

---

Diminution of Value Methodology for  
Increased Liquefaction Vulnerability (for  
where the residential building has been or  
will be rebuilt)

---

**NOVEMBER 2016**

---

## TABLE OF CONTENTS

<b>(A)</b>	<b>EXECUTIVE SUMMARY</b>	<b>3</b>
<b>(B)</b>	<b>BACKGROUND</b>	<b>6</b>
(B1)	Purpose	6
(B2)	Increased vulnerability damage	6
(B3)	Diminution of value methodologies	6
(B4)	Statutory context – Earthquake Commission Act 1993	7
(B5)	Background to Canterbury earthquakes and residential property market	8
<b>(C)</b>	<b>DEFINING THE VALUATION OUTCOMES SOUGHT</b>	<b>9</b>
<b>(D)</b>	<b>ASSUMPTIONS (LEGAL AND VALUATION)</b>	<b>12</b>
<b>(E)</b>	<b>INPUTS TO VALUATION METHODOLOGY</b>	<b>16</b>
(E1)	Engineering advice regarding the impact of ILV	16
(E2)	Repair costs	21
(E3)	Market sales evidence	24
<b>(F)</b>	<b>THE METHODOLOGY</b>	<b>26</b>
(F1)	Introduction	26
(F2)	Development of matrix to apply to land values	26
(F3)	Valuation Process	30
(F4)	Phase 1 - Assessing the Pre-earthquake Valuation	31
(F5)	Phase 2 - Identifying the severity classifications	31
(F6)	Phase 3: Calculating the Total Percentage Discount	32
(F7)	Phase 4: Calculating the Final DoV	38
(F8)	Review of DoV assessments	39
(F9)	DoV assessments where part of the land has been repaired	39
	<b>APPENDIX TWO: PRE-EARTHQUAKE VALUATION OF INSURED LAND</b>	<b>43</b>

## (A) EXECUTIVE SUMMARY

- 1 This paper describes the methodology developed by the professional valuation advisors to the Earthquake Commission (**EQC**) in conjunction with legal and engineering advice to determine what, if any, reduction or diminution in value (**DoV**) of insured residential land has resulted from what is defined as Increased Liquefaction Vulnerability (**ILV**) land damage to that land, a form of natural disaster damage under the Earthquake Commission Act 1993, in circumstances where the residential building that was on the land prior to the Canterbury earthquake sequence has been or will be removed from the land, and a new house has been or will be rebuilt, due to the extent of the earthquake damage.
- 2 The methodology has been developed for the purpose of enabling EQC to settle residential land claims for ILV land damage on the basis of a payment of the DoV, in circumstances where:
  - 2.1 the DoV of the land is the most appropriate measure of the insured's loss as a result of the ILV land damage, rather than the cost of repairing that damage; or
  - 2.2 part of the land which has suffered ILV land damage (including the area required to support the residential building) has been repaired, but there remains a loss in value to the unremediated area of land.
- 3 For these purposes, the methodology must assess the DoV caused by ILV land damage – that is, the **change** in the insured land's vulnerability to liquefaction **as a result of subsidence to insured land** caused by the Canterbury earthquake sequence.
- 4 Other matters which may affect the value of insured land as a direct or indirect result of the Canterbury earthquakes are to be excluded from the DoV. Accordingly, the DoV must exclude any value reduction as a result of:
  - 4.1 other earthquake-related natural disaster damage or effects, such as general changes in seismicity in the Canterbury region;
  - 4.2 decisions by regulatory authorities regarding building regulations, or services; and
  - 4.3 general market uncertainty and stigma following the earthquakes.
- 5 The methodology described in this paper has been developed specifically for the situation in which the main residential building (the **house**) on that land with ILV land damage at the time of the Canterbury earthquake sequence has been or will be removed or demolished, and a new house has been or will be rebuilt. The methodology for properties where the house remains on the land has been addressed in a separate report: *Diminution of Value Methodology for Increased Liquefaction Vulnerability (for properties with residential building in place)* (June 2016) (**ILV DoV Methodology (Residential Building in Place)**).

- 6 The methodology described in this paper enables expert valuers to assess the DoV, in absolute dollar terms, that the insured land has suffered from its value immediately prior to the first earthquake of 4 September 2010 as a result of ILV land damage caused by the Canterbury earthquake sequence. The methodology has essentially four parts:
  - 6.1 Determination of the pre-earthquake (September 2010) value for the relevant area of insured land (being either the entire insured land or the unrepaired insured land if the ILV damage to part of the land has been repaired), using conventional valuation techniques;
  - 6.2 Identification of an appropriate percentage adjustment (if any) for ILV land damage;
  - 6.3 Application of the percentage adjustment to the pre-earthquake value of the insured land; and
  - 6.4 Exercise of valuation judgement as to the resulting DoV.
- 7 A matrix of DoV adjustments to insured land value for increased liquefaction vulnerability has been developed based on the matrix set out in the ILV DoV Methodology (Residential Building in Place), taking into account information provided by EQC's engineering advisers, Tonkin + Taylor, regarding the practical implications of ILV damage on the land and the redevelopment of the land for residential building purposes in accordance with current building standards and practices.
- 8 A second matrix of DoV adjustments to insured land value has been developed to be applied to residual areas of land with ILV damage on properties where parts of the land (including the land required to support the building platform) has been repaired.
- 9 Use of these matrices to determine DoV adjustments will ensure the consistent and principled assessment of DoV across land that has suffered ILV land damage. Given the lack of granularity in the engineering information available about the nature and extent of the ILV damage on each property, valuation judgement has primarily been exercised in the development of the methodology. In this process, EQC's valuers have been able to test and consider the DoV percentage reductions that would be produced by the methodology in light of the engineering advice about the nature and extent of ILV damage in different areas of Canterbury. Valuation judgement will be further required in assessing the pre-earthquake value of the land to which the DoV adjustment is applied, and in some cases in the application of the adjustment to the pre-earthquake value to produce a final DoV figure.
- 10 EQC's valuers principally responsible for this report, and the development of the DoV methodology for ILV land damage to insured land, are:
  - 10.1 Dave Townsend FNZIV, FPINZ, a registered valuer who works for his own company and has been involved in the valuation and property consultancy industry for the past 34 years. Dave is a contractor to, and advises, EQC on a range of valuation matters. Working as a contracted Lead Valuer with EQC often involves working with and advising local valuers in the event of specific land value issues that arise throughout New Zealand;

- 10.2 Ken Blucher, a registered valuer and Fellow of the New Zealand Property Institute (FPINZ) with over 34 years valuing experience. Based in Wellington, he is a Director at Darroch and has a wealth of experience with respect to EQC claims, compensation work, disposal of surplus Crown properties and Treaty settlements acting on behalf of the Crown. Ken also advises clients on various legislative matters, specifically relating to rating. Ken has been a key member of the valuation team assisting EQC with property and valuation policy advice in Christchurch, since September 2010 through to the current day. He is currently Valuation team leader with respect to the assessment of properties with IFV and ILV; and
  - 10.3 Chris Bridges ANZIV, SPINZ, a Christchurch based Registered Valuer with 33 years' experience in valuation and property advice. Chris manages his own company, and provides valuation advice to EQC on a range of matters. He is a key member of the team that has developed the methodology for DoV valuation.
- 11 The methodology has also been reviewed by the independent Expert Valuation Panel appointed by EQC. The Expert Valuation Panel comprises four senior members of the valuation profession nominated by the Institute of Valuers and the Property Institute of New Zealand. The Expert Valuation Panel has approved the methodology as an appropriate methodology for assessing the DoV caused by increased vulnerability to liquefaction that accords with accepted valuation standards and practice.

.....

## **(B) BACKGROUND**

### **(B1) Purpose**

- 12 The purpose of this paper is to explain the development of a methodology to determine what, if any, reduction or diminution of value (**DoV**) of residential land has resulted from Increased Liquefaction Vulnerability (**ILV**) land damage in circumstances where the house has been or will be rebuilt. This methodology is generally to be used as an alternative basis of settlement for ILV land damage claims, rather than the cost of repairing that damage. However, this methodology also addresses the DoV of residual areas of insured residential land where the ILV land damage to the building platform has been repaired but there remain other areas of insured residential land with unrepaired ILV land damage.
- 13 This paper and methodology address only properties with ILV land damage. As ILV land damage only affects the flat lands of Canterbury (rather than the Port Hills), this paper is confined to the assessment of DoV for flat land properties.
- 14 The methodology and this paper reflect a combination of valuation, legal and engineering advice provided to EQC.

### **(B2) Increased vulnerability damage**

- 15 The 2010-2011 Canterbury earthquake sequence (**CES**) has resulted in certain types of land damage that may not severely impact the owner's present ability to use the land, but which have made the land more vulnerable to certain future natural disaster events.
- 16 These types of land damage result largely from the lowering of ground levels. This change in turn has increased the land's vulnerability to future natural disasters, namely flooding and liquefaction damage in the event of another significant earthquake. These types of land damage have been classified as:
- 16.1 Increased Liquefaction Vulnerability (**ILV**); and
  - 16.2 Increased Flooding Vulnerability (**IFV**).
- 17 ILV and IFV land damage are each discussed in more detail in section (F) of the ILV DoV Methodology (Residential Building in Place) and section (G) of the IFV DoV Methodology (Residential Building in Place) respectively.
- 18 This report sets out the methodology for assessing DoV for ILV land damage, where the pre-earthquake residential building has been or will be removed or demolished, and a new building has been or will be rebuilt.

### **(B3) Diminution of value methodologies**

- 19 Ordinarily, EQC does not settle land claims by reference to any DoV of land damaged by a natural disaster. Rather, it settles such claims based on the estimated cost of repair. However, ILV and IFV land damage have led to the need to consider settling claims by reference to the DoV to the property caused by the damage to the land resulting from the earthquakes.

- 20 Methodologies for assessing DoV resulting from ILV and IFV land damage have already been developed for properties where the pre-earthquake house remains in place. These are as set out in the reports:
- 20.1 *Diminution of Value Methodology for Increased Liquefaction Vulnerability (for properties with residential building in place)* (May 2016) (**ILV DoV Methodology (Residential Building in Place)**); and
- 20.2 *Diminution of Value Methodology for Increased Flooding Vulnerability* (updated March 2015) (**IFV DoV Methodology (Residential Building in Place)**).
- 21 A methodology has also been developed for IFV land damage where the pre-earthquake residential building has been or will be rebuilt. This is set out in the *Diminution of Value Methodology for Increased Flooding Vulnerability (for where the residential building has been or will be rebuilt)* (October 2016) (**IFV DoV Methodology (Residential Building has been or will be Rebuilt)**).
- 22 In the context of EQC's settlement policy for IFV land damage, the High Court confirmed that DoV is an available basis of settlement in appropriate circumstances. Accordingly, the above methodologies are being used by EQC in appropriate circumstances as the basis of settlement of ILV and IFV land damage claims.
- 23 Consistent with its approach to ILV land damage where the residential building remains in place, EQC has decided to develop a methodology to provide a consistent framework for the assessment of any DoV to land resulting from ILV land damage for properties where the pre-earthquake residential building has been or will be removed or demolished, and a new house has been or will be rebuilt.
- (B4) Statutory context – Earthquake Commission Act 1993**
- 24 EQC provides statutory insurance for residential buildings and land (where the buildings have private fire insurance), for damage resulting from a natural disaster. The scope of the cover is set out in the Earthquake Commission Act 1993 (the EQC Act).
- 25 As regards land, EQC covers the land on which the house is situated, 8m around the house (and any appurtenant structures such as sheds), the main access way (up to 60m from the house) and land supporting that access way.
- 26 EQC provides building cover, in general, up to \$100,000 (plus GST) for each earthquake event. There is no equivalent fixed cap for land cover. Instead, EQC insures the land up to a maximum amount, being the value of the smaller of certain areas, which will typically be the area of the land damaged or lost, or the minimum lot size for an equivalent residential purpose under the District Plan applicable to the property.
- 27 EQC may settle both land and building claims, up to the maximum amount, by way of payment, replacement or reinstatement at its discretion. In the past, EQC has settled land claims either by payment or reinstatement. Where it settles by payment, the payment has been calculated by reference to the cost of reinstatement or repair (subject to that amount not exceeding the maximum amount). Where land

has been “lost”, for example by landslip, EQC has typically paid the maximum amount, being generally the value of the area of land lost.

