Earthquake Commission
2 August 2017

Insurance Liability Valuation
as at 30 June 2017

Final Report

MJW

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Contents

Appendices

1   Executive Summary

1.1   Valuation results

1.1.1   Canterbury earthquake claims

The gross estimated ultimate claims costs from the Canterbury earthquake events are $10,733 million.   This is a reduction of $448 million since 31 December 2016.

Canterbury earthquakes only
Ultimate claims costs, central estimate, undiscounted, including CHE - 30 June 2017 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Claims paid to date (excl. CHE)*	2,445	5,322	430	117	191	8,505
Estimated future (excl. CHE)	210	433	38	7	12	700
Gross estimated ultimate incurred claims	2,655	5,755	467	124	203	9,205
Claims handling expenses (CHE)						
Paid to date	466	806	113	38	49	1,473
Estimated future	14	29	11	1	1	56
Total	480	835	124	39	50	1,529
Gross ultimate incurred claims including CHE	3,134	6,591	591	164	253	10,733
31 December 2016 comparatives						
Gross ult incurred claims including CHE	3,290	6,800	675	165	251	11,181

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

For a description of the EQ1 – EQ4 and AS events, please refer Section 2.9.1.

The majority of Canterbury earthquake claims have been resolved. There is however, considerable uncertainty in regard to those which are yet to be resolved.

1.1.2   *Kaikoura earthquake claims*

The gross estimated ultimate claims costs from the Kaikoura earthquake event are $544 million. This has reduced from our previous estimate primarily as a result of the change to the estimated ultimate CHE. It should be stressed how uncertain the estimate of ultimate claims costs is and that it will change as new information develops.

For purposes of this valuation, the Kaikoura earthquake event does not include the storm damage that occurred on 15 November 2016. The 15 November 2016 storm is included in the BAU provision.

Kaikoura earthquake only
Estimated ultimate claims costs (undiscounted) - 30 Jun 2017

	KEQ $m
Claims costs paid to date	
Land	3
Building	84
Contents	0
CHE	24
Total	112
Estimated future	
Land	7
Building	359
Contents	23
CHE	43
Total	432
Gross ultimate incurred claims cost - central estimate	
Land	11
Building	443
Contents	23
CHE	67
Total	544
31 December 2016 comparative	
Gross ult inc claims cost - cent est	563

1.1.3   All EQC claims

The table below shows the gross ultimate claims costs (Canterbury earthquakes and Kaikoura earthquake) and how the net outstanding claims liabilities (all EQC claims) are derived.

All EQC claims
Gross ultimate claims costs to net outstanding claims liabilities - 30 June 2017 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	KEQ $m	Total $m
Gross ultimate claims excl CHE, undisc - central est	2,655	5,755	467	124	203		477	9,682
Claims handling expenses (CHE)	480	835	124	39	50		67	1,596
Gross ult claims incl CHE, undisc - central est	3,134	6,591	591	164	253	n.a.	544	11,278
Reinsurance recoveries, undiscounted - central estimate	(1,602)	(2,478)	0	(0)	0	-	0	(4,080)
Net ult inc claims incl CHE, undisc - central est	1,532	4,113	591	164	253	n.a.	544	7,198
Net claims costs paid to date	(1,062)	(2,844)	(430)	(117)	(191)		(88)	(4,732)
CHE paid to date	(466)	(806)	(113)	(38)	(49)		(24)	(1,497)
Discounting	(0)	(6)	(1)	(0)	(0)	(1)	(6)	(14)
Net OS including CHE, disc - central est	5	456	48	8	13	41	426	996
Net risk margin, diversified, 85% PoA	3	255	27	5	7	25	96	416
Net OS including CHE, disc - 85% PoA	7	710	74	13	19	65	522	1,412

The table above shows the Kaikoura event ('KEQ') with a gross ultimate claims costs of $544 million. Payments to date are $112 million (including $88 million claims costs).

The diversified risk margin (85% PoA) is $416 million. This has increased significantly since the previous valuation, due to the treatment of land litigation with respect to the central estimate. Refer Section 8.2.2 for details.

1.2   Current insurance activities

1.2.1   Canterbury earthquake building claims

EQC has been managing its pool of reopened claims. These are generally likely to be more complicated than average and therefore take longer than average to settle.

1.2.2   Canterbury earthquake land clams

EQC is continuing to settle its land claims. In respect of Green Zone properties, there are some 1,200 properties to settle.

EQC has made an interim settlement payment to LINZ for Red Zone properties. A final settlement will be made after 30 June 2017.

The land litigation cases from insurers are ongoing. 9(2)(h)

1.2.3   Memorandum of Understanding with Southern Response

A Memorandum of Understanding has been signed with Southern Response ('SRES'). EQC and Southern Response have agreed to share resources in an effort to more quickly settle customers' residential building claims arising out of the Canterbury Earthquake Sequence in applicable cases.

The two organisations apply agreed processes to assess which of them is best placed to manage open EQC residential building claims made by SRES Customers. SRES may accordingly manage some EQC claims on EQC's behalf.

SRES would act as EQC's agent in these applicable cases, completing the assessment and settling the EQC claim in accordance with the EQC Act, along with any entitlements the customer may have under their insurance policy.

1.2.4   *Kaikoura earthquake event*

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016.

EQC has appointed participating insurers as EQC's agents for carrying out some of its functions for certain claims related to the Kaikoura earthquake.

EQC has been working with insurers to establish more automated data transfer between the parties. Almost all claims have been lodged with EQC (via the insurers) and some reserving information has been provided although not yet with enough robustness to inform the valuation other than at a high level.

1.2.5   *Other claims*

There have been several natural disaster events over the past year, other than the Kaikoura earthquake. These have primarily related to weather events. Section 7 details the breakdown of the major events.

1.3   Canterbury earthquakes

1.3.1   *Developments since prior valuation*

Since the previous valuation, there have been developments in respect of land settlements, land litigation, and reopened building provisions.

Below is a brief note on these developments and what has been done as a consequence.

Land: payments and legal challenge

In respect of Green Zone properties, some properties have been affected by the lodgement of court proceedings by insurers in respect of land settlements. EQC had intended to complete settlement of all properties by 30 June 2017 although there is a residual number to complete.

For Red Zone properties, a partial payment was made to LINZ in April 2017. This will be fully settled after 30 June 2017.

In respect of estimating a provision, we have retained our approach from the previous valuation and have explicit provisions for;

- land costs assuming the properties are settled according to EQC policy, and
- litigation risk.

These developments have resulted in a reduction of the estimated ultimate land claims costs of $550 million since December 2016. Section 1.3.4 has more detail on this.

Legal challenge - individual

There are a number of legal challenges in respect of individual properties. These involve building and land settlements. As at the previous valuation we had assumed that there would be 400 cases in total and that there will be costs associated with legal advice, engineering and other professional advice and potentially in respect of claims settlement.

There has been some development in assessing the components of this provision and the estimate has been revised accordingly.

The external legal costs have been incorporated in the additional CHE costs, see below.

We would highlight the difficulties in estimating the number of legal cases which may arise in the future, especially due to the nature of some of the issues.

We would also note that we have not included any explicit allowance for any possibility of legal liability outside of the EQC Act.

Building financial close - insurers

9(2)(j)

Building reopened claims

The valuation as at 31 December 2016 included reopened provisions for a variety of outstanding claims issues. These reopened provisions fall into one of the following categories.

- Remedial work carried out as a result of the EQR programme. This can be further broken down into:
    - CEDAR. Properties that require remediation as a result of the CEDAR review.
    - General remediation. Other properties.
- Drainage claims.
- Reopened Opt-out /Cash settled claims. Challenges on previously cash settled amounts as to their adequacy.
- Individual legal challenges – mentioned above
- Financial close – insurers – mentioned above.
- Unreported remedial and secondary repair issues. In addition to the identified issues above, it is expected there will be further reported remedial and secondary repair work to undertake.

We have updated these provisions as experience has emerged. The table below summarises the provisions held in respect of the various categories as at 31 December 2016 and those held for this valuation.

	30 June 17 $m	31 Dec 16 $m
CEDAR	74	
Remedials	51	
Drainage	15	
Complaints / Disputes	37	
Individual litigation	9(2)(j)	
Financial close - insurer		
Unreported		
Total	447	485

Further detail on these provisions is provided in Section 1.3.3.

Canterbury CHE

Based on a greater understanding of the complexity and the forecast time required to complete all outstanding claims and finalise all completion activities, it has been recognised that there will be further pressure on claims handling expenses and as a result, there has been an increase in the estimated ultimate CHE of $28 million.

1.3.2   Key areas of judgement

In undertaking the valuation there are some areas of judgement required that materially affect the results.   These are briefly discussed below.

Canterbury building claims

In respect of building claims, a key area of judgement in the provision is understanding how claims are being reopened, the expected quantum per claim and how systemic this might be.

Another area of judgement is estimating the provision for Financial close as there has been limited communication and little clarification for the rationale for challenge rationale from the insurers.

Canterbury land claims

9(2)(h)

1.3.3   Canterbury building claims – key assumptions

Remedial – CEDAR

Remedial – CEDAR refers to properties with issues relating to the sub floor area.   As at the valuation date, there are 9(2)(j) properties in this group.   They have been triaged by EQC staff into the following groups:

9(2)(j)

9(2)(j)

These estimates are based on reported issues in respect of each property and don't allow for any issues which have not yet been raised.   Also, given the history of estimated undercap properties going overcap, it is anticipated that some cost escalation will occur.

9(2)(j)

The table below summarises the calculation for CEDAR remediation and also shows the calculation from the previous valuation.

	30 June 2017			31 December 2016		
	Number	Avg Cost ($000s)	Total cost ($000s)	Number	Avg Cost ($000s)	Total cost ($000s)
9(2)(j)						
Total	9(2)(j)		73,630	9(2)(j)		

Remedial - general

In addition to the above there are a number of non-CEDAR related properties requiring remediation work.   EQC have indicated that there are some 9(2)(j) properties in this category.   We have been advised by EQC that approximately 9(2)(j) of these are expected to cost on average 9(2)(j) with the remainder expected to cost 9(2)(j) each.

Therefore, the total provision for this category is $51 million.   This compares with previous provision of 9(2)(j).

Analysis carried out by EQC operations suggests that recently settled properties are settling in line with assumptions.

Drainage claims

There are around 9(2)(j) remaining drainage claims.   150 of these have been notified in 2017.   EQC will be accepting drainage claims throughout 2017, albeit with the burden of proof on the claimant. We have assumed that there will be a further 250 drainage claims to the end of 2017 – assuming they are notifying uniformly over the year

The costs to date have averaged 9(2)(j) although it has been recently observed that the drainage issues are becoming more complex.   It was suggested by EQC operations that an average cost of 9(2)(j) may be prudent.

Consequently, we have allowed a total provision of $15 million (9(2)(j) drainage claims at 9(2)(j) each).

Reopened Opt-out /Cash settled claims

As at the valuation date there were around 9(2)(j) complaints / cash settlement challenges.   These are predominantly 'Opt out' and cash settled claims.

We had previously assumed these claims may cost on average, 9(2)(j) each.   However, we note that the JART report includes claim categories for 'confirmed overcap' and 'potential overcap'.   Clearly the remaining claims are more difficult to resolve than we may have originally thought.

We have therefore increased our provision to allow an average settlement cost of 9(2)(j) with the total provision being $37 million.

Individual legal challenges

9(2)(h)

Financial close – insurers

9(2)(j)

9(2)(j)

Unreported remedial and secondary repair issues

As at the previous valuation, we had a provision for unreported remedial and secondary repair issues. It was based on some general industry assumptions about failure rates in the building industry.

We have seen evidence of cost pressure on the building claims costs. Since the previous valuation, there have been claim payments of $88 million. In addition to this, we have increased building provisions (other than the unreported provision) by $10 million. The unreported provision has been reduced as these costs have been realised. However, given the cost pressures, we have only reduced the provision by $33 million.

At some point, EQC will wind down the Canterbury earthquake response and roll any remaining issues into the normal operational activities. This is unlikely to occur until after reinsurance involvement is complete which will be dependent on satisfactory resolution of the Financial close – insurers issue and also the land litigation.

We have assumed that these issues will be resolved by the end of 2018.

In respect of the unreported remedial and secondary repair issues, we have determined that a pragmatic approach to managing this provision is to reduce the provision evenly until the end of 2018. This approach will be reviewed as experience emerges.

Summary of Canterbury building claim provisions

	30 June 2017			31 December 2016		
	Number	Avg Cost ($000s)	Total cost ($000s)	Number	Avg Cost ($000s)	Total cost ($000s)
CEDAR	9(2)(j)		73,630	9(2)(j)		
Remedials			51,230			
Drainage			15,180			
Opt-out/Cash disputes			37,150			
Individual litigation						
Financial close - insurer						
Unreported						
Total	9(2)(j)		446,940	9(2)(j)		485,000

1.3.4   Canterbury land claims – key assumptions

As at 31 December 2016 the most material components of the land valuation model related to the settlement of IFV and ILV affected properties.

The valuation model was most robust for Green Zone land, where detailed inspections and valuations had been carried out for most properties. Properties in the Red Zone required a greater degree of judgement.

Experience over the past six months has demonstrated that our modelling has been prudent, especially so for Red Zone properties.

The estimated ultimate land claims costs as at 30 June 2017 is $715 million. This is a reduction of $550 million from the previous valuation ($1,265 million). The reduction can be broken down into the following components:

9(2)(h)

IFV Red Zone

The estimation of IFV DoV rates as at 31 December 2016 relied on the Exacerbated Flooding Coverage ('EFC') as a guide. However, the EFC information for the Red Zone was not complete. As a consequence, we assumed a prudent DoV rate for all IFV affected properties. The DoV rates for all Red Zone properties have now been determined and are lower than that which were assumed.

This has resulted in a reduction if the estimated ultimate claims costs.

The estimated residual LINZ settlement amount uses this lower IFV DoV rate.

ILV Red Zone

At 31 December 2016, all cleared site ILV affected properties were modelled as receiving repair cost. This included all Red Zone properties.

9(2)(j)

At the time of running the previous valuation, we had DoV rates for in-situ properties only. We now have ILV DoV rates for cleared sites and also have repair / rebuild information for all Red Zone properties.

9(2)(j)

The use of cleared site and in-situ DoV rates, rather than just in-situ DoV rates has resulted in a reduction in the estimated ultimate claims costs.

The estimated residual LINZ settlement amount uses in-situ and cleared site rates according to the state of the property as informed by LINZ.

9(2)(j)

Green Zone

Green Zone properties were modelled as receiving repair cost (if cleared site) or DoV (if in-situ).

Actual settlements have been almost wholly DoV based. As these payments are significantly lower than a repair cost payment, there has been a reduction in the estimated ultimate claims costs.

Silt & Port Hills

We have removed our remaining provision for silt removal, on the grounds that there does not appear to have been any claims against this category for some time.

In respect of Port Hills, the closure of almost all of the remaining claims has led to a release of prudential reserves that were held.

