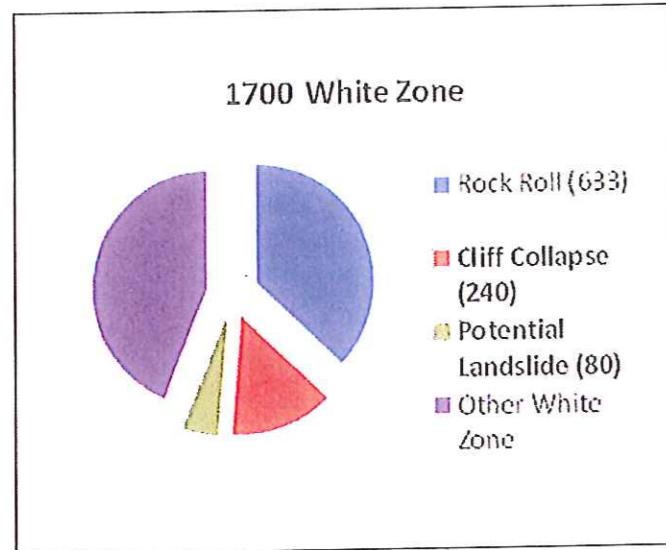


Port Hills White Zone – Cliff Collapse/Debris Inundation and Landslips- Context



Geotechnical Information for Cliff Collapse/ Debris Inundation

- Agreed dataset with CERA, CCC and geotechnical advisors
- GNS modelling of risk contours
- Risk will **not** reduce significantly over time

Possible Group 1 Criteria for Cliff Collapse

- Properties at an **immediate life-safety risk** that cannot be remediated
- Horizontal **infrastructure difficult and costly to maintain** (sewerage, access, roads, water).

Possible Group 2 Criteria for Cliff Collapse

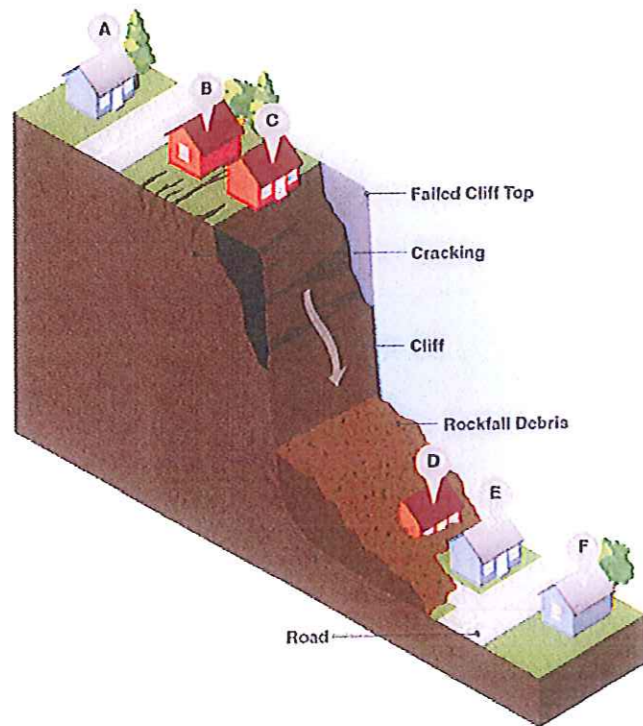
- **No immediate life-safety concerns** that cannot be remediated on an individual basis.
- Buildings are not badly damaged, and investments in repair are viable (building consents may be available)
- Horizontal infrastructure can be **economically maintained for now**

Issue exists (discussed overleaf) where buildings are damaged, and it would be inadvisable to invest in repairs/ rebuilds (building consents unlikely to be available)

