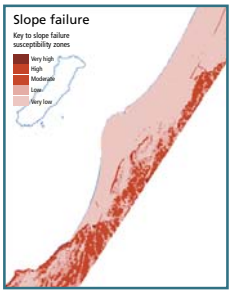
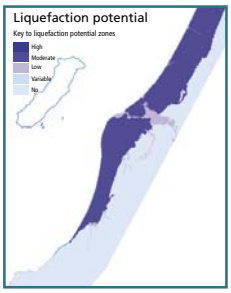
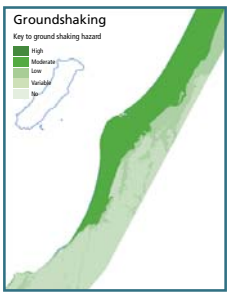
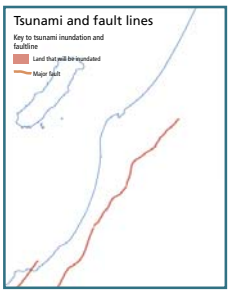
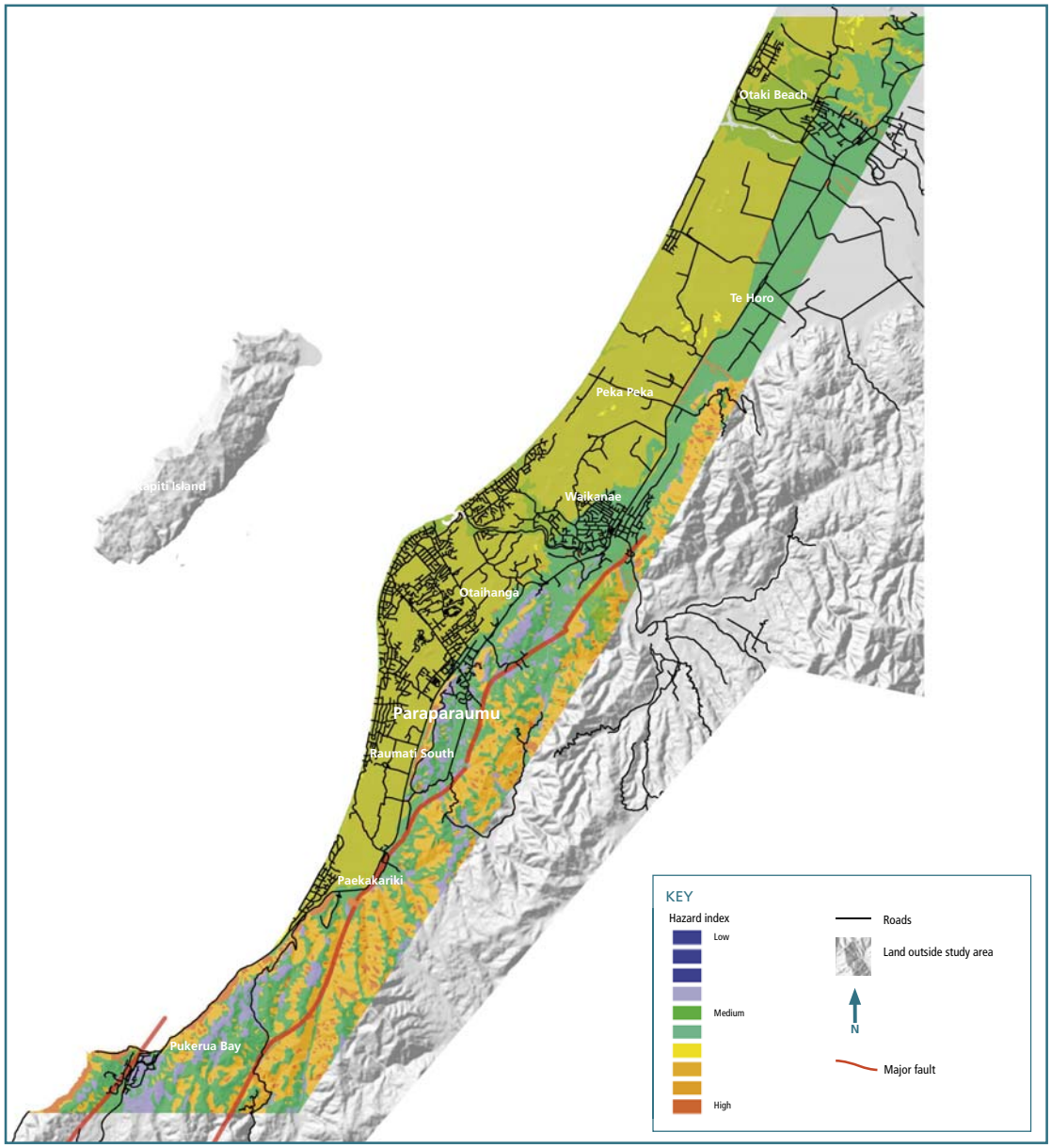
# Combined earthquake hazard map
## Kapiti Coast




