MOKIHINUI HYDRO PROPOSAL
CONSENT APPLICATIONS
REVIEW OF ASSESSMENT OF EFFECTS ON NATURAL HAZARDS

JULY 2008

Prepared by:
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1.0 Introduction

1.1 Background

This report provides a review of the assessment of environmental effects (AEE) provided by Meridian Energy Ltd (Meridian) in support of resource consent applications relating to the Mokihinui Hydro Proposal (MHP).

The Mokihinui Hydro Proposal includes a dam located on the Mokihinui River approximately 3 km upstream from the township of Seddonville and 11 km upstream from the river mouth, a new lake upstream of the dam extending to just below the Mokihinui Forks Ecological Area, a new transmission line to carry electricity from the power station to the existing Inangahua-Waimangaroa transmission line at Cedar Creek, and a new substation at Cedar Creek.

This report will provide the decision-maker with information and advice related to the effects of the proposed activities on natural hazards.

1.2 Qualifications

My full name is Bruce Wilson Riddolls. I have a Master of Science with Honours and a Doctorate of Philosophy, both in Geology. I am a principal of Riddolls Consultants Limited, consulting geologists, established in 1987, and based in Christchurch.

I have had over 35 years experience in the application of geology (including hazards assessment) in natural resources projects, both in New Zealand and overseas. Initially I was employed by the Institute of Geological and Nuclear Sciences Limited (then NZ Geological Survey, DSIR), and then headed the geological services group of Worley Consultants Ltd (now Maunsell Ltd). My work experience has included commissions from state owned enterprises, local authorities and various corporations.

My professional affiliations are memberships of the Geological Society of New Zealand and the NZ Geotechnical Society. From 1998-2002, I was regional Vice-president of the International Association of Engineering Geology and the Environment, a world-wide professional body, representing both New Zealand and Australia.

1.3 Scope of Report

This report is prepared under the provisions of Section 42A of the Resource Management Act 1991 (RMA).

To carry out this review of the consent application I have considered the relevant sections of the AEE submitted by the Applicant, and reviewed the following technical reports:

- AEE Appendix 1, Mokihinui Hydro Proposal, project engineering description, Damwatch Services Ltd, final, November 2007, for Anderson Lloyd.

- Mokihinui Hydro Proposal; Geological interpretation of M11 dam site and reservoir shoreline, Damwatch Services Ltd, March 2008.
- Mokihinui Dam; Effect of landslides on dam and reservoir, Opus International Consultants, August 2007

I have also taken into account issues raised by submitters in relation to the effects on natural hazards.

In addition, I carried out a site visit on Wednesday 5th March 2008.

It should be emphasised that any conclusions reached or recommendations made in this report are not binding on the decision-maker. It should not be assumed that the decision-maker will reach the same conclusion or decision having considered all the evidence to be brought before it by the applicant and submitters.

The review has only considered the information that has been made available to date. It is possible that the reasons and conclusions reached by the author may be altered in response to further investigation and/or new information that becomes available prior to the hearing of the applications.

2.0 Submissions

The issues raised by submitters in relation to effects on natural hazards essentially relate to slope stability matters consequent upon reservoir inundation.

3.0 Assessment of Effects

3.1 Hazards Assessment

This report focuses on hazards of a geological nature, which have been recognised by the applicant as essentially comprising:

- slope stability in reservoir and upstream catchment areas
- earthquakes (including active faults)

I consider that each hazard has been considered by the applicant in a professionally competent manner. In the following assessment of effects only slope stability matters are addressed, as issues associated with earthquakes are being covered in reporting on dam engineering.

3.2 Review of Assessment of Effects

I have reviewed the assessment of effects on natural hazards and mitigation measures proposed by the Applicant and discuss these issues in the following sections.

3.2.1 Effect of reservoir inundation on general shoreline slope stability

a) Assessment

The AEE did not contain an assessment of the potential for reservoir-raising to cause destabilisation of valley slopes along the shoreline. This led to a request for further information from the applicant. The response is as follows:

"Geological mapping was undertaken with particular focus on features with the potential to cause reservoir blockage. No features were identified which are of concern in this respect, although *ground-based* studies have so far been limited to small parts of the reservoir margin."

