BEFORE THE ENVIRONMENT COURT AT AUCKLAND **ENV-2020-AKL-000064**

I MUA I TE KOOTI TAIAO O AOTEAROA TĀMAKI MAKAURAU ROHE

IN THE MATTER	of an appeal under the first schedule of the Resource Management Act 1991 (**RMA**)
BETWEEN	**AWATARARIKI RESIDENTS INCORPORATED** Appellant
AND	**BAY OF PLENTY REGIONAL COUNCIL** First Respondent
AND	**WHAKATĀNE DISTRICT COUNCIL** Second Respondent and Requestor of Plan Change 17

STATEMENT OF EVIDENCE OF CHRIS PHILLIPS ON BEHALF OF WHAKATĀNE DISTRICT COUNCIL

CATCHMENT MANAGEMENT

10 August 2020

BROOKFIELDS LAWYERS
A M B Green / R H Ashton
Telephone No. 09 379 9350
Fax No. 09 379 3224
Email: green@brookfields.co.nz
P O Box 240
DX CP24134
AUCKLAND

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1. EXECUTIVE SUMMARY

1.1. For the reasons set out in this statement of evidence, in my opinion catchment management approaches in common use in New Zealand will not, either singly or collectively, alleviate the risk of future debris flows on the Awatarariki Stream fanhead. This conclusion aligns with evidence from other experts (Mr Basset, Professor Davies and McSaveney and Mr Hind) and in several reports (Davies 2017, McSaveney et al. 2005).

1.2. Vegetation enhancement, stream clearance (i.e. log jam removal), or structural measures such as engineered detention systems (for example, check dams within the catchment) while technically feasible (but not reasonably practicable) are likely to be, technically difficult to implement, cost-prohibitive and have little material impact on a future debris flow hazard. This conclusion aligns with information contained in McSaveney et al's. 2005 report and with evidence from other experts (Professors Davies and McSaveney, Mr Bassett, and Dr Massey).

1.3. In respect of appellant's concerns relating to improved catchment management as an alternative to the Proposed Plan Changes to reduce the hazard, in my opinion these would have little material impact on reducing future debris flow occurrence.

2. INTRODUCTION

2.1. My full name is Christopher John Phillips.

2.2. My evidence is given on behalf of the Whakatāne District Council (the **District Council**) in relation to:

(a) Proposed Plan Change 1 (Awatarariki Fanhead, Matatā) to the Operative Whakatāne District Plan; and

(b) Proposed Plan Change 17 (Natural Hazards) to the Bay of Plenty Regional Natural Resources Plan (a private plan change request from the District Council)

(together referred to as the **Proposed Plan Changes**).

2.3. My evidence relates to catchment management aspects of the Proposed Plan Changes. My evidence will cover:

(a) The viability of catchment management practices as an alternative to reduce debris flow risk to properties on the Awatarariki Stream fanhead to an acceptable level.

2.4. I prepared expert evidence for the first instance hearing of submissions to the Proposed Plan Changes held in March 2020. I did not attend the hearing as the Hearing Commissioners had no questions in relation to my evidence.

3. QUALIFICATIONS AND EXPERIENCE

3.1. I am a Principal Scientist and Portfolio Leader for “Managing Land & Water” with Manaaki Whenua - Landcare Research, a Crown research institute, at Lincoln.

3.2. My qualifications include:

(a) A PhD in Agricultural Engineering from Canterbury University, and a Post-Graduate Diploma in Commerce from Lincoln University. My PhD studies focused on understanding the flow properties of debris flows;

(b) An MSc (Hons) in Earth Science from Waikato University; and

(c) A BSc in Geology and Physical Geography from Otago University.

3.3. I am a past member of the New Zealand Geological Society, a member of the New Zealand Hydrological Society, an honorary (life) member of the New Zealand Association of Resource Management, a past Director of the Australasian Chapter of the International Erosion Control Association, and Secretary and board member of ecorisQ (an international association of professionals working on sustainable solutions for natural hazard risk management).

3.4. I have 40 years’ experience in research and consulting activities as part of the former New Zealand Forest Service, the Ministry of Forestry, and currently Manaaki Whenua - Landcare Research. I have provided consultancy services for most of New Zealand’s forestry companies advising them on aspects of erosion, slope stability, and environmental impacts relating to plantation forestry. Similarly, I have provided advice to district and regional councils on matters relating to erosion and its management.

