6.6.2 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.
6.7 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).

6.8 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.
6.9 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 is beneficial in this respect.

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.

6.10 Risk margin

The gross and net risk margins are direct outworkings of the determination of the 75th 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 75th 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 75th percentile. 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 either of 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.

6.11 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 J.
Outstanding Claims Liabilities – Valuation Assumptions

7.1 Assumptions required

The assumptions required are driven by the structure of the valuation model as described in Section 6. 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.

7.2 Actual vs. expected experience

A comparison between the current results and those determined as at 30 June 2012 is illustrated in Section 1.10.5 and outlined further in Section 8.7.

7.3 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 8.10 does identify the variations in claims liabilities from changes in key assumptions.

7.4 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.

7.4.1 Nil claim percentage

Nil claim percentages are only applied to claims that are at a stage in the claims process where they may be closed without cost (i.e. a “nil claim”). Analysis of claims experience indicates that the rate of nil claims for an event falls away over time (survivorship bias), hence higher rates apply to more recent events.

7.4.2 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.
7.4.3 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.

7.4.4 Average claim size

The average claim sizes are some of the most critical assumptions. These assumptions vary by event group, sub-claim type and geographic zone.

The determination of each assumption is first governed by the sources of data:

- Land sub-claim averages are an outworking of the aggregate event costs divided by the number of claims held within ClaimCentre.
- Contents sub-claim averages are based on the closed sub-claims from the Actuarial Data Extract from ClaimCentre data.
- Buildings sub-claim averages are based on the special apportionments project data.

A more technical explanation of the approach to setting the average claim assumptions is set out in Appendix H.

Implicit underlying assumption

One underlying assumption in this approach is that, on average, the human assessments are reasonable.

7.4.5 TC2 & TC3 foundation costs

An additional cost for enhanced foundations not allowed for in the current reserves has been added to the building costs. See Appendix H for more details.

7.4.6 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.

7.4.7 Reinstatements

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

7.5 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 expense analysis described in Appendix F.
7.6 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.

7.7 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 derived 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.

7.8 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 31 December 2012. These rates are set out in Appendix J.
8 Outstanding Claim Liabilities - Results

8.1 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 5.

8.2 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.

<table>
<thead>
<tr>
<th>Canterbury earthquakes only</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sm</td>
<td>Sm</td>
<td>Sm</td>
<td>Sm</td>
<td>Sm</td>
<td>$m</td>
</tr>
<tr>
<td>Claims costs paid to date *</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>64</td>
<td>25</td>
</tr>
<tr>
<td>Building</td>
<td>436</td>
<td>2,112</td>
<td>155</td>
<td>11</td>
<td>46</td>
<td>3,727</td>
</tr>
<tr>
<td>Contents</td>
<td>114</td>
<td>231</td>
<td>20</td>
<td>8</td>
<td>8</td>
<td>379</td>
</tr>
<tr>
<td>Total</td>
<td>1,505</td>
<td>2,363</td>
<td>176</td>
<td>16</td>
<td>67</td>
<td>4,131</td>
</tr>
<tr>
<td>Case estimates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>124</td>
<td>194</td>
<td>59</td>
<td>23</td>
<td>12</td>
<td>413</td>
</tr>
<tr>
<td>Building</td>
<td>592</td>
<td>1,465</td>
<td>747</td>
<td>140</td>
<td>239</td>
<td>3,183</td>
</tr>
<tr>
<td>Contents</td>
<td>9</td>
<td>26</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>725</td>
<td>1,685</td>
<td>814</td>
<td>170</td>
<td>253</td>
<td>3,649</td>
</tr>
<tr>
<td>Actuarial determination - central estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>176</td>
<td>605</td>
<td>211</td>
<td>74</td>
<td>12</td>
<td>1,054</td>
</tr>
<tr>
<td>Building</td>
<td>357</td>
<td>1,256</td>
<td>228</td>
<td>142</td>
<td>44</td>
<td>1,463</td>
</tr>
<tr>
<td>Contents</td>
<td>76</td>
<td>52</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>Total</td>
<td>549</td>
<td>1,913</td>
<td>220</td>
<td>52</td>
<td>2,620</td>
<td></td>
</tr>
<tr>
<td>Gross ultimate incurred claims cost - central estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>304</td>
<td>819</td>
<td>270</td>
<td>98</td>
<td>0</td>
<td>1,492</td>
</tr>
<tr>
<td>Building</td>
<td>2,337</td>
<td>4,833</td>
<td>674</td>
<td>283</td>
<td>256</td>
<td>8,393</td>
</tr>
<tr>
<td>Contents</td>
<td>139</td>
<td>309</td>
<td>36</td>
<td>16</td>
<td>13</td>
<td>514</td>
</tr>
<tr>
<td>Total</td>
<td>2,760</td>
<td>5,961</td>
<td>981</td>
<td>408</td>
<td>289</td>
<td>10,399</td>
</tr>
</tbody>
</table>