- 28 In the case of ILV and IFV land damage, rather than paying the cost of repairing the land, another option is for EQC to pay a claimant DoV of the property resulting from the land damage. The High Court has confirmed that DoV may be a more appropriate measure of the claimant’s true loss.

**(B5) Background to Canterbury earthquakes and residential property market**

- 29 The ILV DoV Methodology (Residential Building in Place) set out detail about other matters relevant to this methodology. These are not repeated in this paper, but include:

29.1 the Canterbury earthquake sequence;

29.2 post-earthquake land classifications;

29.3 the nature of the Canterbury market before and after the earthquakes; and

29.4 relevant valuation principles and standards.

### (C) DEFINING THE VALUATION OUTCOMES SOUGHT

- 30 The objective of the methodology, therefore, is to provide, for each parcel of insured land with ILV land damage, a dollar value for the DoV of the land resulting from that damage.
- 31 More specifically, the objective is to assess the **discount** from the price that would have been paid for the **land on the day prior to the earthquake** that would be agreed between a **willing buyer and willing seller** because of the **specified physical change** to the land, with **full knowledge** about that change and its impact on the vulnerability of the land to liquefaction, and the costs of repair options, and advice from competent and **reasonable advisors** recommending any course of action, but **excluding** consideration of any increase in the **immediate foundation costs** that would need to be incurred when rebuilding a house on the land.
- 32 The key elements of this objective can be broken down as follows:
- 32.1 **Discount:** EQC is not attempting to assess the value of the land, or all changes in value after the earthquake; EQC is only assessing the change in value resulting from certain physical land changes. The total change to the land value may reflect impacts for uncertainty, stigma, externalities, etc. which need to be disregarded.
- 32.2 **Land:** The DoV is that of the land insured by EQC with no buildings on it, but taking account of the potential use of that land as a platform for a residential building. EQC is assessing the DoV in order to settle claims of damage to land only (the insurance of residential buildings and personal property being separate). Where the house that existed prior to the earthquake is either not capable of being, or will not be, repaired as a result of the earthquakes, damage to the land does not affect the value of that building, but only the value of the land as a platform for a residential building. However, to the extent that the damage to the land will also affect the value of any potential residential building situated on the land, this will be reflected in the discount of the value of the land.
- 32.3 The methodology described in this paper is limited to assessing DoV on properties where the house that existed prior to the earthquakes is going to be or has been rebuilt. The methodology for assessing DoV arising from ILV land damage on properties where the house that existed prior to the earthquakes is still in place on the land, and is going to be repaired, is set out in the ILV DoV Methodology (Residential Building in Place).
- 32.4 **The day prior to the earthquake:** The DoV is the discount from the value of the land immediately prior to the earthquake. That value reflects the value of the land when the damage occurred.
- 32.5 **Willing buyer and willing seller:** The objective is still to determine, as much as possible, what value would be attributed to the physical damage in an open market transaction.

- 32.6 **Specified physical change:** EQC is assessing the DoV that results from physical changes to the land, specifically ILV land damage. The engineering assessment of the physical change and the practical implications of that physical change is carried out by EQC's engineers, Tonkin + Taylor. The basis of this engineering assessment, including relevant assumptions, is set out in section (F), below.
- 32.7 **Full knowledge:** While the details of the physical changes were not ascertained immediately after the earthquake (and were not for some time), those physical changes (including increases to vulnerability) had already occurred. The market participants are taken to have full knowledge of those changes and their impacts (other than on value), including therefore the pre-earthquake vulnerability of the land to liquefaction damage. This does not entail full knowledge of every detail regarding the land, changes, repair options and costs etc., but rather the level of detail a reasonable buyer and seller would obtain from relevant experts.
- 32.8 **Reasonable advisors:** EQC compensates for loss as a direct result of land damage; it does not compensate for regulatory changes made following the earthquakes (e.g. decisions regarding the maintenance of services in the Red Zone). The assessment of DoV will therefore not take into account future known or potential regulatory changes that have occurred after the earthquakes. However, an assessment of the DoV may reflect future steps that a property owner may reasonably wish to take as a result of the change to the land.
- 32.9 **Excluding immediate foundation costs:** Residential buildings are separately insured by EQC against earthquake damage and are generally also covered by private insurance. Where the residential building has suffered earthquake damage that is not capable of, or will not be, repaired, it is assumed that the EQC and private insurance will enable the insured to rebuild the residential building on the land, including foundations that meet current regulatory requirements. Any increases in the immediate costs of building foundations that are the result of the ILV land damage are therefore not taken into account in assessing the DoV.
- 33 Aspects of the above are elaborated on in the assumptions section, below.
- One DoV assessed for the 2010-2011 earthquake series*
- 34 The EQC Act responds to damage caused by each natural disaster event separately. However, as the valuation of a DoV for ILV land damage is a difficult exercise involving the application of valuation judgement based on limited market information, EQC's valuers consider that it is necessary to value the effect of all ILV caused by the entire Canterbury earthquake sequence. Due to the variable and often insignificant change from one event to another, this provides a truer change of the land's loss of amenity and value. This is because, in general, the change across the sequence will be larger and the loss of value more confidently and accurately identified.
- 35 Further, an assessment of DoV across the entire earthquake sequence is necessary because the engineering assessment of ILV is also based on the changes across the entire sequence. This is predominantly because the engineering assessment of ILV

land damage is based on a manual application of engineering judgement taking into account highly complex information, which is not feasible to undertake separately for each earthquake.

- 36 Accordingly, the valuation of DoV for ILV land damage will be undertaken for each property to reflect the discount in value arising from all ILV land damage caused over the full Canterbury earthquake sequence. Any apportionment of the DoV to specific earthquake events is a matter being considered by EQC, and does not form part of this paper.

*Scope of methodology*

- 37 This methodology is focused on assessing DoV for land where the house that existed prior to the earthquakes has been or will be removed or demolished, and a new house has been or will be rebuilt.
- 38 This methodology is not intended to provide the basis for assessing DoV arising from ILV land damage on properties where the house that existed prior to the earthquakes is still in place on the property and has been or is going to be repaired. Instead, the DoV arising from ILV land damage for such properties is assessed in accordance with the ILV DoV Methodology (Residential Building in Place).

## **(D) ASSUMPTIONS (LEGAL AND VALUATION)**

39 This methodology is based on a range of legal and valuation assumptions. EQC's legal advisors and valuers currently consider that assumptions will need to be made in relation to matters listed below. These assumptions are likely to be valid and appropriate at the time that valuations for Canterbury earthquake damage are completed, and given the nature of the land insurance provided under the EQC Act. The assumptions are as follows.

### *Date of valuation*

40 The DoV is to be assessed as the reduction from the land value immediately before the earthquake on 4 September 2010. In practice, the value on 3 September 2010 is used.

### *Willing buyer and seller*

41 The DoV is based on the standard valuation assumption that the value is the exchange value between a willing, but not anxious, seller and a willing, but not anxious, buyer.

### *Basis of valuation*

42 The value immediately before the September earthquake will be the Market Value of the insured land where reasonable comparable market indicators are available.

43 The DoV will be based on a market value that refers to a set of assumptions as to what is to be valued. This assumptions-based market value is unable to draw on directly comparable market sales given the absence of information regarding ILV land damage in the Canterbury market to date, and the difficulties in isolating the impact of ILV land damage from other earthquake damage suffered by the land. Instead, the assumptions-based market value will draw from evidence of market sales in Canterbury following the earthquakes, hedonic modelling, and international literature concerning the impact of vulnerability to natural disasters on property values. It will take into account the information provided by Tonkin + Taylor regarding the impact of different levels of liquefaction vulnerability on land and residential buildings that may be built on affected land. It will not take into account any short term stigma which may temporarily affect land values.

### *Land to be used as a residential site*

44 The EQC Act provides cover for natural disaster damage (being a physical change resulting from a natural disaster that affects the use and amenity of the property) to residential land and buildings. In this context, the Act is primarily concerned with a physical change caused by the earthquakes that affects the use and amenity of residential land as a building platform for a residential building, and its associated uses.

45 Consistent with the scheme and purpose of the EQC Act, for the purposes of assessing DoV, it is assumed that the land will continue to be used as a residential site.

46 The assessment of DoV is of the value of the land as a platform for a residential building. However, as noted above, to the extent that the damage to the land will also affect the value of any potential residential building situated on the land, this

will be reflected in the discount of the value of the land. Consistent with standard valuation practice for land, this assessment will be of the highest and best use of land as a residential building platform (taking into account the relevant characteristics of the land and locality).

- 47 As the DoV assessment is based on vacant land, the valuers must assess the impact of the ILV land damage taking into account the likely characteristics of a potential residential building situated on the land, including taking into account any regulatory requirements or practices that would be relevant to any redevelopment (such as foundation design).

#### *Insurance*

- 48 This methodology proceeds on the assumption that insurance will be generally available to properties affected by ILV land damage, once a residential building is rebuilt on the affected land. If the assumption is incorrect in relation to a specific property, this will be considered further.

#### *Finance*

- 49 It is also assumed that finance to purchase residential land or land with a rebuilt residential building will be available on normal terms for any property for which insurance is available.

#### *Public availability of information regarding liquefaction vulnerability*

- 50 Liquefaction vulnerability will be disclosed to buyers and sellers through their assumed advisors, who have access to the New Zealand Geotechnical Database (**NZGD** – formerly the Canterbury Geotechnical Database), and potentially through Land Information Memoranda (**LIMs**).

#### *DoV to only reflect ILV land damage*

- 51 One of the most important assumptions is that the DoV will be the reduction in value resulting only from physical changes to that residential land assessed by EQC as ILV land damage. This assumption is made to ensure that EQC is compensating customers for only natural disaster damage that is covered under the EQC Act.
- 52 The DoV will not therefore reflect any changes in vulnerability to liquefaction resulting from external changes or effects, whether as a result of the earthquakes or otherwise. Equally it will not reflect changes in value due to increased knowledge of pre-existing vulnerability as opposed to increased vulnerability due to the earthquake damage. For example:
- 52.1 *Operational services:* It will not consider whether the land has, and will continue to have, operational services such as roading, telephone, sewerage etc. The fact that the council has decided that it will not maintain services in the residential Red Zone to the same level as before the earthquakes, is not something that EQC will be compensating for.
- 52.2 *Neighbouring properties:* Any effect from the earthquakes on neighbouring properties will be disregarded.
- 52.3 *Short term temporary stigma:* Any short to medium-term stigma arising from the earthquakes that may temporarily affect land values will be disregarded.

- 52.4 *Non-insured land:* EQC is making an insurance payment to claimants for loss in value of the insured land resulting from damage to that land. To the extent the property includes land that is not insured, the DoV EQC is assessing will not include any DoV resulting from the damage to that uninsured land.
- 52.5 *Vulnerability not caused by physical changes to the insured land:* Natural disaster damage under the EQC Act is limited to physical damage to the insured residential land. Accordingly, any increase in liquefaction vulnerability resulting from other changes – such as changes in seismicity– which are unrelated to a physical change to the land are not included. Details of the assumptions around seismicity are discussed further in relation to Tonkin + Taylor’s ILV Assessment Methodology Report in section (F4) of the ILV DoV Methodology (Residential Building In Place).
- 52.6 *Damage which will be separately compensated for by EQC:* Other forms of land damage, such as deep lateral spreading cracks, may also result in an increase in vulnerability to liquefaction damage. However, these are compensated for by EQC paying the remediation costs for those cracks, and therefore they are not included in any assessment of DoV for ILV land damage.
- 52.7 *Changes in regulatory and building practice:* EQC understands that, since the Canterbury earthquake sequence, the increased seismicity in the region and increased awareness of the vulnerability to liquefaction have led to changes in building regulations and practices. These changes have resulted in more extensive geotechnical testing and more robust foundation designs being required in areas that are vulnerable to liquefaction. These are not changes that arise from the physical damage to the land, and therefore will not be compensated for. However, the implications of the ILV land damage to the land will be assessed in light of current regulation and practice. Accordingly, an increase in foundation requirements under current regulation and practice that directly results from the physical change to the land will be taken into account except to the extent that it is covered by the EQC and private building insurance response, discussed further below. Further information on this issue can be found at section (I2) of the ILV DoV Methodology (Residential Building in Place).