Litigation risk

9(2)(j)

1.3.5   Estimated ultimate claims costs – movement since 31 December 2016 - Canterbury only

The estimated ultimate gross claims cost for Canterbury earthquake events has moved from $11.181b as at 31 December 2016 to $10.733b as at 30 June 2017.   Shown below is a graphical representation of the change in estimated ultimate incurred liabilities.
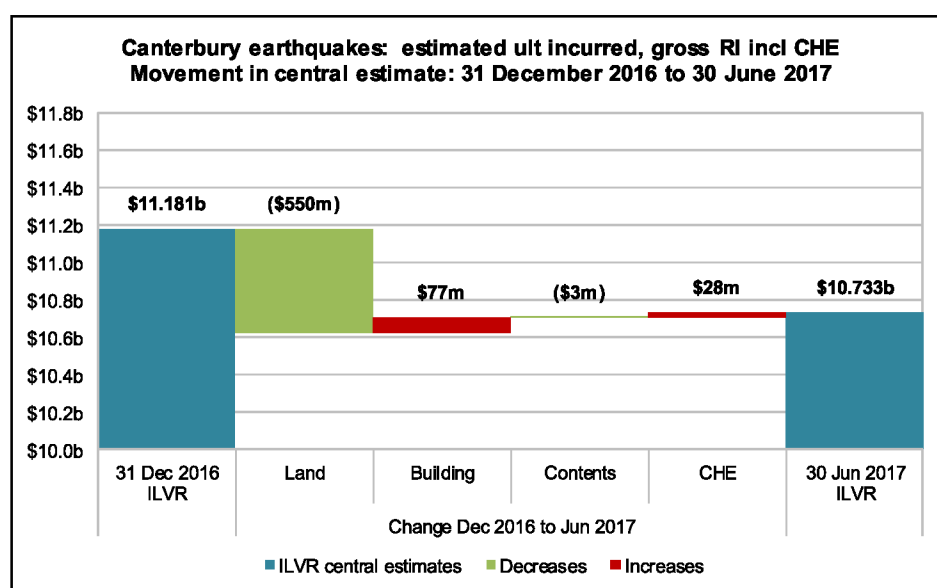
1.4 Kaikoura earthquake

Development

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016.

Memorandum of Understanding

In order to facilitate the more efficient management of claims, a Memorandum of Understanding (MoU) has been signed between EQC and eight insurers. In summary, almost all building and contents claims will be managed by the relevant insurer on behalf of EQC, who will then invoice EQC for their share of claims costs and claims handling expenses.

Building and contents claims that will be managed by EQC include:

- Claims relating to properties where there is still an open or otherwise unresolved prior EQC claim.
- Claims where the insurer is not party to the MoU.

EQC will also be managing all land claims.

Information developments

The MoU describes, amongst other things, how the insurers:

- Lodge claims.
  - Provide reserving and assessment information.
  - Invoice EQC for claims costs and also for claims expenses.

Progress has been made on the first two of these although the reserving information appears to be based on default figures at present.

In respect of claims costs, there has been little that has been invoiced so far with total Kaikoura claims costs only $88 million as at 30 June 2017.

Given the lack of structured data that has been received to date, we have made direct contact with some actuarial teams to help calibrate our Kaikoura valuation model. More details are provided in Section 1.4.2.

1.4.1 Kaikoura claims costs - judgement

In respect of Kaikoura earthquake claims, EQC and the MoU insurers have been working on establishing lines of communication to facilitate claims settlement. Although some progress has been made, there is little substantial evidence to suggest we should change our view of the average costs per claims. We have however, changed our view of the ultimate number of claims.

1.4.2 Kaikoura claims – key assumption

As at 31 December 2016 an exposure based model was constructed to estimate the total claims costs arising from the Kaikoura earthquake event. We divided the damage zones according to the nature of the land movement and/or damage in the different areas affected. The zones are:

- The Land Damage Likely ('LDL') zones:
  - Fault rupture: LDL-F
  - Slope instability: LDL-S

- Both fault rupture and slope instability: LDL-FS
- Liquefaction: LDL-L
- The Land Damage Unlikely ('LDU') zones:
  - High shaking: LDU-H
  - Moderate shaking: LDU-M
  - Low shaking: LDU-L
- Apartments in the Wellington region: WGN-A

Number of claims

We estimated that there would be approximately 36,000 exposures lodged with around 29,000 of these being in respect of building claims.

As at 30 June 2017, EQC have lodged around 47,000 exposures with around 35,500 of these being in respect of building claims. The table below illustrates this and provides some context for the difference between what was estimated and what has been experienced.

Claim notifications by zone

	Expected			Actual to 30 June 2017			Actual less expected		
	Land	Building	Contents	Land	Building	Contents	Land	Building	Contents
LDL-FS	93	104	21	36	106	73	(57)	2	52
LDL-F	6	7	1	4	10	9	(2)	3	8
LDL-S	669	791	163	157	726	469	(512)	(65)	306
LDL-L	1,060	1,468	469	186	841	498	(874)	(627)	29
LDU-H	102	2,272	543	312	2,364	1,503	210	92	960
LDU-M	32	2,824	652	275	3,781	1,281	243	957	629
LDU-L	0	17,411	2,089	2,264	27,461	3,786	2,264	10,050	1,697
WGN-A	122	3,882	1,692	4	254	536	(118)	(3,628)	(1,156)
Total	2,084	28,759	5,631	3,238	35,543	8,155	1,154	6,784	2,524

The principal source of the difference in numbers of building claims related to the Land Damage Unlikely – Low Shaking zone where we estimated 17,411 building claims, whereas 27,461 have been lodged. This damage zone is effectively all of NZ except for areas likely to have experienced land damage or moderate to high shaking. It includes 7,000 claims from Christchurch and 8,000 from the greater Wellington area (excluding Apartments).

This difference in estimated numbers of claims has not resulted in a material change in the estimated total claims costs.

The other feature of note is the number of building claims lodged in respect of Wellington Apartments. The expected relates to the number of individual dwellings. Whereas, for the actual claims lodged to date, many have been lodged body corporates on behalf of entire buildings. Consequently, we consider it appropriate to retain our view of the number of Wellington apartment claims until such time as we have clarity on the number of dwellings relating to each claim.

In addition, we have received some initial information from EQC operations in respect of Multi Unit Building claims ('MuBs') that are being managed by EQC. This information is not inconsistent with an assumption that 50% of all dwellings might lodge a claim. This was the assumption used for the previous valuation and has been retained for this valuation.

Average claims costs

There have been a small number of Kaikoura claims paid with the total paid to date $88m.

There is therefore little information with which to adjust the building damage assumptions at this stage. The key building assumptions from the Kaikoura model run as at 30 June 2017 are shown below.

Components of Kaikoura building claim costs

	Number of dwellings exposed	Number of dwellings expected to claim	Expected number of non-nil dwelling claims	Mean expected cost to EQC	Mean cost per dwelling claim
Land damage likely					
fault rupture and slope instability	140	95	95	$8.2m	9(2)(i)
fault rupture	13	12	12	$0.9m	
slope instability	1,006	747	739	$40.0m	
liquefaction	2,800	1,179	1,120	$64.1m	
Land damage unlikely					
high shaking	3,179	2,294	2,065	$108.9m	
moderate shaking	18,086	3,781	3,403	$149.0m	
low shaking	n.a.	27,761	16,657	$14.2m	
Wellington apartments	8,144	4,221	2,954	$58.1m	
Total	**33,368**	**40,090**	**27,044**	**$443.4m**	

The large difference in lodged claims in the *Land damage unlikely – low shaking* zone, would fall into the $1k per claim category, or approximately an extra $10m. This would be more than offset by the 627 fewer reported claims in the *Land damage likely – liquefaction* zone, with a total impact of around $36m.

Claims handling expenses

EQC have carried out a budgeting exercise for the likely claims handling expenses arising from the Kaikoura earthquake. These expenses will be incurred internally and also as a result of the MoU.

The most recent budget prepared by EQC indicates that the ultimate CHE costs will be $67 million.

It is relatively early in the settlement of Kaikoura claims with limited information with which to estimate future costs (both claims and expenses). Consequently, there is a high degree of uncertainty in the estimate of the ultimate CHE costs.

Remedial and litigation

There is no additional provision for remedial work or litigation. Primarily this is because the exposure based model uses Building Damage Ratios which implicitly allow for each property to be 'fully' remediated.

1.5   Implications of above

In respect of Canterbury Earthquake claims only, the implications of the above are that the building provision has been strengthened slightly whilst the land provision was shown to be more than adequate and reduced.

1.6   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.

There is considerable uncertainty regarding the estimate for the Kaikoura earthquake.   Care should be taken in relying on this estimate at this stage. Refer to Section 9.3.3 for more detail.

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.

1.7   Key recommendations

1.7.1   Progress against previous recommendations

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

- In respect of settling the remaining land claims

    - Record the properties that have been sold.   *Ongoing*

    - Improve the quality of the link between properties in the land model and properties in the ADE.   *Stage 1 complete*

1.7.2   Current Recommendations

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

- In respect of settling the remaining Canterbury earthquake land claims

    - Record the properties that have been sold.

    - Improve the quality of the link between properties in the land model and properties in the ADE.

- Collect timely and accurate information in respect of the Kaikoura earthquake claims managed under the MoU.

1.8   Authors

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2   Report description

2.1   Addressee

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

2.2   Report commissioned by

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

2.3   Purpose

This report was commissioned to provide information with regards to:

- EQC's insurance liabilities and reinsurance recoveries for use in the financial statements as at 30 June 2017.
- The development of EQC's Canterbury earthquakes claims costs since 31 December 2016.
- An estimate of the claims costs arising from the Kaikoura earthquake.

2.4   Scope

2.4.1   Insurance liabilities components

The insurance liabilities include:

- Outstanding (OS) claims liabilities – which relate to the future direct and indirect claims costs and reinsurance recoveries for claims incurred up to 30 June 2017.
- Premium liabilities – which relate to the future net claims costs and administration and reinsurance expenses for future claims arising from unexpired risks as at 30 June 2017.

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

Premium liabilities are not included directly on 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 8.

2.5   Effective valuation date

The effective date of the valuation is 30 June 2017.

2.6   This report

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

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

2.7   Previous valuations

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

The most recent valuation for EQC, which is referenced in this report, is the Insurance Liability Valuation Report ('ILVR') as at 31 December 2016 (dated 21 March 2017).

2.8   Definitions of technical terms

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

2.9   Event groups

2.9.1   Canterbury earthquake claim events

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

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

- EQ1 – 4 September 2010 event – Darfield event

- EQ2 – 22 February 2011 event – Lyttelton event

- EQ3 – 13 June 2011 event (including 21 June 2011 event)* - Sumner event

- EQ4 – 23 December 2011 event

- Aftershocks ('AS') – the ten other events shown on the Business Information Unit ('BIU') Daily Report as well as 'Other Canterbury claims' included in the Daily Report totals.   The logic used to identify these claims is based on the claim's Territorial Local Authority and loss cause and is consistent with the BIU's definition It does not include claims from the 14 February 2016 event.

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

2.9.2   Kaikoura earthquake claim events

At 12:02am on 14 November 2016, an earthquake occurred near Culverden (approximately 100km north of Christchurch). This caused other faults to rupture in a domino effect, and other earthquakes occurred in a North-East direction towards Seddon. This earthquake event group has been named the Kaikoura earthquake. For the purposes of this report, it has the three-letter code KEQ.

2.9.3   *Other claim events*

Other outstanding EQC claims, including those arising from landslips, hydrothermal events, and from earthquakes outside Canterbury are categorised as 'BAU' (Business As Usual) claims. This includes the 14 February 2016 earthquake event.

2.9.4   *Components of premium liabilities*

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

- Business as Usual ('BAU') claims.
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury.
- Enhanced seismicity in respect of Canterbury earthquake claims and Kaikoura earthquake claims.

2.10   Professional standards

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

2.11   MJW staff involved in the investigation

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

- Craig Lough   Principal
- Jeremy Holmes   Principal
- 9(2)(a)
-

3   Canterbury Event Key Assumptions

	BUILDING CLAIMS as at 30 June 2017			
Assumption	Explanation	30 Jun 2017 provision	31 Dec 2016 provision	Informed by
Resolution	• Resolution of properties is now materially completed so key assumptions now relate to reopened claims, litigation and Financial Close with Insurers (see below)			• EQC data on resolved claims
Remedial - CEDAR	• 9(2)(j) claims with identified subfloor issues triaged into ▮▮▮▮▮▮ 9(2)(j) ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮	$74m	9(2)(j) ▮▮	
Remedial - general	• Non-CEDAR remediation work. Based on 9(2)(j) claims. 9(2)(j) ▮▮▮▮▮▮▮▮ 9(2)(j)	$51m	9(2)(j)	• EQC data on remedial enquiries
Drainage claims	• 9(2)(j) reported properties plus 9(2)(j) future requiring remediation to drains at average cost of 9(2)(j)	$15m		• EQC data on drainage claims
Reopened Opt-out /Cash settled claims	• Current JART report has 9(2)(j) open cash complaints. Assume average cost of 9(2)(j)	$37m		• Sense checked against EQC data (not formally reviewed)
Individual legal challenges	9(2)(h) ▮▮			

Assumption	Explanation	30 Jun 2017 provision	31 Dec 2016 provision	Informed by
				9(2)(h)
Financial Close-Insurers	9(2)(j)			

BUILDING CLAIMS as at 30 June 2017				
Assumption	**Explanation**	**30 Jun 2017 provision**	**31 Dec 2016 provision**	**Informed by**
	9(2)(j)			
Unreported remedial & secondary repair issues	• Provision of 9(2)(j) as at Dec16. Assume that provision will not be required as at Dec18 – as material issues will be resolved. Run this provision down linearly over the period. • Experience since previous valuation has demonstrated cost pressures on known claims.	9(2)(j)	9(2)(j)	• Refer Dec16 ILVR • Experience since Dec16

	LAND CLAIMS as at 30 June 2017			
Assumption	**Explanation**	**30 Jun 2017 provision**	**31 Dec 2016 provision**	**Informed by**
Land model outcome as per policy	Green Zone: estimated future settlements based on estimates of: • Cat 1-7 damage for all properties • ILV DoV payments for in situ properties, ILV repair cost for cleared sites. NB that this approach is how the costs have been modelled (with data available) and may not reflect actual settlement. • IFV DoV payments for all affected properties • Red Zone: as per Green Zone but all ILV settled by DoV	Ultimates approx 9(2)(j) for Green Zone and $136m for Red Zone	Ultimates approx 9(2)(j) for Green Zone and 9(2)(j) for Red Zone Higher than Jun 2017 because higher IFV and ILV DoV rates were used (based on what was known at the time)	• CMS extract showing which claims are open/closed T+T advice on: • lists of properties in Green/Red Zones qualifying for ILV and/or IFV damage • DoV rates as per EQC policy and calculated by T+T (where known) • IFV DoV rates where not already known are based on information supplied by T+T • Repair cost estimate based on ground improvement land trials

9(2)(h)

22

4   Kaikoura Event Key Assumptions

	KAIKOURA CLAIMS as at 30 June 2017			
Assumption	Explanation	30 Jun 2017 provision	31 Dec 2016 provision	Informed by

• Claim numbers	• Based on exposure list of all properties, subdivided by 'building damage' zones.
	• Building damage zones were based on land damage characteristics and shaking intensity:
	  ▪ Land damage likely (Fault rupture, Slope instability, Liquefaction)
	  ▪ Land damage unlikely (High, Medium and Low shaking)
	  ▪ Wellington apartments
	• Assumptions on reporting rates and non-zero claim rates were based on prior earthquakes (e.g. EQ1)
	• The increase in the numbers of claims is dominated by the low shaking zones – which are expected to have low average damage costs.
		Around 39,000 building claims	Around 29,000 building claims	T&T ground observations from GNS, previous earthquake events, initial discussions with insurers' actuaries.

