Determination 2016/034

Regarding the authority's refusal to grant a section 72 waiver for two building consents for proposed buildings on land subject to a natural hazard in Matata, Bay of Plenty

Summary

This determination considers the authority's refusal to grant a waiver under section 72 of the Act for two proposed buildings which are situated on land subject to a debris flow hazard. The determination considers the risk to occupants from debris flow events, and the extent to which the proposed work will mitigate this risk.

1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004[1] ("the Act") made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, Ministry of Business, Innovation and Employment ("the Ministry"), for and on behalf of the Chief Executive of the Ministry.

1.2 The parties to the determination are:

- The applicant, the Whakatane District Council ("the authority"), carrying out its duties as a territorial authority or building consent authority
- R Martin, A Martin and M Rose ("the second applicants[2]") as the owners of 6 Clem Elliott Drive, represented by a legal adviser
- T Fahey, G Fahey and K Maurirere, ("the owners") as the owners of 100 Arawa Street.

1.3 This determination arises from the authority's refusal to grant a waiver under section 72 of the Act for two proposed buildings at 6 Clem Elliott Drive and 100 Arawa Street ("the proposed buildings") which are situated on land subject to a debris flow natural hazard at the Awatarariki fanhead in Matata.

1.4 The authority stated the matter to be determined is:

> Whether or not it is reasonable for the [authority] to grant a waiver or modification of the Building Code under section 72(c) of the Building Act 2004 for building consent applications for dwellings on land that is subject to debris flow and debris flood natural hazards.

1.5 I take the view that the matter to be determined[3] is therefore whether the authority was correct to refuse to grant a waiver under section 72 of the Act for the proposed buildings.

[1] The Building Act, Building Code, Acceptable Solutions and Verification Methods, past determinations and guidance documents issued by the Ministry are all available at www.building.govt.nz or by contacting the Ministry on 0800 242 243.
[2] The owners of 6 Clem Elliott Drive were treated as applicants in the application made by the authority
[3] Under sections 177(1)(b), 177(2)(a) and 177(3)(a)

1.6 In making my decision, I have considered the submissions of the parties and the other evidence in this matter.

1.7 I acknowledge that although this determination relates to the second applicants' and owners' proposed buildings, there is likely to be a wider application for other buildings in the Awatarariki Stream area.

1.8 Unless otherwise stated all references to sections are to sections of the Act and all references to clauses are to clauses of the Building Code.

2. The proposed building work

2.1 The proposed building work for 6 Clem Elliott Drive consists of two self-contained units occupied as a single dwelling, by the current owners during holiday periods. The single dwelling is to have an attached garage. The second applicants note the debris matter that was deposited on the section has been rearranged with a finished height of the lower half of the section being 1.5m higher than previously.

2.2 The proposed building at 100 Arawa Street is for a holiday home in the short to medium term converting to permanent use as a dwelling on retirement of the owner. The owners note the section has been elevated from 0.5-0.75m in height and levelled following the 2005 event. The owners also note a 1.8m fence has been erected on the west side of the vacant lot and a 'very solid' front fence is to be built at 1.5m high.

2.3 The buildings are designed to comply with NZS 3604:2011 Timber Framed Buildings except the manufactured roof trusses. They will have a combination of piled foundations and concrete slab with light weight claddings and roofs.

3. Background

3.1 On 18 May 2005 a band of intense rain over the catchments behind the coastal settlement of Matata triggered landslips and debris avalanches in stream headwaters ("the 2005 event"). That event resulted in several large debris flows, which with their associated flooding destroyed 27 homes and damaged many other properties. A previous determination ("the previous determination") has dealt with the issue of dangerous building notices issued for eight affected houses.[4]

3.2 Following the 2005 event the authority undertook a series of investigations and consultation proposing to discuss constructing a debris detention structure in the upper catchment of the Awatarariki Stream to manage the debris flow hazard. The authority engaged specialist geotechnical engineers ("the geotechnical engineers") to assist. However, in December 2012 the authority decided not to proceed with the project due to construction challenges and the cost of maintenance.

3.3 At some stage prior to 8 July 2014, the second applicants and the owners either applied for building consents from the authority or proposed to apply for building consents. I have not been provided with this information.

3.4 The Ministry received an application for determination, lodged by the authority and the second applicants on 8 July 2014.

[4] Determination 2006/119 Dangerous building notices for houses in Matata, Bay of Plenty *(Department of Building and Housing)* 7 December 2006.

4. The initial submissions

4.1 The authority

4.1.1 The authority provided a written submission dated 2 July 2014 with their application for determination. The submission provided detailed background information which I do not propose to reproduce in full. In summary the background information provided by the authority contended that:

- Research shows that Matata has been built on debris deposited during historic debris flows, floods and avalanches.
- The reports from the authority's geotechnical engineers conclude there are several properties on the Awatarariki fanhead within a high debris flow hazard area, with an annual loss of life risk exposure ranging from 1x10-2 to 1x10-6.
- The authority contends it is not unreasonable to consider the Matata township will experience a debris flow once every 30 to 40 years with a debris flow on the Awatarariki fanhead once every 50 to 150 years.
- The effects of climate change show scientists predicting a greater incidence of extreme weather events; this is evident in the high incidence of high intensity rainfall events in the Whakatane district in the last decade.

4.1.2 The authority also provided discussion on sections 71 and 72 of the Act. The authority has considered the following, in summary:

Is the land subject or likely subject to one or more natural hazards?

