BEFORE A HEARING PANEL: WHAKATĀNE DISTRICT COUNCIL AND BAY OF PLENTY REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of submissions and further submissions on Plan Change 1 (Awatarariki Fanhead, Matatā) to the Operative Whakatāne District Plan and Plan Change 17 (Natural Hazards) to the Bay of Plenty Regional Natural Resources Plan

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STATEMENT OF EVIDENCE OF TOM BASSETT
ON BEHALF OF WHAKATĀNE DISTRICT COUNCIL

ENGINEERING

15 January 2020

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1. INTRODUCTION

1.1. My full name is Tom Bassett.

1.2. 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**).

1.3. My evidence relates to the Engineering effects aspects of the Proposed Plan Changes. My evidence will cover the multiple debris flows that occurred at Matatā in May 2005, investigations that were subsequently commissioned, learnings that occurred, and solutions that were considered. Specifically, I will cover:

(a) The extent and scale of the 2005 debris flow event

(b) The hazard and risk mitigation investigations that were undertaken by Tonkin and Taylor Ltd (T+T) and others during the period May to August 2005

(c) The event frequency

(d) Historic debris flows in Matatā

(e) The infrastructure and planning analyses and options (including early warning systems) that were developed by T+T and presented to the Council and community in August 2005

2. QUALIFICATIONS AND EXPERIENCE

2.1. I am a Chartered Engineer (CEng) with the qualifications BE (Hons) and ME from the University of Auckland, and MBA from the University of Otago.

2.2. I have nearly 40 years post-graduate experience, principally in the water resources disciplines of hydrology and catchment management. I am a member of the British Institution of Civil Engineers and the New Zealand Hydrological Society.

2.3. Since 1994, I have been employed by Tonkin & Taylor Ltd (T+T) as a water resources engineer. I was for two years the Resource Group Manager of the Water Resources Group, and subsequently for two years the Discipline Manager of the Water Engineering sub-Discipline.

2.4. I am a Principal of T&T and have wide experience in water resources engineering including hydrological analysis, computational modelling, catchment management investigations and reporting.

2.5. Specific project experience related to catchment management and river engineering includes:

(a) Hydrological analysis, hydraulic modelling and river control works on the Tongariro River

(b) Hydraulic modelling and river control works on the Tauranga-Taupo River

(c) Hydrological analysis and runoff modelling, and hydraulic modelling in relation to the Sarawak River barrage in East Malaysia

(d) Hydraulic modelling of the Manawatu River

(e) Integrated Catchment Studies for Metrowater and Auckland City

(f) Hydrological analysis of extreme event flows in the Sibulan River, Mindanao

(g) Probable Maximum Precipitation and Flood modelling for various New Zealand catchments.

3. MY ROLE

3.1. In May 2005, following the debris flow in Matatā, Whakatāne District Council (WDC) appointed T+T to assist with disaster recovery activities and coordinate hazard and risk management investigations following the event.

3.2. I was appointed by Council to the role of Hazards and Risk Team Leader, and coordinated the input of various parties who contributed to the investigations required to report to Council.

3.3. The original scope of work prepared by WDC for the Hazards Team included the following:

(a) To identify the cause of the disaster (landslip/flood or both)

(b) To identify the nature and extent of short- and long-term risks still facing Matatā as a result of this event

(c) To identify what action plans and processes needed to be put in place to address the short term and long-term risks still facing Matatā as a result of the event

(d) To identify what future land use provisions needed to be put in place.

3.4. Investigations to gather the information required to address the items in the scope proceeded through June and July, to identify infrastructure and planning options to manage risk and protect the community. The objective was to enable development of a detailed action plan of capital works and planning measures to mitigate future debris flow risk.

3.5. During the investigations on behalf of Council I worked closely with the various agencies including the then Environment Bay of Plenty (EBoP), the then Transit NZ, NZ Railways Corporation (ONTRACK), Geological and Nuclear Sciences (GNS) and several central government departments.

3.6. There was also consultation with the community during the investigations, with individuals formally and informally and at public meetings.