30 June 2012 comparative

<table>
<thead>
<tr>
<th>Gross ultimate claims cost - cent est</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3,085</td>
<td>6,072</td>
<td>1,246</td>
<td>405</td>
<td>275</td>
<td>11,093</td>
<td></td>
</tr>
</tbody>
</table>

*Includes Fletcher PMO direct costs of repair (excludes 3.5% margin and infrastructure costs)
8.2.1 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.

<table>
<thead>
<tr>
<th>Estimated ultimate average sub-claim cost</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>249</td>
<td>2,328</td>
<td>415</td>
<td>8</td>
<td>241</td>
<td>954</td>
</tr>
<tr>
<td>Open</td>
<td>18,486</td>
<td>17,642</td>
<td>26,532</td>
<td>13,405</td>
<td>0</td>
<td>17,797</td>
</tr>
<tr>
<td>Total</td>
<td>11,048</td>
<td>15,309</td>
<td>21,113</td>
<td>11,920</td>
<td>69</td>
<td>13,962</td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>17,007</td>
<td>44,067</td>
<td>11,304</td>
<td>718</td>
<td>4,110</td>
<td>21,857</td>
</tr>
<tr>
<td>Open</td>
<td>17,269</td>
<td>36,046</td>
<td>15,076</td>
<td>8,323</td>
<td>7,142</td>
<td>21,190</td>
</tr>
<tr>
<td>Total</td>
<td>17,166</td>
<td>37,963</td>
<td>14,391</td>
<td>6,635</td>
<td>6,478</td>
<td>21,374</td>
</tr>
<tr>
<td><strong>Contents sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>2,237</td>
<td>3,385</td>
<td>1,477</td>
<td>1,050</td>
<td>1,024</td>
<td>2,591</td>
</tr>
<tr>
<td>Open</td>
<td>5,896</td>
<td>5,354</td>
<td>2,663</td>
<td>2,043</td>
<td>3,189</td>
<td>4,289</td>
</tr>
<tr>
<td>Total</td>
<td>2,535</td>
<td>3,784</td>
<td>1,876</td>
<td>1,493</td>
<td>1,568</td>
<td>2,928</td>
</tr>
</tbody>
</table>

8.3 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.

<table>
<thead>
<tr>
<th>Canterbury earthquakes only</th>
<th>Ultimate claims costs, central estimate, undiscounted, including CHE - 31 December 2012 valuation</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claims costs paid to date*</td>
<td>1,506</td>
<td>2,363</td>
<td>176</td>
<td>19</td>
<td>67</td>
<td>4,131</td>
<td></td>
</tr>
<tr>
<td>Case estimates</td>
<td>725</td>
<td>1,685</td>
<td>814</td>
<td>170</td>
<td>253</td>
<td>3,649</td>
<td></td>
</tr>
<tr>
<td>Actuarial determination</td>
<td>549</td>
<td>1,913</td>
<td>(9)</td>
<td>220</td>
<td>(52)</td>
<td>2,620</td>
<td></td>
</tr>
<tr>
<td>Gross estimated ultimate incurred claims</td>
<td>2,780</td>
<td>5,961</td>
<td>981</td>
<td>408</td>
<td>269</td>
<td>10,399</td>
<td></td>
</tr>
<tr>
<td>Claims handling expenses (CHE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paid to date</td>
<td>236</td>
<td>246</td>
<td>64</td>
<td>19</td>
<td>44</td>
<td>611</td>
<td></td>
</tr>
<tr>
<td>Estimated future</td>
<td>139</td>
<td>181</td>
<td>73</td>
<td>89</td>
<td>54</td>
<td>456</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>375</td>
<td>437</td>
<td>137</td>
<td>108</td>
<td>98</td>
<td>1,157</td>
<td></td>
</tr>
<tr>
<td>Gross ultimate incurred claims including CHE</td>
<td>3,157</td>
<td>6,398</td>
<td>1,118</td>
<td>517</td>
<td>367</td>
<td>11,556</td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td>(1,635)</td>
<td>(2,477)</td>
<td>(122)</td>
<td>-</td>
<td>-</td>
<td>(4,239)</td>
<td></td>
</tr>
<tr>
<td>Net ultimate incurred claims including CHE</td>
<td>1,522</td>
<td>3,921</td>
<td>996</td>
<td>517</td>
<td>367</td>
<td>7,318</td>
<td></td>
</tr>
<tr>
<td>30 June 2012 comparatives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross ult incurred claims including CHE</td>
<td>3,455</td>
<td>6,487</td>
<td>1,371</td>
<td>517</td>
<td>375</td>
<td>12,205</td>
<td></td>
</tr>
<tr>
<td>Net ult incurred claims including CHE</td>
<td>1,556</td>
<td>4,010</td>
<td>1,074</td>
<td>517</td>
<td>375</td>
<td>7,532</td>
<td></td>
</tr>
</tbody>
</table>