Geotechnical Information for Landslips

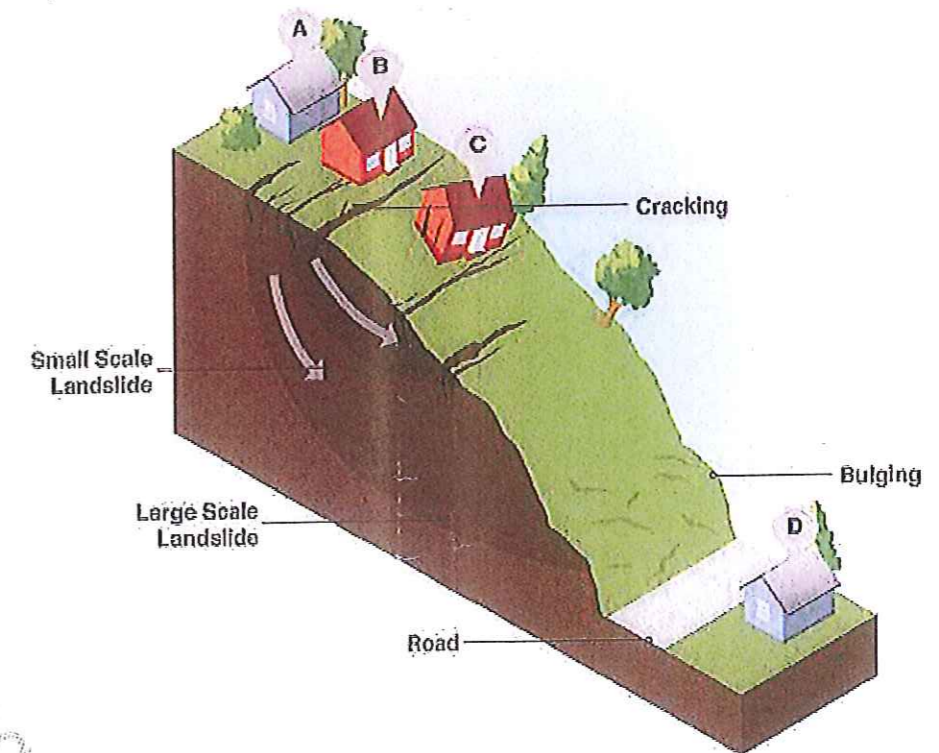
- **Geotechnical investigations still underway** (in part reliant on rainfall)
- CERA has commissioned a desktop study for landslips, and initial results are available
- Some buildings have damage, and it does not appear sensible to repair these.

Cliff Collapse/ Debris Inundation Graphic and Legend



House	Description
C	<ul style="list-style-type: none"> • Significant land damage • Life-safety risk • High risk of further collapse • Not economically viable or practical to remediate • Group 1
D	<ul style="list-style-type: none"> • Inundated by debris • Life-safety risk • Not economically viable or practical to remediate • Group 1
B	<ul style="list-style-type: none"> • Land cracking associated with cliff collapse • No significant life-safety risks • Likely restrictions on further building • Group 2- GREEN Zone
E	<ul style="list-style-type: none"> • Little or no land damage now • No significant life-safety risk • Low risk of inundation from further events • Group 2- GREEN Zone
A	<ul style="list-style-type: none"> • Some or minor land damage • Little risk of further land damage • GREEN Zone
F	<ul style="list-style-type: none"> • No land damage, and not directly exposed to risk • GREEN Zone

Landslip Graphic



There are 16 major landslips in the White Zone

- 5 are connected with cliff collapse/debris inundation areas (life risk)
- 1 is separate from cliff collapse/debris inundation areas (life risk) and may require a separate response (straddles Green and White Zone)
- The remaining 10 could potentially be green zoned, but further monitoring, detailed investigation and mapping will be necessary; approximately 340-360 buildings are within the area of these landslips, of which 85-110 may be badly damaged.
- There are outstanding issues with those landslip properties that have significant building or land damage given the potential comparison with cliff collapse/debris inundation-affected properties

- See overleaf -



Port Hills White Zone – Cliff Collapse/Debris Inundation and Landslips

Category	# Properties <i>(All numbers indicative)</i>	Value <i>(All figures indicative)</i>	Implications	Issues
Group 1	145-155 (130 with s124 notices)	\$90-100M	<ul style="list-style-type: none"> Retreat 	<ul style="list-style-type: none"> Nature of assistance package to be decided (Red Zone precedent will be strong) Voluntary offer
Group 2	75-100 (14 with s124 notices)	\$48-70M	<ul style="list-style-type: none"> Monitor and manage through standard CCC natural hazard processes No building consents for major renovations available 	<ul style="list-style-type: none"> No assistance proposed Lifting of existing s124 notices required (CCC indicates that this is unlikely to be a problem)
Vacant				
G1	3	\$750,000	<ul style="list-style-type: none"> Building consents may not be available 	<ul style="list-style-type: none"> Nature of assistance package to be decided (if any)
G2	0	0		
G1 Commercial	3	\$2.8M	<ul style="list-style-type: none"> Building consents may not be available 	<ul style="list-style-type: none"> Nature of assistance package to be decided (if any)
G1 Not-for-Profit	TBC	N/A	<ul style="list-style-type: none"> Building consents may not be available 	<ul style="list-style-type: none"> Nature of assistance package to be decided (if any)