• Claim severity	• Assumptions on building damage ratios (severity) were based on discussions with T+T, ground observations from GNS and general reasoning. • Preliminary discussions with insurers' actuarial teams has not added much value yet. Will discuss further prior to finalising assumptions for 30 June 2017.	9(2)(i)	9(2)(i)	T&T ground observations from GNS, previous earthquake events, initial discussions with insurers' actuaries.
• CHE	• EQC have carried out a revised budget which has produced a lower estimated ultimate CHE cost.	$67m	$86m	EQC Budget

5   Canterbury earthquake claim liabilities

There have been a number of developments that have occurred over the six months from 31 December 2016 that have affected the estimation of EQC's Canterbury claims costs. These relate to:

- Land model
  - Actual settlements – Red Zone
  - Actual settlements – Green Zone
  - Updated land information
  - Legal challenge
- Building model
  - Resolved and reopened claims
- Claims Handling Expenses (CHE)

These have been discussed earlier in Section 1.3.

5.1.1   *Valuation vs operational approach*

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

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

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

5.2   Valuation results – Canterbury earthquakes

5.2.1   *Estimated ultimate claims costs – Canterbury earthquakes only*

The table below summarises the main components involved in estimating the ultimate cost of claims to EQC arising from the Canterbury earthquakes only as at 30 June 2017.

Canterbury earthquakes only
Ultimate claims costs, central estimate, undiscounted, including CHE - 30 June 2017 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Claims paid to date (excl. CHE)*	2,445	5,322	430	117	191	8,505
Estimated future (excl. CHE)	210	433	38	7	12	700
Gross estimated ultimate incurred claims	2,655	5,755	467	124	203	9,205
Claims handling expenses (CHE)						
Paid to date	466	806	113	38	49	1,473
Estimated future	14	29	11	1	1	56
Total	480	835	124	39	50	1,529
Gross ultimate incurred claims including CHE	3,134	6,591	591	164	253	10,733
31 December 2016 comparatives						
Gross ult incurred claims including CHE	3,290	6,800	675	165	251	11,181

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

The table below shows the components split by exposure.

Canterbury earthquakes only
Estimated ultimate claims costs (undiscounted) - 30 June 2017 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Claims costs paid to date *						
Land	49	373	46	3	1	472
Building	2,271	4,648	355	102	183	7,559
Contents	125	301	29	12	7	475
CHE	466	806	113	38	49	1,473
Total	2,911	6,128	543	155	241	9,978
Estimated future						
Land	51	181	10	1	(0)	243
Building	155	248	27	6	11	447
Contents	3	4	1	0	0	9
CHE	14	29	11	1	1	56
Total	224	462	48	8	13	756
Gross ultimate incurred claims cost - central estimate						
Land	100	554	56	4	1	715
Building	2,426	4,896	381	108	195	8,006
Contents	129	305	30	13	8	484
CHE	480	835	124	39	50	1,529
Total	3,134	6,591	591	164	253	10,733
31 December 2016 comparative						
Gross ult inc claims cost - cent est	3,290	6,800	675	165	251	11,181

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

5.2.2   *Estimated ultimate claims costs – variability in modelled results*

The actual ultimate incurred claim costs arising from the Canterbury earthquake events will not be known until the last claim is settled.   The figures shown in Section 5.2.1 are the central estimate (mean) of a distribution of modelled outcomes.

The charts below illustrate the variability in the ultimate claims liabilities for EQ1 and EQ2 according to our valuation model, split by Canterbury earthquake event.   The numbers shown correspond to the central estimates.

Canterbury Earthquakes only

EQ1 - Estimated gross ultimate incurred claims (undisc, incl CHE) spread of model results

EQ2 - Estimated gross ultimate incurred claims (undisc, incl CHE) spread of model results
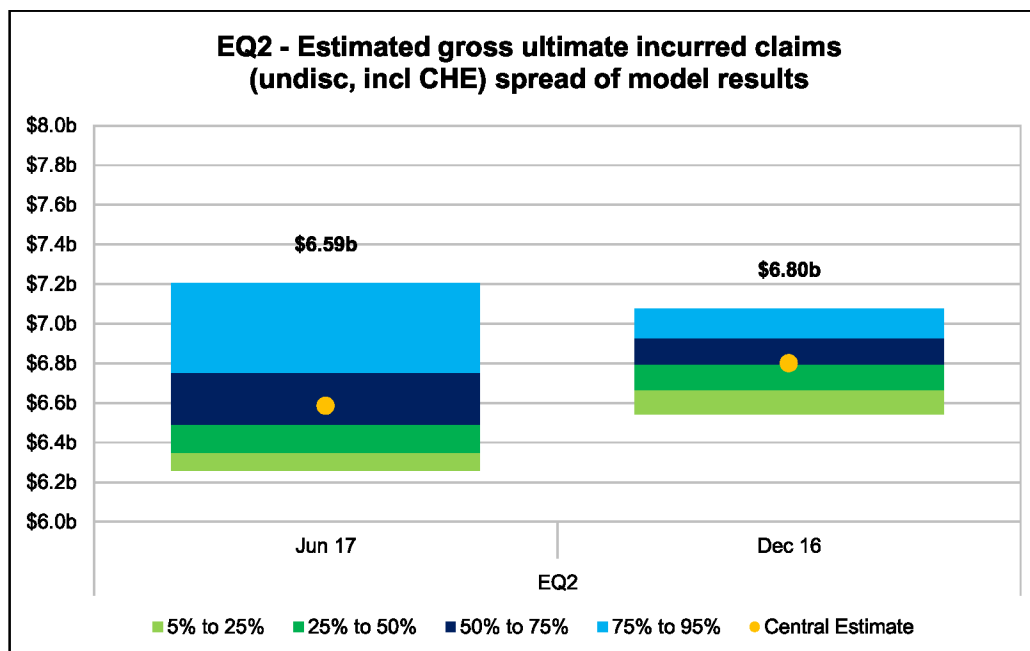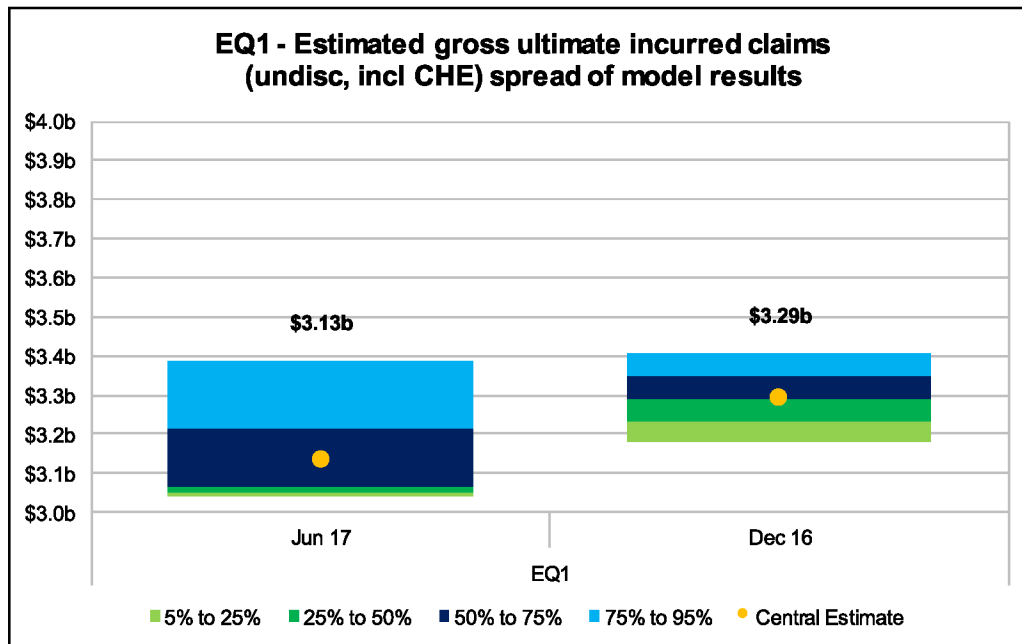
Estimated gross ultimate incurred cost incl CHE

	EQ1	EQ2	EQ3	EQ4	AS
30 June 2017 ILVR					
5%	$3.039b	$6.244b	$0.555b	$0.159b	$0.246b
25%	$3.052b	$6.340b	$0.578b	$0.162b	$0.251b
50%	$3.066b	$6.495b	$0.593b	$0.164b	$0.254b
75%	$3.212b	$6.765b	$0.605b	$0.166b	$0.256b
95%	$3.387b	$7.236b	$0.622b	$0.168b	$0.261b
Central Est	$3.134b	$6.591b	$0.591b	$0.164b	$0.253b
31 December 2016 ILVR					
5%	$3.178b	$6.541b	$0.619b	$0.162b	$0.248b
25%	$3.231b	$6.665b	$0.636b	$0.164b	$0.250b
50%	$3.288b	$6.795b	$0.660b	$0.165b	$0.251b
75%	$3.348b	$6.928b	$0.713b	$0.167b	$0.253b
95%	$3.406b	$7.077b	$0.756b	$0.168b	$0.255b
Central Est	$3.290b	$6.800b	$0.675b	$0.165b	$0.251b

5.2.3   Gross claim payments – comparison to previous estimates

The following chart shows actual gross claim payments for Canterbury earthquakes to 30 June 2017 (including EQR payments and CHE) as the solid black line.   Projected payments are shown as the blue broken line.

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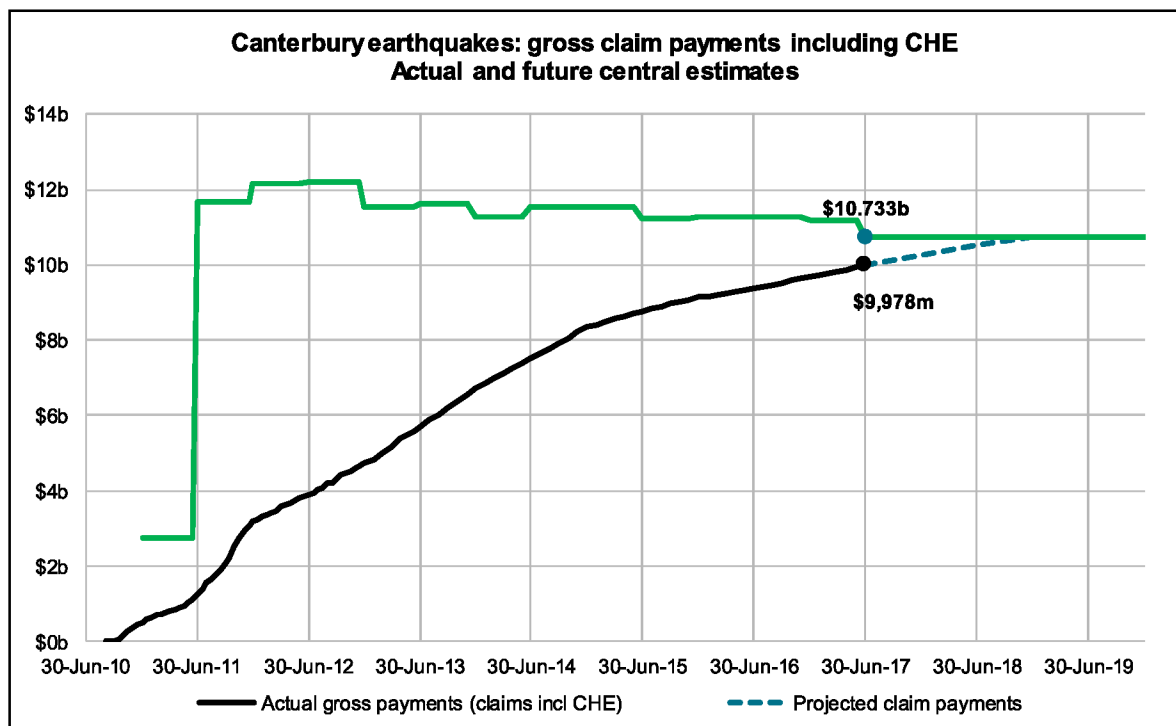
The valuation reflects our understanding of anticipated future cashflows.   CHE payments are assumed to continue until 30 June 2019.   The final two years of CHE payments are assumed to be small and will be required for a variety of tail issues including managing warranty / rework and litigation.