**Earthquake hazard mitigation measures**

| Hazard | Effect on ground | Effect on facilities | Mitigation options: existing facilities | Mitigation options: planned facilities |
|---|---|---|---|---|
| Fault movement | Ground disturbances vertically and horizontally over a zone depends on depth to rock below surface. Cracks in land surface. | Upheaval, tearing apart, movement of foundations, severe damage to structures which cross the fault. | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) strengthen to survive<br>b) move facilities from fault zone<br>c) limit damage by providing weak links or isolation | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) construct facilities elsewhere<br>b) incorporate special strengthening<br>c) provide weak links or special isolation to limit damage |
| Ground shaking | Violent horizontal and vertical motions for up to one minute duration. | Cracking, fracture, collapse of buildings. Breaks in underground services. Deformation of surface infrastructure. | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) strengthen or base isolate<br>b) secure/improve vulnerable parts<br>c) limit damage by providing weak links or isolation. | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) comply with current codes for design and construction<br>b) incorporate strength and resilience<br>c) secure vulnerable parts and contents |
| Liquefaction | Shaking causes some soils to behave like liquid, causing loss of support to structures above. Such soils may be up to 10m below ground surface. Lateral movement of large soil masses, especially adjacent to rivers. Variable subsidence of ground surface. | Sinking and tilting of structures supported on liquefied material. Severe damage to underground services. Flotation of empty underground tanks and chambers. | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) install piles<br>b) install gravel drains<br>c) drain liquefiable layers<br>d) prepare for quick reinstatement | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) compact ground at site<br>b) install piles and gravel drains<br>c) drain liquefiable layers |
| Slope failure | A significant soil masses moves bodily down the slope, from few hundred millimetres to many metres. Landslides occur at many different locations. | Ranges from deformation of foundations and structural failures to total destruction of site and all buildings and infrastructure above and below ground. | 1. Verify.<br>2. Assess impact.<br>3 Options:<br>a) stabilise slope – retaining walls<br>b) stabilise slope – ground anchors<br>c) improve drainage, reduce erosion | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) find a better site<br>b) stabilise slope retaining walls<br>c) stabilise slope – ground anchors<br>d) improve drainage, reduce erosion |
| Tsunami | Land flooded. Scouring action erodes soil dramatically | Flooding of basements. Undermining/destruction of surface infrastructure. Exposure/ damage to underground services. Undermining of foundations. Bodily movement of some structures, equipment, vehicles etc. | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) construct protective sea walls<br>b) shift critical facilities to higher level | 1. Verify.<br>2. Assess impact.<br>3. Options:<br>a) find a better site<br>b) construct protective sea walls<br>c) design special foundations / dikes<br>d) put critical facilities at high level |

### Background statement

In recognition of the earthquake hazard in the Region, the Greater Wellington Regional Council has carried out studies on ground surface rupture from active faulting, ground shaking, liquefaction potential and associated ground damage, slope failure and tsunami inundation (Wellington Harbour). Single factor hazard maps have been produced by Greater Wellington for each of these earthquake hazards.

This map sheet is part of a series of four map sheets showing the combined earthquake hazard for the main urban areas in the western part of the Wellington Region. The map series is one of Greater Wellington's natural hazard education and awareness initiatives.

The combined earthquake hazard map is a generalised map of earthquake hazard reflecting possible effects on a typical range of facilities (buildings, roads, services, etc). The methodology has involved broad assessments of many factors which determine the effects of earthquakes.

This map series was prepared for Greater Wellington by Ian R Brown Associates Ltd in association with Kingston Morrison Ltd and Victoria University of Wellington.

### Warning

The hazard assessment methodologies developed for each of the earthquake hazard components and the methodology used to combine and present the hazard information impose certain qualifications and limitations on the use of the information. Details on the qualifications and limitations, and assessment methodologies of the component earthquake hazard studies are available from Greater Wellington. The methodology used to combine the various earthquake hazards are described in the Greater Wellington Report on Mapping Methodology and Risk Mitigation Measures WRC/RP-T-96/22.

The information provided on these maps cannot be substituted for a site specific investigation. The site specific potential for and consequent damage from active faulting, amplified ground shaking, liquefaction, slope failure, and tsunami inundation should be assessed by qualified and experienced practitioners.

### Bibliographic reference

Greater Wellington Regional Council (1996). Sheet 4 Kapiti (1st ed.) Combined Earthquake Hazard Map 1:30000, Pub. No. WRC/RP-T-96/16 Greater Wellington Regional Council, Wellington, New Zealand.

### Notes on earthquake hazard mitigation measures

1. Check that the broad indication of hazard from the maps is correct for a particular site. (In many case, this could prove cost-effective towards mitigation.)
2. Obtain professional advice on implications and available countermeasures.
3. Mitigation options shown are in brief general terms. Professional advice will be needed to account for particular circumstances at the site.

### Single component hazard maps

These combine to produce the Combined Earthquake Hazard Maps. Maps of the single components (ground shaking, liquefaction and earthquake induced slope failure) are available from the Hazard Analyst at Greater Wellington.



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