*Rebuilding to be funded by building insurance*

- 53 Residential buildings are separately insured under the EQC Act and are generally also insured for earthquake damage under private insurance policies.<sup>1</sup> Where the residential building has been damaged in the earthquake sequence to the extent that it cannot or will not be repaired, it is assumed that the insured will receive sufficient funds from EQC and the private insurer to enable the insured to rebuild the residential building in compliance with current regulatory requirements.
- 54 Accordingly, for the purposes of this methodology it is assumed that any increase in the immediate foundation costs that would be incurred in rebuilding on the land that may result from the ILV land damage has been met by the separate insurance of the

---

<sup>1</sup> Section 18 deems residential building to be insured under the EQC Act where the building is insured under a contract of fire insurance. However, contracts of fire insurance almost invariably also include insurance for damage caused by other specified events, including, generally, earthquakes.

residential building. Any increases in foundation requirements that may result from the ILV land damage will therefore not be taken into account in assessing the DoV, except to the extent that the impact on future development of the land (later extensions to the new building, or subsequent rebuilding that is not met by insurance) is relevant to the assessment of DoV.

- 55 As described in section (I2) of the ILV DoV Methodology (Residential Building in Place) and sections (E1) and (F6) of this report, this assumption may not affect the DoV assessed in many cases. That is because the advice received from EQC's engineers, Tonkin + Taylor, is that while ILV land damage may in certain circumstances increase the foundation requirements for new residential buildings, this is not the case in many situations.
- 56 If in any particular case this assumption does not hold, and it is demonstrated that in the case of the particular property ILV land damage has increased foundation costs, the DoV of the land for that property will be separately considered.

## **(E) INPUTS TO VALUATION METHODOLOGY**

57 Given the limited direct market evidence specific to ILV land damage, it is necessary to look to a range of other valuation inputs to provide the best indication possible as to what the reduction in market value of the property resulting from ILV land damage would be.

58 In the present circumstances, it is considered appropriate to consider the following information as inputs to this methodology:

### **58.1 Engineering advice regarding practical implications of liquefaction**

**vulnerability:** This involves advice from Tonkin + Taylor regarding how a particular level of severity of liquefaction vulnerability, and changes in that liquefaction vulnerability, affects a property in terms of the likely level of land and building damage that may be experienced in a future earthquake. Advice has also been provided regarding the effect of ILV land damage on future foundation costs.

**58.2 Repair cost evidence:** This involves consideration of advice from Tonkin + Taylor regarding the methods and costs of repairing ILV land damage, and considering the relationship between such costs and the DoV of land.

**58.3 Market sales evidence:** This involves:

- (a) considering general trends in the Canterbury property market since the earthquakes;
- (b) an analysis of the information available in the Canterbury market about liquefaction vulnerability and ILV land damage caused by or resulting from the Canterbury earthquake sequence;
- (c) hedonic modelling and linear regression analysis of recent sales in Canterbury, with a particular focus on undamaged or repaired properties, to assess whether any statistically significant difference in price can be observed between properties with different levels of liquefaction vulnerability; and
- (d) review of research published in New Zealand and international literature concerning the effects on market values of properties in areas affected by liquefaction vulnerability and other natural hazards.

59 Each of these is outlined below, where appropriate by reference to the detailed discussion of these topics in the ILV DoV Methodology (Residential Building in Place).

### **(E1) Engineering advice regarding the impact of ILV**

60 Tonkin + Taylor have prepared a report on the practical implications of liquefaction vulnerability *Practical Implications of Increased Liquefaction Vulnerability* (revised, October 2016) (the ***Practical Implications Report***), which has been provided to EQC's valuers. This identifies the likely advice that a geotechnical engineer would be expected to give a willing buyer or willing seller of a property with ILV land damage about the practical implications that result from the land having experienced a

material increase in liquefaction vulnerability due to the Canterbury earthquake sequence.

- 61 The *Practical Implications Report* was initially published in conjunction with the ILV DoV Methodology (Residential Building in Place), and focused on the practical implications of ILV land damage for properties where the pre-Canterbury earthquake sequence (pre-CES) residential building remained in place. Following this, further work has been completed by T+T to describe the practical implications for land on which new residential buildings are constructed using TC2 or TC3 foundations without ground improvements. This is now included in Chapter 6 of an updated version of the *Practical Implications Report* published at the same time as this report.
- 62 As for properties where the pre-Canterbury earthquake house remains in place, the primary practical implications of a material increase in liquefaction vulnerability are:
- 62.1 **Increased likelihood of land and building damage:** Properties with ILV land damage are likely to experience increased liquefaction-related damage in a future earthquake event at a particular shaking level than they would have prior to the Canterbury earthquake sequence. In particular, in a future event it is expected that the ground surface subsidence will result in:
- (a) increased likelihood of moderate-to-severe land damage; and
  - (b) increased likelihood of significant building damage.
- 62.2 **Increased frequency of land and building damage:** Properties with ILV land damage are likely to experience material damage to land and buildings in less severe (more frequent) earthquakes than they would have prior to the Canterbury earthquake sequence.
- 63 Tonkin + Taylor assessed these implications for different areas of Canterbury by considering the following at 100 year and 25 year return period levels of shaking, as set out in the *Practical Implications Report*.
- 64 Each of these issues is discussed in detail in the *Practical Implications Report* and the valuers' understanding of these implications is set out in the ILV DoV Methodology (Residential Building in Place).
- 65 The practical implications of ILV land damage for land where the pre-earthquake residential building has been or will be removed or demolished, and a new residential building has been or will be rebuilt, are assessed having regard to the implications of increased liquefaction vulnerability to the land and a new residential building on the land, rather than the pre-earthquake residential building. Accordingly, Tonkin + Taylor was requested to provide advice concerning the practical implications for ILV land damage for new residential buildings constructed using TC2 or TC3 MBIE surface foundation solutions, without ground improvement to repair ILV land damage.
- 66 In summary:

- 66.1 For construction of new residential buildings on land that is materially vulnerable to liquefaction there are two practical options:
- (a) a ground improvement solution in accordance with the MBIE Guidance, in combination with a TC2 foundation. This solution also repairs ILV land damage in the area remediated, returning the vulnerability of the land to at least the level of vulnerability it was prior to the CES; or
  - (b) an MBIE surface foundation solution in accordance with the MBIE Guidance. MBIE surface foundation solutions do not repair ILV land damage.
- 66.2 For properties with new residential buildings constructed using MBIE surface foundations without ground improvement works to repair the ILV land damage, the increased likelihood of moderate-to-severe liquefaction related land damage caused by ground surface subsidence caused by the earthquake sequence will be the same as if the surface foundations had not been constructed.
- 66.3 However, a new residential building constructed in accordance with MBIE Guidance will be more resilient to liquefaction-related damage in a future earthquake event than typical pre-Canterbury earthquake buildings.

67 The effect of ILV land damage on the likelihood and frequency of building damage in future earthquake events on properties constructed in accordance with the MBIE Guidance is set out in further detail below.

***Increased risk of building damage for residential buildings constructed in accordance with MBIE Guidance***

- 68 Liquefaction can cause damage to residential buildings by a variety of mechanisms. However, the experience of the Canterbury earthquake sequence 2010-2011 was that the type of liquefaction-related land damage that has the most potential to cause significant building damage is differential ground surface subsidence.<sup>2</sup>
- 69 Differential ground surface subsidence can cause the building to settle in one of two ways. First, the building platform may tilt as a whole or settle in plane (planar building settlement). Planar building settlement is not expected to cause significant structural damage, although it may cause damage to connected services and cause other losses of amenity.
- 70 Second, depending on the type of differential ground surface subsidence, the building foundations may bend or “break” (out-of-plane distortion). Out-of-plane distortions occur when the building foundation and superstructure are not sufficiently stiff or strong to remain planar when uneven ground surface subsidence occurs beneath the building. This can cause significant structural damage to the foundations and superstructure, particularly if low stiffness and low strength foundations are used.

---

<sup>2</sup> Excluding lateral spreading land damage.

71 The MBIE surface foundation systems specified in the MBIE Guidance have been developed to meet the performance requirements of the New Zealand Building Code and provide improved residential building performance and resilience when compared to typical pre-earthquake residential buildings. They are designed to reduce out-of-plane distortions in favour of planar distortions from expected liquefaction related land damage at 25 year return period levels of earthquake shaking. Planar distortions cause less damage to the superstructure, and with the high stiffness and high strength MBIE surface foundation solutions they are more easily relevelled with minimum damage where liquefaction causes differential ground surface settlement.

72 All of the MBIE surface foundation solutions can be relevelled at relatively modest cost. The cost is not particularly sensitive to the level of planar distortion experienced; that is, releveling 50 mm of planar distortion can be achieved for between \$15,000 and \$30,000 while releveling of a planar distortion of 200mm is expected to cost between \$20,000 and \$35,000, depending on the foundation type. In contrast, if out-of-plane distortion occurs, repair costs can range between \$28,000 and \$41,000 for distortion of 50 mm and \$100,000 and \$113,000 for 200 mm.<sup>3</sup>

*Impact of ILV land damage on likelihood of building damage in a 1 in 25 year event*

73 The MBIE Guidance provides foundation solutions that have been designed to achieve certain uniform minimum levels of performance in serviceability limit state (SLS), being 1 in 25 year levels of shaking. These solutions aim to substantially reduce damage and repair costs in SLS event, such that any damage is expected to be 'readily repairable'.

74 Based on Tonkin + Taylor's data, at 1 in 25 year return period levels of earthquake shaking, approximately 90% of the consented buildings in Christchurch that have been designed using MBIE foundations are expected to sustain planar settlement that does not require releveling and is not expected to result any structural damage. Approximately 10% of properties are expected to sustain planar settlement or out-of-plane distortions that are able to be relevelled with only minor structural damage.

75 Accordingly, as a result of the ground surface subsidence due to the CES, the change in liquefaction vulnerability severity at 25 year return period levels of shaking is not expected to materially increase the risk of liquefaction-related building damage for residential buildings constructed using MBIE surface foundations.

*Impact of ILV land damage on likelihood of building damage in a 1 in 100 year event*

76 The NZ Building Code and the MBIE Guidance do not require foundations and buildings to be assessed and therefore designed to achieve particular levels of performance at 1 in 100 year levels of shaking. However, it is more likely that, even at 1 in 100 year levels of shaking, new residential buildings that have been designed and constructed in accordance with the MBIE Guidance are expected to have a reduced chance of material building damage and be more resilient (able to be

---

<sup>3</sup> Figures provided are from Table 6.2 of the *Practical Implications Report*, and are for a standard 146 m<sup>2</sup> building. The costs cited do not include professional fees or additional site works.

relevelled and repaired) when compared to typical pre-earthquake residential buildings.

- 77 Based on Tonkin + Taylor's data, at 1 in 100 year return period levels of earthquake shaking, approximately 45% of the consented buildings in Christchurch that have been designed using MBIE foundations are expected to sustain planar settlement that does not require releveling at post-CES levels of liquefaction vulnerability. Very few of these consented buildings may sustain out-of-plane distortions that require releveling and/or repair of minor structural damage at post-CES levels of liquefaction vulnerability. For most of these properties, ILV land damage is not expected increase the risk of building damage beyond an expectation of planar settlement that does not require releveling and is not expected to result any structural damage.
- 78 Approximately 40% of properties are expected to sustain planar settlement or out-of-plane distortions that are able to be relevelled with only minor structural damage. Approximately 15% of the properties are expected to sustain out-of-plane distortions that require releveling and repair of moderate structural damage. For these properties, ILV land damage may have increased the risk of releveling and minor to moderate structural damage. In many cases, the increase in structural damage will be low, associated with the Minor change in severity. However, in the case of properties with a Minor or Major change in severity, they may have had a more significant change in the chance of planar or out-of-plane differential settlement and associated structural damage
- 79 Accordingly, it is reasonable to conclude that for properties that have increased liquefaction vulnerability at 100 year return period levels of earthquake shaking, new residential buildings that have been constructed using MBIE surface foundation solutions are expected to have a smaller increase in the chance of material building damage due to ILV land damage and be more resilient (able to be relevelled and repaired) when compared to pre-CES residential buildings.