5.2.4   Movement in Canterbury earthquake claims costs

Movement in ultimate incurred claims costs

	Building $m	Contents $m	Land $m	CHE $m	Total $m
31 December 2016 ILVR					
Paid to date	7,444	474	326	1,441	9,685
Estimated future payments	485	13	940	59	1,496
Gross ultimate incurred claims	7,928	486	1,265	1,500	11,181
Movements over period					
Payments	115	1	146	32	293
Estimated future payments	(37)	(3)	(697)	(3)	(741)
Gross ultimate incurred claims	77	(3)	(550)	28	(447)
30 June 2017 ILVR					
Payments	7,559	475	472	1,473	9,978
Estimated future payments	447	9	243	56	756
Gross ultimate incurred claims	8,006	484	715	1,529	10,733

Canterbury earthquakes only
Comparison to 31 December 2016 ILVR Results

	EQ1			EQ2			EQ3			EQ4			AS			Total		
	Jun 17 $m	Dec 16 $m	Change $m	Jun 17 $m	Dec 16 $m	Change $m	Jun 17 $m	Dec 16 $m	Change $m	Jun 17 $m	Dec 16 $m	Change $m	Jun 17 $m	Dec 16 $m	Change $m	Jun 17 $m	Dec 16 $m	Change $m
Gross ultimate claims excl CHE, undiscounted - central estimate																		
Land	100	265	-165	554	868	-314	56	127	-71	4	5	-1	1	1	-0	715	1,265	-550
Building	2,426	2,412	+14	4,896	4,822	+73	381	394	-12	108	109	-1	195	191	+3	8,006	7,928	+77
Contents	129	129	-1	305	306	-1	30	30	-1	13	13	-0	8	8	-1	484	486	-3
Total	2,655	2,806	-152	5,755	5,996	-241	467	551	-84	124	126	-2	203	200	+3	9,205	9,680	-476
Claims handling expenses (CHE)																		
Paid	466	468	-2	806	773	+34	113	113	+0	38	37	+1	49	50	-1	1,473	1,441	+32
Future	14	15	-1	29	31	-2	11	11	-0	1	2	-0	1	1	-0	56	59	-3
Total	480	483	-4	835	803	+32	124	124	+0	39	39	+1	50	51	-1	1,529	1,500	+28
Gross ult claims incl CHE, undisc - central est	3,134	3,290	-155	6,591	6,800	-209	591	675	-83	164	165	-1	253	251	+2	10,733	11,181	-447
Reconciliation to gross outstanding (OS)																		
Gross ult cost incl CHE, undisc - central est	3,134	3,290	-155	6,591	6,800	-209	591	675	-83	164	165	-1	253	251	+2	10,733	11,181	-447
Paid claims costs excl CHE	(2,445)	(2,409)	-36	(5,322)	(5,118)	-204	(430)	(409)	-21	(117)	(117)	-0	(191)	(191)	-0	(8,505)	(8,243)	-262
Paid CHE	(466)	(468)	+2	(806)	(773)	-34	(113)	(113)	-0	(38)	(37)	-1	(49)	(50)	+1	(1,473)	(1,441)	-32
Gross OS incl CHE, undisc - central est	224	413	-189	462	909	-447	48	153	-105	8	11	-2	13	10	+2	756	1,496	-741
Reinsurance recoveries, undiscounted - central estimate																		
Past payments recoveries	(1,383)	(1,355)	-28	(2,478)	(2,478)	+0	-	-	-	-	-	-	-	-	-	(3,861)	(3,833)	-28
Future payments recoveries	(219)	(406)	+187	(0)	(0)	-0	0	(0)	+0	(0)	(0)	0	-	-	-	(219)	(406)	+187
Total expected recoveries	(1,602)	(1,762)	+159	(2,478)	(2,478)	-0	0	(0)	+0	(0)	(0)	0	-	-	-	(4,080)	(4,239)	+159
Net ult inc claims incl CHE, undisc - central est	1,532	1,528	+4	4,113	4,322	-209	591	675	-83	164	165	-1	253	251	+2	6,654	6,942	-288
Reconciliation to net outstanding																		
Gross OS incl CHE, undisc - central est	224	413	-189	462	909	-447	48	153	-105	8	11	-2	13	10	+2	756	1,496	-741
Future payments recoveries	(219)	(406)	+187	(0)	(0)	-0	0	(0)	+0	(0)	(0)	+0	-	-	+0	(219)	(406)	+187
Net OS including CHE, undisc - central est	5	7	-2	462	909	-447	48	153	-105	8	11	-2	13	10	+2	536	1,090	-553
Discounting	(0)	(0)	+0	(6)	(9)	+2	(1)	(1)	+1	(0)	(0)	-0	(0)	(0)	-0	(7)	(11)	+3
Net OS Including CHE, disc - central est	5	6	-2	456	900	-444	48	152	-104	8	11	-2	13	10	+2	529	1,079	-550
Net risk margin, diversified, 85% PoA	3	4	-2	255	161	+94	27	27	-1	5	2	+3	7	2	+5	295	291	+4
Net OS Including CHE, disc - 85% PoA	7	11	-3	710	1,061	-351	74	179	-104	13	13	+0	19	12	+8	824	1,370	-546

5.2.5   Movement in results

9(2)(j)

5.2.6   Drivers of results

The key drivers of the result are:

9(2)(h) and 9(2)(j)

5.2.7   Implications of results

The implication of these issues is that the land provision has been reduced as it is considered that it was more than sufficient provide for the Canterbury earthquake land claims.

5.3   Claims handling expenses (CHE)

5.3.1   Canterbury earthquakes

Based on a greater understanding of the complexity and the forecast time required to complete all outstanding claims and finalise all completion activities, it has been recognised that there will be further pressure on claims handling expenses and as a result, there has been an increase in the estimated ultimate CHE of $28 million.

5.3.2   CHE rates

The tables below illustrate the estimated ultimate CHE for the Canterbury earthquakes and also illustrates this as a percent of the gross ultimate claims costs.

Canterbury earthquakes only
CHE - 30 June 2017 valuation

	EQ1	EQ2	EQ3	EQ4	AS	Total
Total CHE $m	479.8	835.4	123.9	39.3	50.4	1,528.8
CHE % of gross ultimate	15.3%	12.7%	20.9%	24.0%	19.9%	14.2%

5.4   Scenario Analysis

5.4.1   Scenario descriptions

9(2)(h) and 9(2)(j)

9(2)(h)
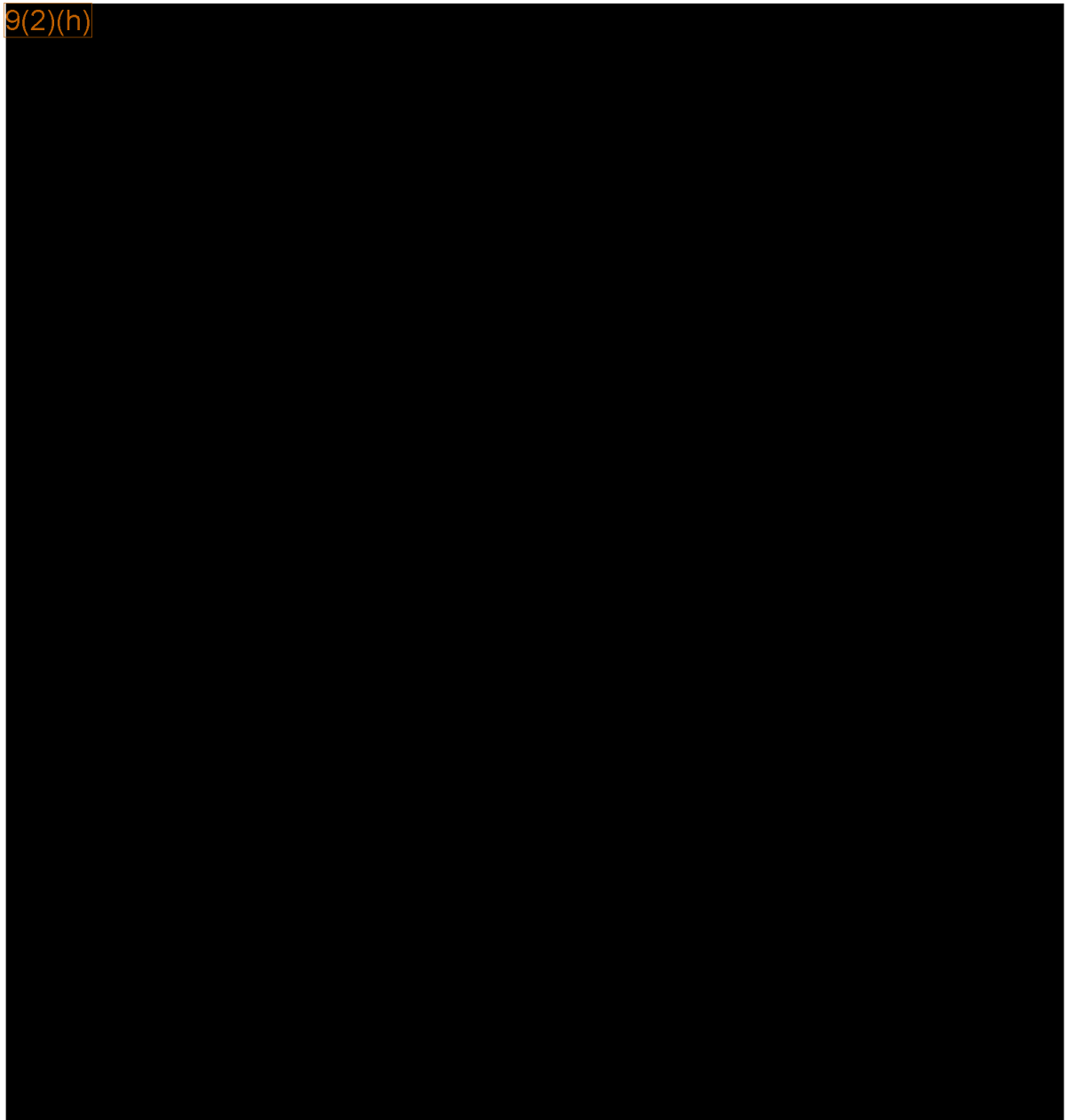
5.4.2   *Scenario results*

We have isolated three particular scenarios to illustrate the potential change to the land claims costs under various outcomes. The scenarios below are:

- Scenario 1 above, 9(2)(h) and 9(2)(j)

- Scenario 5
- Scenario 9

Scenario analysis

Central estimate outstanding claims (land only), gross of reinsurance, undiscounted, excluding CHE

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m	Difference $m	Difference %
Results: base assumptions	51	181	10	1	(0)	243		

9(2)(h)

5.5   Breakdown of land claims costs

The table below shows the decomposition of the ultimate land claims costs both, with and without allowance for the weighted litigation scenarios described above.

We have also illustrated the net impact of the litigation allowance on the risk margin.

9(2)(h)

The central estimate ultimate cost of land claims is $715 million. 9(2)(h)

6   Kaikoura earthquake claim liabilities

With the implementation of the MoU there will necessarily be a lag in claims information finding its way into EQC's claim management system. This has the effect of delaying any informational changes to the Kaikoura earthquake model.

6.1   Valuation results – Kaikoura earthquake

6.1.1   Estimated claims costs – Kaikoura earthquake

The results from our simplified model are shown below. Note that not all dwellings will make a claim, and of those that do, not all will result in a valid claim.

Central estimate ultimate cost of Kaikoura claims

Land damage grouping	Number of dwellings	Land $m	Building $m	Contents $m	Total $m	c.f. Dec 2016 $m
Land damage likely						
fault rupture and slope instability	140	1.1	8.2	0.2	9.6	13.3
fault rupture	13	0.1	0.9	0.0	1.1	1.2
slope instability	1,006	4.6	40.0	1.7	46.3	59.2
liquefaction	2,800	3.6	64.1	3.6	71.3	91.2
Land damage unlikely						
high shaking	3,179	0.7	108.9	4.3	113.9	119.6
moderate shaking	18,086	0.3	149.0	2.3	151.5	119.1
low shaking	n.a.	-	14.2	4.8	19.0	11.3
Wellington apartments	8,144	0.3	58.1	6.3	64.6	62.0
Central estimate claims excluding	**33,368**	**10.6**	**443.4**	**23.3**	**477.3**	**476.8**
Claims handling expenses					66.7	86.4
Central estimate claims including CHE					**544.0**	**563.3**

The most significant cost is assumed to relate to building claims. The table below details some key parameters of the Kaikoura building cost.

Components of Kaikoura building claim costs

	Number of dwellings exposed	Number of dwellings expected to claim	Expected number of non-nil dwelling claims	Mean expected cost to EQC	Mean cost per dwelling claim
Land damage likely					
fault rupture and slope instability	140	95	95	$8.2m	$87k
fault rupture	13	12	12	$0.9m	$80k
slope instability	1,006	747	739	$40.0m	$54k
liquefaction	2,800	1,179	1,120	$64.1m	$57k
Land damage unlikely					
high shaking	3,179	2,294	2,065	$108.9m	$53k
moderate shaking	18,086	3,781	3,403	$149.0m	$44k
low shaking	n.a.	27,761	16,657	$14.2m	$1k
Wellington apartments	8,144	4,221	2,954	$58.1m	$20k
Total	**33,368**	**40,090**	**27,044**	**$443.4m**	**$16k**

From the table above, it can be seen that of the 140 dwellings that resided on a fault rupture & slope instability zone, we have assumed that 94 will result in a claim with 93 receiving a non-nil payment. The average payment for these dwellings is $87k (note that some dwellings have building values less than $100k).

6.2 Background

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016. The earthquake started at about 15 kilometres north-east of Culverden and 60 kilometres south-west of the tourist town of Kaikoura and at a depth of approximately 15 kilometres. Ruptures occurred on multiple fault lines in a complex sequence that lasted for about two minutes. The cumulative magnitude of the ruptures was 7.8, with the largest amount of that energy released far to the north of the epicentre.

The shaking caused significant damage for areas immediately around the fault lines that ruptured, including a number of very large land slips. It also caused significant shaking in Wellington although this most affected medium rise buildings which had natural shaking frequencies similar to that produced by the earthquake.

The chart below illustrates the quakes greater than magnitude 5.0 that occurred on 14 November 2016. The size and colour of the circles represent the magnitude of the quakes.
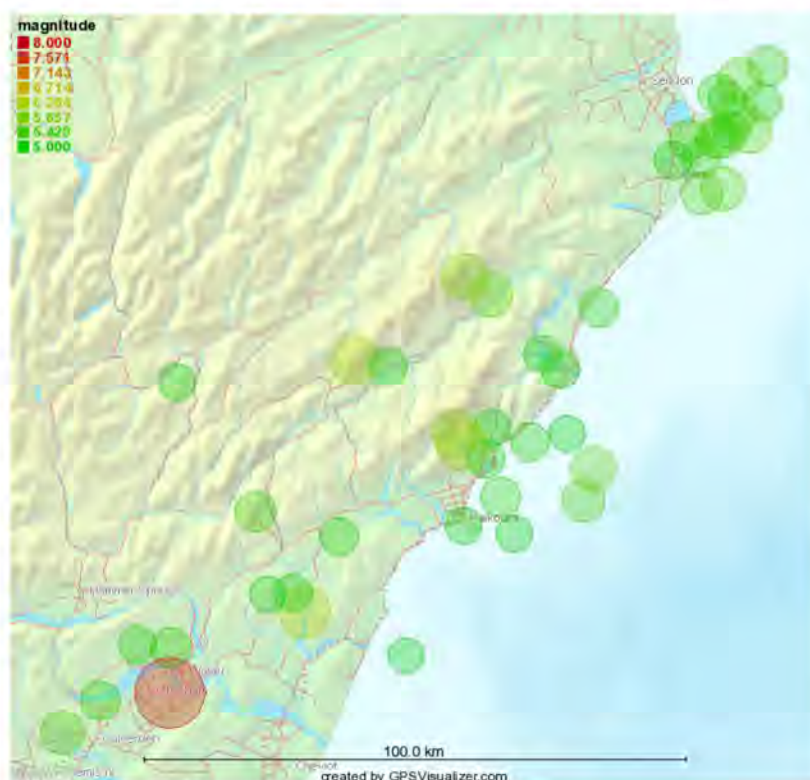
Source: GeoNet project, sponsored by EQC, GNS Science and LINZ

6.2.1   *Valuation developments*

Given the immediacy of the event there is little information from which to draw a firm estimate of the ultimate costs. As a consequence, we have used an exposure based approach to determine our estimate. It should be noted that this will almost certainly change as information develops.

The approach that we have used combines:

- An exposure / damage ratio model. It may be referred to as a simplified catastrophe model although it is only in respect of one event and the damage ratios are applied in a fairly broad fashion.