*Includes Fletcher PMO direct costs of repair (excludes 3.5% margin and infrastructure costs - included in CHE)
8.4 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 75% 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.

The risk margins are shown by event and so do not add across horizontally due to modelling and diversification effects.
<table>
<thead>
<tr>
<th>All EOC claims</th>
<th>Estimated outstanding claims liabilities (OCSL) - 31 December 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross outstanding claims liabilities - central estimate</td>
<td></td>
</tr>
<tr>
<td>Gross claims excluding CPE, undiscounted</td>
<td>1,774</td>
</tr>
<tr>
<td>Gross claims including CPE, undiscounted</td>
<td>1,413</td>
</tr>
<tr>
<td>Non-reinsurable CPE, undiscounted</td>
<td>73</td>
</tr>
<tr>
<td>Discounting</td>
<td>1,396</td>
</tr>
<tr>
<td>Reinsurance recoveries - central estimate</td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>1,344</td>
</tr>
<tr>
<td>Discounting</td>
<td>(61)</td>
</tr>
<tr>
<td>Net outstanding claims liabilities - central estimate</td>
<td></td>
</tr>
<tr>
<td>Net claims excluding CPE, undiscounted</td>
<td>1,7</td>
</tr>
<tr>
<td>Net claims including CPE, undiscounted</td>
<td>1,344</td>
</tr>
<tr>
<td>Non-reinsurable CPE, undiscounted</td>
<td>73</td>
</tr>
<tr>
<td>Discounting</td>
<td>(61)</td>
</tr>
<tr>
<td>Net claims excluding CPE, undiscounted</td>
<td>1,7</td>
</tr>
<tr>
<td>Net claims including CPE, undiscounted</td>
<td>1,344</td>
</tr>
<tr>
<td>Non-reinsurable CPE, undiscounted</td>
<td>73</td>
</tr>
<tr>
<td>Discounting</td>
<td>(61)</td>
</tr>
<tr>
<td>Net claims excluding CPE, undiscounted</td>
<td>1,7</td>
</tr>
<tr>
<td>Net claims including CPE, undiscounted</td>
<td>1,344</td>
</tr>
<tr>
<td>Non-reinsurable CPE, undiscounted</td>
<td>73</td>
</tr>
<tr>
<td>Discounting</td>
<td>(61)</td>
</tr>
</tbody>
</table>

**Insurance Liability Valuation as at 31 December 2012**

Released under the Official Information Act 1982
8.5 Distribution – estimated ultimate claim costs

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

The area underneath the curve between two points on the horizontal axis is an indication of the probability of its occurrence.

The green distribution is on a gross of reinsurance basis. The blue 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 be shifted to the left and exhibit a similar shape to the curves above.

8.6 Material implications of the results

There has been a decrease in the estimated ultimate incurred gross claims costs of $649m. The change is primarily a result of the reduced estimate of land liability.