- A common sense approach should be taken to determine if this is 'likely'. Previous determinations and court decisions provide that 'likely' means there has to be a reasonable probability that something could happen.
- The authority is of the view the data obtained following the 2005 event, the reports by the geotechnical engineers and climate change predictions does satisfy the test that the land is likely to be subject to debris flow in the future.

Has adequate provision been or will be made to protect the land, building work, or other property referred to in that subsection from the natural hazard or hazards?

- There has been no provision made or proposed to protect the land, building work or other property from the debris flow hazard.
- The authority contends an individual property owner will not be able to provide protection that can resist the debris flow of 2 tonnes per cubic metre at a flow of 5-10 metres per second (the estimated 2005 event) and may worsen the effect of the hazard on adjoining land by deflecting debris flow.

Is debris flow a natural hazard to which sections 71 to 74 relates?

- The authority contends that although debris flow is not specifically identified as a natural hazard in the Act, it could be considered part of erosion, falling debris or inundation, or a combination thereof.

Will the proposed building work accelerate, worsen, or result in a natural hazard on the land on which the building work is to be carried out, or any other property?

- Debris flows are thick muddy slurries, able to transport almost all solid material such as boulders and houses. The authority contends construction of the buildings will not accelerate, worsen or result in a natural hazard but the greater number of buildings the more likely they are to be mobilised and impact upon others.

Does the building work comply with the building code?

- The authority has assumed the building work complies with the building code except for Clause B1 Structure, B2 Durability and E1 Surface water. The authority does not believe it is reasonable to grant a waiver of Clause B1 for the buildings being located in the high risk debris flow zone as the performance criteria for B1 have not been satisfied.
- The authority contends it is logical to apply the annual probability of exceedance for ultimate limit states for wind and earthquakes[5] to debris flows.

4.1.3 The authority provided the following documentation with their application:

- Various photographs of the 2005 event and the location of the buildings.
- Various topographical and geotechnical maps of the Matata and Awatarariki stream, prepared by the authority's geotechnical engineers.
- Three reports from the authority's geotechnical engineers:
  - "The Matata Debris Flows Preliminary Infrastructure and Planning Options Report", August 2005.
  - "Quantitative Landslide Risk Assessment, Matata Escarpment" Final Draft, June 2013
  - "Supplementary Risk Assessment, Debris Flow Hazard" Matata, Bay of Plenty, November 2013
- "Matata debris flow mitigation – cost benefit analysis of options", NZ Institute of Economic Research, November 2005.
- "The 18 May 2005 debris flow disaster at Matata: Causes and mitigation suggestions", Institute of Geological and Nuclear Sciences, July 2005 ("The GNS report").
- "Debris Flow Emergency at Matata, New Zealand, 2005, Inevitable Events, Predictable Disaster" T Davis, Natural Hazards Research Centre, Dept Geological Sciences, University of Canterbury, New Zealand, June 2005.

4.2 The second applicants

4.2.1 The second applicants provided a written submission received on 29 September 2014. In summary the second applicants contend that:

- Investigations removed white sand to a depth of 1.5m without being contaminated with brown silt or debris, which is different to the authority's GNS report which claims there is evidence of previous debris flows.
- The reports from the authority's geotechnical engineer have been over emphasised. The second applicants contend the 2005 event is expected to be classed as rare with a return period of several hundreds to thousands of years rather than decades. The second applicants note nature is difficult to predict and the true loss of life will never be known. The determination application is about individual life, or loss of it.

[5] As found in the Acceptable Solutions/NZS 1170.0:2002

- In respect of the second applicant's property no boulders or timber covered the northern half as evidenced by photographs. The second applicants contend their property is protected by stop banks on the river, debris on the reserve and is higher than neighbouring sections. There was no sediment removed from the property.
- New Zealand has had no risk of life assessment plans; this was not adopted into the Resource Management Act. The second applicants submit risk of this nature is between 'man and mother nature'.
- The second applicants detail various infrastructure improvements and stream mitigation undertaken following the 2005 event.
- The second applicants stated in relation to boulders, the 2005 event did not dislodge the larger boulders from the stream and the second applicants have monitored them on an annual basis.
- The second applicants noted the earthquakes in the Matata area have loosened the soil around the boulders allowing water to seep into the cracks.

4.2.2 The second applicants provided a section from the authority's geotechnical engineer's report, and exerts of various reports relating to the 2005 event. The second applicants provided evidence, including photographs of:

- houses built before the event and the status of these houses after the 2005 event
- new building consents issued by the authority after the 2005 event
- in relation to boulders, the 2005 event did not dislodge the larger boulders from the stream and the second applicants have monitored them on an annual basis.

4.3 The owner

4.3.1 The owner was provided with the authority's written submission in draft form for comment; his comments are included in the authority's submission. In summary the owner contends:

- Following the 2005 event the vacant lot for his proposed building only had sand and silt with a few small logs, no boulders were present. The owner had been in the process of erecting a new fence around his section and he believes if the fence had been in place only minimal flood water would have been on his property.
- The owner does not believe there is a build-up that could cause dams blocking the clear flow of the water.

5. The first determination, the hearing, and site visit

5.1 The first draft determination

5.1.1 The first draft determination was issued to the parties for comment on 14 November 2014. The hearing was not accepted by the second applicants who requested a hearing.

5.2 The hearing

5.2.1 On 16 February 2015 I held a hearing in Whakatane. It was attended by the following:

- three officers of the authority
- an engineering geologist engaged by the authority
- a Professor from the University of Canterbury engaged by the authority
- two councillors from Whakatane District Council
- the second applicant
- the owners and their lawyer
- a landowner of 24 Clem Elliott Drive
- an officer from the Bay of Plenty Regional Council.