- An average cost per claims model. This is the traditional method for estimating BAU events and was used to help inform the exposure model.

Both of these approaches have their shortcomings, especially as there is little information as to what might be reasonable damage ratios, the lodgement of claims from insurers is not fully complete and the heterogeneity of buildings (mix of rural residential buildings and urban apartments) make damage ratios or average cost per claim hard to estimate.

6.2.2   *Modelling approach*

For building claims, we have modelled the cost to EQC as being a function of four elements:

- The number of dwellings exposed to potential damage

- The probability that each of these which will report a claim (where a claim has not already been reported for that dwelling)

- The probability that a reported claim will result in some non-zero cost to EQC

- The distribution of the cost of each non-zero claim to EQC. This is specified as:

The methodology is applied in a stochastic manner. That is, each element is simulated as a random process and the distribution of results is analysed.

For land and contents claims we used a similar methodology though with some exceptions. The building claims are by far the most significant component of the cost; these are discussed in this Executive Summary.

Exposure base

We obtained a dataset of housing stock based on that used for the Minerva model. The number of dwellings in each zone are given below.

Number of dwelling exposures

Zone	Number of dwellings
LDL-FS	140
LDL-F	13
LDL-S	1,006
LDL-L	2,800
LDU-H	3,179
LDU-M	18,086
LDU-L	rest of the country
WGN-A	8,144

Reporting percentage

For the valuation model, we allowed for those properties in each zone where there was already a claim associated with that dwelling and then applied probabilities that the remaining dwellings would lodge a claim. The table below summarises the assumptions.

Reporting percentage assumptions - building claims

Zone	Proportion having already notified a claim	Assumed probability of future notification	Implied ultimate proportion notified	Implied ultimate proportion Dec-16
LDL-FS	30.6%	50.0%	65.3%	96.0%
LDL-F	85.7%	50.0%	92.9%	99.3%
LDL-S	47.7%	49.2%	73.4%	96.0%
LDL-L	24.4%	23.7%	42.3%	55.1%
LDU-H	59.9%	31.6%	72.5%	77.3%
LDU-M	17.7%	3.9%	21.0%	16.7%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	2.1%	50.0%	51.1%	49.9%

n.a. - not applicable

For the WGN-A zone, which was not addressed in the T+T model, we conducted some random sampling to test whether those dwellings in the exposure data labelled as apartments were genuinely mid-high rise apartments (as opposed to townhouses or 1-2 level terraced housing which might possibly be referred to as apartments). Our sampling found that the majority were genuine mid-high rise apartments, and we understand that these were fairly susceptible to the long, slow rocking of the Kaikoura event. We used a reporting percentage for new claims of 47.5% which implies an ultimate reporting rate of 50% for Wellington apartments.

For the LDU-L zone, which was also not addressed in the T+T model, we identified 11,068 claims notified to date where the QPID was matched to a property in the LDU-L zone. There were an additional 1,343 claims which were not matched to a QPID but for which T+T have estimated that they are located in the LDU-L zone. We have assumed there will be another 5,000 +/- 3,500 claims notified in the LDU-L zone.

Non-zero percentage

High level analysis of other events suggests that around 70% of building claims reported will result in some non-zero cost to EQC. The other 30% are closed without cost to EQC. This however is likely to vary by zone i.e. the more damaged zones will have fewer zero claims. The table below shows the assumptions we have used.

Non-zero probability assumptions - building claims

Zone	Assumed probability that a notification will result in a non-zero cost	Assumed probability Dec-16
LDL-FS	99%	99%
LDL-F	99%	99%
LDL-S	99%	99%
LDL-L	95%	95%
LDU-H	90%	90%
LDU-M	90%	90%
LDU-L	60%	60%
WGN-A	70%	70%

Taking the weighted average non-zero percentage over all zones results in an overall non-zero percentage for the Kaikoura event of around 70%.

Combining our reporting and non-zero assumptions gives implied proportions of exposures resulting in non-zero damage by zone. These implied figures are reasonably consistent with the T+T assumptions.

Claim size

In the valuation model, we have used a lognormal distribution to model Building Damage Ratios ('BDRs') for each zone and capped the results at 100%. The lognormal distributions are scaled to achieve the intended mean and proportion capping at 100% based on our discussions with T+T. The assumptions are:

BDR distribution assumptions

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied proportion of non-zero claims with 100% BDR	Average non-zero BDR where <100%
LDL-FS	0.3958	1.4075	61%	47%
LDL-F	0.3958	1.4075	61%	47%
LDL-S	-1.5013	1.4075	14%	26%
LDL-L	-1.4213	1.4075	16%	27%
LDU-H	-1.6032	1.2686	10%	25%
LDU-M	-1.9560	0.8326	1%	19%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	n.a.	n.a.	n.a.	n.a.

n.a. - not applicable

For the LDU-L and WGN-A zones we have used a lognormal distribution to model the actual damage amount in dollar terms (rather than the BDR). The parameters of the lognormal distributions are such that:

- In the LDU-L zone the average building damage is $1,000 and the CoV[1] is 250%
- In the WGN-A zone the average building damage is $25,000 and the CoV[1] is 200%

[1]CoV – coefficient of variation i.e. the mean of a distribution divided by the standard deviation of that distribution.

Claims handling expenses

A range of potential claims handling expenses was estimated by EQC as a function of the likely number of claims involved and categorised according to the various cost elements. For our valuation purposes, we have used the budgeted figure of $67m produced by EQC for the ultimate CHE cost of the Kaikoura event. As the MOU process is still developing, this figure will be reviewed and subject to change as insurers start to present EQC with their fee invoices.

6.2.3   Areas of judgement

The estimation of the losses arising from the Kaikoura event is clearly the area with the most judgement. We have taken the view for this valuation that the use of a simplified model will enable us to create an estimate for the valuation while also conveying the inherent uncertainty in it.

6.2.4   Drivers of results

Key drivers of the result are:

- The number and severity of damaged buildings in rural areas in the South Island
- The extent of damage in South Island towns, especially Kaikoura, Waiau, and Culverden.
- The extent of damage in apartment blocks in Wellington.

6.2.5   Implications of results

The most material implication of the Kaikoura event is that there will be significant costs for EQC.

6.3   Claims handling expenses (CHE)

6.3.1   CHE rates

The tables below illustrate the estimated ultimate CHE for the Kaikoura earthquake and also illustrates this as a percent of the gross ultimate claims costs.

As noted earlier in Section 1.4.2, the estimated ultimate CHE cost is uncertain and is likely to be revised as experience develops.

Kaikoura earthquakes only
CHE - 30 June 2017 valuation

	KEQ
Total CHE $	66.7
CHE % of gross ultimate	12.2%

7   BAU claim liabilities

The central estimate outstanding claims for BAU events is $41 million as at 30 June 2017.   The table below summarises the quantum of the most significant of these.

Summary of BAU provisions by event

	14 Nov 2016 Landslip	9 Mar 2017 Landslip	6 Apr 2017 Landslip	Other	Prior periods	Total
Number of closed subclaims	263	43	15	859		
Number of open subclaims	225	502	993	1,015	744	3,479
Total number of subclaims	488	545	1,008	1,874		
Estimated ultimate claims inc CHE ($000s)	7,377	8,651	14,011	16,470		46,508
Less: paid to date ($000s)	(4,378)	(1,946)	(224)	(6,204)		(12,751)
Central estimate outstanding - undiscounted ($000s)	2,999	6,706	13,787	10,266	7,338	41,095

The 14 February 2016 earthquake event is included in the prior period category.   To date, EQC has paid $48 million in claims costs for this event.

Claims with loss dates after 1 May 2017 have been put into the new claim centre i.e. CMS8, whereas all older claims are still managed in CMS4. CMS8 claims are not included in the ADE and are not used in the BAU model. However, we obtained a summary of CMS8 claims from EQC and have included an additional $3.5 million in the BAU model to allow for these. This $3.5 million is included in the figures above.

8   Overall results

8.1   Claims incurred

The gross incurred claims costs for all Canterbury and Kaikoura EQ events, incurred to 30 June 2017, include:

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

Claims costs paid to date are known, but those to be paid in the future are unknown and so must be estimated.   The approach that we have taken is to estimate the ultimate incurred claims costs and then deduct payments made to 30 June 2017 in order to determine the estimated OS claims liability.

The ultimate incurred claims costs are calculated in respect of Canterbury and Kaikoura earthquake events only.

It is not useful (or practical) to include ultimate incurred claims costs from BAU events as this would include a vast number of smaller events which may have been materially settled.   This makes comparisons of BAU claims costs between valuations meaningless.

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 and Kaikoura earthquakes plus BAU) and are discounted for the time value of money and include risk margins at the 85th percentile.

8.2 All outstanding claims

8.2.1 Ultimate and outstanding claims liabilities – all claims

The table below summarises the key components of the gross ultimate claims costs and the derivation of the outstanding claims liabilities ('OSCL') as at 30 June 2017

The net discounted OSCL at a probability of adequacy of 85% is $1.412b. The largest component of the liabilities is in respect of EQ2.

All EQC claims
Gross ultimate claims costs to net outstanding claims liabilities - 30 June 2017 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	KEQ $m	Total $m
Gross ultimate claims excl CHE, undisc - central est	2,655	5,755	467	124	203		477	9,682
Claims handling expenses (CHE)	480	835	124	39	50		67	1,596
Gross ult claims incl CHE, undisc - central est	3,134	6,591	591	164	253	n.a.	544	11,278
Reinsurance recoveries, undiscounted - central estimate	(1,602)	(2,478)	0	(0)	0	-	0	(4,080)
Net ult inc claims incl CHE, undisc - central est	1,532	4,113	591	164	253	n.a.	544	7,198
Net claims costs paid to date	(1,062)	(2,844)	(430)	(117)	(191)		(88)	(4,732)
CHE paid to date	(466)	(806)	(113)	(38)	(49)		(24)	(1,497)
Discounting	(0)	(6)	(1)	(0)	(0)	(1)	(6)	(14)
Net OS including CHE, disc - central est	5	456	48	8	13	41	426	996
Net risk margin, diversified, 85% PoA	3	255	27	5	7	25	96	416
Net OS including CHE, disc - 85% PoA	7	710	74	13	19	65	522	1,412

8.2.2 Movement in net outstanding claims liabilities – all claims

The table below shows the movement in the net outstanding claims liabilities since 31 December 2016. The decrease of $550 million is largely a result of the reduction in estimated ultimate land claims costs.

The net OSCL (85% probability of adequacy, discounted) has decreased from $1.961b as at 31 December 2016 to $1.412b as at 30 June 2017.

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

- Actuarial determination; this has decreased by $283m on a net of reinsurance basis.
    - -$20m as a result of the Kaikoura earthquake.
    - -$288m as a result of changes from the Canterbury earthquakes.
    - +25m for new storm events.
- Claim payments; $387m of net payments since 31 December 2016.
- Risk margin has increased by $118m.
- Discounting has remained relatively unchanged.

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

All EQC claims

Reconciliation of change in outstanding claims liability from 31 December 2016 ILVR

| | Prior Periods (to 31 December 2015) | | | | | | | Current | | All Periods | | | |
	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	Subtotal $m	KEQ	BAU $m	OEQ $m	KEQ	BAU $m	Total $m
Net OSCL (85% PoA, discounted) as at 31 December 2016	8	1,061	179	13	12	9	n.a	649	31	1,272	649	41	1,961
Remove net risk margin (85% PoA)	(1)	(161)	(27)	(2)	(2)	(1)	n.a	(98)	(5)	(193)	(98)	(6)	(297)
Net OSCL (central estimate, discounted) as at 31 December 2016	7	900	152	11	10	8	1,087	550	27	1,079	550	34	1,664
Remove discounting	0	9	1	0	0	0	11	5	0	11	5	0	16
Net OSCL (central estimate, undiscounted) as at 31 December 2016	7	909	153	11	10	8	1,098	555	27	1,090	555	35	1,680
Estimated net paid over period	(6)	(238)	(21)	(1)	0	(4)	(270)	(103)	(14)	(266)	(103)	(18)	(387)
Change in net actuarial determination	4	(209)	(83)	(1)	2	4	(284)	(20)	21	(288)	(20)	25	(283)
Net OSCL (central estimate, undiscounted) as at 30 Jun 2017	5	462	48	8	13	7	544	432	34	536	432	41	1,010
Add discounting	(0)	(6)	(1)	(0)	(0)	(0)	(8)	(6)	(0)	(7)	(6)	(1)	(14)
Net OSCL (central estimate, discounted) as at 30 June 2017	5	456	48	8	13	7	536	426	33	529	426	41	996
Net diversified risk margin (85% PoA, discounted)	3	255	27	5	7	3	n.a	96	22	295	96	25	416
Net OSCL (85% PoA, discounted) as at 30 June 2017	7	710	74	13	19	10	n.a	522	55	824	522	65	1,412

8.3 Premium liabilities

The table below summarises the key results of the estimation of EQC's premium liabilities as at 30 June 2017. The premium liabilities will be used in the liability adequacy test.

The total value at 75% probability of adequacy is $239 million. This is greater than the $149 million unearned premium reserve. This means that an additional unexpired risk reserve will be required in the accounts as at 30 June 2017.

The largest component ($103 million) relates to projected costs of future claims arising from major events (other than those related to Canterbury earthquakes) during the period of the runoff of risks on the books as at 30 June 2017.   These claims are modelled by Minerva.

The next largest component ($86 million, as compared to $89 million as at 31 December 2016) relates to projected costs of future claims arising from Canterbury earthquakes during the period of the runoff of existing risks as at 30 June 2017.   This decreased slightly as a result of decreased probabilities of seismic activity as reported by GeoNet.

The component relating to the enhanced seismicity following the Kaikoura earthquake ($28 million, as compared to $36 million as at 31 December 2016) has also decreased due to lower GeoNet probabilities. Although more recent, it is expected that the future costs will be smaller than the Canterbury component due to the relative lack of exposure around Kaikoura.

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

The cost to EQC of reinsurance has increased considerably for cover negotiated since the Canterbury events.   The future reinsurance costs for unexpired risks are $82 million.

Estimated Premium Liabilities - 30 June 2017

	BAU $m	Minerva $m	Cant EQ $m	KEQ $m	Total $m
Unearned premium reserve					149
Cost of future claims from unexpired risks					
Gross claims, undiscounted - central estimate	17	48	65	24	154
Administration and reinsurance costs for unexpired risks					
Claims administration expenses	3	5	7	2	16
Policy (non-claims) admin expenses for unexpired	5	0	0	0	5
Future reinsurance costs for unexpired risks	0	62	18	2	82
Reinsurance recoveries					
Reinsurance recoveries, undiscounted	0	(12)	(3)	(0)	(15)
Net premium liabilities, undiscounted - central estimate	25	103	86	28	242
Discounting	(0)	(1)	(1)	(0)	(3)
Net premium liabilities, discounted - central estimate	24	102	85	28	239
Diversified risk margin, discounted - 75% PoA					0
Net premium liabilities, discounted - 75% PoA					239

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

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

● The expected claims costs are currently inflated due to the heightened seismic conditions in Canterbury.