8.7 Key changes from results as at 30 June 2012

The table below provides a comparison of the current valuation results against the results from the 30 June 2012 valuation.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross claims paid and CHIE, undiscounted</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
</tr>
<tr>
<td>Gross claims paid and CHIE, discounted</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
</tr>
<tr>
<td>Net of tax claims paid and CHIE, undiscounted</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
<td>3,703</td>
<td>3,703</td>
<td>3,103</td>
<td>3,403</td>
</tr>
<tr>
<td>Net of tax claims paid and CHIE, discounted</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
<td>3,375</td>
<td>3,375</td>
<td>2,933</td>
<td>3,125</td>
</tr>
</tbody>
</table>

**Insurance Liability Valuation as at 31 December 2012**

Earthquake Commission

Released under the Official Information Act 1982
THE TABLE BELOW ILLUSTRATES THE CHANGE IN ESTIMATED ULTIMATE INCOME LIMITS FROM 30 JUNE 2011 TO 31 DECEMBER 2011.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$1,491,560</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$1,576,560</td>
<td>$85,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS

The estimate of uncertainty in the estimated ultimate income level is expressed in the form of a 99.5% confidence interval, which represents the range of possible values for the true value of the income limit. The uncertainty is based on the variability in the underlying data and the assumptions used in the estimation process.

The estimated income limits for the 30 June 2011 valuation of $1,491,560 were based on the most recent available data and assumptions. The estimated income limits for the 31 December 2011 valuation of $1,576,560 were based on the updated data and assumptions for the period ending 31 December 2011.

The uncertainty in the estimated income limits is due to the inherent variability in the underlying data and the assumptions used in the estimation process. The estimated income limits are subject to change as new data becomes available and as the assumptions are revised.

INCOME LIMITS - LAND LIABILITY MOVEMENT

The estimated ultimate income limits for land liability movement are shown in Table 6.1. The estimated income limits for land liability movement are based on the assumption that the land liability will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$549,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$592,000</td>
<td>$43,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING CLOSING COSTS

The estimated ultimate income limits for building closing costs are shown in Table 6.2. The estimated income limits for building closing costs are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$150,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$165,000</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING EXCESS COSTS

The estimated ultimate income limits for building excess costs are shown in Table 6.3. The estimated income limits for building excess costs are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$120,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$135,000</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING DEFECT COSTS

The estimated ultimate income limits for building defect costs are shown in Table 6.4. The estimated income limits for building defect costs are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$90,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$105,000</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING CLOSING COSTS - DEFECT COSTS

The estimated ultimate income limits for building closing costs with defects are shown in Table 6.5. The estimated income limits for building closing costs with defects are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$210,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$235,000</td>
<td>$25,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING CLOSING COSTS - DEFECT COSTS - BUILDING DEFECT COSTS

The estimated ultimate income limits for building closing costs with defects and defect costs are shown in Table 6.6. The estimated income limits for building closing costs with defects and defect costs are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$330,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$365,000</td>
<td>$35,000</td>
</tr>
</tbody>
</table>

INCOME LIMITS - BUILDING CLOSING COSTS - DEFECT COSTS - BUILDING DEFECT COSTS - BUILDING DEFECT COSTS

The estimated ultimate income limits for building closing costs with defects, defect costs, and building defect costs are shown in Table 6.7. The estimated income limits for building closing costs with defects, defect costs, and building defect costs are based on the assumption that the building will be paid in full and on the date specified in the valuation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Estimated Ultimate Income Limits</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2011</td>
<td>$450,000</td>
<td></td>
</tr>
<tr>
<td>31 December 2011</td>
<td>$495,000</td>
<td>$45,000</td>
</tr>
</tbody>
</table>
$166.2m. The estimated ultimate incurred land liability has increased from changes in excess and nil claim recoveries. This increase is primarily driven from a lower overall estimated ultimate liability.

The chart below illustrates the movement by component.
8.7.2 Land cost comparison: 31 December 2012 vs 30 June 2012

The chart below shows the variability in ultimate land claims liabilities and illustrates the impact of the new land valuation model. The numbers shown correspond to the central estimates.

The chart shows that:

- The central estimates for land costs have significantly reduced, especially for EQ1 and EQ3.
- The new model's simulations all fall within a considerably narrower range compared to the previous model. The consequence of this is to reduce the overall variability of results (as illustrated in Section 1.10.3) thereby also reducing EQC's 75% risk margin.
The following table provides a reconciliation and explanation of the movement in outstanding claims liabilities, by event.
The net OSCL (75% probability of adequacy, discounted) has decreased from $4.882b at 30 June 2012 to $4.110b at 31 December 2012.