3.5. Throughout my career I have focused on studying how and why erosion occurs, with an emphasis on how vegetation affects erosion and slope stability (including forestry and its various phases of management).

3.6. I have been involved in and led research and consultancy projects on the effects of forestry on erosion, sediment generation, sediment yield and vegetation recovery in many regions of New Zealand including Hawke's Bay, Coromandel, Marlborough, Central North Island, Nelson, West Coast, Gisborne-East Coast, Auckland and Canterbury. This has included research on debris flows.

3.7. I have also been involved in integrated catchment management research having led research related to riparian management, erosion and sediment control, and knowledge management. I was the co-developer of a 10-year Ministry of Business Innovation and Employment (**MBIE**) research programme "Integrated catchment management for the Motueka River catchment".

3.8. I developed and currently co-lead a 5-year MBIE research programme "Smarter targeting of erosion control".

3.9. I have appeared as an expert witness for forestry companies on district and regional council plan change hearings and in the Environment Court, providing evidence on erosion processes and sediment implications of forestry operations, including debris flows.

4. MY ROLE

4.1. I have not been directly involved in the development of the Proposed Plan Changes. Manaaki Whenua - Landcare Research was approached by the District Council in 2018 to review a report by Professor Tim Davies on "The significance of sediment stored behind log jams to the 2005 Awatarariki debris flow; implications for risk management". In that assessment I concluded:

(a) Log jams (or dams), while posing a risk in principle to the generation and volume of future debris flows, are not likely to be significant in terms of total volume of sediment generated and future debris flow hazard; and

(b) The removal of such dams would be logistically difficult, involve on-going cost, and provide only marginal benefit to the reduction in risk from future debris flows.

4.2. I was approached by the District Council in February 2019 to attend a meeting of "experts" in preparation for a hearing later in 2020. Following that meeting I was asked to prepare evidence on the 'catchment management effects' aspects of the Proposed Plan Changes, and to respond to submitters concerns.

4.3. I visited the Awatarariki Stream catchment in August 2019 and took a helicopter reconnaissance flight over the catchment. I re-visited the catchment in July 2020 (with Professors Davies and McSaveney, Jeff Farrell and John Douglas) and walked about 1 km upstream of the railway bridge. I have not physically visited the headwaters.

4.4. I have "explored" the catchment using Google Maps and aerial photographs to understand the topography, vegetation cover, and relevant catchment attributes, including the range of erosion processes operating within the catchment. I have viewed photographs, including those of the stream and its catchment immediately following the event in 2005 in addition to those in PowerPoint presentations and numerous reports to gain as full an understanding of the area as reasonably possible without walking the entire catchment, many parts of which are inaccessible. I am also familiar with similar streams affected by debris flows in the Coromandel and other parts of New Zealand caused by intense rainstorms and associated landsliding having observed these during my research.

4.5. In preparing this evidence I have read and assessed documents and reports related to the 2005 event (impacts and proposed future mitigation measures) and attended meetings of expert witnesses to gain an understanding of the initial event, the subsequent responses to it, and the Proposed Plan Changes aimed at addressing the significant risk from debris flow hazards to loss of life and damage to buildings and structures on the Awatarariki Stream fanhead.

5. CODE OF CONDUCT

5.1. I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2014. I also agree to comply with the Code when presenting evidence to the Court. I confirm that the issues addressed in this brief of evidence are within my area of expertise, except where I state that I rely upon the evidence of another expert witness. I also confirm that I have not omitted to consider material facts known to me that might alter or detract from the opinions.

6. SCOPE OF EVIDENCE

6.1. This statement of evidence covers the following:

(a) The viability of proactive catchment management practices as an alternative to reduce debris flow risk to properties on the Awatarariki Stream fanhead to an acceptable level;

(b) It does not cover detailed planning issues, design of engineering alternatives, debris flow early warning systems, nor any other alternatives including formal hazard and risk assessment, analysis and management, as this is covered by other experts; and

(c) Is limited to the catchment of Awatarariki Stream <u>above</u> the fanhead (i.e. where the stream emerges from the 'canyon' cut through the old sea cliffs or about where the railway line is located). It does not cover the catchment between the fanhead and the Matatā Lagoon except for the consideration of log dam management practices in the catchment and their viability to reduce life safety risk and to properties on the fanhead.