Some cliff collapse and landslip properties share similar characteristics

- Little immediate life risk
 - May have suffered land damage that cannot be remediated and/or
 - Building may have severe structural damage
- Would be inadvisable to invest further in these areas. Existing processes (i.e. building consents) should be effective in ensuring that no further significant investment occurs
- Property owners will not be able to continue to live in these properties
- **Issue arises around whether to include in any assistance package**
- One scenario is to provide no assistance, and rely on normal insurance procedures (seeking information from EQC on their possible approach, but insurance proceeds for build damage is likely to be forthcoming)
- Offering any assistance would raise significant precedent issues around landslips in New Zealand.
- **Very difficult to isolate these properties from similar cliff collapse properties**

Cause	Location	# Properties	Possible Action
Life risk close to dwelling	Heberden Avenue	3	Place in Group 1 or Group 2 (possible subdivision)
Access issues:			
Private Roads	Redcliffs	2	Place affected properties in Group 1 or remediate/mitigate
Public Roads	Heberden Avenue	2	
Group remediation required	Redcliffs	16	Assess whether remediation feasible and cost effective. Possibly assist property owners with remediation works

Landslip Sites - Breakdown of figures

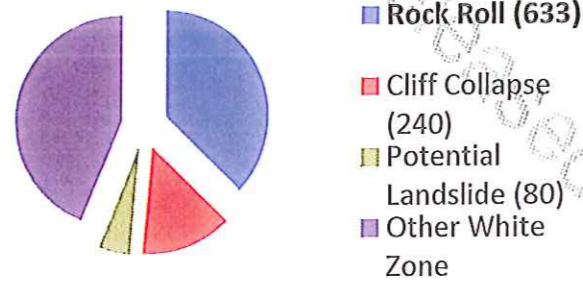
Description of Sites	Number of Sites (16 in total)
Connected with cliff collapse/debris inundation areas	5
Can likely be green zoned (little land or building damaged observed)	1
May be possible to green zone, but more investigation required (potential life safety impact, or land damage suggests building consents may not be available)	10

Other Cliff Collapse/ Debris Inundation Issues

- Demolitions- CERA will want to manage demolitions for Group 1 sites, given health and safety considerations, and the potential impact on critical infrastructure
- Many Group 1 dwellings may not be badly damaged; therefore, insurance proceeds may not be as high as for the Red Zone Flat Land
- Some Group 2 properties may subsequently need to be acquired to remediate critical infrastructure lifelines. Specific communications needed to manage this potential issue. (May affect 14 properties in Redcliffs, Peacock's Gallop and Heberden Avenue)
- 2 Green Zone properties in Redcliffs included in Group 1 (1 property) and Group 2 (1 property). Specific communications needed to manage this issue

Port Hills White Zone – Rock Roll

1700 White Zone



1. State of Play

Overview

- 298 properties AIFR from rock roll is worse than 1 in 1,000 (at 2012 risk level)
- 633 properties AIFR from rock roll is worse than 1 in 10,000 (at 2012 risk level)
- 23 different areas ('sub-sectors')

Geotechnical Information

- Risk contours have been modelled (GNS)
- GNS developing an alternative 1yr scenario with the effect of aftershocks removed; final model to be delivered Monday.

