

MINUTES OF MEETING

Meeting Number 1 **Project Number** 42197580

Title of meeting Redcliffs School Cliff Stability and Hazard Mitigation **Date** 05/05/2015 **Time** 2-3.30 pm

Present Don Macfarlane (AECOM); Ian Wright (CCC); Jan Kupec (CERA); Steven Woods (MWH) **CC**

Venue: CCC Meeting Room M2.05

NOTE:
 These are the meeting minutes of the above named Technical Experts discussing questions raised by Redcliffs School Board of Trustees. The specific questions discussed were:

1. *What sort of event (size, extent) would give rise to a rockfall that would require the school to close immediately to allow reassessment of the cliff to be carried out?*
2. *What is the probability of such an event occurring?*
3. *How long would the subsequent cliff assessment take to complete?*
4. *What volume of rocks would need to be cleared from the bund after such an event, and how long would this take?*
5. *What is the expected extent of damage to the bund after such an event, and how long would it take to repair such damage?*
6. *On what basis would the remaining cliff be in a more dangerous state than currently after any future rockfall event?*

| Item | Description | Action By When | Action By Whom |
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| A. General Discussion and Background | | | |
| <i>Items 1 to 5 below were not discussed in detail but were included to ensure that we all had the same appreciation and understanding of the background and issues</i> | | | |
| 1 | <p><i>Topic discussed</i></p> <p><i>Is the GNS cliff collapse model appropriate to use as basis for engineering solution? Is it sufficiently conservative?</i></p> <p><i>Agreed:</i></p> <p>Technical information obtained from the GNS work on Cliff collapse and mass movement, which is the best information available at this time, is appropriate and sufficiently conservative</p> | | |
| 2 | <p><i>Topic discussed</i></p> <p><i>Is the proposed/conceptual engineering solution appropriate and robust?</i></p> <p><i>Agreed:</i></p> <p>Yes, both robust and appropriately conservative</p> | | |
| 3 | <p><i>Topic discussed</i></p> <p><i>Is the risk assessment sufficiently comprehensive?</i></p> <p><i>Outcome:</i></p> <p>The proposed structure is sited beyond the calculated (modelled) limit of rockfall debris and flyrock and so is</p> | | |

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| | <p>inherently conservative.</p> <p>Brief discussion of societal risk v AIFR but agreed that as structure is conservatively sited cf. the extent of the hazard this is not an issue from a technical perspective</p> | | |
| 4 | <p><i>Topic discussed</i></p> <p><i>Is the objective ALARP (engineers approach) or zero risk (apparently the Ministry approach)?</i></p> <p><i>Outcome:</i></p> <p>Not directly discussed. Zero risk is not achievable. The Ministry is more concerned with possible consequences (in particular disruption of schooling) than risk, which they have accepted as extremely low</p> | | |
| 5 | <p><i>Topic discussed</i></p> <p>Where is the REAL risk zone?</p> <p>(a) before engineering works</p> <p>(b) after proposed works</p> <p><i>Outcome:</i></p> <p>Current risk zone (ie. before engineering works) is closer to cliff than proposed bund has been sited; risk zone after engineering works will be between the bund and the cliff</p> | | |
| B. What are the implications of a further cliff collapse - as per the questions raised by the BOT: | | | |
| 6 | <p><i>Topic discussed</i></p> <p>(i) <i>What sort of event (size, extent) would give rise to a rockfall that would require the school to close immediately to allow reassessment of the cliff to be carried out?</i></p> <p><i>Outcome:</i></p> <p>We identified three scenarios, each with different implications and levels of uncertainty:</p> <p>(a) bund is hit by rocks – indicates that the design assumptions based on GNS model were wrong. Bund would have to be inspected for damage, maintenance requirements, etc. Hazard and risk would need to be reappraised.</p> <p>(b) any earthquake event that results in school being evacuated (pupils sent home) will almost certainly cause rockfall from the cliff. Rocks may not reach the bund but the new hazard/risk would need to be appraised</p> | | |

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| | <p>(c) material change in cliff face (eg. open cracks, new rockfall) with or without earthquake.</p> <p><i>(ii) What is the probability of such an event occurring?</i></p> <p><i>Agreed:</i></p> <p>Consider for next 50 years. Cannot quantify but can generalise as</p> <p>(a) bund hit by rocks – highly unlikely</p> <p>(b) earthquake event that results in school being evacuated (pupils sent home) – possible [for probabilities refer to the NZ Seismic Hazard Model]</p> <p>(c) material change in cliff face (eg. open cracks, new rockfall) – quite likely with or without earthquake</p> <p><i>(iii) How long would the subsequent cliff assessment take to complete?</i></p> <p><i>Agreed:</i></p> <p>For the above scenarios:</p> <p>(a) bund hit by rocks – complete reassessment of hazard and risk model would be required. Depending on reason (earthquake or not) this could take months depending on site accessibility and priority of other sites around city</p> <p>(b) earthquake event that results in school being evacuated (pupils sent home) – if rockfall debris accumulated between bund and cliff (bund not hit) reassessment of risk could be done in days to weeks (depending on how schools are prioritised?).</p> <p>(c) material change in cliff face (eg. open cracks, new rockfall) – can be checked within hours but outcome cannot be predicted with certainty</p> <p><i>(iv) What volume of rocks would need to be cleared from the bund after such an event, and how long would this take?</i></p> <p><i>Agreed:</i></p> <p>This is an all or nothing situation, not possible to accurately quantify. Could be a quick and easy fix, could be a long, risky</p> | | |