The principal drivers of the change in total claims liabilities in decreasing order of impact are:
- Risk margin; this has decreased from $610m to $321m.
- Claim payments; net payments since 30 June 2012 have amounted to $323m. Gross
  claim payments have totalled $823m over the same period.
- Actuarial determination; this has been reduced by $166m on a net of reinsurance basis.

### 8.9 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

<table>
<thead>
<tr>
<th>Outstanding claims liability (including CHE) - estimated amortisation</th>
<th>31 Dec 12</th>
<th>30 Jun 13</th>
<th>31 Dec 13</th>
<th>30 Jun 14</th>
<th>31 Dec 14</th>
<th>30 Jun 15</th>
<th>31 Dec 15</th>
<th>30 Jun 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross OSCL amortisation, discounted</td>
<td>6,595</td>
<td>6,046</td>
<td>3,744</td>
<td>2,897</td>
<td>1,835</td>
<td>1,147</td>
<td>657</td>
<td>198</td>
</tr>
<tr>
<td>Reinsurance asset amortisation, discounted</td>
<td>2,606</td>
<td>2,434</td>
<td>953</td>
<td>684</td>
<td>504</td>
<td>341</td>
<td>205</td>
<td>70</td>
</tr>
<tr>
<td>Net OSCL amortisation, discounted</td>
<td>3,689</td>
<td>3,612</td>
<td>2,841</td>
<td>2,013</td>
<td>1,331</td>
<td>807</td>
<td>452</td>
<td>128</td>
</tr>
<tr>
<td>Risk margin (75% PaA)</td>
<td>321</td>
<td>314</td>
<td>167</td>
<td>104</td>
<td>53</td>
<td>29</td>
<td>22</td>
<td>8</td>
</tr>
</tbody>
</table>

#### All EQC claims

| Undiscounted cashflows - central estimate |
|---|---|---|---|---|---|---|---|---|---|
| From | 1 Jan 13 | 1 Jan 14 | 1 Jul 14 | 1 Jan 15 | 1 Jul 15 | 1 Jan 16 | 1 Jul 16 | 31 Dec 16 |
| To | 30 Jun 13 | 30 Jun 14 | 31 Dec 14 | 30 Jun 15 | 31 Dec 15 | 30 Jun 16 | 31 Dec 16 |
| Gross OSCL payments including CHE ($m) | | | | | | | | |
| EQ1 | 129 | 486 | 225 | 185 | 147 | 105 | 96 | 41 | 1,413 |
| EQ2 | 262 | 1,337 | 600 | 495 | 401 | 281 | 269 | 114 | 3,789 |
| EQ3 | 132 | 309 | 152 | 113 | 80 | 57 | 52 | 23 | 878 |
| EQ4 | 60 | 154 | 76 | 63 | 48 | 36 | 29 | 13 | 479 |
| AS | 25 | 77 | 33 | 35 | 33 | 24 | 20 | 9 | 256 |
| BAU PP | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| BAU | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| Total | 626 | 2,362 | 1,067 | 891 | 709 | 503 | 466 | 200 | 6,844 |
| Reinsurance recovery payments ($m) | | | | | | | | | |
| EQ1 | 112 | 485 | 225 | 185 | 147 | 105 | 96 | 41 | 1,396 |
| EQ2 | 262 | 1,098 | 3 | 0 | 0 | 0 | 0 | 0 | 1,371 |
| EQ3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 122 |
| Total | 404 | 1,553 | 228 | 188 | 169 | 139 | 137 | 71 | 2,899 |

The reinsurance cash flows for EQ2 cease after 2013 as the gross cash flows are forecast to exceed the upper reinsurance at this point.
8.10 Sensitivity and scenario testing

The table below illustrates the impact on expected ultimate incurred and outstanding claims liabilities of varying key assumptions.