ALL NUMBERS WILL CHANGE

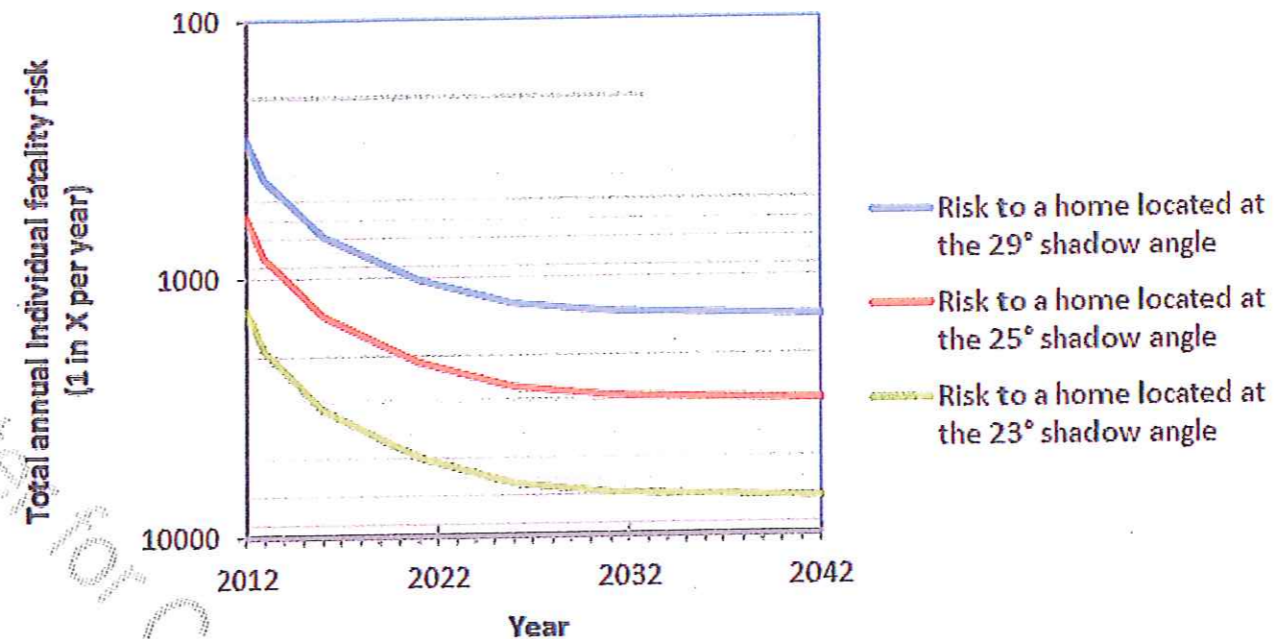
- Rock roll risk will decrease over time as seismic activity reduces, further seismic events would interrupt trend
- Model assumptions and uncertainty
 - Scale factor of 1.2 to allow for unmapped boulders and rock masses having been broken and disturbed by the earthquakes
 - 0.67 occupancy ie an average person will spend 16/24 hours per day at home
 - GNS estimates uncertainties on the AIFR modelling at about an order of magnitude (factor of 10) in either direction

Sub-sector analysis

- Options
 - Accept risk
 - Mitigate (fence, bund, at source)
 - Retreat (interim or long term)
 - Cost/benefit analysis

2. Results to date

Risk levels decrease over time



Cost benefit ratio varies between sites and depending on timeframe

Area	Number of houses (Value in \$m)				INDICATIVE BCR (Cost of mitigation in \$m)			
	Y1		Y5		Y1		Y5	
	Worse than 1 in 1000	Worse than 1 in 10000	Worse than 1 in 1000	Worse than 1 in 10000	Worse than 1 in 1000	Worse than 1 in 10000	Worse than 1 in 1000	Worse than 1 in 10000
Wakefield Ave North	28 (19)	28 (19)	0 (0)	28 (19)	2.3 (8)	2.3 (8)	0 (0)	2.3 (8)
Wakefield Ave South	38 (14)	43 (16)	8 (3)	43 (16)	3.2 (5)	3.5 (5)	2.5 (1)	3.5 (5)
Avoca Valley	29 (14)	36 (16)	0 (0)	33 (15)	1.2 (11)	1.5 (11)	0 (0)	1.3 (11)
Bowenvale West	4 (2)	39 (25)	0 (0)	20 (14)	1.1 (2)	1 (24)	0 (0)	2.4 (6)
Bowenvale East	33 (21)	33 (21)	0 (0)	16 (10)	4.5 (5)	4.5 (5)	0 (0)	4 (2)
Morgans Valley	0 (0)	18 (10)	0 (0)	18 (10)	0 (0)	1 (10)	0 (0)	1 (10)
Lyttelton SE	3 (1)	57 (25)	1 (0)	10 (4)	3.2 (0)	4.8 (5)	0.9 (0)	6.2 (1)
Lyttelton NW	11 (4)	49 (20)	0 (0)	49 (20)	2.6 (2)	3 (7)	0 (0)	3 (7)
TOTAL (including other areas, approximate)	298 (\$162)	633 (\$335)	20 (\$10)?	450 (\$250)?	(\$90)?	(\$127)?	(\$10)?	(\$90)?

What the numbers mean: Wakefield Ave South as an example.