3.7. The specific investigations that I coordinated, and carried out by various parties, as part of the scope included:

(a) Consideration of stream reinstatement issues (T+T and EBoP)

(b) Collation of topographical information (T+T)

(c) Interviews for May 2005 flood experiences (Dr Ian Shearer for WDC)

(d) Historical research into previous events (Dr Ian Shearer for WDC)

(e) Hydrological analyses (EBoP)

(f) Computational hydraulic modelling of watercourses (T+T)

(g) Catchment processes (GNS)

(h) Review of the regulatory and planning framework (T+T)

(i) Lagoon management plan (Department of Conservation).

3.8. I presented a summary of the investigations and outcomes to WDC and to the Matatā community in August 2005, and T+T prepared a report for Council, viz “The Matatā Debris Flows: Preliminary Infrastructure and Planning Options Report” (August 2005). Options presented in that report formed part of the basis of Council’s decisions for risk mitigation measures in Matatā, and the Business Case presented to Government for funding support for what became the Matatā Regeneration Projects.

3.9. In December 2005, following a Government request for further information to clarify aspects of the Business Case, Council confirmed its strategy to provide protection from future debris flows to the Matatā community. The Cabinet approved funding support to the Whakatāne District in December 2005.

3.10. Subsequently I was Project Manager for various T+T projects for Council, which developed designs and provided specialist technical information and analysis in relation to the Matatā Regeneration Projects. I provided expert evidence for WDC at resource consent hearings in relation to those projects, and at the Environment Court for appeals to the consents that were granted for the works in the Awatarariki catchment.

4. CODE OF CONDUCT

4.1. Although this is a Council hearing 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 Hearings Panel. 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.

5. SCOPE OF EVIDENCE

5.1. This statement of evidence covers the following:

(a) An overview of the May 2005 event and its effects in the Awatarariki catchment and on the fanhead (**The May 2005 Event**);

(b) Discussion of rainfall return period (**Event Frequency**);

(c) Comment of previous known events (**Debris flows in Matatā**);

(d) Outline of the investigations following the event (**Hazard and Risk Investigations**);

(e) Description of the options identified to manage the hazard in the catchment (**Awatarariki catchment options**);

(f) Response to Submissions; and

(g) Conclusion.

6. THE MAY 2005 EVENT

6.1. In May 2005 extreme rainfall fell in the hills along the Matatā escarpment. The causative meteorological conditions of this storm are described in detail by Mr Blackwood.

6.2. Key facts extracted from the various investigations following the event, based on recorded rainfall at Awakaponga, were as follows:

(a) 308 mm of rainfall in the 20 hour period from 10 pm on 17 May 2005

(b) Approximately 106 mm between 10 pm on 17 May and 6 am on the morning of 18 May

(c) After a relatively dry period until noon, a further 150 mm fell between 2 pm and 6 pm which included:

i. A peak one hour depth of 94.5 mm (between 4:30 pm and 5:30 pm)

ii. A peak 90 minute depth of 125 mm (between 4 pm and 5:30 pm)

(d) The rainfall included a 15 minute period from 4:45 pm in which 30.5 mm was recorded.

(e) The peak 90 minute rainfall recorded (125 mm) lies on the envelope of maximum rainfall depths recorded in New Zealand. Analyses at the time showed that the expected Probable Maximum Precipitation at Awakaponga in 90 minutes would be approximately 160 mm.

6.3. For the 2005 event it was estimated that the rainfall depths in the catchments behind Matatā may have been up to 30% greater than recorded at Awakaponga, due to orographic effects of the topography and higher elevations.

6.4. As described by Dr McSaveney in his evidence the rain event triggered debris flows in the catchments upstream of Matatā. These transported significant volumes of debris including boulders, trees, rocks and silt with floodwaters on to the catchment fanheads on the coast.

6.5. This was most significant for the township itself from the Waitepuru and Awatarariki catchments at the eastern and western ends of the town, and to a lesser extent from the central Waimea catchment. Significant debris was carried into the town causing damage to private property and civil infrastructure.