7. ASSESSMENT OF THE PROPOSED PLAN CHANGES

7.1 To assess the viability of proactive catchment management practices to reduce debris flow risk to properties on the Awatarariki Stream fanhead to an acceptable level, one needs to understand:

(a) Firstly, the physical nature of the catchment and the erosion processes that occur there;

(b) Secondly, what ‘catchment management’ is and the methods or practices that can be used to manage and reduce natural hazards (e.g. landslides, debris flows, rock falls, and floods); and

(c) Finally, if the Proposed Plan Changes are feasible in managing these hazards.

7.2. In this evidence, I use the term landslide as a broad encompassing term to include debris avalanches, debris slides, land slips and debris flows but concur with McSaveney et al. (2005) that the use of the term debris flow can be a keyword for the entire phenomenon; from an initiating landslide on a steep slope, the rapid flow along a steep confined channel, and the deposition on a debris fan (Hungr 2005).

The Awatarariki Stream catchment

7.3. The Awatarariki Stream catchment rises in elevation from sea level to about 300 m (Figure 1). The catchment is quite steep in the mid-upper reaches and is deeply incised lower down with the stream gradient increasing through a gorgy section (“box canyon” – McSaveney et al. 2005; Lambert 2008) before emerging on the fanhead (Figure 1). Awatarariki Stream is approximately 4.15 km long and drains a 4.5 km^2 catchment (Arts 2005; Bull et al. 2010). However, Davies (2017) suggests that the main stem stream length is 2.8 km and that of the main channel and its tributaries as 7.5 km. Regardless of which figures are “correct” this is a small steep catchment and therefore responds quickly to rainfall events with an estimated time of concentration of 45 minutes (Arts 2005). Such a small, steep catchment is also prone to landslide-induced debris flows (McSaveney et al. 2005; Bassett 2006).

7.4. The fanhead comprises an area of approximately 7 ha, with the Awatarariki Stream flowing through or across the fanhead to a sediment basin and then to Matatā Lagoon (Boffa Miskell 2017).

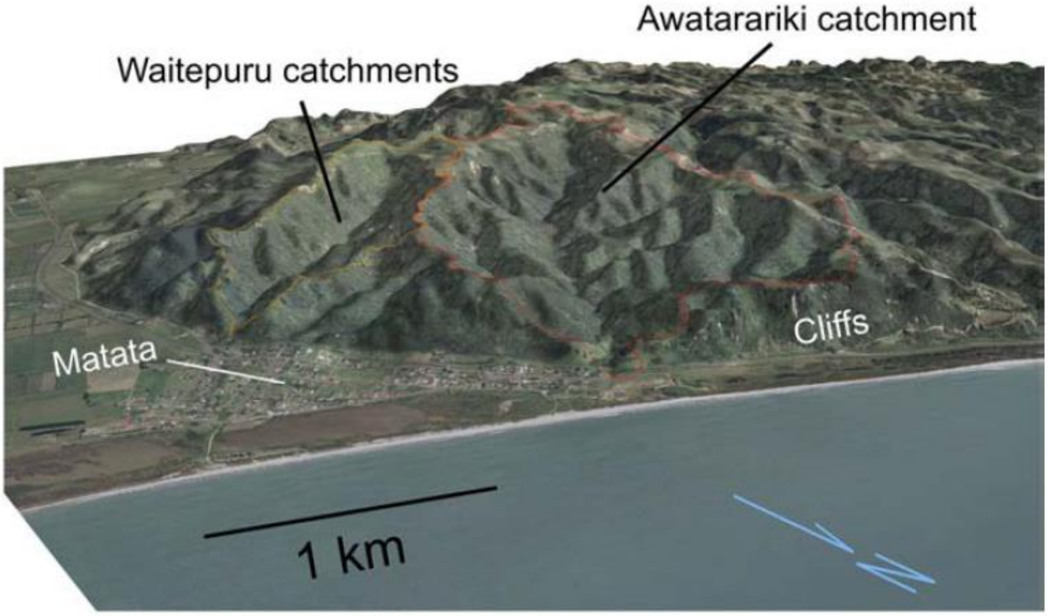

Figure 1 A 3-D perspective of the Awatarariki catchment. From Bull et al. (2010).

7.5. Most of the catchment is in a native reserve (Matatā Reserve). Most forest in Awatarariki and Waitepuru Stream Valleys is relatively young (Lambert 2008). The condition of the vegetation, other than where landslides have occurred is reported by Douglas (2017) to be in good condition. The vegetation cover as interpreted from Google Earth, the reconnaissance flight, and the catchment visit in July 2020, indicate past phases of landslide activity and subsequent revegetation.

