

Port Hills White Zone – Rock Roll (816 properties)

1. Background

- Earthquakes have increased pre-existing risks of rock roll in the Port Hills - with resultant increase in risk to life and property.
- Further rock roll may be triggered by earthquakes, or by non seismic events such as rain, snow and frost.
- Estimated 94 properties where the chance of been killed is greater (worse) than 1 in 1000; 435 at 1 in 10,000.
- By comparison, the risk of dying from a road accident is around 1 in 10,000 - but overall risks to life can be high (1 in 300 for a person in the 45-64 age band).
- Risk level reduces over time.

Refer boxes 5, 6, 10 and 12 for detail

2. Issues

- Christchurch City Council issued section 124 notices prohibiting access to 268 properties at risk of rock roll based on observational information.
- Modelling of risk zones does not align in all cases with the properties subject to s124 notices (54 fall outside the modelled 1 in 10,000 zone).
- Christchurch City Council intends to review the placement of s124 notices in light of the modelling – but no guarantees of outcomes.

Refer box 13 for detail

3. Options

- Do nothing and let the Christchurch City Council processes run their course (could augment by “buying time”).
- Mitigate by constructing protective barriers (6-18 month lead time before barriers would be in place).
- Purchase offer to affected parties.

4. Conclusions to date

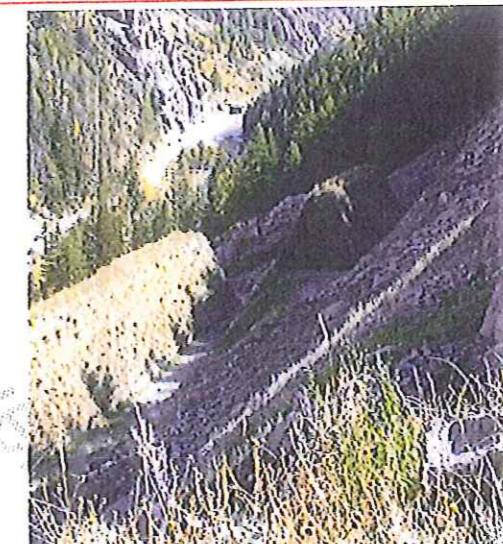
- Natural hazard management usually rests with local government – but there are reasons for central government involvement.
- Protection is often more cost-effective than retreat – but impossible to protect in all cases.

Key Issues

- Approach going forward around risk level and timeframe.
- Work with Council around removal of s124 notices.
- Agree cost share model with Council.

Refer boxes 11, 14 and 15 for detail

5. Mitigation Costs	Risk Level	2012		2016	
		Number of properties	Cost to remedy (\$m)	Number of properties	Cost to remedy (\$m)
	1 in 1,000	94	30-40	22	4-8
	1 in 10,000	435	110-180	290	65-120



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6. State of Play

Overview

- **94 properties** with an Annual Individual Fatality Risk (AIFR) **greater than 1 in 1,000** (at 2012 risk level).
- **435 properties** with an AIFR **greater than 1 in 10,000** (at 2012 risk level), including the 94 properties described above.
- **268 buildings** have section 124 Building Act notices preventing entry (issued by Christchurch City Council).

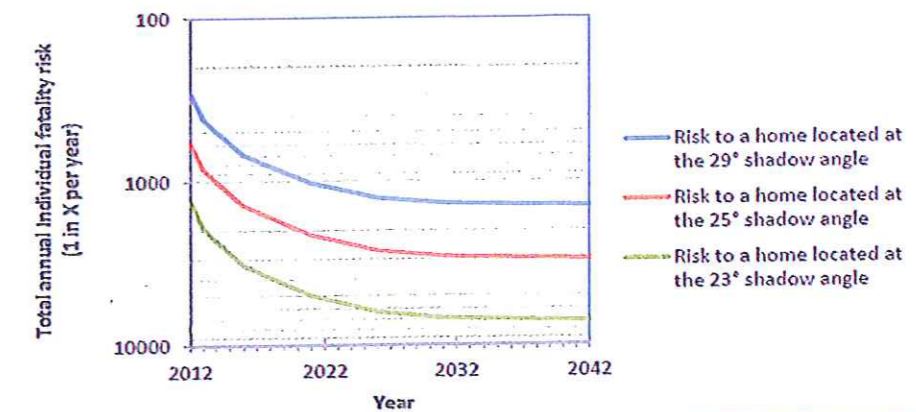
Geotechnical Information

- The Institute of Geological and Nuclear Sciences (GNS) has completed studies of rock roll
- This GNS study includes maps showing where there is heightened AIFR due to rock roll.
- GNS has produced AIFR estimates for multiple scenarios, including a conservative one (occupancy 24 hours per day, multiplication of known boulders by a factor of 1.2), and a less conservative one (occupancy 16 hours per day, residents are not in their homes during aftershocks).
- GNS estimates uncertainties in their AIFR modelling at about an order of magnitude (i.e. 1 in 1,000 may in fact be 1 in 100, or 1 in 10,000).
- It is expected that rock roll risk will decrease over time, as seismic activity reduces (this may change in the event of a further significant and local seismic event).

