Natural Hazards in New Zealand

Information updated and sourced from GNS Science in 2013

CoreLogic uses data from GNS Science to provide hazard information on the following natural hazards:

- Earthquakes: including amplification, liquefaction and fault rupture
- Landslides
- Flooding
- Coastal hazards (Sea spray is Manukau City only)
- Volcanic and geothermal (Rotorua only)
- Aircraft noise (Manukau City only).

To determine each hazard rating for a property, three main factors are considered:

- The susceptibility of an area to a specific hazard
- The likely strength or intensity of an event when it occurs, ie what is the potential for damage
- The likelihood or chance of the event occurring.

However in many instances there is insufficient information available on the likely intensity of an event or on the likelihood of it occurring so an assessment of the susceptibility of a property to a hazard is all that is possible.

This report provides further background information into what these hazards are and how they are each specifically determined.

Earthquake hazards

As New Zealand is a seismically active country, earthquakes occur regularly – in fact around 14,000 earthquakes are recorded by GNS Science each year. Of those, only around 100-150 can be felt, and an even smaller number will cause damage.

What is an earthquake hazard?

To determine the hazard rating for earthquake, the following are looked at:

- Likelihood of a certain intensity occurring
- Susceptibility to amplification (or increased shaking) due to local soil conditions
- Susceptibility to liquefaction due to local soil conditions
- Susceptibility to fault rupture.

How is the likelihood of an earthquake determined?

GNS Science has instruments spread throughout New Zealand recording all the earthquakes that occur. As well, they have studied newspaper and other reports of large earthquakes that happened before instrumental recordings began so the location and size can be estimated. All of this information has been used to create an historic earthquake catalogue.

Scientists also study features, including active faults and subduction zones, to try to understand how often they generate earthquakes and how large those earthquakes might be.

All of these possible earthquakes are combined with the historic earthquake catalogue to create a synthetic earthquake catalogue that better predicts the likelihood of earthquakes across New Zealand.

Likelihood in main centres

Centre	Moderate shaking	Strong shaking
Wellington CBD	every 10 years	every 120 years
Christchurch CBD	every 20 years	every 850 years
Dunedin CBD	every 80 years	every 1720 years
Auckland CBD	every 180 years	every 8200 years

What is the likelihood of increased shaking?

Different rock or soil types will behave differently in any given earthquake. The materials of the earth vary in strength and density and in some places shaking can be affected by the type and thickness of soil resulting in an increased intensity of shaking. Higher levels of shaking typically lead to more damage to buildings and property.

Types of rock or soil:	Likely response in a strong distant earthquake compared to an adjacent 'shallow soil' site	Likely response in a strong and close by earthquake compared to an adjacent 'shallow soil' site
Strong Rock	LITTLE or NO increase in shaking	SLIGHT increase in shaking
Weak Rock	LITTLE or NO increase in shaking	SLIGHT increase in shaking
Shallow Soil	NO increase in shaking	NO increase in shaking
Deep or Soft Soil	MODERATE increase in shaking	MODERATE increase in shaking
Very Soft Soil	LARGE increase in shaking	MODERATE decrease in shaking (houses) MODERATE increase in shaking (high-rise buildings)

Information updated and sourced from GNS in 2013

How is the likelihood of an increase shaking determined?

How the susceptibility of a property is determined in terms of its behaviour during ground shaking is based on the best available geological maps. The description of the rock/soil on these maps and an assessment of the age of the materials are used to estimate the thickness, strength, and stiffness of the soil or rock beneath a property. Comparison with similar materials elsewhere in New Zealand where earthquake shaking has been amplified allows an assessment of susceptibility to be made.

What is liquefaction?

Liquefaction is a process whereby soil behaves more like a liquid than a solid. It can occur at sites with very wet, loose, sandy or silty soils when they are strongly shaken during an earthquake. The shaking causes the soil particle structure to collapse, and any water present lubricates the soil, so the whole mass behaves more like a liquid than a solid.

How is the likelihood of liquefaction determined?

How a property is rated in terms of its susceptibility to liquefaction is based on the best available geological maps. The description of the rock/soil on these maps and an assessment of the age of the materials are used to estimate the dominant grain size of the soil and rock and the likely depth to groundwater beneath a property. Comparison with similar materials elsewhere in New Zealand where earthquake shaking has caused liquefaction allows an assessment of susceptibility to be made.

What is fault rupture?

A fault is a fracture, or zone of fracturing, in rock along which there has been displacement of one side relative to the other. This displacement may only be a few centimetres or several kilometres. An active fault is one that has broken through to the ground surface and along which the areas on either side have moved in recent geological time. Typically the amount of displacement on New Zealand's active faults in a single earthquake is between 1 and 5 metres, sufficient to damage any building that is built across the fault.

How is the likelihood of fault rupture determined?

GNS Science holds a database of all known active faults in New Zealand. Studies have shown that most active faults move more than once and when they move it is usually in the same place. Where faults have been studied in detail and their location has been accurately recorded, this information is used directly in the property report. In areas where there are active faults but the locations are poorly known, a large zone within which future movement is expected to occur, is created and used. However not all active faults have been found. In some areas the geology is too young to record fault movements, in other areas erosion is very fast and removes up the evidence of past fault ruptures. Properties in these areas are rated with a statement that gives the reason why no assessment is possible.