*Relevance of structure and materials of the building*

- 80 The extent of the increased likelihood of building damage in a 1 in 25 year event does not depend on the structure and materials of the building. The MBIE Guidance requires a foundation system to be used that can accommodate aspects of the building structure and design, so as to achieve the uniform minimum performance levels.
- 81 Buildings that are heavier, with brick and tile claddings and roof, and that have complex shapes, may have an increased likelihood of building damage in a future earthquake above a 1 in 25 year level of shaking than those that are lightweight, simple shapes, and on stronger or stiffer foundations. However, every building is unique and will perform differently. Given the number of variables that need to be considered, it is difficult to assess how a particular building will perform.

**Increased foundation requirements**

- 82 As noted in section (D) of this methodology, for the purposes of assessment of DoV for land where the pre-Canterbury earthquake house has been or will be rebuilt, any immediate increase in foundation costs due to ILV is not taken into account. However, EQC's valuers have considered the relevance of potential future increases in foundation costs, in the event that the new building is subsequently redeveloped.

- 83 As noted in the ILV DoV Methodology (Residential Building in Place), there is insufficient information available to carry out a property specific assessment as to whether ILV land damage will increase the foundation requirements for a new building. However, there is reason to believe that properties where the ILV land damage will increase the foundation costs will be reasonably rare.
- 84 Where the severity classification at 25 year return period levels of earthquake shaking has not changed, it is not expected that any additional ground improvement works or enhanced foundations would be required than if the land had not suffered ILV land damage.
- 85 Where the severity classification at 25 year return period levels of shaking has changed, whether ILV land damage results in more resilient foundations or ground improvements being required in the event that the house is rebuilt will depend on whether a non-specific engineering assessment or a specific engineering assessment is undertaken:
- 85.1 A non-specific engineering assessment relies on simplified procedures, is not sensitive to depth to groundwater and therefore does not change significantly as a result of ground surface subsidence. Under this approach, therefore, ILV land damage is unlikely to change the level of foundations or ground improvements assessed as being required. This approach is the most commonly adopted to date in relation to rebuilding residential buildings damaged in the Canterbury earthquake sequence.
- 85.2 A specific engineering assessment incorporates more sophisticated liquefaction vulnerability analysis, and applies engineering judgement. Using this approach foundation or ground improvement costs can, in some areas, be reduced from the costs that would be incurred on a non-specific engineering assessment. If this approach were undertaken, ILV land damage may change the type of foundations or ground improvements that would be assessed as being required.
- 86 However, even applying a specific engineering assessment, whether or not there is an increase in foundation requirements due to ILV land damage, and (if there is an increase) the extent of any such increase in terms of costs, will depend on a number of other factors relevant to the design of foundations. If new foundations are needed in the future for a particular property in Canterbury, a site specific assessment, including additional investigations where necessary, would need to be carried out in the course of selecting or designing those foundations. Until this is done for a particular property, it will not be known whether ILV land damage has resulted in increased foundation costs for that property.

**(E2) Repair costs**

- 87 There is little prior experience anywhere in the world relating to engineering works to reduce liquefaction vulnerability of individual residential land parcels. Therefore, EQC undertook extensive engineering work to develop potential land repair methods to reduce the vulnerability of land to future liquefaction damage, both for cleared sites and for sites where a repairable building remains standing.
- 88 EQC, engineers, contractors and private insurers undertook a collaborative Ground Improvement Programme to test a number of potential ILV repair methods identified

by EQC. In this programme, the land on 30 properties identified as having ILV land damage was repaired. One of the aims of the Ground Improvement Programme was to allow EQC to determine the cost of such works, to inform settlement decisions.<sup>4</sup>

89 As a result of the Ground Improvement Programme:

89.1 MBIE has now updated its guidelines on *Repairing and rebuilding houses affected by the Canterbury earthquakes (2015) (MBIE Guidance)* and provides options for ground improvement that can be undertaken on properties so that homes can be rebuilt with TC2 type foundations. All of these solutions can be used as ILV land damage repair methods for cleared sites;

89.2 MBIE has included Horizontal Soil Mixed (**HSM**) beams in the updated guidelines as a method for reducing vulnerability of land to liquefaction in moderate seismic events where the house remains in place. However, in most cases there are practical constraints that mean it is unlikely to be a feasible option for most property owners; and

89.3 there are feasible repair methods available for almost all of the cleared sites if the repair is limited to the footprint of the (former) house and 1-2m around it.

90 Repair of ILV land damage therefore may be more readily undertaken where the pre-earthquake residential building is required to be demolished or rebuilt due to earthquake damage than when the residential building remains in place. However, the exact methodology and cost of ILV land damage repair will depend on a combination of technical characteristics of the land, which must be specifically considered by an engineer in relation to the land.

91 In the ILV DoV Methodology (Residential Building in Place), the ultimate methodology developed, and in particular the percentage discounts, did not reflect a direct relationship with repair costs, consistent with international literature and market analysis of New Zealand sales data. However, the more ready availability of ILV land damage repairs in the case of vacant land raises the issue of whether the costs of repair should be taken into account directly in assessment of the DoV attributable to ILV land damage of such land.

92 In considering the relevance of repair costs, EQC's valuers note that landowners faced with ILV land damage may either:

92.1 remediate the land so that in the event of a future earthquake the land is less vulnerable to liquefaction; or

92.2 leave the land as it is and accept the greater vulnerability to liquefaction.

93 The last option will be considered in light of the practical implications of ILV land damage for a new residential building, constructed in accordance with regulatory requirements, the MBIE Guidance and current practice. As noted in section (E1) of

---

<sup>4</sup> While the Ground Improvement Programme successfully identified a range of ground improvement methods, the cost of those methods applied to a particular property will ultimately require site specific assessment.

this report, Tonkin + Taylor's advice is that ILV land damage is not expected to increase the risk of building damage to a residential building constructed in accordance with MBIE Guidance for a 25 year return period level of shaking, although the risk does increase for more severe events.

- 94 Landowners therefore may take no remedial steps to repair ILV land damage for vacant sites, depending on variables including: the cost and expense of remediation strategies, particularly in circumstances where the techniques are reasonably newly developed, the landowner's expectations as to how long they will remain on the property, and their appetite to accept the risk of future liquefaction related land damage.
- 95 It is also necessary to consider, in assessing what weight to place on repair costs, that the DoV assessment is concerned with the *increase* in liquefaction vulnerability caused by the Canterbury earthquake sequence. Costs associated with removing liquefaction vulnerability that is not the result of ILV land damage are therefore not directly relevant to this assessment.
- 96 EQC's valuers understand that no techniques for vacant land have been developed or are in practice likely to be deployed that repair only *increased* liquefaction vulnerability associated with ILV land damage, as opposed to addressing overall liquefaction vulnerability of a property. In particular, it is unlikely that a repair of ILV land damage will be undertaken using a method other than a ground improvement recommended by MBIE, as in practice it is only these methods that enable residential buildings to be readily rebuilt with TC2 type foundations. EQC's engineers advise that it is generally not practical to modify the MBIE ground improvement methods to provide customised ILV repair solutions for individual properties (i.e., repair the ILV land damage only and provide no better performance). Accordingly, in many cases, following an MBIE ground improvement being undertaken, land will be less vulnerable to liquefaction damage than prior to the CES.
- 97 Accordingly, there are no readily available costs for methodologies that repair the ILV land damage, rather than returning the land to a lower level of liquefaction vulnerability than prior to the Canterbury earthquake sequence..
- 98 In addition, in many cases, ILV land damage will also not have resulted in any change in the ground improvements that would be appropriate for the property to address liquefaction vulnerability, and therefore no increase in the costs that would be incurred if a ground improvement was undertaken. The engineering advice is that an increase in ground improvement costs (or the need for a ground improvement, where it would not previously have been required) may occur only where a less common site-specific engineering assessment is undertaken, and where a property has moved from one severity classification to another at 25 year return period levels of shaking. Even if a site-specific assessment is undertaken, only one third of Green Zone properties with ILV land damage have had a change in severity classification that may affect the assessment of ground improvements under the MBIE Guidance.
- 99 Therefore, for most Green Zone properties, ILV land damage has not resulted in any different ground improvement work being required to enable TC2 foundations to be

used consistent with MBIE Guidance, compared to what the land would have required prior to the earthquakes.

- 100 Finally, EQC's valuers understand that ground improvements to resolve ILV land damage have not been undertaken frequently in the context of the Canterbury rebuild, despite the availability of these techniques from at least 2014. This suggests that remediation of ILV land damage by undertaking ground improvement works does not play a significant role in decision-making regarding redevelopment of land in Canterbury.
- 101 For these reasons, EQC's valuers do not consider that it is necessary or appropriate for the discounts for ILV land damage to reflect a direct relationship with repair costs.
- 102 In the IFV DoV Methodology (Residential Building in Place) and IFV DoV Methodology (Residential Building has been or will be Rebuilt), repair costs of IFV land damage are used where available as a trigger to review the DoV in light of those costs, in particular if the repair costs are less than the DoV assessed. However, in the case of ILV land damage, as repair costs require site specific assessment, EQC will only have costs of ILV repair available for a property if that repair is likely to be undertaken, and therefore likely to form the basis of EQC's settlement of ILV land damage for the property. In addition, given the expected range of ground improvement costs, it is less likely that the DoV for ILV land damage will be greater than the repair costs. For these reasons, EQC's valuers do not consider it is necessary to provide for a review of the DoV in light of repair costs for ILV land damage.

**(E3) Market sales evidence**

- 103 The relevant market evidence, including the literature reviewed, for ILV land damage is considered in section (J) of the ILV DoV Methodology (Residential Building in Place).
- 104 The available market evidence primarily comprises studies of improved properties and includes very little that is directly focussed on vacant land sales.
- 105 EQC's valuers considered whether there was any further sales evidence that would be relevant to the development of the methodology, in particular whether it would be useful to examine vacant land sales in Christchurch since the earthquakes.
- 106 There is a reasonable number of vacant land sales in Christchurch, however these are spread across different technical categories, and in areas with different levels of pre-earthquake liquefaction vulnerability, and presumably knowledge of that vulnerability. It would be difficult to isolate the impact of ILV land damage from other characteristics of the land which may affect value when analysing sales data. This is particularly the case given that the Canterbury market is characterised by a number of factors not present in other markets, such as the position of the buyer and seller as regards any earthquake damage insurance settlements at the time of the sale.
- 107 In the course of developing the ILV DoV Methodology (Residential Buildings in Place), EQC commissioned an hedonic modelling study of Christchurch property sales by Auckland University. That study initially considered both vacant and

improved properties. No statistically significant results were obtained from the analysis of vacant land sales, given the small sample size. This experience reinforces to EQC's valuers that detailed analysis of vacant land sales is unlikely to produce any material information.

- 108 Given this, EQC's valuers considered that any analysis of vacant land sales was unlikely to be useful to the development of this methodology. Accordingly, an alternative analysis was required.
- 109 The value of vacant residential land is informed by the expected value of the property once a house is built on the land. That is, a willing buyer will take into account the development potential of the land, and the value of the land once it is developed, in assessing the price he or she is willing to pay for the land.
- 110 It follows that, if ILV land damage would reduce the value of the property once any residential building was built on the property (for example, because of the risk of increased land and building damage in a future earthquake event), then the ILV land damage will most likely also reduce the value of the land, as a building platform, to a similar extent. Put in simple terms, for example, if a property once developed with a residential building is likely to be worth \$10,000 less due to ILV land damage, it follows that a willing buyer is likely to pay approximately \$10,000 less for the land due to ILV land damage.
- 111 Accordingly, EQC's valuers consider that market evidence concerning the impact of vulnerability to liquefaction and other natural disasters on improved property values is relevant to the impact of vulnerability to liquefaction and other natural disasters on values of vacant residential land.