6.6. During the event the bulkier material (boulders and trees) was spread across the Awatarariki fanhead, principally in the vicinity of Clem Elliott Drive. There was also significant flow through properties on Arawa and Richmond Streets. Large volumes of finer material (silt and sand) were conveyed into Te Awa o te Atua and Railway lagoons, to the east and west respectively of the fanhead.

6.7. Initially the volume of debris material that was transported out of the Awatarariki catchment was estimated to be 200,000 m^3; this was revised in late 2005 after additional ground survey information to 330,000 m^3 as a basis for planning. Based on more extensive survey information gathered by LiDAR in mid-2006, and a review of pre- and post-event ground profiles, the estimate of the volume of material carried out of the catchment was revised to be approximately 250,000 m^3. During the subsequent design process, the volume adopted for design was 300,000 m^3.

6.8. Peak debris and water discharges in the streams flowing to Matatā were estimated at the time to have been between five and twenty times the theoretical 100 year flood discharges, with water components of the catchment discharge up to twice the estimated 100 year floods.

6.9. It was estimated, based on calculations by EBoP technical staff in 2005, that the peak debris flow in the Awatarariki catchment during the event, comprising both water and debris material, was approximately 325 m^3/s. Subsequent detailed computational modelling of the event by T+T indicated that the peak flow may have actually exceeded this for a short period. These peak flow values compare to a theoretical 100 year flood peak for the catchment estimated at the time to be 44 m^3/s.

6.10. On the Awatarariki fanhead, numerous houses were destroyed or significantly damaged and the road and rail transport links were disrupted. The railway bridge over the Awatarariki Stream was washed out with the rail link completely severed.

7. EVENT FREQUENCY

7.1. At the time it was estimated that the rainfall that triggered the debris flows had a return period between 200 years and 500 years, though as Mr Blackwood explains in his evidence it was possibly a more frequent event.

7.2. Mr Blackwood also explains that the effects of climate change are likely to increase the frequency of these events, i.e. make them more common. For instance, by the 22nd century, an event which in 2005 had an expected frequency of 200 years to 500 years, might be expected to have a return period as low as 40 years to 50 years depending on future CO_2 emissions and actual warming.

8. DEBRIS FLOWS IN MATATĀ

8.1. In terms of an historical context, research commissioned by Whakatāne District Council following the event showed that Matatā has been affected by floods of various impacts since European settlement. This included anecdotal reporting of debris transported out of the Awatarariki catchment in 1939. Reporting in the Whakatāne Beacon following the May 2005 event included reference to a flood in 1869 that destroyed a flour mill, and another in 1950 with photographs of debris and damage to roading infrastructure.

8.2. As Dr McSaveney explains in his evidence “there is irrefutable evidence for previous debris flows at Matatā…. and that large prehistoric debris flows built the land beneath Matatā over the last 7,000 years”.

9. HAZARD AND RISK INVESTIGATIONS

9.1. As noted above the work scope for the Hazard and Risk Team investigations was to identify the cause of the disaster, the nature and extent of risks still facing Matatā, what action plans and processes needed risks still facing Matatā, and what future land use provisions needed to be put in place.

9.2. It was clear from the May 2005 event that the township of Matatā faced a degree of risk that had not been historically appreciated. The event revealed the nature of the hazard to the town which could set in motion catchment processes with potentially devastating effect for the downstream properties and with significant risk to life.

9.3. The objective for the investigation of infrastructure and planning options was to enable development of a detailed action plan of capital works and planning measures to address and mitigate future risk in events like that experienced in May 2005.

9.4. Investigations proceeded from late May, with a final reporting date identified in August. During the investigations consultation with the community also proceeded, with individuals and as groups. Two public meetings were held:

(a) On 29 June 2005, to provide a general progress update to the community, and also specifically to present:

(i) The draft GNS report on catchment processes, “The 18 May 2005 debris flow disaster at Matatā: Causes and mitigation suggestions”; and

(ii) Interim Report on Flood Recovery and Rehabilitation of Matatā Wildlife Refuge (which includes the Matatā lagoons), prepared for Department of Conservation.