Information updated and sourced from GNS in 2013

Landslide hazard

What is a landslide hazard?

A landslide is the movement of rocks and/or soil down a slope under the influence of gravity. Some landslides are extremely fast moving and others are slow. Some involve large amounts of material that can cause extensive damage to properties; others are only a minor inconvenience.

Whether an area is susceptible to landslides depends on the slope, geology, soil and the proximity to cliffs or steep slopes (above or below the area of interest).

How is a landslide hazard determined?

The landslide hazard can be determined in different ways, depending on the availability of information. The hazard can be assessed based on field investigations, correlation with similar areas with historical recorded landslides or the use of a susceptibility model. The property report is based on a susceptibility model that combines a slope-geology model and a runout-collapse model. For example, a flat area may have a low susceptibility according to the slope-geology model but its proximity to steep slopes above or below it can substantially increase the susceptibility and this is accounted for in the runout-collapse model. The results of the susceptibility model are complemented with historical information when available.

Flood hazard

What is a flooding hazard?

Flooding is the most common natural hazard in New Zealand and can be caused by river flooding, ponding in flat areas due to heavy rainfall, and ponding due to blocked drains or waterways blocked by debris.

How is a flood hazard determined?

A flood hazard can be determined in several ways, including information on the extent of historical floods, a qualitative assessment based on the best available knowledge, and flood modelling techniques.

With a flood model, local authorities use records of river flows and rainfall in their area to calculate how frequently floods of different heights occur and to determine the areas likely to be flooded.

The property report provides a general flood assessment based on historic and pre-historic flood plain deposits as recognised in soil profiles. The presence of flood deposits indicates the area was susceptible to flooding in the past but changes in climate, river flows, river position and the construction of flood protection works such as stop banks can mean an area that was flooded in the past may now be protected.

The historic and pre-historic flood information is complemented with numerical modelling information where available. Currently this level of flood information is only available for some areas within the Greater Wellington region.

Information updated and sourced from GNS in 2013

Coastal hazard

What is a coastal hazard?

Any property built near the coast could be subject to coastal hazard. Coastal hazards include coastal erosion, sea level rise, storm surge, sea spray and tsunami, however, the property report only includes information on tsunami and sea spray.

What is sea spray hazard?

Sea spray is carried from the ocean by the wind and these airborne salts are severe up to 500m from the coast but can carry 50km or more. Salt can affect metal, masonry, clay and reinforced concrete. It is particularly corrosive when it accumulates on surfaces that are not regularly washed by rain.

How is sea spray hazard determined?

The high sea spray hazard zone is defined as all offshore islands and any area up to 500m from the coast or 100m from a tidal estuary or sheltered inlet. This data is available in the property report for Manukau City only.

What is a tsunami?

A tsunami is a wave or series of waves caused by the displacement of a large amount of water in a lake or the sea.

How is tsunami hazard determined?

Tsunami hazard was developed following the New Zealand National Tsunami Review. The tsunami model uses the maximum wave height at the coast for two return periods (100 and 500 years) to create a set of inundation zones. These zones are compared to another model developed more recently for defining tsunami evacuation zones. It must be stressed that the inundation zones are estimates and there is much uncertainty as to how large the 100 and 500 year tsunami might be at a particular location and how far inland they might travel. In addition, both models rely on good elevation data and in some areas of New Zealand this is not available. Where the elevation model is of low quality there is more uncertainty. In harbours and estuaries there is further uncertainty as to how waves will behave and as a consequence the results in these areas have more uncertainty.

Geothermal hazard

Is geothermal activity - a hazard or a resource?

Geothermal activity presents a resource that property owners may be able to use but there are also hazards associated with geothermal activity, such as geysers and steaming ground. It occurs in a number of places around New Zealand, although the property report only covers the Rotorua Geothermal Field which is managed by Environment Bay of Plenty.

Information updated and sourced from GNS in 2013

How is the presence of a geothermal hazard determined?

Ground temperature measurements at a shallow depth have been made over the geothermal field and areas with elevated ground temperatures identified. It is possible that geothermal features like warm/hot ground, springs and steam vents could form in these areas in the future.

Areas above a geothermal field can also experience gas emissions, as the geothermal gases pass through the system. Hydrogen sulphide (H2S) gas may be present and under some circumstances may cause health problems. When combined with the elevated ground temperatures it can be damaging to buildings. Gas surveys have been conducted over the Rotorua Geothermal Field and are included in the property report.

Aircraft noise hazard

What areas are affected by aircraft noise?

Any property near an airport will be subject to noise from aircraft during take-off and landing. Properties further from the airport may also experience noise if they are beneath or close to a flight path. The level of noise will vary depending on how high the flight path is above the property, the type of aircraft and how it is being flown.

How is the aircraft noise determined?

International airports in New Zealand monitor noise levels on a regular basis. The readings made plus some estimates are used to create noise contour maps and these are available from the local council. The noise levels measured are not a measure of the maximum noise level but instead the average equivalent sound level over a 24 hour period, with a penalty added for noise during night time (between 10 pm and 7 am). The property report only covers Auckland Airport in Manukau City.

Information updated and sourced from GNS in 2013