5.2.2 I was accompanied by a Referee engaged by the Chief Executive under section 187(2) of the Act, together with an officer of the Ministry, a risk specialist engineer, and a lawyer. Before the hearing the opportunity was taken to visit and inspect the properties and surrounding area on 15 January 2015.

5.2.3 All the attendees spoke at the hearing to clarify various matters of fact and were of assistance to me preparing this determination. The further written evidence provided included a letter dated 27 March 2007 from the authority to the owners in respect of 100 Arawa Street, Matata, to the effect that the authority considered it reasonable to grant a waiver or modification of the building code in respect of the natural hazard concerned.

5.2.4 There was discussion between the parties surrounding the background to the determination, the nature of the natural hazard concerned and possible design solutions.

5.2.5 The views put forward at the hearing, and evidential submissions provided at the hearing are summarised below.

5.3 Background to the 2005 event

5.3.1 The authority provided a history of the 2005 event and subsequent events and stated they were seeking central government guidance regarding the administration of the Building Act. The advice received indicates it is not reasonable to allow building on the site due to the natural hazard concerned. Following the 2005 event some buildings were relocated and one building consent has been issued for a 'garage' that is not habitable.

5.3.2 The owner and the second applicants provided a history of how they brought their respective sections and some preliminary comments about the determination. The owner's lawyer expressed concern the models and records of the 2005 event seem inconsistent with what happened. It was understood from the district plan it was a permitted activity to build on the Awatarariki fan head.

5.4 The natural hazard

5.4.1 The authority's engineer showed the video[6] of a debris flow in Indonesia. In summary a debris flow usually occurs in severe rainstorm in a catchment with lots of sediment to be moved, once sediment is mixed into water it becomes denser and can mobilise. It is estimated around 300,000 cubic meters of material was involved in the 2005 event as the flow volume. The second applicant disputes what occurred in

---

[6] https://www.youtube.com/watch?v=bt05FIIZPgM Reproduced with the permission of Franck Lavinge and University La Sorbonne, Laboratory of Physical Geography, France.

2005 was a debris flow, stating the homes were affected by water. The owner argues that only sand is found on his property at around 1.5-2m deep; not silt.

5.4.2 In relation to the likelihood of a natural hazard; Clause B1 of the Building Code requires buildings to withstand the loads they are likely to experience during construction, throughout their life and when they are altered, being not less than 50 years. In terms of the probability of a natural hazard the authority's engineer explained the modelling process 'back analysis' using the 2005 event and the different size of events estimated (refer table 5.1 of the engineer's report at Appendix A1.3). The models show the volume (of material) and velocity of a likely debris flow.

5.5 Possible design solutions

5.5.1 In relation to frequency and size of a natural hazard, this will 'feed into' the starting point of a design. The likely impact from a debris flow will allow a structural engineer to come up with a design solution to deal with the type of impact. It is accepted by the parties a standard 3604 building and foundations will not meet the likely impact criteria. It is discussed at the hearing the design standard should be to build for an event with the same cubic volume as the 2005 event.

5.5.2 Possible design solutions were discussed at the hearing specific to the owners section and the second applicant's section as there were different features to be taken into account, in summary:

- For 6 Clem Elliott Drive coastal hazard rules apply in that the structure must be removable. The ground level is around 1.5m higher than neighbouring properties. There are no properties downstream from the owner's property.
- For 100 Arawa Street the coastal hazard provisions do not apply, as the section is at ground level.

5.5.3 There is a possibility for a 'platform house' with the foundations built at a higher elevation to allow debris to flow underneath. The platform and above structure would need to have enough integrity to resist the estimated forces. It was acknowledged that there are cost implications in this type of design solution and a structural engineer would need to be engaged to come up with a design solution. It was agreed it would be of assistance to a prospective structural engineer to see a copy of this draft determination so that appropriate assessments could be made.

6. The submissions following the hearing

6.1 Following the hearing held on 1 May 2015, the authority provided a summary of design loads from a debris flow from the Awatarariki catchment upon a structure constructed on the fanhead. The authority noted its advisors had sought international advice, in summary:

- No evidence could be located of any design guidelines for construction of residential buildings on debris fanheads internationally.
- Determining the minimum height to the underside of the floor support structure is problematic for the following reasons:
  - high levels of uncertainty in debris modelling and unconfined debris flow events

  - o there is only one dataset to calibrate modelling against for the current case and further research is required
  - o the front face of a debris flow can be several boulders high
  - o debris flows can include large trees that are difficult to design for as they float very high in dense or hyperconcentrated flows

- The authority provided a table of design factors that structural engineers could apply in designing a residential building on the Awatarariki fanhead (below) noting with regard to item 5 that:
  - o the minimum height of 7m and 4m reflected the relevant safety factor of 2 on boulder dimension, and
  - o the upper limits of 10m and 6m being derived similarly using a with a safety factor of 3 on boulder dimension. Further research would be required to support a reduced clearance height value.

Table 1 Design Factors – Awatarariki Fanhead

Item	Descriptor	Parameter
1.	Event magnitude	300,000m3 (approximates the 2005 event)
2.	Return period	200-500 years
3	Flow parameters · Flow density (p) · Coulomb-type friction (μ) · Viscous-turbulent friction (Xi) · Earth pressure coefficient (λ)	 1700kg/m3 0.02 1500 m/s2 1.75
4.	Flow velocity at the southern boundary of 100 Arawa Road	3 m/s
5.	Minimum height to underside of floor support structure at 100 Arawa Road	7m-10m
6.	Flow velocity at the southern boundary of 6 Clem Elliott Drive	1 m/s
7.	Minimum height to underside of floor support structure at 6 Clem Elliott Drive	4.0m or 6.0m

Given the uncertainty, the authority concluded that the Ministry needed to provide it with guidance on what the minimum clearance height should be.