"In both reports (Appendix 1 and geological interpretation report), the assessment of mass movement features in the Gorge (based on helicopter reconnaissance, analysis of aerial photography and ground-based field observations) highlights that the basement rocks of the reservoir area are susceptible to low volume, shallow debris slides and subordinate rockfall from areas of localised surficial distress. Reservoir-induced movement of this material is not considered to be a significant hazard for the proposed hydro scheme."

I concur with this assessment.

b) Mitigation

Potentially adverse effects of "low volume" instability mainly relate to safety of people, and removal of vegetation. As the location of such instability is essentially unpredictable, mitigation is not a practical option.

3.2.2 Effect of reservoir inundation on County Hill Rockslide stability

a) Assessment

In s6.2.1 of AEE Appendix 1, it is stated that County Hill, on the left bank of the gorge about 2 km upstream from the dam site, is formed of granitic debris that is considered to have originated from an ancient rockslide on the opposite bank, while in s9.2.2.1 of the geological interpretation report, the slide debris terrain is described as showing surface evidence (eg tension cracks) of renewed activity as a result of the 1929 earthquake. The applicant has further advised that:

"Both reports (Appendix 1 and geological interpretation report) state that it is considered extremely unlikely that a similar-scale catastrophic event would affect the Gorge within the lifetime of the proposed hydro scheme, and identify the right bank source area as a stable feature. However, the geological report identifies that the left bank rockslide material resulting from the ancient event has been subject to subsequent surficial rockfall, including movement initiated by the 1929 Murchison Earthquake. The debris consists of coarse, well-graded granite fragments (to block size) and is unlikely to fail en masse. A tension fracture near the top of County Hill was identified as being the probable result of 1929 earthquake-induced stress. While the toe position of this discontinuity has not been identified, its location at the head of the slope indicates that the feature is thin and precludes there being anything but a low volume veneer of unstable material that could be in contact with the reservoir. Reservoir induced instability is considered to have low likelihood and no blockage potential is foreseen."

I concur with this assessment.

b) Mitigation

Monitoring of County Hill Rockslide stability during and after inundation and identification and implementation of any necessary corrective measures are likely to be more practical measures than prior engineered remedial works.

3.2.3 Rockfall-induced reservoir wave effects

a) Assessment

The applicant has provided the following additional information:

"Larger rockfalls in the granite terrain at M11.5 and M12.5 were explicitly assessed to ascertain their potential impact on the hydro scheme (Geological Interpretation Report s9.2.1). Consequently, these rockfalls were interpreted to comprise multiple cascades of debris resulting from successive seismic events, rather than one catastrophic failure. The constructed cross sections (Figures 6c-e in Geological Interpretation Report) suggest that the rockfall debris in the upper slopes forms a relatively thin veneer over in situ granite outcrop, within which there are no known deep-seated slip surfaces. The reservoir will inundate the thicker debris accumulation present in the toe area, leaving only small volumes of the upper slope rockfall veneer susceptible to disturbance.

Wave generation by rockfall is modelled in a separate referenced report: Mokihinui Dam; Effect of Landslides on Dam and Reservoir", Opus International Consultants, August 2007. This report uses the entire M11.5 and M12.5 rockfall volumes to provide 'worst-case seismic scenarios' that would by far exceed the severity of any wave effect caused by reservoir induced mass movement".

I concur with this assessment.

b) Mitigation

Rockfall mitigation measures are not a practical option.

3.2.4 Effects of Landslides upstream of Reservoir

a) Assessment

The applicant has recognised the potential for landslide dams to develop naturally upstream of the reservoir, establishment of the latter having no bearing on the risk of this occurring. Such a dam occurred as the result of an earthquake in 1929, after which a period of 2.5 weeks elapsed before the impounded water reached breaching level. On the basis of this precedent, it is considered lag periods of this order provide sufficient time to implement appropriate response strategies (such as issuing warnings to affected parties downstream).

I concur with this assessment.

b) Mitigation

No mitigation measures are warranted.

4.0 Consent Conditions

The applicant has not provided draft consent conditions specific to the various landslide hazard scenarios recognised. However, these issues would be covered adequately by draft conditions 14-16 as proposed by Mr Foster.