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| | <p>exercise. Removing rock would possibly require third party land owner agreement and a resource consent that may be difficult to obtain.</p> <p style="padding-left: 40px;">(v) <i>What is the expected extent of damage to the bund after such an event, and how long would it take to repair such damage?</i></p> <p><i>Agreed:</i></p> <p>Not expected to happen. If it does, would expect damage to be relatively minor and easy to repair. However (a) consent likely to be required; (b) access to undertake the work may be considered too risky; and (c) indicates complete reassessment of risk model is needed</p> <p style="padding-left: 40px;">(vi) <i>On what basis would the remaining cliff be in a more dangerous state than currently after any future rockfall event?</i></p> <p><i>Agreed:</i></p> <p>Any further “significant” seismic event would be expected to damage cliff and potentially loosen more rock – although the cliff would not necessarily be in worse condition than it is currently, it is likely that there would be increased rockfall debris shed from the cliff. The need to remove this (and how to do it safely) would need to be assessed on basis of the actual outcome. An updated hazard appraisal, including risk assessment of the latest conditions would almost certainly be required.</p> | | |
| 7 | <p><i>Topic discussed</i></p> <p><i>What other issues might affect discussion outcomes?</i></p> <p style="padding-left: 40px;">(i) <i>Could neighbours disrupt the process?</i></p> <p><i>Outcome:</i></p> <p>It is understood that some neighbours have not accepted the red zone offer so it is reasonable to assume that there may be an objection to the proposed bund by an owner whose dwelling would be close to the structure</p> <p style="padding-left: 40px;">(ii) <i>How might proposed works affect/merge with/conflict with works proposed by third party owners, if any?</i></p> <p><i>Outcome:</i></p> <p>We don’t really know what they may be proposing/hoping. With the new District Plan it is unlikely they would be able to</p> | | |

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| | <p>get engineering works close to the cliff consented.</p> <p>(iii) <i>How might proposed works affect/merge with/conflict with works proposed for Main Road?</i></p> <p><i>Outcome:</i></p> <p>Not directly discussed. Not expected to affect proposals for the school but might be relevant to neighbouring properties</p> <p>(iv) <i>What, if any engineering works is CERA considering for the cliff top along Balmoral Lane/Glendever Terrace?</i></p> <p><i>Outcome:</i></p> <p>CERA/Crown have no plans for engineering works on the cliff top.</p> | | |
| 8 | <p><i>Any other issues?</i></p> <p>Much of the discussion on the above items noted that the technical issues are not the most important. The key issues for the Ministry seem to be</p> <p>(i) Even with the proposed engineering works in place, there is no certainty that the school will not face future disruption</p> <p>(ii) The possible consequences if another significant event (rockfall with or without earthquake trigger) occurs – no engineer will give an absolute assurance that the engineering works will prevent rocks from reaching the school grounds even though all would expect this to be an extremely unlikely outcome with the bund in place</p> <p>(iii) If the bund was constructed, this would be the only school in NZ protected from cliff collapse by such a structure [to the best of our knowledge]</p> <p>(iv) While the school may make the decision to self-evacuate in the case of a future earthquake that caused rockfall or cliff collapse, we expect that the Ministry for Education or Civil Defence, or their agents, would need to be involved in the decision to return to the site.</p> <p><i>Comments:</i></p> <p>We, the technical experts attending the meeting, believe that:</p> <ol style="list-style-type: none"> the proposed technical approach is a robust and conservative solution for the site and the hazard; | | |

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| | <p>2. there is a very low probability of an event that would damage the proposed bund;</p> <p>3. there is only a low probability that the school would need to be closed to allow inspection of and/or repairs to the bund in the extremely unlikely event that the bund becomes damaged;</p> <p>4. because of the sensitivity of the school site it will likely be treated differently to other sites and land uses that rely on the same GNS risk model. It is expected that the school would have more stringent requirements for re-assessment after an event and any level of reassessment beyond a simple visual inspection is likely to take weeks to months.</p> <p>NOTE: The group was not clear on exactly what the protocols would be in the future as planning for future emergencies is still evolving.</p> | | |

Authorised by (Chair)

Name of Chair

Date