## **(F) THE METHODOLOGY**

### **(F1) Introduction**

- 112 The valuation of DoV assesses the reduction in land value immediately prior to 4 September 2010 caused by the ILV land damage suffered by the land as a result of all earthquakes up to, and including, 24 December 2011.
- 113 The DoV is calculated by applying a percentage adjustment derived from a matrix developed by EQC's valuers to the pre-earthquake value of the land, then testing the resulting DoV against valuation judgement to ensure that the reduction is appropriate.

### **(F2) Development of matrix to apply to land values**

- 114 As outlined in section (E3) above, EQC's valuers consider that there is a direct relationship between the impact of ILV on property values and land values. That is, as the land value will reflect its use primarily as a building platform, a negative feature which will reduce the ultimate value of the property when the land is developed will similarly affect the value of the land.
- 115 The best available market evidence concerning the impact of vulnerability to liquefaction and other natural disasters on improved property values was used to develop the ILV DoV Methodology (Residential Building in Place). That Methodology incorporates a matrix which reflects valuer judgement as to the relative impact on property value of different increases in severity of liquefaction vulnerability. The development of the matrix was the result of a detailed process between EQC's engineering advisors, valuers and legal advisors. This process ensured that all available information that was relevant to the assessment of loss in value was presented to and considered by EQC's valuers. The process included workshops to discuss the engineering information and advice, and draft matrices that were considered and refined as further engineering information became available.
- 116 EQC's valuers believe that the same relativities between different severities of ILV land damage and frequency considerations should be reflected in the DoV for land. For example, ILV land damage that results in a Major change in liquefaction vulnerability a 1 in 100 year event should be treated as relatively more significant than ILV land damage that results only in a Minor change in liquefaction vulnerability in a 1 in 100 year event. This is subject to the need to adjust certain relativities to reflect the different practical implications on future risk of building damage for houses constructed in accordance with the MBIE Guidance, as discussed in section (E1), above.
- 117 Accordingly, EQC's valuers consider that the most robust way of developing a methodology to assess DoV on land resulting from ILV land damage, is to adjust the matrix from the ILV DoV Methodology (Residential Building in Place) to apply to land values. This will have the advantage of:
- 117.1 preserving the structure of the way in which various practical implications of ILV land damage are considered by valuers; and
- 117.2 providing consistent relative discounts for the different practical implications of ILV land damage with those assessed for properties where the residential

building remains in place, to the extent that the practical implications are the same.

- 118 The ILV DoV Methodology (Residential Building in Place) matrix contains percentage discounts from the property value. As the assessment of DoV for properties where the pre-earthquake building has been or will be removed or demolished is based on a discount from the land value, it is necessary to determine the equivalent discounts to be applied to a land value.
- 119 For the reasons given above, EQC's valuers consider that the discount from the value of the land should be, in numerical terms, the discount from the land developed to highest and best use as a residential building site (taking into account the relevant characteristics of the land and locality). For example, if a vacant site is worth \$100,000 but fully developed with a house built would be worth \$150,000, and assuming ILV land damage that would be assessed as 5% from the value of the property:
- 119.1 the DoV assessed for the property if developed with a residential building that accorded with the properties highest and best use would be \$7,500 or 5% of \$150,000;
- 119.2 the discount for ILV land damage should be the same in absolute numerical terms for the land: that is, \$7,500 or 7.5% of the value of the land.
- 120 For the example property, the property to land value ratio is 1:1.5 (that is, the property value (\$150,000) is 150% of the land value (\$100,000)). It follows that the adjustment to the percentage discount applied to the property value to achieve an equivalent numerical discount for the land value is also 1.5 or 150% (that is, 7.5% is 150% of 5%).
- 121 In order to develop a matrix to be applied to land values for ILV land damage, EQC's valuers therefore undertook analysis of the relationship between land and improved property values in Christchurch to determine whether a consistent relationship between land and improved values existed. This analysis was based on available assessments of pre-earthquake land and property values carried out on properties with IFV land damage. There is no equivalent data set for ILV properties, however, the IFV properties are distributed throughout the Christchurch area and there is no reason in the EQC valuers' opinion to consider that a different relationship would exist between ILV properties and IFV properties.
- 122 This analysis and the conclusions reached are set out below. The conclusions from that analysis have also been adopted and applied in the methodology for assessing DoV caused by IFV land damage to properties where the pre-earthquake house has been or will be removed or demolished. For the reasons given above, EQC's valuers consider it is appropriate that an equivalent approach be taken in relation to the two different forms of damage on this issue.
- ***Analysis of existing IFV population***
- 123 An analysis of pre-earthquake quake insured area land values (**PQLV**) compared to pre-earthquake property (capital) values (**PQV**) was undertaken for IFV properties where the residential building remains in place, where those values had already

been assessed as part of the assessment of DoV under the IFV DoV Methodology (Residential Building in Place).

- 124 A total of 4,318 IFV valuations were analysed by grouping them into the suburb description as originally provided by Tonkin + Taylor. For each suburb, the median ratio (on a percentage basis of PQLV to PQV) was calculated. A copy of this analysis is provided in Appendix One.
- 125 The analysis showed some strong general trends:
- 125.1 the median proportion of PQLV to PQV for all properties is 57%.
- 125.2 the median proportion of PQLV to PQV analysed per suburb is 58%.
- 125.3 in suburbs where the price of houses is typically low, the percentage of PQLV to PQV was lower than the median, for example, Bromley is 49% .
- 126 A low proportion of land value to property value indicates the likelihood of a higher quality or larger house in the locality. If these proportions were used to assist with the development of an adjustment to the percentages in the existing ILV matrix, a lower proportion indicates the need for a higher adjustment and vice versa. Based on the percentages above, the adjustment would range 1.72 to 2.04 (Bromley)
- 127 In suburbs where the price of houses is typically higher, the proportion of PQLV was higher than the median. For example, the proportion for Fendalton is 76%, most likely reflecting high value sites that are underutilised by existing housing.
- **Analysis of Land utilisation for modern homes**
- 128 Given the cleared sites methodology considers the future risk to a new house that has / will be built, the valuers consider a more reliable proxy for the relationship between land values and the value of developed property is to analyse the land value to capital value relationship for newer housing throughout Christchurch.
- 129 This approach avoids the distortion that occurs when considering the analysis of the existing housing stock which includes small houses on large sections. For example in the 1950s, a 90 m<sup>2</sup> bungalow may have been built on a 1000 m<sup>2</sup> site, whereas today in the same locality a typical dwelling may be 140 m<sup>2</sup> on a 600 m<sup>2</sup> site.
- 130 Accordingly, an analysis of properties built between 2000 and 2010 was undertaken, again across suburbs. To do this, the 2007 rating capital values and land values were considered by selecting houses with a build date after 2000,<sup>5</sup> being the age of properties most likely to represent modern homes.
- 131 The analysis shows for a median proportion of PQLV to PQV of 61% for all properties. Importantly, the range of proportion of PQLV to PQV for modern properties is much smaller than for all properties. Fendalton properties, (representing a high value area) have a proportion of 55.8%, whilst Aranui, Wainioni, Burwood and Avonside have a proportion of 61.6%

---

<sup>5</sup> Property category codes RD200 A, B, C and RF200 A, B, C.

- **Single unit dwellings (after 2000)**

132 Repeating the analysis considering only single unit residential dwellings shows a median ratio of PQLV to PQV of 62% for all properties. Similarly Fendalton properties have a ratio of 61%, whilst Aranui, Wainoni, Burwood and Avonside have a ratio of 67% indicating adjustments ranging from 1.49 to 1.61.

133 We note that when only houses built later than 2000 were considered, the proportion for a high valued area is now below the median (by a small amount), whereas it was previously higher.

134 EQC's valuers are comfortable that this result is appropriate, as the added value of improvements (for a modern house) is likely to be higher in a high value area. It also most likely reflects higher utilisation of expensive land in a high value area.

- **Multi unit properties (after 2000)**

135 We have also considered flats built after 2000 as a separate grouping, recognising the land value relationships are considered less reliable as cross lease sites rarely trade in the open market. As a consequence less reliance has been placed on flats as a separate group.

- **Summary of results**

136 The table below summarises the results of the analysis. This shows the average results across Christchurch, the results for Fendalton as an example of higher value areas in western Christchurch, and the average of the results for Aranui and Wainoni as examples of lower value suburbs in eastern Christchurch:

	<b>All Property categories</b>	<b>RD and RF&gt;2000</b>	<b>RD&gt;2000</b>	<b>RF&gt;2000</b>
<b>All</b>	58% (1.72)	62% (1.61)	62% (1.61)	69% (1.45)
<b>Fendalton</b>	76% (1.32)	56% (1.79)	61% (1.64)	51% (1.96)
<b>Aranui and Wainoni</b>	57% (1.75)	65% (1.54)	67% (1.49)	67% (1.49)

Table 1: summary of results

137 It is considered that the proportion of land to property value for modern dwellings is the most meaningful, as, in the case of the land to be valued, the demolished dwelling will be replaced by a modern dwelling. It is also appropriate to remove the influence of multi-unit developments, to focus on the predominant type of residential building that will be built on cleared sites.

138 Considering only newer housing stock the range of proportions across suburbs compressed to the extent that the variation between suburbs is negligible. This supports the adoption of a single adjustment.

139 A default position, based on a ratio of 61% - 67% PQLV compared to PQV would indicate that the matrix discounts for property values could be multiplied by a factor of approximately 1.6 to apply to land values.

- **Conclusions**

- 140 Based on this analysis, EQC's valuers consider that it is appropriate to develop a single matrix to reflect the percentage discounts to land values from ILV land damage, without any differentiation for high or low value properties or by suburb.
- 141 Taking into account the range of ratios between land and building values in the above analysis, EQC's valuers consider that it is appropriate to apply a multiplier of 1.6 between equivalent discounts in the ILV DoV Methodology (Residential Building in place) methodology and discounts to be applied to land value.
- 142 The matrix in the ILV DoV Methodology (Residential Building in Place) was developed in the context of the pre-earthquake existing housing stock in Christchurch, which included a broad range of property types including old and new housing. However, EQC's valuers consider that the matrix developed was not dependent on the type of housing that was being considered and that the same matrix would have been developed even had that methodology focused on a particular subset of properties, such as properties with recent housing.
- 143 EQC's valuers' conclusion in the IFV DoV Methodology (Residential Building in Place), and adopted in the ILV DoV Methodology (Residential Building in Place), that the use of a percentage discount was the best means of reflecting the discount in property values is also consistent with this. As noted in the IFV DoV Methodology (Residential Building in Place), the use of a percentage discount to assess the loss in value due to increased flooding vulnerability was supported by international literature on the impact of natural hazards on property values. The effect of a percentage discount approach is that the DoV assessed is directly proportional to the value of the property. The value of a property reflects many different characteristics, including the age of any house on the property. EQC's valuers are comfortable that properties with the same impacts from ILV land damage would generally experience a reduction in value of the same proportion of their property value, regardless of whether they were high or low value properties, and regardless of the age of the house on the property.
- 144 EQC's valuers therefore consider the original matrix forms an appropriate base for a matrix that will be applied to vacant land, taking into account its development potential. EQC's valuers also consider that it is appropriate to create this new matrix using an adjustment derived from properties with recent housing as the best reflection of the land to property value ratio of the properties once a new house has been built on the land.

**(F3) Valuation Process**

- 145 The assessment of DoV involves a multi-phase process as follows:
- 145.1 **Phase 1 - Assessing the Pre-earthquake Valuations.** A brief summary of the assessment of pre-earthquake values is set out in this section, with further detail provided in **Appendix Two**;
- 145.2 **Phase 2 - Identifying the severity classifications;**
- 145.3 **Phase 3 - Calculating the Total Percentage Discount;**

145.4 **Phase 4 - Calculating the Final DoV**, which includes a review by EQC's valuers.