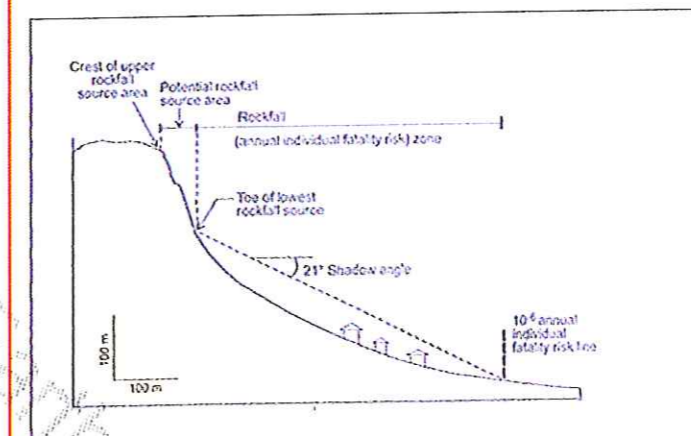
9. Considerations for rock roll mitigation options:

- **Life-safety risk due to rock roll:** will decrease over time.
- **Precedent:** Central Government involvement may set precedent in other parts of New Zealand affected by rock roll.
- **Effectiveness of protection structures:** may not reduce risk to an acceptable level.
- **The cost of reducing life risk:** high relative to other sectors (i.e. transport).
- **The cost of fences or bunds:** in addition to capital and maintenance costs, could include interim assistance to households.
- **Timeliness of mitigation:** 6-18 months required for protective works (depending on scale of project, number of work sites, procurement methodology and approach to land/access issues).
- **Societal and individual risk tolerance.**
- **Community acceptance of life-safety risks and timeliness of mitigation.**
- **Division of Government and Christchurch City Council roles:** funding, land purchase for fences/bunds, ownership and maintenance.

7. Reduction of annual individual fatality risks due to rock roll in the Port Hills over time



8. Representation of rock roll



10. Risk Parameters

- There is no "correct" level of risk.
- GNS suggests an Annual Individual Fatality Risk figure somewhere between the range of 1 in 1,000, and 1 in 30,000.
- Compared to transport, protecting statistical lives from rock roll is relatively expensive, especially at risk levels of 1 in 10,000 or lower.
- A joint approach with the Christchurch City Council is needed to ensure consistency with approach regarding s124 notices.
- A level of on-the-ground assessment is desirable.

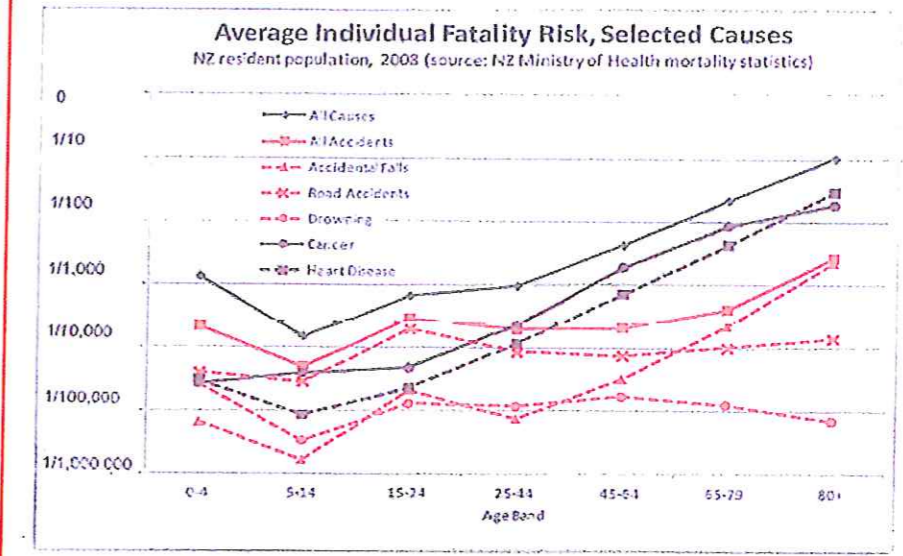
11. Cost-benefit ratio of Port Hills sites, including changes over time