Management of Awatarariki Stream catchment to reduce debris flow risk on the Awatarariki fanhead

7.6. The Proposed Plan Changes aim to reduce life safety and property damage risks from future debris flows and the associated sediment and debris transport onto the fanhead and beyond to the Matatā Lagoon.

7.7. Catchment management actions or interventions in New Zealand are primarily designed to improve water quality, reduce erosion, manage some natural hazards, and enhance biodiversity. The latter can largely be ignored in this case as the Awatarariki Stream catchment is almost entirely within the Matatā Reserve comprising native vegetation in various stages of recovery from past logging activities (Douglas 1993, 2017) and from past erosion events (Lambert 2008).

7.8. At the time of the May 2005 storm that caused the debris flows, the catchments above the town of Matatā were largely vegetated in secondary and regenerating native forest, with some pastoral land on the crests of the southern and western ridges (Bassett 2006).

7.9. For catchment management purposes, an intact cover of indigenous vegetation is generally regarded as the "gold standard" where the erosion protection value of the vegetation is regarded as high for all but the most severe storm events (e.g., Marden & Rowan 1988; 1993; Douglas 2017). It is also the sought after "endpoint" of most catchment restoration efforts.

7.10. Because of the steep contributing slopes and bluffs, any catchment management/soil conservation measure such as vegetation enhancement, physical land contouring, or any other structural measure to provide any additional benefit beyond the native vegetation that is there, is likely to have limited value, even if it might be feasible to implement.

7.11. The contributions of sediment and runoff from the small amounts of farmland at the top and western margins of the catchment would not, in my opinion, contribute to any elevated risk of sediment delivery to or sediment build up within the catchment, or to enhanced debris flow activity.

7.12. The southern and western margins of the catchment are currently in pastoral farmland. Planting these or allowing them to regenerate to indigenous forest, while aesthetically pleasing or potentially enhancing biodiversity, would not reduce the risk of future debris flows because:

(a) The areas in pasture/farmland are small relative to the whole catchment;

(b) The slopes are gentler there and less prone to landslides, and as a result sediment delivery to the catchment is likely to be small; and

(c) Debris flows are often generated in severe storms where the 'vegetation" effect is overridden by the amount and/or intensity of the rainfall (see McSaveney et al. 2005).

7.13. The only “gain” within the reserve would be to manage the steeper parts more actively by including supplementary indigenous planting and vegetation management (weed removal) and including pest management to improve the health of the forest. However, the feasibility of doing this as mentioned above, is questionable as large parts of the catchment are very steep with many bluffs, and access into parts of the catchment is difficult. In my view, any increase in “erosion protection” would be negligible and it would not materially reduce the overall risk of future debris flows. This concurs with the observations of Douglas (2001; 2017) that “the interception potential of the bush during storm events is high and a higher level of protection would be difficult to achieve”, i.e., manipulating the vegetation would not add any value in terms of hazard reduction.

7.14. Interventions that promote rapid revegetation of any future landslide-affected areas (or bare areas) within the catchment might be beneficial in terms of reducing surface erosion and sediment delivery to the stream to help reduce sediment build up in the stream bed. However, techniques such as hydroseeding (usually with exotic grasses) are not feasible (nor desirable) as this reserve is largely native, and access would not be reasonably practical. Broadcast aerial delivery of native seeds might help enhance the natural processes of revegetation on these bare surfaces. However, in my opinion this would not be a significant improvement over the natural process because the reserve is of reasonable size, adequate seed sources exist, and the natural revegetation-recovery process has occurred following past landslide events.

7.15. The rainfall figures reported for the 2005 event (McSaveney et al. 2005; and others) are typical of those that have and continue to cause landslides and debris flows in many parts of New Zealand in similar terrain. Such localised high intensity rainstorms with their associated severe landscape responses (i.e., landslides and debris flows) are also not uncommon, with areas outside of the storm cell showing little or no landscape response.

7.16. I concur with McSaveney et al. (2005) that “rainfall interception by the native vegetation was not a useful mitigating factor in the 2005 storm because the forest and soils were already wet from earlier rain, in the hours before the deluge”. I also concur with McSaveney et al. (2005) that “the risk of future debris flows caused by such extreme rainfall will not be materially changed by enhancing the present vegetation”.