6.2 On 1 July 2015 the Ministry responded to the authority with further questions, in summary:

- Is there any information that attempts to quantify the various uncertainties?
- The safety factor value needs to be explained. It is assumed the boulder dimension is doubled and trebled for a linear relationship, is this correct?
- It would be useful to articulate the drivers behind the differences between the velocity and boulder size for the two properties.
- It was noted the authority’s expert at the hearing stated the 2005 event had changed the profile (contours) of the land and this would influence future

debris flows away from 6 Clem Elliott Drive in particular, in addition the owners had raised the property since the 2005 event.

6.3 The authority and the authority's geotechnical engineers replied on 18 August 2015. The authority again noted a high degree of uncertainty with quantifying and managing the risk of future debris flows on the fanhead. In summary the authority's engineers stated:

- Quantification of uncertainties is subjective not objective as there is only a single recorded event at Matata. Applying data from other sites is 'optimistic' due to the unique nature of the Awatararike debris flow catchment.
- In geotechnical terms, engineers usually quantify uncertainty with respect of soil or rock strength where sampling can be undertaken to make reasonable estimates in order to apply factors of safety. In contrast, debris flows are different in that the major uncertainty lies with the event size and return period. In the current case, the return period is uncertain and disputed.
- The 2005 event is often assigned a 200 year return period, but a 'more realistic perspective' is to consider as being more than decades and less than a millennia. The expert's cannot provide certainties due to lack of information and therefore recommend using the shortest feasible return periods.
- In relation to the factor of safety, many are possible (flow volume, peak flow, peak flow depth, boulder volume and boulder size). The evidence provided showed an illustration of a boulder 7m in diameter. There is a lack of basis of fact and therefore an increase in boulder volume cannot have a factor of safety.
- There is no way to establish a 'purely rational design elevation' for a building platform to boulders carried by a debris flow will pass safely underneath.
- The authority's experts do not have information on the height/boulder size dynamic as it depends on a number of complex factors combining at a single point in time, for example, the flow rate from the catchment, spatial distribution of boulders, topographic contours of the land it is flowing over and the way in which the flow distributes over the contours.
- It is not reasonable to assume the present land surface will remain <u>unaltered</u> during the course of a future event. For example, the experts do not know what erosion and deposition occurred during the 2005 event. Although it is noted that elevation increases help, the expert's cannot say that a property without a physical barrier will not be impacted by a future flow just because it has a slightly higher elevation.
- The current case is not a standard engineering problem. The legislation demands qualifications of risk on a property-by-property basis, however, the experts consider the lack of information must equate to the need to make a high risk assessment.

6.4 On 19 August 2015 I provided the above correspondence (paragraphs 6.1, to 6.3) to the other parties for comment.

6.5 On 21 September 2015 the second applicants provided a written submission in response. In summary:

- It is correct the return period is around 200 years as was the 2005 event, however, the second applicants consider the last recorded debris flow on the fanhead was in around 1950 and there is no evidence of larger debris flows when inspecting building foundations.

- In a site investigation of the 6 Clem Elliott Drive at 2m deep no debris flow material was found. A report from a structural engineer in 1989 noted there was no soft layers or swampy sub soils present unless they were below the 4m depth of the firm sand.
- It is unclear why the authority does not accept the 2005 event as evidence of a debris flow in determining the 'uncertainties' of a future event.
- The boulder measuring 1.8m on Clem Elliott Drive following the 2005 event was mechanically placed after being transported from another area. GNS referred to a boulder 7m in diameter however, it is not specified where this was located in relation to the second applicants section. If the 7m in diameter boulder is being used as the governing factor of safety for a design platform elevation of the proposed building, it is concerning as a boulder of this size never came near the site.
- The authority's response that they do not have information on the height/boulder size dynamic leaves it unclear how the design factor has been calculated.
- The second applicants do not agree with the authority's geotechnical engineers that the 2005 event changed the profile contours and the land and would influence the future debris flows away from the site. It is agreed the elevation of the site would help in a future debris event.
- The second applicants submitted evidence in relation to a neighbouring building (12 Clem Elliott Drive) constructed in 1989 as a pole house with engineering testing of subsoil and recommended foundations construction. In the 2005 event the deck to the building was damaged but the poles supporting the structure withstood the impact of the debris flow. The structure was relocated to another section in Matata in 2006. This is clear evidence that an engineered designed building can withstand a debris flow.

6.6 In addition, the second applicants provided the following further documents:

- a report from consulting engineers dated 6 April 1989
- a photograph of the mechanically placed boulders on the second applicants' site following the 2005 event.

6.7 On 17 November 2015 the authority provided a peer review report[7] on the authority's geotechnical engineer's quantitative debris flow risk modelling. This was provided to the parties on 18 November 2015. In summary:

- The authority sought the peer review in relation to work defining the area of land that will form a proposed retreat zone in a future District Plan variation proposal.
- The fatality risk map used by the authority's geotechnical engineers necessarily incorporates a number of simplifying assumptions which result in uncertainties that are difficult to quantify. The peer reviewers therefore place greater reliance on the boulder distribution that occurred in the 2005 event and a

[7] The peer review report was completed by a Professor of Canterbury University and an emeritus scientist from GNS Science.

‘conservative approach’ being ‘10^{-5} per year fatality risk … as the minimum extent of the area to be retreated from.’