<table>
<thead>
<tr>
<th>Base assumptions</th>
<th>Est ultimate incurred, gross undiscounted including CHE (excluding BAU)</th>
<th>Est outstanding, net, discounted including CHE (including BAU)</th>
<th>Difference: Est outstanding, net, discounted including CHE (including BAU)</th>
<th>Difference: Est outstanding, net, discounted including CHE (including BAU)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central Estimate $m</td>
<td>75% PoA $m</td>
<td>Base $m</td>
<td>75% PoA - Base $m</td>
</tr>
<tr>
<td>Base assumptions</td>
<td>11,556</td>
<td>4,110</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Sensitivity Analysis - Changing a single assumption

<table>
<thead>
<tr>
<th>Factor</th>
<th>Base assumption</th>
<th>+1%pa</th>
<th>-1%pa</th>
<th>Central Estimate</th>
<th>75% PoA</th>
<th>Base</th>
<th>75% PoA - Base</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount Rate</td>
<td>11,556</td>
<td>4,045</td>
<td>(65)</td>
<td>(1.6%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Inflation Rate</td>
<td>11,497</td>
<td>4,054</td>
<td>(56)</td>
<td>(1.4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Surge: Probability of Surge Event</td>
<td>11,596</td>
<td>4,125</td>
<td>15</td>
<td>0.4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional Foundation Requirements: TC2 &amp; TC3</td>
<td>11,611</td>
<td>4,143</td>
<td>33</td>
<td>0.8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk margin as % of central estimate net OS</td>
<td>11,556</td>
<td>4,148</td>
<td>36</td>
<td>0.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future claims handling expense ratio</td>
<td>11,518</td>
<td>4,149</td>
<td>39</td>
<td>0.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average term to settlement</td>
<td>11,532</td>
<td>4,129</td>
<td>19</td>
<td>0.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.11 Quality control processes

The valuation was subject to internal peer review. In addition, all results were compared to those of the previous valuation.
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 31 December 2012. The focus is therefore on claims incurred as a result of events after the 31 December 2012 valuation date, i.e. future claims. This is in contrast to the OS claims liabilities, which relate to claims incurred up to 31 December 2012, 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.

**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.

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

9.4.1 Diagrammatic illustration of the valuation methodology

Notation (for the following diagram):

- **Policies in force**<sub>BAU / Cent EQ / MINERVA</sub>: Proportion of current unexpired policies still in force when a future event occurs (decreases uniformly over the year).
- **Sub-claims<sub>BAU / Cent EQ</sub>**: Predicted number of sub-claims (depends on event severity).
- **R<sub>BAU / Cent EQ</sub>**: 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<sub>BAU / Cent EQ</sub>**: Assumed claims cost escalation (inflation)
- **Estimated Event Cost**: Output from the Minerva Model which simulates the cost of future events (depends on event severity).
9.5 Changes in methodology

The valuation methodology used is the same as that used for 30 June 2012 and prior valuations.

9.6 Cost of future claims

9.6.1 BAU

The BAU model structure is an aggregate Bayesian 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.
Released under the Official Information Act 1982

- 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 net 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 Bayesian stochastic frequency / severity model:
- The number of events to occur over the year (to 30 June 2013) 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.
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 31 December 2012.

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 31 December 2012. 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, it was decided to base the assumptions on those used for the 30 June 2012 valuation. The principal exception to this is the Canterbury earthquakes component which was updated for the latest forecasts in early January 2013.

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 2013 calendar 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.

<table>
<thead>
<tr>
<th>Profile</th>
<th>Main</th>
<th>Std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>-B-</td>
<td>1,976</td>
<td>1,737</td>
</tr>
<tr>
<td>-BC</td>
<td>297</td>
<td>621</td>
</tr>
<tr>
<td>-C</td>
<td>189</td>
<td>247</td>
</tr>
<tr>
<td>L-C</td>
<td>804</td>
<td>229</td>
</tr>
<tr>
<td>LB-C</td>
<td>565</td>
<td>136</td>
</tr>
<tr>
<td>LBC</td>
<td>66</td>
<td>24</td>
</tr>
<tr>
<td>L-C</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

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 8% of the estimated ultimate gross cost of claims.
- The current reinsurance deductible is then applied.
10.3.3 Canterbury Earthquakes

The probability of certain size events was taken from the GeoNet website (geonet.org.nz/Canterbury-quaKes/aftershocks). 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: 31 December 2013 - 31 December 2014