7.17. On-going pest management can also help to ensure that the mature and recovering native forest in the reserve stays healthy. However, due to the steepness of the terrain, these interventions may not be practical or feasible across the whole reserve. I concur with the conclusion of John Douglas that "apart from animal pest work, which has been carried out, to improve the native vegetation status, little more can be done in the upper catchment". This conclusion is also based on my own experience (Phillips & Davie 2007) in that natural factors (e.g. storm intensity, soil and geological structure) have a far greater influence on erosion rates and sediment yield than animal pests.

7.18. Over time, debris and sediment is delivered to the stream channel via erosion of the side slopes from landslides, rock falls, tree toppling, and surface erosion, all of which cause the stream bed to aggrade (Figures 2 and 3). This is a natural process.

7.19. Because of the deeply dissected nature of the catchment, the many steep bluffs, and the intact native vegetation cover, these erosion processes are not able to be managed or mitigated by any current common catchment management practice.

7.20. Logs and vegetation delivered to the streams from cliff tops and by landslides may also create barriers or log jams behind which sediment and debris can accumulate (Figure 3). This also is a natural process. These log jams are removed only in the largest erosion events such as in 2005 when debris flows evacuate all (or nearly all) stored material within the channel (usually down to bedrock – see Figure 4) delivering it downstream onto the fanhead where it is deposited as the debris flow loses energy as the slope gradient lessens, the flow depth reduces, and the debris flow loses water.

7.21. With time, the bare slopes next to the stream channel created by a large debris flow eventually re-vegetate. The vegetation age is often an indicator of how frequently debris flows occur in such channels (Figure 5).

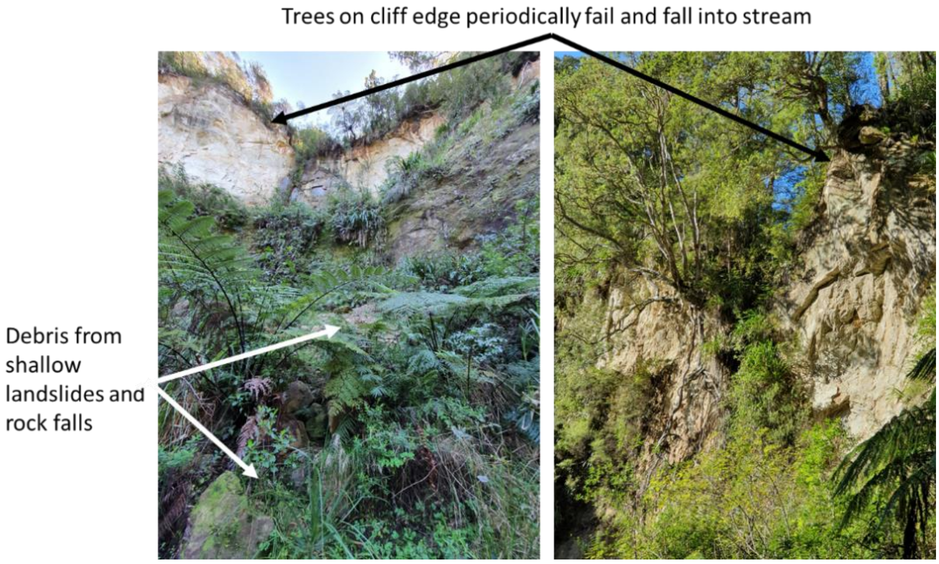

Figure 2 Photograph illustrating how sediment and woody debris are delivered to the Awatarariki Stream, July 2020.

Figure 3 Photograph illustrating how fallen trees and woody debris delivered from cliff failures and/or toppling have the potential to form log jams in the Awatarariki Stream, July 2020.

Figure 4 Cleaned out channel following 2005 debris flow. Photo M. McSaveney (McSaveney et al. 2005).