● The central estimate claims costs may not be the best decision-making tool for setting levy rates for such a highly-skewed distribution.

- EQC's considerations differ from insurers and will include such factors as the Crown's appetite for managing earthquake risk including pre and post-funding.

8.3.1 Material implications of the results

As the net discounted premium liability at 75% probability of adequacy ($239 million) exceeds the unearned premium reserve ($149 million) it will be necessary to hold an additional unexpired risk reserve.

8.3.2 Key changes from results as at 30 June 2016

The net discounted premium liabilities at the 75th probability of adequacy have increased from $216 million as at 30 June 2016 to $242 million as at 30 June 2017.   The increase is driven by the introduction of a new enhanced seismic provision following the Kaikoura earthquake event.   We have also updated some of the attritional claims and expense assumptions.

8.3.3 Quality control processes

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

Actual vs. expected experience

The current data does not support an exact analysis of actual claims experience against that expected from the 30 June 2016 premium liabilities calculations. This is because there is no way of identifying incurred claims costs arising from unexpired risks as at the previous valuation. 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 2016.

The undiscounted net central estimate cost of future claims as at 30 June 2016 was $216 million.

8.4 Quality control processes

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

9   Uncertainty, Limitations and Reliances

9.1   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.

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

The actual ultimate incurred claim costs arising from the Kaikoura earthquake will take some time to estimate accurately. There is very little data with which to form an estimate.

9.2   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.

9.3   Key uncertainties

9.3.1   Exceptional uncertainties arising from the Canterbury earthquakes

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

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

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

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

9.3.2   Land valuation uncertainties

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

- The extent to which properties have valid claims – this risk has reduced significantly with few challenges to claim eligibility.

- The impact of the 'diminution of value' cover interpretation.

- The assumed market value cap for a number of properties in Canterbury.

- Legal, valuation and engineering challenge and different interpretation of the land cover provisions in the EQC Act.

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

- The actual claims outcome will differ to some degree from the estimates.

- There are confidence ranges in the estimated liabilities for each event.

- Different practitioners could legitimately arrive at quite different estimates of claims cost.

9.3.3   Uncertainties arising from the Kaikoura earthquake

The Kaikoura earthquake has resulted in a high level of uncertainty.   In a similar manner to the Canterbury earthquake sequence, it will take some time to identify, quality and settle all earthquake damage.   Specific sources of uncertainty include:

- The Memorandum of Understanding ('MoU') will place claims handling in the hands of insurers.

  - This will necessarily delay the receipt of information surrounding each claim.

  - There will not be perfect consistency in how claims are managed across all insurers, affecting the claims outcome.

- There is little information as to the extent of residential building damage in the South Island. Many properties will be rural and access to these will be limited.

- There is little information on the extent of damage to residential buildings in Wellington, especially apartment blocks which may have suffered disproportionately.   This may take some time to assess fully as it will require detailed engineering investigations.

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

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

9.4.1 Official Information Act (OIA)

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

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

9.5 Key reliances

In completing this report, considerable reliance has been placed on data and information supplied to MJW by EQC and its external advisors. The most important reliances were placed on the data sources listed in Section D.1.

More details regarding data, information and reliances are set out throughout Section D.

9.6 Quality control and risk management processes

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

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

We undertake to ensure the robustness of these by:
- Internal peer review, including:
    - Detailed review of data, assumptions, methodology and results.
    - Periodic rotation of staff which allows, over time, a 'fresh set of eyes' over aspects of the valuation process.
- Data validation where possible to independent sources (e.g. management accounts, daily reports)
- Analysis of change in assumptions for reasonableness.
- Comparison of results to previous models and valuations.
- Comparing results to alternative models.
- External review, including
    - Discussions with EQC staff
    - Discussions with external auditors at year end.

Earthquake Commission
2 August 2017

Insurance Liability Valuation
as at 30 June 2017

Appendices

MELVILLE JESSUP WEAVER

Willis Towers Watson Alliance Partner

A EQC – Background

A.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.

- 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 Responsible for the Earthquake Commission.

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

Details on EQC's operations including what is covered under insurance, can be found on its website www.eqc.govt.nz or in previous ILVRs.

A.1.1 Reinstatement of cover limits

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

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

B   Canterbury land settlement

B.1.1   Ministerial Direction - Unclaimed damage

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

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

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

- 19 December 2012. Relates to residential building and states that all apportioned residential building damage will be covered by EQC, so long as at least one valid claim has been made for that residential building.

- 19 December 2013. An amendment to the previous residential building direction stating that no excess shall apply to apportioned damage where no valid claim was made.

- 29 October 2015. Relates to residential land and states that all apportioned residential land damage will be covered by EQC (subject to the land cap), so long as at least one valid claim has been made. Excesses will be deducted from all apportioned damage claim payments

These directions have consequences for the gross and net exposure of EQC in that all damage is covered by EQC (subject to there being at least one claim) but not necessarily the reinsurers.

B.1.2   Remediation of land claim damage

Canterbury land suffered visible and other forms of land damage. Other land damage includes ILV and IFV. Visible flat land damage is broken into 7 categories, descriptions of which can be found on the EQC website www.eqc.govt.nz.

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

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

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

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

- Repair of damage on the Port Hills.

Damage categories 1 – 7 on the flat

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

Diminution of value

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

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

ILV damage on the flat

EQC's policy in respect of ILV damaged land considers

- Whether the property qualifies for settlement
- The costs and ability to repair the land and the DoV that has been incurred.

IFV damage on the flat

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

EQC's policy in respect of IFV damaged land considers

- Whether the property qualifies for settlement
- The costs and ability to repair the land and the DoV that has been incurred.

Repair of damage on the Port Hills

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

Further details can be found on EQC's website www.eqc.govt.nz.

C   Kaikoura Earthquake – Methodology and Assumptions

This appendix summarises the methodology used to estimate the cost of the Kaikoura earthquake of 14th November 2016. The Kaikoura model only deals with damage from the earthquakes, not damage from the storms in Wellington shortly afterward (which are addressed using the standard BAU model).

The methodology described below is very similar to that for the 31 December 2016 ILVR. The main difference is that we have more information regarding the number of claims reported in each zone, and have modified some of our assumptions regarding future claim notifications accordingly. Note that, even though the 90-day deadline for reporting claims to EQC has now passed, there are still a number of claims which have been notified to the relevant insurer but have not yet been loaded into CMS.

As at 1 May 2017 there were 37,877 claims loaded into CMS relating to the Kaikoura earthquake (including 33,375 building claims). Discussions with EQC staff at the time suggested that there could be at least another 2,500 claims still with two particular insurers that have not yet been allocated an EQC claim number. A review of lodgement pattern to date suggested that there could be up to 4,000 extra claims in total.

By 30 June 2017 the number of claims loaded into CMS was 40,220 (including 35,543 building claims). Very few claims have been lodged in regard to Wellington apartments, however, we understand that in many cases only one claim has been lodged by the body corporate representing a number of units. We have estimated that there will be a total of 39,000 building claims for the Kaikoura earthquake.

C.1   Zone classification

The methodology described below is applied to eight distinct zones, based on discussions with T+T. The zones are:

- The Land Damage Likely ('LDL') zones:
    - Fault rupture: LDL-F
    - Slope instability: LDL-S
    - Both fault rupture and slope instability: LDL-FS
    - Liquefaction: LDL-L
- The Land Damage Unlikely ('LDU') zones:
    - High shaking: LDU-H
    - Moderate shaking: LDU-M
    - Low shaking: LDU-L
- Apartments in the Wellington region: WGN-A

The picture on the following page illustrates the various zones. The LDU-L zone is effectively the rest of New Zealand.

DRAFT

LEGEND

State Highway	
Rivers	

Areas Likely to be Affected by Land Damage

Fault Rupture	
Slope Stability	
Liquefaction and Lateral Spreading	

Areas Likely to be Affected by Shaking Damage Only

High	
Medium	
Low	

Land Damage Index sourced from GNS, University of Thessaloniki, University of Texas, University of Canterbury, Tonkin + Taylor, EQC and URS Slope models. Shake Damage areas sourced from USGS PGA Contours with engineering judgement.

EARTHQUAKE COMMISSION
KAIKOURA EARTHQUAKE 2016
Preliminary Kaikoura Earthquake Damage Index Map
Overview

Tonkin+Taylor
105 Carlton Gore Rd, Newmarket, Auckland
www.tonkintaylor.co.nz

A3 SCALE 1:600,000
0   7   14   21   28   35 (km)

DRAWN		Dec.16
CHECKED		
APPROVED		
10001154-0000-MAP006.mxd		
1:600,000		
1001154.000		

Figure 1

C.2   Methodology overview

For building claims, we have modelled the cost to EQC as being a function of four elements:

- The number of dwellings exposed to potential damage[1]

- The probability that each of these will report a claim (where a claim has not already been reported for that dwelling)[1]

- The probability that a reported claim will result in some non-zero cost to EQC

- The distribution of the cost of each non-zero claim to EQC. This is specified as:

  - For claims other than those in the LDU-L zone and WNG-A zones, the percentage of the building which is damaged by the earthquakes i.e. a Building Damage Ratio ('BDR')

  - For claims in the LDU-L and WNG-A zones, the cost of the claim in dollars.

[1]Except for the LDU-L zone.

For the LDU-L zone we directly modelled the number of claims reported, rather than modelling the exposure and reporting percentage.

For land and contents claims we used a similar methodology with some exceptions:

- The likelihood of a claim notification was modelled as a function of whether or not a building claim is notified

- The claim amounts were modelled as dollar costs rather than BDRs.

C.2.1   Stochastic modelling

The methodology above is applied in a random, stochastic manner. That is, for each dwelling in each zone we randomly simulate:

- Whether or not a claim will be notified

- Whether or not a notified claim will result in some non-zero cost to EQC

- The amount of that non-zero cost to EQC.

The results are aggregated for each zone and for each type of claim i.e. land, building and contents. This is done 10,000 times and the distribution of results is analysed.

C.3   Exposure base

We obtained a dataset of housing stock from T+T, based on data from Minerva, detailing the residential dwellings categorised by zone. We also obtained a dataset directly from Minerva from which we extracted dwellings in the Wellington region which were categorised as residential apartments. The number of dwellings in each zone are given below.

Number of dwelling exposures

Zone	Number of dwellings
LDL-FS	140
LDL-F	13
LDL-S	1,006
LDL-L	2,800
LDU-H	3,179
LDU-M	18,086
LDU-L	rest of the country
WGN-A	8,144

C.4 Building claims

C.4.1 Reporting percentage

For the valuation model, we allowed for those properties in each zone where there was already a claim associated with that dwelling and then applied probabilities that the remaining dwellings would lodge a claim. The table below summarises the assumptions.

Reporting percentage assumptions - building claims

Zone	Proportion having already notified a claim	Assumed probability of future notification	Implied ultimate proportion notified	Implied ultimate proportion Dec-16
LDL-FS	30.6%	50.0%	65.3%	96.0%
LDL-F	85.7%	50.0%	92.9%	99.3%
LDL-S	47.7%	49.2%	73.4%	96.0%
LDL-L	24.4%	23.7%	42.3%	55.1%
LDU-H	59.9%	31.6%	72.5%	77.3%
LDU-M	17.7%	3.9%	21.0%	16.7%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	2.1%	50.0%	51.1%	49.9%

n.a. - not applicable

For the WGN-A zone, which was not addressed in the T+T model, we conducted some random sampling to test whether those dwellings in the exposure data labelled as apartments were genuinely mid-high rise apartments (as opposed to townhouses or 1-2 level terraced housing which might possibly be referred to as apartments). Our sampling found that the majority were genuine mid-high rise apartments, and we understand that these were fairly susceptible to the long, slow rocking of the Kaikoura event. We have seen far fewer reported claims to date for Wellington apartments than we have estimated as at 31 December 2016. However, it is possible that there are still some claims (particularly body corporate claims) that have been notified to the relevant insurer but have not been reconciled and loaded into CMS.

For the LDU-L zone, which was also not addressed in the T+T model, we identified approximately 27,500 building claims to date that appear to be related to properties in the LDU-L zone. We have assumed that perhaps further 1,500 claims will be reported to EQC, resulting in around 29,000 claims. This compares to an estimate of around 14,000 – 21,000 claims as at 31 December 2016.

C.4.2 Non-zero percentage

High level analysis of other events suggests that around 70% of building claims reported will result in some non-zero cost to EQC. The other 30% are closed without cost to EQC. This however is likely to vary by zone i.e. the more damaged zones will have fewer zero claims. The table below shows the assumptions we have used.

Non-zero probability assumptions - building claims

Zone	Assumed probability that a notification will result in a non-zero cost	Assumed probability Dec-16
LDL-FS	99%	99%
LDL-F	99%	99%
LDL-S	99%	99%
LDL-L	95%	95%
LDU-H	90%	90%
LDU-M	90%	90%
LDU-L	60%	60%
WGN-A	70%	70%

Taking the weighted average non-zero percentage over all zones results in an overall non-zero percentage for the Kaikoura event of around 67%.

Combining our reporting and non-zero assumptions gives implied proportions of exposures resulting in non-zero damage by zone. These implied figures are reasonably consistent with the T+T assumptions.

C.4.3 Claim size

In the valuation model, we have used a lognormal distribution to model BDRs for each zone and capped the results at 100%. The lognormal distributions are scaled to achieve the intended mean and proportion capping at 100% based on our discussions with T+T. The assumptions are:

BDR distribution assumptions

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied proportion of non-zero claims with 100% BDR	Average non-zero BDR where <100%
LDL-FS	0.3958	1.4075	61%	47%
LDL-F	0.3958	1.4075	61%	47%
LDL-S	-1.5013	1.4075	14%	26%
LDL-L	-1.4213	1.4075	16%	27%
LDU-H	-1.6032	1.2686	10%	25%
LDU-M	-1.9560	0.8326	1%	19%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	n.a.	n.a.	n.a.	n.a.

n.a. - not applicable

For the LDU-L and WGN-A zones we have used a lognormal distribution to model the actual damage amount in dollar terms (rather than the BDR). The parameters of the lognormal distributions are such that:

- In the LDU-L zone the average building damage is $1,000 and the CoV[1] is 250%
- In the WGN-A zone the average building damage is $25,000 and the CoV[1] is 200%

[1]CoV – coefficient of variation i.e. the standard deviation of a distribution divided by the mean of that distribution.

The building damage ratio assumptions are the same as that used as at 31 December 2016.

C.5   Land and Contents claims

For details on our contents and land claims assumptions, please contact the authors.

D   Data and Information

D.1   Sources of data – Canterbury earthquake claims

The most important sources of data for the Canterbury earthquake investigations were:

- Actuarial Data Extracts from the Claim Centre Claims Information Management System ('ADE'). Data as at 30 June 2017 was used to inform the ultimate incurred claims costs and net outstanding claims liabilities.