**(F4) Phase 1 - Assessing the Pre-earthquake Valuation**

- 146 EQC engaged Northland Valuers Malone Limited (**Northland Valuers**) an independent valuation company, to determine the pre-earthquake values for the insured land of properties with ILV land damage, as at 3 September 2010, the day before the first of the 2010-2011 Canterbury earthquakes.<sup>6</sup> The valuations are therefore not distorted by the effects of the 2010-2011 Canterbury earthquakes on the property market.
- 147 The land values are based on market sales before the valuation date of 3 September 2010, using vacant land sales where available. In established areas where limited land sales existed, improved sales are also considered using a residual approach to arrive at a land value.
- 148 Using accepted valuation techniques, adjustments are made for differences in:
- 148.1 land size;
  - 148.2 location and surrounding properties;
  - 148.3 physical attributes including contour, outlook, views and shape;
  - 148.4 tenure;
  - 148.5 zoning; and
  - 148.6 situation (inside, corner or rear lot).
- 149 Once completed, the pre-earthquake values are being audited by EQC's valuers to ensure that an appropriate process has been followed and that the values produced are consistent with assessments undertaken for IFV properties.
- 150 The assessment of pre-earthquake values and the audit of those values had not been completed at the date of this report. However, based on the work done to date, EQC's valuers consider that the process being followed is appropriate and that it will produce valuations in line with the market evidence. Accordingly, EQC's valuers are satisfied that it is appropriate to use the pre-earthquake values assessed by Northland Valuers as the base to determine DoV for properties with ILV land damage.
- 151 The assessment of pre-earthquake values by Northland Valuers, and the audit of those valuations by EQC's valuers, are discussed further in **Appendix Two**.
- (F5) Phase 2 - Identifying the severity classifications**
- 152 In order to apply the ILV DoV Methodology to a particular property, its severity and extent of change classifications must be identified.

---

<sup>6</sup> Northland Valuers Limited's current engagement is to assess properties with ILV land damage, where those properties do not also have IFV damage.

153 The severity and extent of change classifications for each property were assessed by Tonkin + Taylor, as described in section (I) of the ILV DoV Methodology (Residential Building in Place), and in the *Practical Implications Report*. These classifications are used in the application of the Extent of Change Allowance and New Vulnerability Status Allowance in Phase 3.

154 These classifications, and how they are used in the assessment of DoV for each property, are discussed further in section (F6) below regarding Phase 3, Calculating the Total Percentage Discount.

### **(F6) Phase 3: Calculating the Total Percentage Discount**

155 Phase 3 involves the calculation of the Total Percentage Discount in value attributable to ILV land damage for each property.

#### **Overview**

156 For the reasons explained in section (F2) above, EQC's valuers adopted as a starting point the discounts for different changes in severity classifications provided in the ILV DoV Methodology (Building in Place).

157 As noted in that methodology, the various percentage discounts outlined below are ultimately based on valuer judgement, taking into account the relevant engineering and valuation information, including in particular the hedonic modelling results. However, no particular discount is directly derived from one particular source.

158 The assessment of percentage discounts is broken down into steps to ensure that all relevant engineering information about the property is taken into account in assessing the relative impact of ILV land damage in different geographic areas in Canterbury. However, the methodology noted that it is the cumulative percentage adjustment that represents the overall exercise of valuation judgement as to the appropriate level of discount attributable to ILV land damage.

159 In adapting the matrix in the ILV DoV Methodology (Residential Building in Place) to apply to land, the valuers have adopted the same approach. In particular, the valuers have tested and considered the cumulative adjustments produced by the below steps having regard to the range and distribution of adjustments assessed for ILV land damage with different engineering classifications. The valuers are satisfied overall that, as a matter of valuation judgement, the methodology produces appropriate results for assessing the DoV attributable to ILV land damage in accordance with the assumptions set out in Section D above.

160 The two steps in Phase 3 used to assess the total percentage adjustment in value attributable to ILV land damage are set out below.

161 *Step 1 – Extent of Change Allowance:* EQC's valuers considered the change in a property's vulnerability at 100 year and 25 year return period levels of shaking. This focuses primarily on the extent of increased likelihood of material land and building damage at those levels of shaking.

162 *Step 2 – New Vulnerability Status Allowance:* EQC's valuers considered whether the property is now vulnerable to liquefaction damage when it was not previously (assessed in an up to 100 year return period levels of shaking).

**Step 1: Extent of Change Allowance**

- 163 Step 1 involves consideration of:
- 163.1 what change there has been to the likelihood of material land and building damage at 100 year return period levels of shaking, including whether that change was Minor or Major;
  - 163.2 what change there has been to the likelihood of material land and building damage in a 25 year return period levels of shaking, including whether that change was Minor or Major; and
  - 163.3 the possibility of an increased likelihood of material land and building damage at levels of shaking between 25 year and 100 return period year levels.
- 164 In considering Step 1, EQC's valuers have also had regard to the different severity classifications both at 100 year and 25 year return period levels of shaking and the practical implications of those classifications.
- 100 year return period vulnerability impacts*
- 165 In the ILV DoV Methodology (Residential Building in Place), EQC's valuers adopted a uniform discount for Minor change irrespective of the combination of pre- and post-earthquake severity classifications, as the implications of Minor change on the chance of future land and building damage was the same. The same is true for the practical implications when applied to land as a building platform.
- 166 Overall, for reasons explained in more detail in the ILV DoV Methodology (Residential Building in Place), EQC's valuers considered that the following adjustments are appropriate for increased vulnerability at 100 year return period levels of shaking:
- 166.1 Minor change: 2%
  - 166.2 Minor or Major change: 4%
  - 166.3 Major change: 6%
- 167 Each of these discounts reflects an increase in the likelihood of land and building damage due to ILV land damage. However, in assessing the impact of ILV land damage on vacant land, while the practical implications of ILV land damage on the likelihood of future land damage are the same for vacant land as for sites where the pre-earthquake house remains in place, the practical implications of ILV land damage on the likelihood of future building damage for a new building constructed in accordance with MBIE Guidance are different from pre-earthquake houses.
- 168 To ensure that the Minor change adjustment reflects this difference in the practical implications of ILV land damage, EQC's valuers have first considered what proportions of the adjustment should be attributed to increased likelihood of building damage and increased likelihood of land damage respectively. They consider that similar weight would be given to likelihood of building damage than land damage, given the relative severity of consequences (in necessarily approximate terms, a 50:50 ratio has been adopted to reflect this).

169 The building damage component has then been discounted to reflect the materially lower increase in risk for buildings constructed in accordance with MBIE Guidance foundations as set out in section (E1).

170 Taking these matters into account, applying the same relativities between Minor, Minor or Major, and Major change as in the ILV DoV Methodology (Residential Building in Place), and applying the 1.6 multiplier between property and land value adjustments, EQC's valuers have adopted the following adjustments:

170.1 Minor change: 2.5%

170.2 Minor or Major change: 4.75%

170.3 Major change: 7%

*25 year return period vulnerability impacts*

171 In developing Step 1, EQC's valuers have also considered what change there has been to the likelihood of material land and building damage at 25 year return period levels of shaking.

172 As for the 100 year return period levels of shaking vulnerability impacts, the adjustments are based on the different percentage discounts for Minor, Minor or Major, or Major change in vulnerability adopted in the ILV DoV Methodology (Residential Building in Place), varied to reflect the different practical implications.

*Change in vulnerability to intermediate frequency events*

173 There are a number of properties that have experienced no material change in vulnerability at 25 year return period levels of shaking (or may have experienced no material change in vulnerability: the so-called "No Change or Minor" properties). These properties still qualify for ILV because the criteria for qualification is whether a material change has occurred at 100 year return period levels of shaking.

174 As outlined in the *Practical Implications Report*, these properties will have experienced a material increase in vulnerability at levels of shaking between 25 year and 100 year return period levels of shaking that is not reflected by the assessed pre- and post-earthquake vulnerability and extent of change at 25 year and 100 year return period levels of shaking. For the reasons outlined in the *Practical Implications Report*, it is not practicable to be granular about the levels of shaking at which changes in vulnerability have occurred. However, EQC's valuers consider it is appropriate to reflect the existence of an increased vulnerability at these intermediate frequencies in the assessment of DoV.

175 In the ILV DoV Methodology (Residential Building in Place), a 2% adjustment was adopted to reflect this vulnerability at intermediate frequencies (essentially, equivalent to a Minor change in vulnerability in a 1 in 100 year event). EQC's valuers consider that this adjustment should be varied to reflect the discussion of the Minor change in vulnerability in a 1 in 100 year event above, and the discussion of the Minor change in vulnerability in a 1 in 25 year event below, and accordingly adopt a 2% adjustment.

*Discounts for change in vulnerability at 25 year return period levels of shaking*

- 176 The percentage discounts for increased risk of land and building damage at 25 year return period levels of shaking have been determined based on the percentage discounts used for the 100 year return period. The percentage adjustments are twice the percentage adjustments for increased likelihood of land and building damage at 100 year return period levels of shaking to recognise the increased frequency at which this damage profile is likely to occur.
- 177 Accordingly, for reasons explained in more detail in the ILV DoV Methodology (Residential Building in Place), EQC's valuers considered that the following adjustments are appropriate for increased vulnerability at 25 year return period levels of shaking:
- 177.1 No change: 2% (to reflect the existence of an increase in vulnerability in intermediate frequencies)
  - 177.2 None or Minor change: 3%
  - 177.3 Minor change: 4%
  - 177.4 Minor or Major change: 8%
  - 177.5 Major change: 12%
- 178 As for the 1 in 100 year event adjustments, each of these discounts reflects an increase in the likelihood of land and building damage due to ILV land damage. EQC's valuers have therefore attributed 50% of the adjustment to the increased likelihood of building damage and discounted this proportion of the adjustment to reflect the materially lower increase in risk for buildings constructed in accordance with MBIE Guidance foundations. As set out in section (E1), neither a Minor or Major change in severity for such buildings results in a increase in the likelihood of material building damage, given the resilience to liquefaction-related damage of buildings constructed in accordance with MBIE Guidance at this level of shaking.
- 179 Taking these matters into account, applying the same relativities between Minor, Minor or Major, and Major change as in the ILV DoV Methodology (Building in Place), and applying the 1.6 multiplier between property and land value adjustments, EQC's valuers have adopted the following adjustments:
- 179.1 No change: 2% (to reflect the existence of an increase in vulnerability in intermediate frequencies)
  - 179.2 None or Minor change: 2.5%
  - 179.3 Minor change: 3%
  - 179.4 Minor or Major change: 6.25%
  - 179.5 Major change: 9.5%
- 180 Where a property has a Major change in vulnerability at both 100 year and 25 year return period levels of shaking, it is considered that making both Major change

adjustments involves double counting the overall impact of the Major change in vulnerability. Properties that fall into this category will receive an adjustment in Step 1 equivalent to a Minor change at 100 year return period levels of shaking and a Major change at 25 year return period levels of shaking. No Green Zone properties have Major change at 100 year and 25 year return period levels of shaking.

*Step 1: Extent of Change overview*

181 The adjustments discussed above result in the following extent of change matrix for Step 1:

<b>Extent of Change classification - 100 year return period</b>	<b>Major</b>	9.0%	9.5%	10.0%	11.0%	12.0%
	<b>Minor or Major</b>	6.75%	7.25%	7.75%	9.875%	12.0%
	<b>Minor</b>	4.5%	5.0%	5.5%	8.75%	12.0%
	<b>None</b>	<b>None or Minor</b>	<b>Minor</b>	<b>Minor or Major</b>	<b>Major</b>	
	<b>Extent of Change classification - 25 year return period</b>					

Table 2: Extent of Change Matrix

182 The figures for “or” categories reflect the adoption of a mid-point between the possible options. In some cases, this produces percentage adjustments to three decimal points. EQC’s valuers recognise that this level of precision in the percentage adjustments overstated the accuracy with which valuation judgements can be made. However, they consider it appropriate to adopt these adjustments as a step in the process, on the basis that the final step in the methodology involves the exercise of judgement as to the appropriate level of precision at which valuations can be made.

**Step 2: New Vulnerability Status Allowance**

183 EQC’s valuers consider that there is some additional discount associated with becoming vulnerable to a natural hazard in addition to the increased risk of land and building damage discussed above.