- It is noted that although there were no fatalities in the 2005 event, the presence of boulders and trees was a ‘widely recognised serious threat to life’. The peer reviewers consider the return period for the 2005 event has been overestimated, and the overall fatality risk underestimated as the boulders and trees tend to travel further than the models predict and debris flows tend to increase in volume in the upper catchment.
- Within the recommended zone for retreat it is noted there is no physical mitigation of the high fatality risk that would be faced by a permanent resident and a substantial fatality risk for visitors to the area. The peer reviewers suggest a warning system to alert people to the imminent danger and allow them to seek shelter or evacuate.
- It is concluded the high fatality risk to residents from debris flows makes such residential use of the area unsafe.

7. The second draft determination

7.1 The determination was amended to take into account the hearing and the submissions received, and a second draft determination was issued to the parties for comment on 12 January 2016.

7.2 The authority responded to the second draft on 21 March 2016: the authority accepted the draft without comment. The owners made no submission in response to the second draft.

7.3 The second applicants responded to the draft determination on 5 February 2016. The second applicants did not accept the draft and requested a hearing, also advising that a submission would be made.

7.4 On 19 April 2016 I wrote to the second applicants requesting their submission and outlined that the test for holding another hearing was to hear new evidence. I gave the second applicants until 9 May 2016 to respond and indicated that unless a response was received the final determination would be issued. On 14 July 2016 I again requested a response from the second applicants to be received by 18 July 2016: that deadline has passed and no submission has been received.

8. Discussion

8.1 I must first analyse whether the land on which the proposed buildings are to be built is subject to a natural hazard under section 71 prior to determining whether it is reasonable to grant a waiver under section 72.

8.2 Section 71

8.2.1 I agree with the submission from the authority (refer paragraph 4.1.2) that the land on which building work is to be carried out is subject to or likely to be subject to a natural hazard, being a debris flow for the purposes of section 71(1)(a). Although not specifically listed under section 71(3) I consider a debris flow or flood clearly falls within ‘falling debris’ of rocks and boulders and ‘inundation’ as flooding.

8.2.2 There was some discussion at the hearing (refer paragraph 5.4.1) that the natural hazard in question is flooding as opposed to a debris flow. I place more weight on the evidence from the authority's geotechnical engineers, in that it is clear from the photographs of the 2005 event that the movement of boulders and houses were the cause of a debris flow, which involves the rapid flow of water and sediment to form a dense 'slurry' that has the ability to pick up large boulders and houses. The characteristics of a debris flow are different to a flood, although both natural hazards involve water or inundation.

8.2.3 In terms of whether the natural hazard is likely to occur, I have previously accepted the approach in *Auckland CC v Weldon Properties Ltd* 7/8/96, Judge Boshier, DC Auckland NP2627/95, [1996] DCR 635 as good law, that "likely" does not mean "probable", as that puts the test too high. On the other hand, a mere possibility is not enough. What is required is "a reasonable consequence or [something which] could well happen".[8] I accept that this interpretation can be applied to the current situation.

8.2.4 I accept the technical evidence provided by the authority that a natural hazard could well happen in the Awatarariki fanhead. I note section 71 asks whether a natural hazard is likely to occur, not whether loss of life in the event of a natural hazard is likely to occur. For this reason I consider the evidence provided regarding annual loss of life risk from debris flows is not relevant to section 71(1)(a). The previous determination quoted from the authority's geotechnical expert that there is an estimated 200 to 500 year return period for the 2005 event, however the GNS report stated:

> Debris flows are likely to be significantly more frequent... for at least several decades…They are unlikely to be as large as the recent events, because the sediment stored in the cannels has been significantly depleted…Although there is less sediment available now, there is still enough for a major debris flow, should the appropriate meteorological circumstances arise.

8.2.5 In my view an event having a 500 year return period cannot be considered 'likely' for the purposes of section 71(1)(a), however the test is not the likelihood of the 2005 event occurring, but the likelihood of a natural hazard occurring. The evidence provided by the authority (refer paragraph 4.1.1) and including the GNS Science confirms this by stating 'the probability of debris flows at Matata is something like every 35 years or so, the probability of debris flows as large or larger than [the 2005 event] may only be once every 500 years or so'.

8.2.6 I accept the modelling provided in the authority's geotechnical engineers report dated November 2013, refer Table 3.1 below. The model used back analysis from the 2005 event to estimate the magnitude and return periods of four different types of debris flow events. The 2005 event is approximate with event no. 3 in terms of magnitude and return period. The report notes the values represent the volume of the flows active within the Awatariki Stream channel rather than the post-event deposits which tend to be somewhat smaller in volume.

[8] Determination 2006/119 Dangerous building notices for houses in Matata, Bay of Plenty (Department of Building and Housing) 7 December 2006

Table 3.1: Assumed event magnitudes and return periods

Event No.	Magnitude	Return Period (years)
1	50,000m^3	50 - 100
2	150,000m^3	100 - 250
3	300,000m^3	200 - 500
4	450,000m^3	500 - 1000

8.2.7 The geotechnical modelling evidence provided shows the likely size of the debris flows that are likely to occur in a 50 to 100 year event compared to a 200 to 500 year event such as occurred in 2005. Based on this evidence I consider a smaller scale debris flow (refer event no. 1 or 2 in Table 3.1) would still be a natural hazard and the land on which the building work is to be carried out on the Awatarariki fanhead is likely to be subject to a natural hazard for the purposes of 71(1)(a).

8.2.8 I also accept the comments from the authority's peer reviewers in relation to the geotechnical modelling; that it is likely the return period has been overestimated for the 2005 event.