- ACE apportionment data from the Business Intelligence Unit ('BIU') – see below.

- Small PAT results - see below.

- EQR paid data.

- Claim-to-address mapping data from the BIU.

- Land cost calculations from EQC & T+T.

- Fletcher Construction completion cost data.

- Trial Balances as at 31 May 2017 and 30 June 2017.

- A Minerva model run generated in January 2011.

- Discussions with EQC employees and contractors.

D.1.1   ACE & Small PAT

Properties with building damage are managed either by EQC or by the relevant insurer.   Generally, all properties with building damage less than the EQC cap ($100,000 +GST) per claim will be managed by EQC with the remainder ('overcap properties') managed by the insurer.

To assess whether a property is overcap, a manual Apportioned Cost Estimates ('ACE') process is carried out.   This will indicate whether any claim has expected damage of more than the cap and therefore whether it should be handed over to the insurer.   All overcap properties, and some undercap properties, will have ACE data.

Undercap properties were not, as a rule, manually apportioned.   For the purposes of the valuation and for reinsurance, undercap properties have been apportioned using a statistical model, developed by the statistician, Dr David Baird.   The statistical apportionment method is referred to as Small PAT (Proxy Apportionment Tool).

D.1.2   Actuarial Data Extract from ClaimCentre

Weekly Actuarial Data Extracts (ADE) were taken from ClaimCentre and the key extracts used were dated 30 June 2017 (for the Canterbury earthquake claims costs).

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

D.1.3   ACE damage data

The ACE damage data (as at 30 June 2017) consisted of a table, provided by the BIU, showing apportioned damage estimates for a number of Christchurch properties.   There were approximately 130,000 properties in the table although many of these had yet to be populated with apportionment information.   There were 49,967 approved properties from this data set that were used in the building model.   The table below details how the usable properties were derived from the total data set.   It is in respect of all review statuses.

ACE data cleaning process

	Number of Properties	Sum of Raw ACE Estimates					
		EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Raw ACE Data	129,254	1,634	5,024	240	29	48	6,975
Remove:							
NAs	(75,904)	-	-	-	-	-	-
Duplicates	(53)	-	-	-	-	-	-
Property ID errors & non-approved	(3,330)	(92)	(195)	(9)	(1)	(4)	(301)
Extremely large estimates (>$100m)	0	-	-	-	-	-	-
Data used in model	49,967	1,543	4,828	231	27	44	6,674

D.1.4 EQR paid data

The EQR paid data (as at 30 June 2017) consisted of a table, provided by the BIU, showing the amounts paid to substantively completed properties. There were approximately 68,000 properties from this data set used in the model.

D.1.5 Tonkin + Taylor land data and assumptions

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

D.1.6 Output from the Minerva loss model

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

D.2 Sources of data – Kaikoura earthquake claims

D.2.1 Actuarial Data Extract from ClaimCentre

The ADE was also used to assist in the Kaikoura earthquake claims costs.

In addition to the data above, to assist in assessing the ultimate claims costs from the Kaikoura event we have also received:

- Exposure data from the Minerva model
- List of properties grouped by land movement information from T+T.

D.3 Sources of information

The additional sources of information used for the investigation were:

- Draft accounts for the period ending 30 June 2017.
- Trial balance for the period ending 30 June 2017.
- Small PAT results.
- CHE Forecast 30 June 2017.
- Daily reports supplied by the BIU.
- Reports supplied by the Fletcher Construction EQR.

- T+T land claims cost model.

- Information from the Treasury website.

- Discussions and correspondence with various relevant EQC staff, contractors and advisors.

D.4   Validation of data

D.4.1   Actuarial data extract

The table below illustrates a reconciliation of the 30 June 2017 Actuarial Data Extract system against the BIU's Daily Report for 1 July 2017.

Canterbury earthquakes only
Reconciliation of ADE to Daily Report

Event	Event Date	Number of Claims	Building $000s	Land $000s	Contents $000s	Paid $m	EQR Paid $m	Total Paid $m	Number of Claims	Paid $m	Number of Claims	Paid $m
		ADE - 30 Jun 2017							Daily Report - 1 Jul 17		Difference	
EQ1	4-Sep-10	156,623	1,405,565	28,060	125,395	1,559	498	2,057	156,622	2,058	(1)	1
AS	19-Oct-10	3,631	8,612	76	470	9	8	17	3,631	17	0	0
AS	14-Nov-10	2,611	6,018	54	238	6	6	12	2,611	12	0	0
AS	26-Dec-10	19,039	39,272	281	3,412	43	41	84	19,039	84	0	0
AS	20-Jan-11	2,852	5,990	107	466	7	8	14	2,852	14	0	0
AS	4-Feb-11	632	2,519	45	343	3	3	6	632	6	0	0
EQ2	22-Feb-11	157,309	3,123,962	312,047	301,374	3,737	1,349	5,086	157,309	5,089	0	3
AS	16-Apr-11	3,647	7,889	34	1,144	9	23	32	3,647	32	0	0
AS	30-Apr-11	192	470	-	33	1	1	2	192	2	0	0
AS	10-May-11	975	2,505	2	135	3	6	9	975	9	0	0
AS	6-Jun-11	2,292	6,721	63	449	7	14	21	2,292	21	0	0
EQ3	13-Jun-11	54,211	312,645	10,744	28,368	352	497	849	54,211	850	0	1
EQ3	21-Jun-11	2,236	9,215	213	521	10	20	30	2,236	30	0	0
AS	9-Oct-11	5,634	13,649	86	613	14	12	26	5,634	26	0	0
EQ4	23-Dec-11	48,795	107,516	1,125	12,463	121	51	172	48,795	172	0	0
Other Canterbury event*		1,219	2,445	-	176	3	-	3	8,794	22	7,575	19
Total		461,898	5,054,994	352,937	475,601	5,884	2,537	8,420	469,472	8,445	7,574	25

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

D.4.2   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.

D.5   Reliances

The key data and information upon which we have placed reliance are described in Sections D.1 to D.3 above.

D.6 Concerns and qualifications

D.6.1 General comments regarding the data held by EQC

The main areas of concern with respect to the use of the data for actuarial purposes is that the claim payment information is held in many different systems which makes it challenging to capture all payments.

This will be exacerbated with the introduction if the new claims management system and retirement of the existing system

D.7 Recommendations

D.7.1 Progress against previous recommendations

Several data-related recommendations were set out in Section 3.6 of the 30 June 2016 report.   The progress against these recommendations is as follows:

- Minerva:

    - Review the model in the light of the recent events.   *Ongoing*

    - Consider whether other catastrophe events besides earthquakes should be included.   *Ongoing*

D.7.2 Current Recommendations

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

We would recommend EQC undertake steps to rationalise the sources of claims information into as few systems as practical.

D.8 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 D.6, we consider that the information provided to us was adequate and appropriate for the purposes of this valuation.

E   Outstanding Claims Liabilities – Valuation Methodologies

E.1   Liability components

EQC's outstanding (OS) claims liabilities to be included in its accounts for 30 June 2017 are, in summary, an estimate of the total value of liabilities arising from all claims incurred up to the valuation date of 30 June 2017.

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.

E.2   Valuation groupings

The OS claims liabilities are subdivided by:
- Event (EQ1 – EQ4, BAU, KEQ).
- Sub-claim (land, building and contents).

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.

E.3   Valuation methodology

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.
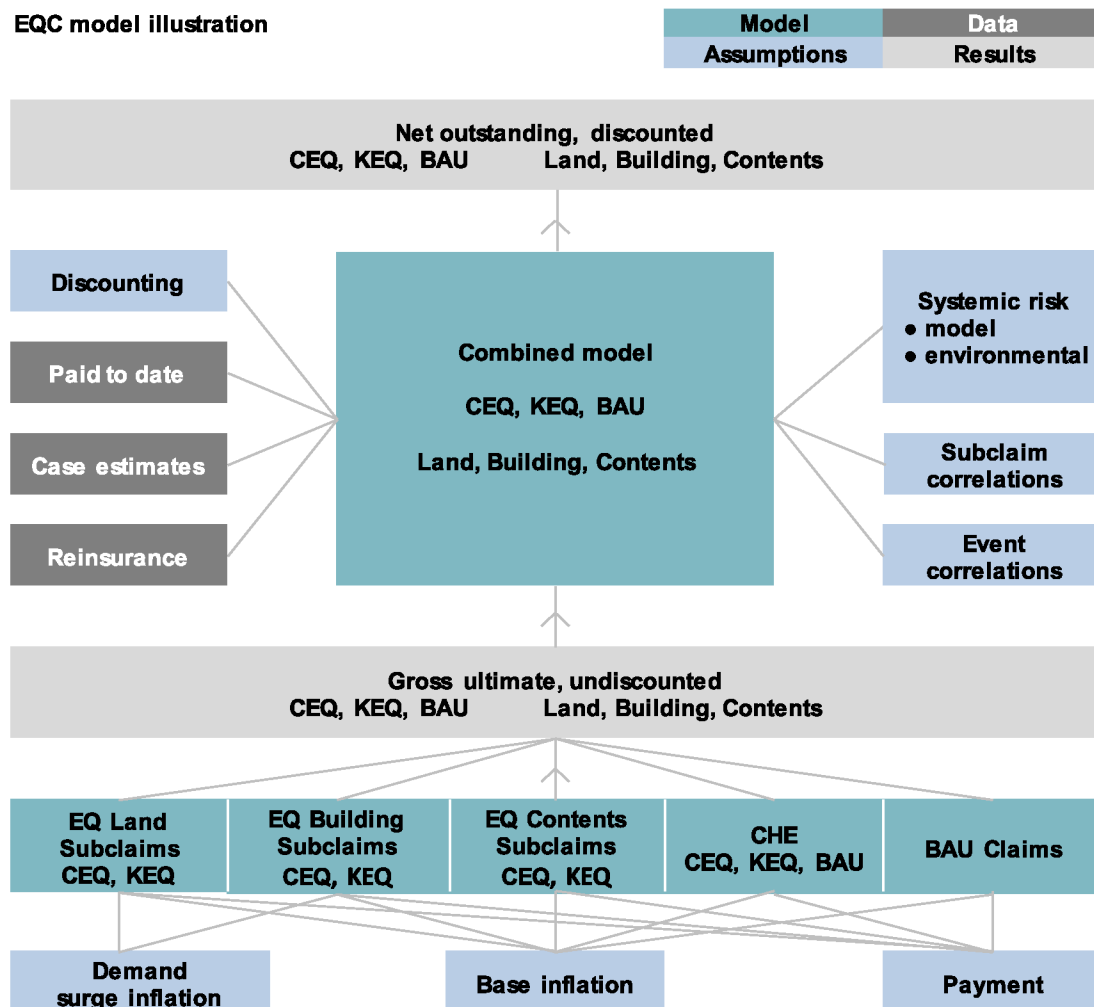
E.4   Gross incurred claims costs

The costs paid to date are known with certainty, but those to be paid in the future are unknown and so must be estimated.   The approach that we have taken is to first estimate the projected ultimate claims costs and then to deduct payments made to 30 June 2017 in order to determine the estimated OS claims liability.

E.4.1   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.

EQC model illustration

Model	Data
Assumptions	Results

Net outstanding, discounted
CEQ, KEQ, BAU   Land, Building, Contents

- Discounting
- Paid to date
- Case estimates
- Reinsurance

Combined model

CEQ, KEQ, BAU

Land, Building, Contents

Systemic risk
- model
- environmental

Subclaim correlations

Event correlations

Gross ultimate, undiscounted
CEQ, KEQ, BAU   Land, Building, Contents

EQ Land Subclaims CEQ, KEQ	EQ Building Subclaims CEQ, KEQ	EQ Contents Subclaims CEQ, KEQ	CHE CEQ, KEQ, BAU	BAU Claims

- Demand surge inflation
- Base inflation
- Payment

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

E.5   Changes since previous valuation

There have been no material changes in methodology since the previous valuation.

E.6   Assumptions required

The assumptions required are driven by the structure of the valuation model.   The key assumptions are shown in Section 3 and 4. For a full set of assumptions, please contact the authors.

F   Premium Liabilities – Methodology and Assumptions

F.1   Liability components

In summary, EQC's premium liabilities are an estimate of the total value of net liabilities associated with the run-off of EQC's unexpired risks as at 30 June 2017.   The focus is therefore on claims incurred as a result of events after the 30 June 2017 valuation date, i.e. future claims.   This is in contrast to the OS claims liabilities, which relate to claims incurred up to 30 June 2017, 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.

F.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.

F.2.1   Event valuation groupings

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

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

The first two event groups above are traditional ones for the estimation of EQC's premium liabilities. The last item reflects the fact that the first two items were based on a 'stable' environment whereas the seismic conditions are more uncertain now. It is expected that this component will reduce over time as seismic conditions stabilise.

F.3   Valuation methodologies

We have 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.

F.4 Changes in methodology

The methodology has not materially changed from the previous valuation. The impact of the Kaikoura aftershocks has changed the assumptions for the 'Enhanced Seismicity' component.

F.5 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.

F.5.1 Minerva

The Minerva component is based on output from the Minerva model in 2011. The only assumption used here is the inflation rate, which is 2.5% p.a.

F.5.2 BAU

The assumptions used for the BAU component are frequency and severity based. Please see the authors for details on these assumptions.

F.5.3 Enhanced seismicity claims

The Enhanced seismicity claims component is based on the probabilities of aftershocks in the Canterbury and Kaikoura region. The table below illustrates the assumptions currently used.

Geonet forecasts - Canterbury region long-term probabilities
One year: 21 July 2016 - 20 July 2017

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	0.8	3
6.0	7.0	6.50	0.07	1
7.0	8.0	7.50	0.006	1

Geonet forecasts - Kaikoura region long-term probabilities
One year: 19 May 2017 - 18 May 2018

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	10.5	21
6.0	7.0	6.50	0.9	3
7.0	8.0	7.50	0.08	1

F.5.4 Non-acquisition expenses

The premium liabilities require assumptions on the policy administration costs and the costs to manage and settle claims. It is assumed that:

- The average annual policy administration costs for unexpired risk is $5m
- The average claims handling cost per claim is $1,495.

F.6   Changes in assumptions

Given the underlying claims process and the valuation methodology, the assumptions are largely based on those used for the 31 December 2016 valuation.   The latest GeoNet Canterbury forecasts were released on 21 July 2016.   The latest GeoNet Kaikoura forecasts were released on 19 May 2017.

G   EQC Reinsurance

G.1   EQC reinsurance

G.1.1   Historical Cover

EQC utilises catastrophe reinsurance to reduce net claims volatility.

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

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

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

This cover was placed in tranches and layers subject to different terms.

This reinsurance structure was the same for the 2011/12 year.

Current cover

9(2)(j)

H   Glossary

Accounting standard

In New Zealand, the accounting standards of the NZ Institute of Chartered Accountants apply. The standard most relevant to **insurance entities** is *NZ IFRS4 Insurance Contracts*.