184 In the ILV DoV Methodology (Residential Building in Place), EQC’s valuers considered that an appropriate adjustment for the fact that a property is now vulnerable at 100 year return period levels of shaking, when previously it was not, is 1%. EQC’s valuers consider that it is appropriate to adopt an equivalent discount, applying the 1.6 multiplier between property and land value adjustments.

185 The adjustments for this step, including a midpoint adjustment for “or” classifications (that is, where it was previously uncertain whether the property was materially vulnerable to liquefaction or not), are set out in Table 2 below:

<b>Pre-CES 100 year return period severity classification</b>	<b>Not Vulnerable</b>	1.6%
	Not Vulnerable or Medium	0.8%
	Other	0%

Table 3: New Vulnerability Status Matrix

**Potential increase in vulnerability due to construction type not included as a variable**

186 The ILV DoV Methodology (Residential Building in Place) included a third step in the assessment of the DoV percentage discount that reflected the Tonkin + Taylor advice for residential buildings constructed prior to the Canterbury earthquakes that heavy structures are expected to be more vulnerable to liquefaction related land damage during an earthquake than lightweight structures, and that the impact of an increase in liquefaction vulnerability is also greater on heavyweight structures.

187 Where a house is rebuilt following the earthquakes, the nature of the building, including whether it is heavy or lightweight is taken into account when designing its foundations. Therefore, at least at 1 in 25 year levels of shaking, the building and foundations will be designed to ensure the same level of resiliency whether the building is heavy or lightweight. There may still be some additional risk of building damage resulting from ILV land damage for heavy buildings, though that would be expected to be less than is the case for pre-earthquake buildings.

188 Given this advice, any adjustment to the DoV amount to reflect increased impact of ILV on heavy structures would be very small. As the DoV is being assessed based on vacant land, and in many cases, the house may not yet have been rebuilt, there would also be difficulty in determining whether a particular property should receive any such adjustment.

189 Having considered the above matters, EQC’s valuers consider that it is not necessary or appropriate to have a separate adjustment for any greater impact of ILV land damage on heavy structures. However, it has been taken into account in considering the overall percentage adjustments.

**Potential increased foundation costs not included as a variable**

190 In developing the above methodology, EQC’s valuers have specifically considered what, if any, weight should be given to the potential for ILV land damage to increase future foundation costs in the event that a further new building is constructed at a later stage.

191 In the ILV DoV Methodology (Residential Building in Place), EQC’s valuers did not consider it would be practical or appropriate to make any specific adjustment for any increased foundation requirements that may be incurred if the house is rebuilt in the future. This was because:

191.1 The engineering advice is that the potential for an increase in future foundation costs is limited to where a less common site-specific assessment is

undertaken, and where a property has moved from one severity classification to another at 25 year return period levels of shaking. Even in such cases, the presence of additional constraints on foundation design may also mean that more resilient (and higher cost) foundations were required on the property irrespective of its vulnerability to liquefaction. There is insufficient information to assess the implications of ILV land damage for potential future foundation costs for any given property without further engineering assessment of each property.

191.2 The ILV DOV methodology is to be applied to properties where the residential building that existed before the Canterbury earthquakes is still in place (and any earthquake damage to the residential building is assumed to have been repaired). In this context, any increase in foundation costs is not a cost that would be incurred immediately, or even in the short to medium future. The nature of such properties will vary, but in most cases they are unlikely to be rebuilt for many years. Costs that will not be incurred for many years generally do not materially affect the market value of a property.

192 As explained in section (D), in assessing the DoV for land where the pre-earthquake residential building has or will be removed or demolished, EQC's valuers have been instructed not to take account of any increase in immediate foundation costs. In relation to future foundation costs, in the event that any new residential building constructed after the Canterbury earthquakes on the land is later redeveloped, the same considerations discussed in relation to foundation costs in the ILV DoV Methodology (Residential Building in Place) apply. Indeed, given a new residential building will be constructed on the site, costs associated with any future redevelopment are likely to be even more remote than in circumstances where the pre-earthquake building remains in place.

***Potential further adjustment in the Red Zone***

193 Tonkin + Taylor's advice concerning the implications of ILV land damage on future foundation requirements is based on the MBIE Guidance, which is strictly applicable only in Green Zone areas of Canterbury.<sup>7</sup> In areas that have been subject to Red Zone offers from the Government, specific engineering guidance for any future building would be required. This would take account, in particular, of the severity of vulnerability to lateral spreading that exists (and that existed before the earthquakes) in much of the Red Zone. Further consideration will be given, in conjunction with advice from Tonkin + Taylor, to determine whether any further adjustment to the DoV percentage discount is required for Red Zone properties.

**(F7) Phase 4: Calculating the Final DoV**

194 The DoV percentage discounts calculated in Phase 2 will be applied to the pre-earthquake values assessed in Phase 1 to determine the DOV amount for each property with ILV land damage.

195 EQC's valuers will then undertake a final review to assess whether, in all the circumstances and having regard to all information about the property, the resulting DoV is reasonable. The valuers may make adjustments as necessary, before confirming the final DoV amount for ILV land damage for each property.

---

<sup>7</sup> MBIE Guidance document (*Guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence*, 2012, as updated April 2015).

196 In particular, the valuers will consider whether the application of standard percentage adjustments to particularly high-value land produces numerical DoV discounts which, when considered as a matter of valuation judgement, are too high given the intrinsic features of the land. That is, in some cases, it may be that a lower percentage adjustment for ILV land damage is appropriate for land with particularly high intrinsic value than for land which are more substitutable in the market. This is consistent with the approach adopted in the IFV DoV Methodology. This issue will be considered on a property by property basis.

197 Once the valuers have confirmed the appropriate DoV amounts, valuation letters for each property will be provided to EQC for settlement purposes.

#### **(F8) Review of DoV assessments**

198 As explained in EQC's ILV Policy statement,<sup>8</sup> EQC claimants may request a review of EQC's decisions in relation to ILV land damage, including the assessment of DoV. Where requested to do so by EQC, EQC's valuers, if appropriate in consultation with EQC's engineers, will review any additional information (or interpretation of existing information) and re-assess the DoV in light of that information.

#### **(F9) DoV assessments where part of the land has been repaired**

199 As discussed in section (E2) above, ILV land damage can be repaired by undertaking a ground improvement, as specified in the MBIE Guidance, when a dwelling is rebuilt. Ground improvements have only been used rarely in Canterbury, but where they are undertaken, they are usually only undertaken on the land under the building footprint, and within 1-2m of the building, in accordance with the recommendations in the MBIE Guidance. Therefore, for most properties, there remains an area of unremediated land, which continues to suffer the practical implications of ILV land damage.

200 Where a ground improvement has been carried out to repair ILV land damage to part of the insured residential land, EQC's valuers understand that EQC will generally settle the ILV land damage based on the costs of undertaking the ground improvement, together with any loss in value resulting from the un-remediated land.

201 The assessment of the DoV for the unremediated land will follow the same process as set out above, except that:

201.1 In Phase 1, the pre-earthquake value will be the value of the area of unremediated land, and will be assessed by EQC's valuers. The process for assessing pre-earthquake values of unremediated land will be captured in a guidance note to this methodology; and

201.2 In Phase 3, the percentage discounts that will be used have been adjusted to reflect only the increased risk of land damage resulting from ILV, rather than any increased risk of building damage, as that will have been addressed by the ground improvement under the building platform.

202 The percentage discounts for areas of land, where the ILV land damage to the building platform has been repaired, are set out below.

---

<sup>8</sup> [www.eqc.govt.nz/ILV](http://www.eqc.govt.nz/ILV).

*Adjusted matrix for Step 1*

203 In considering the percentage adjustments for ILV land damage to unremediated land, EQC’s valuers used the above matrices as a base, but removed any element that related to an increased risk of building damage. This reflects the circumstances noted above, that ground improvements are undertaken on the land under the building footprint and within 1-2m of the building, and eliminate the practical implications of ILV land damage for the remediated area.

204 EQC’s valuers consider that the following adjustments are appropriate for increased vulnerability at 100 year return period levels of shaking:

204.1 Minor change: 1.5%

204.2 Minor or Major change: 3.25%

204.3 Major change: 5%

205 EQC’s valuers considered that the following adjustments are appropriate for increased vulnerability at 25 year return period levels of shaking:

205.1 No change: 1.5% (to reflect the existence of an increase in vulnerability in intermediate frequencies)

205.2 None or Minor change: 2.25%

205.3 Minor change: 3%

205.4 Minor or Major change: 6.5%

205.5 Major change: 10%

206 The adjustments discussed above result in the following extent of change matrix for Step 1 for areas of land where the building platform has been repaired:

<b>Extent of Change classification - 1 in 100 year return period</b>	<b>Major</b>	6.5%	7.25%	8%	9.75%	11.5%
	<b>Minor or Major</b>	4.75%	5.5%	6.25%	8.875%	11.5%
	<b>Minor</b>	3%	3.75%	4.5%	8%	11.5%
	<b>None</b>	<b>None or Minor</b>	<b>Minor</b>	<b>Minor or Major</b>	<b>Major</b>	
	<b>Extent of Change classification - 1 in 25 year return period</b>					

Table 4: Extent of Change Matrix

*Adjusted matrix for step 2*

207 EQC’s valuers consider that the appropriate additional adjustments associated with becoming vulnerable to a natural hazard in addition to the increased risk of land and building damage are as follows:

<b>Pre-CES 100 year return period severity classification</b>	<b>Not Vulnerable</b>	0.8%
	Not Vulnerable or Medium	0.4%
	Other	0%

*Table 5: New Vulnerability Status Matrix*

.....

**APPENDIX ONE – COMPARISON OF LAND VALUE TO TOTAL VALUE FOR IFV PROPERTIES WITH RESIDENTIAL BUILDING IN PLACE, ASSESSED TO DATE**