8.2.9 Having accepted the building work is on land subject to a natural hazard, I am not required to consider section 71(1)(b).

8.2.10 Under section 71(2)(a) it is accepted that no adequate provision has been or will be made to protect the land. The authority has detailed in its submissions the consultation and research processes undertaken following the 2005 event, and the decision not to provide any debris detention structure in the upper catchment of the Awatarariki Stream. In my view no adequate provision has been made to protect the land.

8.3 Appropriateness of a Section 72 waiver

8.3.1 Having accepted that the proposed buildings are on land subject to a natural hazard in terms of section 71, I must now consider the implications of section 72. This section states that the authority must issue a building consent if all the requirements set out in subsections (a) to (c) are met.

8.3.2 The first question is whether building work to which an application for building consent relates, will not accelerate, worsen or result in a natural hazard on the land on which the building work is to be carried out on or any other property.

8.3.3 The building work proposed in the building consent applications to the authority consisted of mostly NZS3604 standard buildings (refer paragraph 2.3). During the course of the hearing it was discussed the possibility of having an elevated building platform to allow for debris flow to pass underneath (refer paragraph 5.5.3 and my conclusion on this matter at paragraph 8.5).

8.3.4 Firstly the building work to which an application for building consent relates, will not accelerate, worsen, or result in a natural hazard on the land on which the building work is to be carried out on or any other property. I accept the submission from the authority that a debris flow can mobilise buildings (as was the case for the 2005 event). The authority submitted the greater the number of buildings that exist within the high debris flow zone, the greater likelihood of buildings being mobilised and one or more buildings impacting upon others. I agree the building work can worsen the effects of a natural hazard on other property if there is an impact between buildings.

8.3.5 Whilst not provided in the documents I have seen it as possible that some site work associated with protecting the property from the natural hazard will negatively impact on other properties in the event of a natural hazard.

8.3.6 I acknowledge that in the event of a large debris flow (like the 2005 event) the extent to which the building work will worsen or result in a natural hazard will be marginal from a proportionality perspective when compared to the natural hazard facing the other property. However, the legislation does not take account of a proportionality factor in considering the consequences of the natural hazard on this section.

8.3.7 Secondly the land must be subject or likely to be subject to one or more natural hazards. This has been discussed in paragraph 8.2.

8.3.8 The final requirement for section 72 is it must be ‘reasonable’ to grant a waiver or modification of the building code in respect of the natural hazard concerned.

8.3.9 There has been little precedent regarding what is ‘reasonable’ in relation to granting a waiver under section 72(c). It is established a waiver or modification must not be granted without careful consideration of all the circumstances of the particular case concerned, taking into account the purposes and principles of the Act.[9] It has also been established there is no need for a waiver if the building will comply with the Building Code throughout its specified life and compelling reasons must exist to support the view that a waiver is appropriate.[10] I note the effect of granting building consent under section 72 is that the authority is exempt from liability under section 392 which could explain why section 72(c) refers to the reasonableness or a waiver or modification.

8.3.10 Referring to Determination 2015/010[11] a framework was developed of factors that should be taken into account when an authority considers whether it is reasonable to grant a modification or waiver under section 67 of the Act. Similar factors are considered in this context as to whether it is reasonable to grant a waiver or modification in respect of a natural hazard. In combination with the suggested factors from Determination 2015/010, I consider the matters to consider in this case include:

- the extent of the waiver or modification in relation to the objectives and performance criteria of the relevant building code clauses
- purposes and principles of the Act, including the life safety risk to the building occupants
- mitigating factors that will reduce the elevated risk for the proposed buildings.

[9] Determination 2012/049 Regarding the refusal to issue a code compliance certificate for a 16-year-old house with monolithic cladding *(Ministry of Business, Innovation and Employment)* 12 July 2012
[10] Ibid
[11] Determination 2015/010 Regarding the authority’s refusal to grant a modification of Clause C3.4(a) of the Building Code in respect of materials used for internal surface linings at a new school hall *(Ministry of Business, Innovation and Employment)* 31 March 2015.

8.4 Purposes and principles of the Act

8.4.1 Life safety is a fundamental principle that underlies the Act and should be taken into account when determining if it is reasonable to grant a section 72 waiver. Section 3 of the Act, which sets out some overarching purposes, specifies the need to ensure that people who use buildings can do so safely.

8.4.2 In relation to the current situation, due to the geographical position of the Awatarariki Stream fanhead, there is an accepted risk of loss of life in the event of a natural hazard, being a debris flow.

8.4.3 The authority's submission states:

> These reports conclude that there are several properties on the Awatarariki fanhead within a High Debris Flow Hazard Area, and that those properties have an annual loss-of-life risk exposure ranging from 1 x 10-2 to 1 x 10-6. Figure 4 is a map of the Awatarariki fanhead area with the annual loss-of-life risk exposure levels overlaid.[12]
>
> The properties that are the subject of this determination are identified with yellow banding. 6 Clem Elliott Drive straddles the boundary of the $1x10^{-3}$ risk contour. 100 Arawa Street sits just beyond the boundary of the $1x10^{-2}$ risk contour

8.4.4 The geotechnical report dated November 2013 (refer Table 6.1 in Appendix A1.3) calculates the 'quantitative loss of life risk' i.e. the annual probability of the person most at risk being killed by a debris flow by calculating the probability of boulder impact and the vulnerability of occupants of dwellings to such an impact.

8.4.5 As stated in Determination 2007/110[13] two circumstances are provided to illustrate situations where it might be reasonable to grant such a waiver or modification where compliance with the Building Code would be impracticable:

(a) In respect of clause B1.3.3, a waiver or modification in respect of erosion might be reasonable because it would relate solely to property damage and would not reduce life safety (as noted in 5.3.3 above, even in a low probability storm there will be time for the occupants to leave before they are in any danger from the collapse of the house).