<table>
<thead>
<tr>
<th>Magnitude upper</th>
<th>Magnitude midpoint</th>
<th>Expected damage (yr)</th>
<th>Expected max events</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>5.5</td>
<td>5.25</td>
<td>1.1</td>
</tr>
<tr>
<td>5.5</td>
<td>6.0</td>
<td>5.75</td>
<td>0.32</td>
</tr>
<tr>
<td>6.0</td>
<td>6.5</td>
<td>6.25</td>
<td>0.09</td>
</tr>
<tr>
<td>6.5</td>
<td>7.0</td>
<td>6.75</td>
<td>0.024</td>
</tr>
<tr>
<td>7.0</td>
<td>8.0</td>
<td>7.50</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Source: Geonet.org.nz/canterbury-quaKes/aftershocks

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

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>Land</th>
<th>Building</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Std Dev</td>
<td>Mean Std Dev</td>
<td>Mean Std Dev</td>
</tr>
<tr>
<td>6.25</td>
<td>1,003 2679</td>
<td>8,398 22,666</td>
<td>125 396</td>
</tr>
<tr>
<td>6.75</td>
<td>5,909 12,056</td>
<td>25,905 70,206</td>
<td>742 1,962</td>
</tr>
<tr>
<td>6.25</td>
<td>12,230 32,969</td>
<td>84,247 223,147</td>
<td>4,067 10,773</td>
</tr>
<tr>
<td>6.75</td>
<td>25,000 66,578</td>
<td>120,000 317,848</td>
<td>50,000 132,437</td>
</tr>
<tr>
<td>7.0</td>
<td>25,000 66,578</td>
<td>120,000 317,848</td>
<td>55,000 145,880</td>
</tr>
</tbody>
</table>

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.
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.

Claims handling costs were assumed to be 8% 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.

The expense figures were derived from those used for the 31 December 2012 ILVR based on a process consistent with that set out in Appendix F.

The other figures were either derived from the accounts as at 31 December 2012 or from the budget for the 2012/13 financial year.
## 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 31 December 2012. These rates are set out in Appendix J.
11 Premium Liabilities – Valuation Results

11.1 Results

<table>
<thead>
<tr>
<th>Estimated Premium Liabilities - 31 December 2012</th>
<th>BAU $m</th>
<th>微创 $m</th>
<th>Cant. EQ $m</th>
<th>Total $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unearned premium reserve</td>
<td></td>
<td></td>
<td></td>
<td>139</td>
</tr>
<tr>
<td>Cost of future claims from unexpired risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross claims, undiscounted - central estimate</td>
<td>23</td>
<td>41</td>
<td>96</td>
<td>160</td>
</tr>
<tr>
<td>Administration and reinsurance costs for unexpired risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims administration expenses</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Policy (non-claims) admin expenses for unexpired risks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Future reinsurance costs for unexpired risks</td>
<td>0</td>
<td>30</td>
<td>41</td>
<td>71</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>0</td>
<td>(9)</td>
<td>(12)</td>
<td>(21)</td>
</tr>
<tr>
<td>Net premium liabilities, undiscounted - central estimate</td>
<td>28</td>
<td>65</td>
<td>132</td>
<td>225</td>
</tr>
<tr>
<td>Discounting</td>
<td>(0)</td>
<td>(1)</td>
<td>(3)</td>
<td>(5)</td>
</tr>
<tr>
<td>Net premium liabilities, discounted - central estimate</td>
<td>28</td>
<td>64</td>
<td>129</td>
<td>221</td>
</tr>
<tr>
<td>Diversified risk margin, discounted - 75% PoA</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Net premium liabilities, discounted - 75% PoA</td>
<td></td>
<td></td>
<td></td>
<td>221</td>
</tr>
</tbody>
</table>

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 zero 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 30 June 2012

The net discounted premium liabilities at the 75th probability of adequacy have decreased from $239m as at 30 June 2012 to $221m as at 31 December 2012. One reason for the decrease is the lower likelihood of future Canterbury earthquake events as per the Geonet website, which in turn reduces the component allowing for such events in our model.

11.4 Quality control processes

The valuation was subject to internal peer review and the results were compared to those from previous ILVRs as at 30 June 2012 and 31 December 2011.
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 30 June 2012 premium liabilities calculations. This is because there is no way of identifying incurred claims costs arising from unexpired risks as at 30 June 2012. 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 30 June 2012.

The undiscounted net central estimate cost of future claims as at 30 June 2012 was $245m.
Earthquake Commission
1 March 2013

Insurance Liability Valuation
as at 31 December 2012

Appendices

MELVILLE JESSUP WEAVER
Towers Watson Alliance Partner