Suburb Name	Number	Land			Insured value			% land to total (Average)	% land to total (Median)
		Total land Value	Average insured land value	Median insured land value	Total capital value	Average insured value	Median insured value		
Bromley	14	\$ 1,547,000	\$ 110,500	\$ 103,000	\$ 3,610,500	\$ 257,893	\$ 211,000	0.43	0.49
Bexley	41	\$ 4,661,000	\$ 113,683	\$ 114,500	\$ 9,205,000	\$ 224,512	\$ 217,000	0.51	0.53
Avonside	77	\$ 12,101,500	\$ 157,162	\$ 144,500	\$ 19,360,000	\$ 251,429	\$ 225,000	0.63	0.64
Phillipstown	153	\$ 16,683,500	\$ 109,042	\$ 124,000	\$ 35,643,000	\$ 232,961	\$ 225,000	0.47	0.55
Waltham	84	\$ 11,487,000	\$ 136,750	\$ 130,500	\$ 21,926,000	\$ 261,024	\$ 230,000	0.52	0.57
Aranui	187	\$ 24,469,150	\$ 130,851	\$ 135,000	\$ 43,928,000	\$ 234,909	\$ 230,000	0.56	0.59
Wainoni	28	\$ 4,104,000	\$ 146,571	\$ 140,500	\$ 7,261,000	\$ 259,321	\$ 237,500	0.57	0.59
Woolston	580	\$ 79,221,679	\$ 136,589	\$ 134,500	\$ 149,043,298	\$ 256,971	\$ 240,500	0.53	0.56
The Pines beach	2	\$ 339,000	\$ 169,500	\$ 169,500	\$ 220,000	\$ 110,000	\$ 250,000	1.54	0.68
Kaiapoi	34	\$ 4,509,000	\$ 132,616	\$ 133,500	\$ 8,806,000	\$ 259,000	\$ 260,000	0.51	0.51
New Brighton	267	\$ 40,674,500	\$ 152,339	\$ 154,000	\$ 72,872,000	\$ 272,929	\$ 260,000	0.56	0.59
Linwood	96	\$ 12,751,500	\$ 132,828	\$ 135,000	\$ 24,279,000	\$ 252,906	\$ 262,000	0.53	0.52
Bishopdale	3	\$ 664,000	\$ 221,333	\$ 217,000	\$ 3,115,000	\$ 1,038,333	\$ 282,000	0.21	0.77
North New Brighton	23	\$ 3,737,500	\$ 162,500	\$ 163,000	\$ 5,924,000	\$ 257,565	\$ 285,000	0.63	0.57
Spreydon	3	\$ 399,000	\$ 133,000	\$ 130,000	\$ 810,000	\$ 270,000	\$ 286,000	0.49	0.45
Burwood	116	\$ 19,370,500	\$ 166,987	\$ 158,000	\$ 29,355,000	\$ 253,060	\$ 295,500	0.66	0.53
Hillsborough	13	\$ 2,383,000	\$ 183,308	\$ 180,000	\$ 3,679,340	\$ 283,026	\$ 300,000	0.65	0.60
South New Brighton	17	\$ 2,966,500	\$ 174,500	\$ 174,000	\$ 5,199,000	\$ 305,824	\$ 300,000	0.57	0.58
Edgeware	54	\$ 10,955,500	\$ 202,880	\$ 203,900	\$ 20,100,000	\$ 372,222	\$ 300,000	0.55	0.68
Dallington	47	\$ 8,394,000	\$ 178,596	\$ 187,000	\$ 15,202,000	\$ 323,447	\$ 310,000	0.55	0.60
Avondale	314	\$ 54,161,000	\$ 172,487	\$ 176,000	\$ 96,343,000	\$ 306,825	\$ 310,000	0.56	0.57
Richmond	125	\$ 23,364,000	\$ 186,912	\$ 188,000	\$ 40,993,500	\$ 327,948	\$ 315,000	0.57	0.60
Mairehau	215	\$ 40,397,000	\$ 187,893	\$ 193,000	\$ 70,869,000	\$ 329,623	\$ 315,000	0.57	0.61
Parklands	155	\$ 26,393,500	\$ 170,281	\$ 181,000	\$ 49,228,000	\$ 317,600	\$ 320,000	0.54	0.57
Sydenham	49	\$ 7,043,000	\$ 143,735	\$ 133,000	\$ 13,954,000	\$ 284,776	\$ 325,000	0.50	0.41
Papanui	38	\$ 9,199,000	\$ 242,079	\$ 220,500	\$ 16,398,000	\$ 431,526	\$ 325,000	0.56	0.68
Bryndwr	50	\$ 12,352,000	\$ 247,040	\$ 229,000	\$ 19,882,000	\$ 397,640	\$ 340,000	0.62	0.67
Christchurch Central	104	\$ 26,392,500	\$ 253,774	\$ 171,000	\$ 47,169,000	\$ 453,548	\$ 340,000	0.56	0.50
Saint martins	152	\$ 30,786,000	\$ 202,539	\$ 203,000	\$ 53,462,000	\$ 351,724	\$ 350,500	0.58	0.58
Opawa	38	\$ 7,937,000	\$ 208,868	\$ 210,000	\$ 13,466,000	\$ 354,368	\$ 357,500	0.59	0.59
Riccarton	63	\$ 16,062,000	\$ 254,952	\$ 199,000	\$ 26,082,000	\$ 414,000	\$ 360,000	0.62	0.55
Somerfield	14	\$ 3,035,000	\$ 216,786	\$ 210,000	\$ 5,134,000	\$ 366,714	\$ 362,500	0.59	0.58
Saint Albans	171	\$ 45,325,500	\$ 265,061	\$ 260,000	\$ 72,300,000	\$ 422,807	\$ 386,000	0.63	0.67
Cashmere	46	\$ 8,773,000	\$ 190,717	\$ 196,000	\$ 16,185,000	\$ 351,848	\$ 395,000	0.54	0.50
Southshore	83	\$ 17,499,500	\$ 210,837	\$ 210,000	\$ 28,540,000	\$ 343,855	\$ 400,000	0.61	0.53
Beckenham	5	\$ 1,101,000	\$ 220,200	\$ 234,000	\$ 1,523,000	\$ 304,600	\$ 415,000	0.72	0.56
Burnside	6	\$ 1,863,000	\$ 310,500	\$ 310,500	\$ 2,640,000	\$ 440,000	\$ 422,500	0.71	0.73
Brooklands	1	\$ 160,000	\$ 160,000	\$ 160,000	\$ 220,000	\$ 220,000	\$ 425,000	0.73	0.38
Spencerville	20	\$ 4,093,000	\$ 204,650	\$ 210,000	\$ 7,470,000	\$ 373,500	\$ 467,500	0.55	0.45
Sumner	73	\$ 27,264,000	\$ 373,479	\$ 360,000	\$ 41,526,900	\$ 568,862	\$ 550,000	0.66	0.65
Strowan	114	\$ 46,672,500	\$ 409,408	\$ 425,000	\$ 70,984,000	\$ 622,667	\$ 575,000	0.66	0.74
Merivale	371	\$ 180,476,500	\$ 486,460	\$ 432,000	\$ 282,947,811	\$ 762,663	\$ 605,000	0.64	0.71
Casebrook	17	\$ 4,682,000	\$ 275,412	\$ 288,000	\$ 7,038,000	\$ 414,000	\$ 635,000	0.67	0.45
Casebrook	17	\$ 4,612,000	\$ 271,294	\$ 288,000	\$ 7,038,000	\$ 414,000	\$ 635,000	0.66	0.45
Fendalton	65	\$ 43,553,500	\$ 670,054	\$ 680,000	\$ 63,732,000	\$ 980,492	\$ 900,000	0.68	0.76

## **APPENDIX TWO: PRE-EARTHQUAKE VALUATION OF INSURED LAND**

### **Background**

- 1 Northland Valuers Malone Ltd (**Northland Valuers**), an independent valuation firm, has been engaged to determine the pre-earthquake values for the insured land of properties with ILV land damage in the Green Zone, where the pre-earthquake building has been or will be rebuilt, as at 3 September 2010, the day before the first of the 2010-2011 Canterbury earthquakes.
- 2 EQC's valuers are undertaking audits of the pre-earthquake land values to confirm that Northland Valuers followed an appropriate methodology in its assessment, and that the resulting values are appropriate to rely on in the assessment of DoV.
- 3 The audit process adopted by EQC's valuers reflects that the values have been prepared by a registered valuer, assisted by a number of experienced local registered valuers. Accordingly the audit reflects that the individual valuations have been professionally developed and considered prior to release to EQC's valuers for audit. The audit is not a review of individual valuations, but focuses on ensuring that an appropriate methodology has been utilised.
- 4 This appendix outlines the general process Northland Valuers is following in assessing the pre-earthquake land values and that EQC's valuers are following in auditing those values.

### **Northland Valuers' Valuation Approach**

- 5 The pre-earthquake insured land values are being provided in the form of a schedule attached to a letter signed by Bob Malone, FNZIV, FPINZ as a registered valuation. The schedule contains additional information related to minimum site areas and values, which EQC may use in the settlement process.
- 6 The land values are based on market sales before the valuation date of 3 September 2010, using vacant land sales where available. In established areas where limited land sales existed, improved sales are also considered using a residual approach to arrive at a land value. Using accepted valuation techniques, adjustments are made for differences in:
  - 6.1 land size;
  - 6.2 location and surrounding properties;
  - 6.3 physical attributes including contour, outlook, views and shape;
  - 6.4 tenure;
  - 6.5 zoning; and
  - 6.6 situation (inside, corner or rear lot).
- 7 The valuations were undertaken by Bob Malone taking into account base information and preliminary valuations provided by local registered valuers. Through the audit process, discussed below, EQC's valuers raise issues and provide comments that assist Northland Valuers in refining its process for assessing pre-earthquake values.

### **Adjustment for Uninsured Land**

- 8 The pre-earthquake values assessed by Northland Valuers are of the land insured under section 19 of the EQC Act 1993. Where a property includes uninsured land, an adjustment is made to the assessed pre-earthquake value of the whole site, which included this uninsured land.
- 9 To assist in this process, EQC provided Northland Valuers with a schedule of the estimated insured land areas for each property.
- 10 Northland Valuers then applies an adjustment to the pre-earthquake value to exclude the uninsured land based on the location of the uninsured land relative to the house and other appurtenant structures on the land.
- 11 Section 2 of the EQC Act 1993 sets out the definition of residential land that is covered by the Act. Based on that definition, uninsured land is at least 8m away from the residential building and other appurtenant structures and is typically around the edges of a property. As land around the edges of a property is worth less than the land under the house (and less than other areas with higher utility such as driveways or land under associated structures), the adjustment for uninsured land is calculated based on a rate less than the average land rate for the property.

### **Audit Process**

- 12 EQC's valuers are undertaking audits to consider if the methodology followed by Northland Valuers in the preparation of pre-earthquake land values is appropriate, and is producing valuations that are consistent with market trends.
- 13 The audits are not a review of individual property values but are intended to ensure that the overall process would have resulted in pre-earthquake values of the insured land that are in line with market data and specific sales at that time.
- 14 The audit process consists of four key steps:
  - 14.1 review of data received;
  - 14.2 analysis of pre-earthquake land values;
  - 14.3 check for outlier pre-earthquake land values;
  - 14.4 roadside review of a sample of properties; and

### **Review of data provided by Northland Valuers**

- 15 Before undertaking any analysis of the results or checks of sample properties, EQC's valuers review the schedule of values provided by Northland Valuers and consider the following matters:
  - 15.1 *Pre-earthquake land value provided for each property:* As a preliminary check on the data transferred, EQC's valuers confirm that the schedule of valuations supplied matches the original schedule provided to Northland Valuers. If a valuation is not provided, or completed, the audit captures the reason that the value has not been supplied, and if further information is required from EQC, the audit summarises the nature of the information required; and

15.2 *Insured land areas based on information provided:* As noted above, EQC provided Northland Valuers with a schedule of the estimated insured land areas for each property. EQC's valuers check insured areas are based on information provided and that this information has been used correctly, including as it is applied to shared land, such as cross lease developments and properties utilising common access ways.

15.3 *Land areas appropriate for tenure:* EQC's valuers also check that the land areas specified are appropriate for tenure, particularly cross leases. EQC provides insured land areas for cross leases, however, there are no legally defined areas for a cross less property, and the actual land areas should be displayed as N/A.

### ***Analysis of land values adopted***

16 The land values are then reviewed in more detail. This involves:

16.1 *Confirming that the assessed values are consistent with market evidence:* EQC's valuers consider information provided by Northland Valuers as to the range of market sales evidence utilised, and how that evidence was analysed and subsequently adjusted to form benchmark values for each locality. In particular, EQC's valuers explore how value levels were determined for areas where there was an absence of directly comparable sales, to confirm the extrapolation from other evidence is soundly based;

16.2 *Considering the relativity of the assessed land values to pre-earthquake rating values:* As a further check, EQC's valuers compare the pre-earthquake land valuations with the pre-earthquake Rating Valuations, focusing on valuations where there are significant variances in the relativity between proposed values and Rating values; and

16.3 *Comparing land values for minimum site, insured area, and actual site:* EQC's valuers check that the relativity between the insured area value, minimum lot value and actual value, if provided, for each property valued is logical, considering both absolute values and value per square metre.

### ***Check for outlier values***

17 In addition to the analysis outlined above, EQC's valuers also look for and review the results of outlier values.

18 In this step, the main checks are of properties' land values, taking into account the location of each property, that have:

18.1 low or high values;

18.2 low or high land value rates per square metre;

18.3 small or large land areas; and

18.4 identifying complex properties where a more detailed review is required, for example rental flats.

***Review of sample of pre-earthquake values***

- 19 EQC's valuers also review a sample of pre-earthquake land valuations, including a roadside inspection, to check that individual land valuations are a reasonable "fit" to the market evidence for the location.

***Reporting and recommendations***

- 20 Questions and recommendations that arise in the course of the audit are discussed with Northland Valuers. Northland Valuers will provide further information, explanations and/or amend their assessment process as appropriate.
- 21 EQC's valuers document the process outlined above along with their conclusions, any recommendations they made, and the responses from Northland Valuers to any recommendations in relation to the values audited. A copy of this documentation will be provided to EQC.