(b) In respect of clause E1.3.2, if the house were, for example, a demonstration home, or a bach used only for holidays, a waiver or modification in respect of water entering the house in, say, a 30 year instead of a 50 year storm, might be reasonable because it would relate to loss of amenity and to property damage but would not reduce life safety.

8.4.6 The further evidence from the authority's engineers (refer paragraph 6.3) articulates the amount of uncertainty involved in this case. The lack of definitive information about debris flows on the Awatarariki catchment area means an engineer has to rely on highly unpredictable parameters and a natural increase in conservatism. The authority's engineers have noted international colleagues have been consulted with however in other parts of the world information about debris flows remains minimal. The authority's peer reviewers concluded a high life safety risk to permanent residents and visitors. In light of the further evidence I consider the life safety risk remains high in this case.

[12] The geotechnical engineer's report, Figure 23 Draft Supplementary Risk Assessment, Debris Flow Hazard, Matata, Bay of Plenty, September 2013

[13] Determination 2007/110 Building consent for a house on land subject to coastal hazards (*Department of Building and Housing*) 17 September 2007

8.5 The Building Code Clauses

8.5.1 In terms of what clauses of the Building Code would be considered under a waiver, the authority has submitted Clauses B1 (Structure), B2 (Durability) and E1 (Surface water) are relevant.

8.5.2 The objective of clause B1.1 is to safeguard people from injury caused by structural failure, loss of amenity caused by structural behaviour and protecting other property from physical damage caused by structural failure. I must therefore consider whether the buildings, once built, will be structurally sound and will continue to be throughout their lives. In other words, I need to consider whether they will comply with the Building Code in respect of Clause B1.

8.5.3 B1.3.1 requires that throughout the intended life of the building there must be a low probability of the house becoming unstable because of:

- B1.3.3(r) removal of support by debris flow
- B1.3.3(e) loads imposed by water.

8.5.4 The original proposed buildings are designed to comply with NZS 3604 (except the manufactured roof trusses). There is no indication from the authority that if it were not for the natural hazard the proposed buildings would comply with Clause B1. I agree that the criteria of Clause B1 have not been met with the constructed form of buildings proposed by the owners and second applicants.

8.5.5 In relation to Clause B2.3.1 buildings must, with only normal maintenance, continue to satisfy the performance requirements of the Building Code for the life of the building being not less than 50 years. Evaluation of this requirement must include likely deterioration in the extent of compliance with Clause B1 such as might arise through loss of support due to Clause B1.3.3(r) not being satisfied over not less than 50 years.

8.5.6 Under Clause E1.3.1 which requires in effect that the buildings must not damage or cause nuisance to other property by diverting surface water in a 10% AEP[14] event (i.e. 10% probability of occurring annually) and Clause E1.3.2 where surface water must not enter the house in a 2% AEP event. It is likely in the event of a natural hazard that other property will be subjected to similar flooding/debris flow. The building work is not likely to create a nuisance to other property in a 10% AEP event.

8.6 Mitigating factors that will reduce the elevated risk

8.6.1 The authority has declined to implement any mitigating factors in relation to the natural hazard (refer paragraph 8.2.10).

8.6.2 In relation to the risk to the building, there are no proposed compensating features to reduce the damage when the land is subject to a debris flow. The proposed buildings are to be built with standard NZS 3604 foundations with no measures to enable any water to pass underneath and no specifically designed foundations or engineered solutions that take into account the possibility of a debris flow or flood, including one of a smaller scale to that of the 2005 event.

8.6.3 In acknowledging the proposed design solution to have the buildings on elevated platforms (refer paragraph 5.5.2) I accept the evidence from the authority's engineers that the unpredictable nature of a debris flow, which has the potential to have more

[14] Annual exceedance probability

than one boulder stacked on top of each other at the front of the flow in addition to trees and other houses, results in this proposed option to be unfeasible in life safety risk assessment terms, and therefore from an engineering design perspective based on the available information I have in front of me. This is decision on non-feasibility is arrived at primarily because of the uncertainty the engineers and the peer reviewers have in predicting a further event, and at what annual exceedance this would have.

8.6.4 In conclusion, I consider on weighing up the above factors regarding a high probability for loss of life, non-compliance with the Building Code clauses and a lack of any mitigating features for the proposed buildings as described in the application, lead to the decision that it is not reasonable for a waiver to be granted under section 72 of the Act in this case.

9. The decision

9.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the authority was correct to refuse to issue a waiver under section 72 of the Act.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 22 July 2016.

John Gardiner
Manager Determinations and Assurance

Appendix A

A1.1 The relevant sections of the Act inclue:

71 Building on land subject to natural hazards

(1) A building consent authority must refuse to grant a building consent for construction of a building, or major alterations to a building, if—

(a) the land on which the building work is to be carried out is subject or is likely to be subject to 1 or more natural hazards; or

(b) the building work is likely to accelerate, worsen, or result in a natural hazard on that land or any other property.

(2) Subsection (1) does not apply if the building consent authority is satisfied that adequate provision has been or will be made to—

(a) protect the land, building work, or other property referred to in that subsection from the natural hazard or hazards; or

(b) restore any damage to that land or other property as a result of the building work.

(3) In this section and sections 72 to 74, natural hazard means any of the following:

(a) erosion (including coastal erosion, bank erosion, and sheet erosion):

(b) falling debris (including soil, rock, snow, and ice):

(c) subsidence:

(d) inundation (including flooding, overland flow, storm surge, tidal effects, and ponding):

(e) slippage.