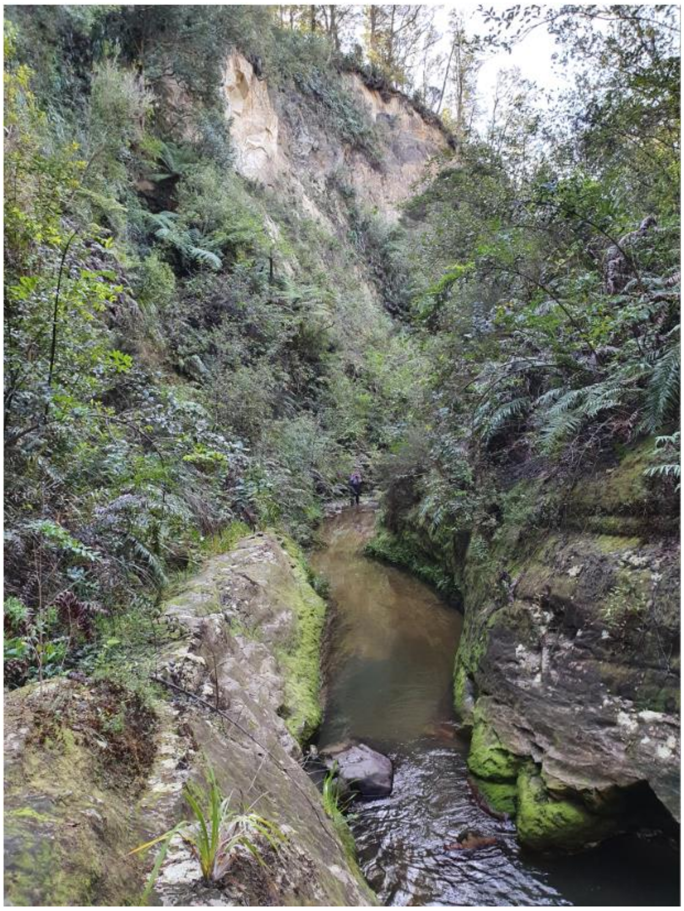

Figure 5 Stream channel about 1.0 km upstream from railway bridge, showing the bedrock channel, revegetation of side slopes and active erosion from cliff edges, July 2020.

7.22. It takes many years for the cycle to repeat, but it is clear from past records that these events have happened in the past and are likely to happen in the future (McSaveney et al. 2005). In some places, active intervention by removing debris dams and "mining" the sediment in the channel can reduce the risk, but in this situation, it is not feasible (Douglas 2017).

8. RESPONSE TO APPEAL GROUNDS

8.1. Alternatives: Catchment management.

8.2. I have read the Notice of Appeal as it relates to my evidence.

8.3. Paragraph 24 of the Appeal Notice suggests that lesser interventions and alternatives exist such as mitigation of hazard while enabling Society members to remain living in their homes.

8.4. My evidence considered improved catchment management as an "alternative" to reduce or mitigate the hazard and risk of future debris flows. Other options or alternatives have been outlined in the statements of evidence of other experts (e.g. Mr Bassett, Dr Massey).

8.5. In my opinion, it will not be possible to mitigate the risk associated with future debris flow events by any common catchment management interventions above the fanhead. Debris flows will continue to be a natural hazard for the Awatarariki Stream fanhead. This view aligns with earlier reports (Davies 2017, McSaveney et al. 2005) and with evidence from other experts (Professors Davies and McSaveney, Mr Bassett).

9. CONCLUSION

9.1. I concur with the findings of McSaveney et al. (2005) that severe rain caused landslides (debris avalanches) which resulted in debris flows that caused the disaster on the Awatarariki Stream fanhead. Such a storm would override any commonly used catchment management mitigations (if they were present). This suggests that implementing such interventions to manage <u>future</u> debris flows, even if practicable, would have limited efficacy.

9.2. I concur with McSaveney et al. (2005) that "maintaining a healthy forest cover has many beneficial effects, however, the storm of 18 May 2005 was too extreme, and way beyond the capacity of any forest cover to protect Matatā from major debris flows and flooding. The risk of future debris flows caused by such extreme rainfall will not be materially changed by enhancing the present vegetation cover". Thus, even if the current forest could be enhanced it will not mitigate against future events such as those that caused the 2005 event.

9.3. Other catchment management actions within the catchment upstream of the fanhead, such as removing log jams when they are formed, will not, in my opinion, have any material effect on changing the nature of the debris flow hazard nor the level of debris flow risk to properties on the Awatarariki Stream fan.

9.4. In conclusion, there is little that can be done that is practicably reasonable in terms of catchment management practices within the catchment that would reduce the risk from future landslide-induced debris flows and that the Proposed Plan Changes to manage the risks on the area of the fanhead are the most appropriate methods for managing the threats to life and property. This conclusion aligns with those of other experts (Davies 2005; Boffa Miskell 2017; McSaveney et al. 2005; others).

Chris Phillips

10 August 2020

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