Area	Number of affected properties (value in \$ millions)				Value of houses divided by cost of mitigation - INDICATIVE ONLY (Cost of mitigation in \$ millions)			
	2012		2016		2012		2016	
	Greater than 1 in 1,000 (\$)	Greater than 1 in 10,000 (\$)	Greater than 1 in 1,000 (\$)	Greater than 1 in 10,000 (\$)	Greater than 1 in 1,000 (\$)	Greater than 1 in 10,000 (\$)	Greater than 1 in 1,000 (\$)	Greater than 1 in 10,000 (\$)
Wakefield North	7 (6)	16 (10)	1 (0)	15 (10)	0.7 (8)	1.3 (8)	0 (0)	1.2 (8)
Wakefield South	9 (3)	35 (13)	4 (2)	33 (12)	0.8 (4)	3 (4)	1.5 (1)	2.8 (4)
Avoca Valley Road	2 (2)	32 (16)	0 (0)	27 (13)	0.1 (11)	1.5 (11)	0 (0)	1.2 (11)
Avoca Tussock Farm	0 (0)	3 (3)	0 (0)	0 (0)	0 (0)	1 (3)	0 (0)	0 (0)
Avoca Port Hills Rd	6 (2)	17 (7)	3 (1)	9 (3)	0.7 (3)	1.5 (5)	1.2 (1)	0.4 (8)
Avoca Stonehaven	5 (2)	24 (11)	2 (1)	14 (6)	0.4 (6)	1.3 (9)	0.2 (3)	0.9 (6)
TOTAL	94 (46)	435 (234)	22 (9)	290 (156)				

What the numbers mean: Wakefield North as an example:

- There are 7 buildings with a risk level of greater than 1 in 1,000 in 2012 and they are worth \$6 million.
- There are 16 buildings with a risk level of greater than 1 in 10,000 in 2012 and they are worth \$10 million. This includes the 7 with a risk level of greater than 1 in 1,000.
- The cost benefit ratio of protection for properties with a risk greater than 1 in 1,000 in 2012 is 0.7. This protection would cost \$8 million.
- The cost benefit ratio of protection for properties with a risk greater than 1 in 10,000 in 2012 is 1.3. This protection would cost \$8 million.

12. Annual Individual Fatality Risks in New Zealand



13. Viewpoints of the Christchurch City Council

Legislative Framework

Section 124 of the Building Act allows a territorial authority to prohibit access to a "dangerous" building based on risk, the possibility of land/building collapse, and the potential to cause injury.

Where it is reasonable to do so, a territorial authority may issue a **building consent** even if the land upon is subject to a **natural hazard**. However, a **hazard notice** (under section 72 of the Building Act) must be registered on the certificate of title, which also appears on Land Information Memoranda.

Christchurch City Council Application of these Provisions

To remove a section 124 notice, the Council must be satisfied that risks have been reduced sufficiently, and protection is appropriately designed and built; Christchurch City Council indicates this is most likely in the case that bunds are used, as questions remain about the effectiveness of fences.

Where a rock roll protection system allows for the removal of section 124 notices, it is likely that a **hazard notice** will not be issued.

Restrictions on building consents and subdivisions are likely until risks associated with rock roll have reduced sufficiently.

14. Rock Roll - Breakdown of Figures

Annual Individual Fatality Risks	Number of properties	Value of properties (\$m)	Number of properties with s124 notices	Value of those properties with s124 notices (\$m)
Risks greater than 1 in 1,000	94	\$54	54	\$31
Risks greater than 1 in 10,000 (includes greater than 1 in 1,000)	435	\$234	214	\$122
Risks less than 1 in 10,000	381	\$175	54	\$22

15. Going Forward

- Finalised figures to be provided.
- Cost sharing with Christchurch City Council to be discussed; typically local government takes responsibility for natural hazard mitigation.
- Confirmation needed that Christchurch City Council will remove section 124 Building Act notices.
- Rapaki Bay in the Port Hills is affected by rock roll:
 - This is Maori Reserve Land, and multiply-owned Maori land
 - Runanga has suggested a like-for-like 'land swap' with other Reserve Land - may require a change to the Christchurch City Council District Plan.