- 38 (14) There are 38 houses with a risk level of greater than 1 in 1000 in year 1 and they are worth \$14 million
- 43 (16) There are 43 houses with a risk level of greater than 1 in 10000 in year 1 and they are worth \$16 million. This includes the 38 with a risk level of greater than 1 in 1000
- 3.2 (5) The cost benefit ratio of protection for properties with a risk greater than 1 in 1000 in year 1 is 3.2. This protection would cost \$5 million
- 3.5 (5) The cost benefit ratio of protection for properties with a risk greater than 1 in 10000 in year 1 is 3.5. This protection would cost \$5 million

3. Considerations

- Current and future life safety risk
- Cost of reducing risk is high relative to other options
- Probable effectiveness
- Cost (capital, maintenance, any interim assistance to households)
- Timeliness (6-18 months lead time for protective works depending on scale of project, number of work sites, procurement methodology, approach to land/access issues etc)
- Societal and individual risk tolerance (see below)
- Community acceptance and impact (certainty, ability to move on with lives)
- Government and CCC roles (funding, development including any land purchase, ownership and maintenance)
- Precedent

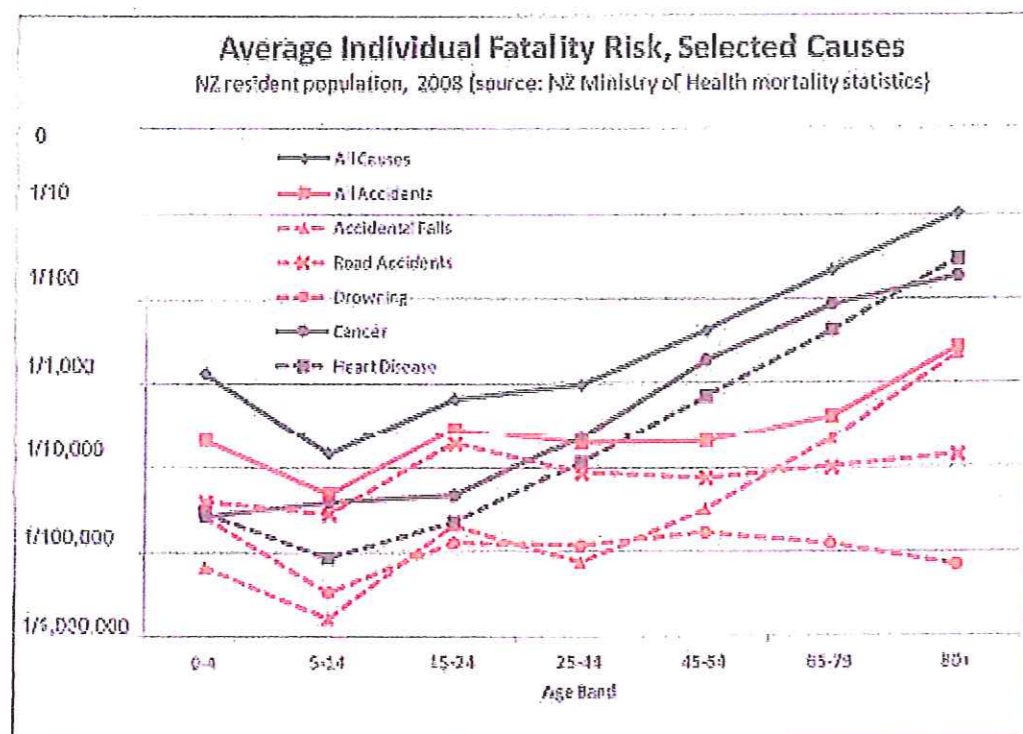
5. Risk Issues

- In most scenarios protection appears more appropriate than retreat
- Issue remains as to whether CCC will remove s124 notices assuming protection structures are built, albeit we are optimistic this will be able to be worked through
- Extent to which protection is desired will reflect a risk tolerance over both the immediate and medium term

6. Going Forward

- Finalised figures to be confirmed
- Funding mix with CCC to be discussed; typically local government takes responsibility for these type of issues
- Confirmation with CCC of removal of s124 notices is critical; suggest meeting with senior CCC officials and Mayor
- Rapaki Bay
 - Houses on multiply owned Maori land
 - Runanga has suggested a like-for-like 'land swap' - may require legislative change re reserve land

4. Comparative Risk



Shadow Angles