72 Building consent for building on land subject to natural hazards must be granted in certain cases

Despite section 71, a building consent authority that is a territorial authority must grant a building consent if the building consent authority considers that—

(a) the building work to which an application for a building consent relates will not accelerate, worsen, or result in a natural hazard on the land on which the building work is to be carried out or any other property; and

(b) the land is subject or is likely to be subject to 1 or more natural hazards; and

(c) it is reasonable to grant a waiver or modification of the building code in respect of the natural hazard concerned.

392 Building consent authority not liable

(2) Subsection (3) applies if—

(a) a building consent has been issued under section 72; and

(b) the building consent authority has given a notification under section 73 . . . and

(d) the building to which the building consent relates suffers damage arising directly or indirectly from a natural hazard.

(3) The persons specified in subsection (4) are not liable in any civil proceedings brought by any person who has an interest in the building referred to in subsection (2) on the grounds that the building consent authority issued a building consent for the building in the knowledge that the building for which the consent was issued, or the land on which the building was situated, was, or was

likely to be, subject to damage arising, directly or indirectly, from a natural hazard.

(4) The persons are—

(a) the building consent authority concerned; and

(b) every member, employee, or agent of that building consent authority.

A1.2 The relevant sections of the Building Code include:

B1 Structure

B1.1 The objective of this provision is to:

(a) safeguard people from injury caused by structural failure,

(b) safeguard people from loss of amenity caused by structural behaviour, and

(c) protect other property from physical damage caused by structural failure.

Performance

B1.3.1 Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives

B1.3.2 Buildings, building elements and sitework shall have a low probability of causing loss of amenity through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during construction or alteration when the building is in use.

B2 Durability

B2.1 The objective of this provision is to ensure that a *building* will throughout its life continue to satisfy the other objectives of this code.

Performance

B2.3.1 Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:

(a) the life of the building, being not less than 50 years, if:

…

E1 Surface Water

E1.1 The objective of this provision is to:

(a) safeguard people from injury or illness, and other property from damage, caused by surface water, and

…

E1.3.1 Except as otherwise required under the Resource Management Act 1991 for the protection of other property, surface water, resulting from an event having a 10 percent probability of occurring annually and which is collected or concentrated by buildings or sitework, shall be disposed of in a way that avoids the likelihood of damage or nuisance to other property.

E1.3.2 Surface water, resulting from an event having a 2 percent probability of occurring annually, shall not enter buildings.

Performance E1.3.2 shall apply only to housing, communal residential and communal non-residential buildings.

A1.3 Relevant tables from the geotechnical engineer's report dated November 2013

Table 5.1: Definition of Intensity Index (I_{DF}) zones

Intensity Zone	Intensity Index (I_{DF})	Debris Description	Description of Effects
1 Red	>15	Mass boulder passage and deposition. Abundant boulders of several metres in diameter with large trees. Deposits several metres thick, boulders commonly being clast supported (boulder to boulder contact)	Complete destruction of surface infrastructure and dwellings. Total loss of dwellings can be expected Impact force from 1m diameter boulder: 15 – 60 kN Impact pressure from flow: 20 – 200 kPa
2 Orange	15 - 5	Abundant boulders and trees within a matrix of sand silt and gravel. Boulders to several metres in diameter but typically less than 1m. Boulders are matrix supported	Severe to moderate effects depending on nature of structure and individual circumstances with respect to boulder impact. Total loss of some dwellings, significant to damage to others Impact force from 1m diameter boulder: 10 – 15 kN Impact pressure from flow: 5 – 20 kPa
3 Yellow	5 – 0.5	Predominantly sand, silt and gravel with occasional boulder, typically less than 0.5m in diameter, although occasional boulders up to 2m in diameter may enter this zone	Generally minor structural damage to dwellings but significant damage to furnishings etc from water and sediment inundation of lower storey. Some significant localised damage may result from isolated boulder impact Impact force from 1m diameter boulder: <10 kN Impact pressure from flow: <5 kPa
4 Blue	<0.5	Predominantly silt and sand-laden water (debris flood) with minor coarse material. No or rare boulders present	Generally insignificant structural damage but flood damage to lower storey Impact force from 1m diameter boulder: Not applicable Impact pressure from flow: <5 kPa

Examples of qualitative risk zone debris type and structural damage

			
Intensity Index Zone: 1 (Red) I_{DF} : > 15	Intensity Index Zone: 2 (Orange) I_{DF} : 5 - 15	Intensity Index Zone: 3 (Yellow) I_{DF} : 0.5 – 5.0	Intensity Index Zone: 4 (Blue) I_{DF} : 0.0 – 0.5

Table 6.1: Design Loss of Life Risk Factors

Flow Intensity Zone	Boulder Impact Zone	Probability of structural impact $P_{(S:H)}$	Vulnerability ($V_{(D:T)}$)	Comments
1	Inside main boulder field	1.00 (100%)	0.75 (75%)	Certain to be impacted by mass boulders
2	Inside main boulder field	1.00 (100%)	0.20 (20%)	Certain to be impacted by mass boulders
3	Inside main boulder field	0.20 (20%)	0.05 (5%)	Risks associated with single boulders
3	Outside main boulder field	0.05 (5%)	0.05 (5%)	Risks associated with rare boulders
4	Inside main boulder field	0.10 (10%)	0.05 (5%)	Risks associated with rare single boulders
4	Outside main boulder field	0.01 (1%)	0.01 (1%)	Risks associated with very rare boulders