Actuarial Data Extract (ADE)

A data extract used to facilitate an actuarial valuation. The data is typically sourced from the claims and policy administration systems.

Actuary

In general, in New Zealand an actuary is a Fellow or Accredited Member of the New Zealand Society of Actuaries or equivalent body.

Aggregate excess of loss reinsurance

See **catastrophe reinsurance.**

Apportioned Cost Estimate (ACE) data

A number of properties have had their building damage apportioned between events in a manual fashion. This process uses all available information on that property (quantity surveyor reports, land damage information, neighbourhood damage, customer reports etc.) to inform the apportionment. These apportionments are called Apportioned Cost Estimates and will be included the ACE data set. The ACE data set includes all overcap properties and a number of undercap properties too.

Attachment date

See **inception date.**

Best estimate

In the context of scenarios, a best estimate means a realistic future scenario, rather than a deliberately pessimistic or optimistic one. Also, see **central estimate**.

Brokerage

An alternative term for commission paid to a **broker.**

Broker

An intermediary who acts for an insured in negotiating their insurance. The broker usually receives payment by way of commission from the insurer with whom the business is placed.

Business as Usual (BAU)

A distinction has been drawn between claims that are related to the Canterbury Earthquake Sequence or the Kaikoura earthquake and those that are from other events (earthquake or other). These other events are referred to as Business as Usual (BAU) events.

Canterbury Earthquake Sequence ('CES')

The sequence of earthquakes and aftershocks in the Canterbury area from 4 September 2010 to the end of 2011. This included four main earthquakes on 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011.

Case estimate

The amount recorded by the insurer's claims personnel (including external claims assessors) as being the amount required to settle an open claim, based on the information available on that particular case. When a claim is first reported and recorded, a nominal placeholder estimate may be entered into the system. Estimates should be updated as extra information comes to light and adjusted to reflect any partial payments that may be made prior to final settlement.

Catastrophe

A catastrophe event for an insurer is generally considered to be a single event that results in one or more claims for very large amounts or in an aggregation of many claims collectively costing an extremely large amount. The nature and impact of potential catastrophe events will vary by insurer according to their business, amount of capital and risk management arrangements. Examples include earthquakes and terrorism.

Catastrophe reinsurance

Usually an excess of loss reinsurance arrangement providing cover to an insurer against very high losses arising from a **catastrophe** event, which meets the definition of 'catastrophe' as specified in the reinsurance policy. The nature and extent of the cover available / provided depends on the nature of the underlying insurer's business and the terms available for such protection. For some events, such as storm or earthquake, the reinsurer may impose a specified time limit on when claims may be covered under the catastrophe treaty.

Cedant or ceding insurer

An insurer who has ceded (passed on) all or part of the risks it has underwritten by way of reinsurance. Analogous to an insured who cedes risk to an insurer.

CEDAR

Canterbury Earthquake Defect And Repair review. MBIE commissioned an independent survey of the repairs of a sample (101 properties) of the earthquake-damaged Canterbury homes selected from more than 2,700 addresses provided by the Earthquake Commission (EQC), Housing New Zealand, and insurers Southern Response and IAG. The survey also included a small sample of houses where homeowners had opted out of an insurer-led home repair programme.

The aim was to assess the Building Code compliance of structural repairs that were exempt from a building consent under Schedule 1 (repairs and maintenance) of the Building Act.

Central Estimate

An estimate that contains no deliberate or conscious over- or under-estimation. NZ Accounting standards define this to be the mean of the probability distribution of future outcomes. Also, see **probability of adequacy**.

Claim frequency

The number of claims divided by exposure over a given time period. This could apply to **reported** or **incurred** claims.

Claims handling expenses (CHE)

The expenses involved in the processing and settlement of claims. Note that this term usually relates only to indirect claims expenses such as internal general administration claims costs. Expenses such as assessors' fees or legal costs, that arise in relation to specific claims, are termed direct expenses and are usually treated as part of the cost of those claims.

Claims paid

The amount paid in respect of claims.

Claims provision and claims reserve

These are both terms used to refer to the amount held or required to provide for future payments on outstanding claims. These terms are sometimes seen as being interchangeable. However, there are variations in the precise usage of both terms according to the context in which they appear.

A claims provision is often used to refer to the amount held in an insurer's accounts. In management accounts, claims reserve may refer to the total **case estimates**, possibly with an additional amount for **IBNR** claims. In actuarial contexts, the technical terms are, respectively, **incurred claims liability** and **outstanding claims liability**. These amounts might also include allowances for **CHE**, **discounting**, **claims paid**, and a **risk margin**. Figures may be given **net** or **gross of reinsurance**.

Closed claims

Those claims for which records have been closed, because settlement has been made and no recoveries are expected. However, see **reopened** claims.

Cover

The extent and nature of protection provided by an insurance policy. This will be defined in the policy documentation.

Deductible

See **excess.**

Demand surge

The increase in the cost of insurance claims following a major loss event. The event puts pressure on the demand for labour and materials to pay for repairs which, in the absence of increased supply, increases the price of these costs.

Diminution of Value (DoV)

Diminution of Value, in the context of IFV or ILV is the loss in value suffered by the homeowner, as a result of the land damage that caused the loss. In assessing the DOV, it does not include any change in value resulting from matters other than the land damage (e.g. a change in the building regulations and practices after the 2010-2011 Canterbury earthquakes).

Discounting

Discounting refers to the (absolute) reduction, for the time value of money, of any future cashflows. The extent of discounting is a consequence of two factors: length of time until payment and the discount rate with an increase in either of these increasing the impact of discounting. Cashflows which have been discounted are said to be *present values*.

Actuarial **professional standards** state that **risk-free discount rates** must be used to calculate present values.

Effective date

The effective date of an **ILVR** is the date to which the valuation calculations apply.

Exacerbated Flooding Coverage ('EFC')

Exacerbated Flooding Coverage ('EFC') is the area of a property that has had exacerbated flooding as a result of the Canterbury Earthquake Sequence. The exacerbated flooding is assessed for a 100-year return period event (as stated in the EQC IFV policy). In the report, 'EFC' is presented as a percentage of the EQC insured land area for a property. It has been used as a proxy to estimate the likely DoV rates for IFV properties which are yet to be assessed.

Excess

The amount of an insured loss that must be borne by the policyholder before the insurer becomes liable to make a claim payment. The amount of the excess will be set out in the policy documentation.

Excess of loss reinsurance

A non-proportional form of reinsurance whereby the insurer pays the cost of a claim up to a specified point (their **retention**) and the reinsurer pays the remainder of the cost. The amount payable by the reinsurer is usually subject to a specified maximum amount which may apply per claim or to the total amount. Also, see **catastrophe reinsurance**.

Experience

The term used to describe the results of blocks of insurance business, particularly when the results are the subject of detailed analysis.

Future Claim Liability (FCL)

A term sometimes used to refer to the **premium liability** arising from unearned policies. It is the value of future claim payments and related **CHE**, arising from future events for which the insurer is liable.

Green Zone

Canterbury land areas such that land repair / rebuild can begin. The Green Zone was further divided into commercial zoned land, Port Hills land, rural land, and three residential flat land categories. The three residential flat land categories describe how the land is expected to perform in future earthquakes, and also describe the foundation systems most likely to be required in the corresponding areas. Also, see Red Zone, TC1, TC2, and TC3.

Gross

Refers to the amounts of premiums, claims and expenses before allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Inception date

Inception date is the date on which cover commences.

Increased Flooding Vulnerability (IFV)

The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events.

Increased Liquefaction Vulnerability (ILV)

The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes.

Incurred

A term relating to claims arising from events that occurring in a specified period.

There are differences in the precise usage of the term according to the context in which it appears. In some contexts, it may refer to the group of claims *occurring* in the period (whether **reported** to the insurer or not) and their eventual cost. In accounting contexts, the term may refer to the amount of *claims payments made plus the change in outstanding claims provisions* from the start to the end of the period.

In an actuarial context, 'incurred' costs are taken to mean the claim costs cost which arise, or come to light) during the period. An alternative expression of this is: claim payments made plus outstanding estimates (inclusive of **IBNR** and **IBNER**).

Further differences may also apply in regard to the inclusion (or not) of **CHE** and **risk margins**. Clarification should be provided in the actuarial commentary as to the precise meaning applied. It should also be stated whether there has been allowance for **discounting** in the quantification of future payments to be made on these claims. Also see **discounting** and **ultimate cost**.

Incurred but not reported (IBNR)

Any claim or claim amount for which, at a particular point in time, the loss event has occurred but the insurer has not yet been notified and/or the claim entered into the claims system. Any **outstanding claims liability** must include an allowance for these claims.

Incurred but not enough reported (IBNER)

A monetary amount relating to **reported** claims. IBNER is defined as the ultimate cost of the claim less the current **case estimate** and could be positive or negative. The **outstanding claims liability** must include an allowance for this.

Incurred claims

Claims that were **incurred** during a specified time period.

Incurred claims liability

See **Outstanding Claims Liability**.

Indirect claims handling expenses

See **claims handling expenses**

Insurance liability valuation report (ILVR)

A report detailing a valuation by the **actuary** of the **insurance liabilities** of an insurer.

Joint Assessment and Review Team (JART)

The process whereby EQC and the relevant insurer would review building claims to assess whether it was likely to go overcap and if so, how it should be apportioned and settled. The JART report is a summary of the properties that had open building issues, categorised by the reason for the issue.

Kaikoura Earthquake ('KEQ')

The earthquake and related aftershocks that occurred on 14 November 2016, beginning 15 km north-east of Culverden and proceeded north-east through Kaikoura to Seddon.

Liability adequacy test (LAT)

A test applied under the **accounting standard** which consists of a comparison of the **unearned premium**, less deferred acquisition costs (DAC), against the **premium liability**. If the test indicates a deficiency, the DAC must be written down by an appropriate amount in the entity's income statement. If the deficiency is greater than the DAC, a premium deficiency reserve must be set up.

Material

In the context of an actuarial report, an item is deemed material if it is significant in the professional judgement of the actuary. This may not necessarily correspond exactly with 'material' as applied in an accounting context.

Net

Refers to the amounts of premiums, claims and expenses after allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Net outstanding claims liability

See **outstanding claims liability.**

Non-reinsurance recoveries

Non-reinsurance recoveries refer to the recoveries against claim payments that come from entities other than reinsurers. It includes amounts in respect of salvage and third parties. It doesn't refer to excesses and deductibles that are deducted from the claim.

Open claims

Those claims that have been **reported** to the insurer but are not regarded as finally settled as claim payments and/or recoveries associated with the claim, may occur in future.

Outstanding Claims Liability (OCL)

The expected value of future payments on claims that were **incurred** on or before the **effective valuation date**. This usually includes future **CHE** associated with those claims, allows for **discounting**, and includes a specified **risk margin**. It may be calculated **gross** or **net of reinsurance** and **non-reinsurance recoveries**.

Outstanding Claims Provisions

The amount in the insurer's accounts providing for **outstanding claims liabilities** at the accounting date.

Premium Liabilities

The value of future claim payments and related **CHE**, arising from future events for which the insurer is liable at the date of calculation.

Probability of adequacy

The statistical probability that a reserve or provision will ultimately prove to be adequate to provide for all relevant payments to be made.

Professional Standard

The form of professional guidance as issued by the New Zealand Society of Actuaries, or such other professional body as may be stated.

Red Zone

Canterbury land areas such that land repair would be prolonged and uneconomic. This includes flat land areas, which sustained significant crustal thinning and Port Hills areas which were at imminent risk of cliff collapse or rockfall. Also see Green Zone, TC1, TC2, and TC3.

Reinstatement premiums

Premiums that become payable under reinsurance treaties, particularly catastrophe reinsurances, when all or part of a layer of cover has been 'used' by the insurer making a claim, but the insurer wishes to reinstate full coverage for the remaining term of the treaty. A 'free reinstatement' may sometimes be included in the original terms of a treaty.

Reopened claims

Claims that had been regarded as settled (i.e. no further claim payments or recoveries) but for which claims records have since been reopened because an additional payment or receipt has been made or is now expected to be made. The **Outstanding Claims Liability** must take the possibility of claims reopening in future into account.

Reported

Claims are said to be reported if the insurer has been notified of their existence.   This is in contrast to **IBNR** claims.

Resolved

For exposures settled by cash payment, the valid building, contents or land exposure is recorded as resolved when the claimant has been paid for that exposure. In the case where the building exposure is settled by managed repair, building exposures are only recorded as resolved when all planned repairs are complete (but the 90-day defect liability and warranty period may not have expired) and the customer has received a full cash payment from EQC for all contents and land exposures. Exposures are also considered resolved if the exposure has not been accepted and the customer informed.

Retention

The amount of risk retained by the direct insurer above which an excess of loss reinsurance will be triggered.   Also see **excess**.

Risk-free discount rates

These are the rates of interest that would be available on a theoretical, riskless investment.   In practice, they are the rates available on very secure investments, such as government bonds of suitable durations, which may be assumed to be free of default risk.

Risk Margin

The amount of extra provision over and above the **central estimate** which is intended to allow for the inherent uncertainty of insurance liabilities.   The relevant **probability of adequacy** associated with the increased amount should be stated.

Sensitivity

The uncertainty in the calculation of insurance liabilities due to the assumptions involved. Accounting and **professional standards** require statements of the effects on the results to be illustrated by sensitivity tests.   These involve reviewing the calculations after varying key assumptions.

Technical Category 1 – TC1

TC1 refers to Green Zone land where it was assessed that future land damage from liquefaction was unlikely. Residential buildings on TC1 land required no special foundation systems, relative to most flat land throughout New Zealand.

Technical Category 2 – TC2

TC2 refers to Green Zone land where it was assessed that minor to moderate land damage from liquefaction was possible in future large earthquakes. Residential buildings on TC2 land require face some restrictions on the type of foundation that is permitted, subject to the house design.

Technical Category 3 – TC3

TC3 refers to Green Zone land where it was assessed that moderate to significant land damage from liquefaction is possible in future large earthquakes. Residential buildings on TC3 land require a site specific geotechnical investigation and a specific engineering foundation design.

Uncertainty

Where full, known information is not available, uncertainty exists as to the exact nature and extent of the ultimate outcome.   In particular, there is inherent uncertainty in any estimation of insurance liabilities, which are necessarily based on assumptions, usually derived from analyses of past experience.   Deviations from estimates are normal and are to be expected.   See also **central estimate, probability of adequacy** and **sensitivity**.

Unearned Premium

The proportion of written premium that relates to the risk still to be covered after the balance date or effective date of the valuation.   The calculation usually assumes that premium is earned evenly over the term of a policy, except for unusual types of risk where this is clearly not the case (for example, Contractors All Risks).   Should a policy be cancelled, the unearned premium as at the cancellation date may be refunded to the policyholder, possibly after allowance for expenses incurred.

Unearned Premium Reserve (UPR)

The total amount of **unearned premiums** held, reflecting the periods of future cover to be provided under policies in force at the balance date or effective date of the valuation.

Valuation date

The **effective date** as at which a valuation has been made.