(b) On 16 August 2005, to present the outcome of the investigations as summarised in the T+T Preliminary Infrastructure and Planning Options Report

9.5. The Preliminary Infrastructure and Planning Options Report prepared for WDC by T+T summarised consideration of the regulatory and planning framework, early warning systems, risk management measures (i.e. engineered infrastructure and controls), and aspects of lagoon management.

9.6. Options identified for mitigation of the risk broadly fell into two categories:

(a) Non-structural, e.g. land use controls, catchment management, and early warning systems; and

(b) Engineered, i.e. debris retention and control structures.

9.7. It was noted that land use controls would seek to control and/or limit development in the areas at risk depending on the level of risk. Catchment management measures include vegetation and pest control, and monitoring of stream beds and slopes in the catchment, noting that in the May 2005 event vegetation and pest management by the Department of Conservation was generally considered to be effective.

9.8. Weather radar systems can provide information to assist early warning of meteorological events as they develop.

9.9. However, with respect to early warning systems, it was concluded in 2005 that a warning system reliant on rain gauges in the catchment as the sole means of managing the debris flow risk was not considered feasible. This was due to the speed of debris flows (5 m/s to 10 m/s), the relatively short catchment flow path (approximately 3 km), and the short response time, i.e. perhaps no more than 10 minutes and maybe less, as discussed in more detail by Professor Davies and Dr Massey.

9.10. With regard to options, and particularly the scale of engineering works, the recommended basis of design to be adopted was the 18 May 2005 event, given:

(a) The rainfall that triggered the event had a return period then estimated to be less than 500 years, and maybe even more frequent than once every 200 years on average

(b) This corresponded to the medium (to low) probability categories used earlier in debris flow protection studies for Aoraki Mount Cook Village

(c) The risk level was broadly similar to the standard adopted for design of houses to withstand wind and earthquake loads, i.e. 1 in 500 years.

10. AWATARARIKI CATCHMENT OPTIONS

10.1. The options identified for the Awatarariki, including a range of engineering options, were:

(a) Option A1: Retreat from hazard;

(b) Option A2: Debris dam in catchment and debris flood channel on fanhead beside existing Awatarariki Stream watercourse;

(c) Option A3: Debris dam in catchment and debris flood channel on fanhead beside realigned Awatarariki Stream watercourse;

(d) Option A4: Debris flow bund and debris flood channel on fanhead beside existing Awatarariki Stream watercourse;

(e) Option A5: Debris flow bund and debris flood channel on fanhead beside realigned Awatarariki Stream watercourse;

(f) Option A6: Debris dam in catchment and debris flood channel on fanhead beside new western Awatarariki Stream watercourse;

(g) Option A7: Debris flow bund and debris flood channel on fanhead beside new western Awatarariki Stream watercourse; and

(h) Option A8: New Awatarariki stream path cut through ridge, and debris flow bund on fanhead with new debris flood channel.

10.2. There were several sub-options that included slight variations on some of the diversion paths that were included as part of these options.

10.3. As noted above the design philosophy for the works in the Awatarariki catchment (and across Matatā) was to provide protection for the community when an event similar to the May 2005 event happens in the future, with an expected return period at the time up to 500 years. However, as mentioned above and as discussed by Mr Blackwood, the now more clearly understood effects of climate change on extreme rainfall, which triggers the catchment processes that generate debris flows, are expected to increase the frequency of an event similar to the May 2005 debris flow.

10.4. Nonetheless, at the time it was clear that there was a range of options available to develop risk mitigation works in the Awatarariki catchment and on the fanhead, with varying benefit in terms of the number of private properties that would be exposed to future debris flows.

10.5. At the time it was expected that any dam structure in the catchment would need to be approximately 12 m to 16 m in height to provide the necessary debris storage capacity.

10.6. Any dam would also need to be designed for associated floodwater flows. These debris floods would pass through the dam and continue into the fanhead with a channel required to convey this flow either to the sea or to the Matatā lagoons.

10.7. If no dam was constructed in the catchment then it was considered debris flow bunds further downstream may have been feasible to protect part of the fanhead. The existence of the state highway and railway transport corridors, however, presented challenges with respect to managing debris flows across these.

10.8. Routing the debris flows directly to the sea was considered. The option considered was to construct a bunded debris flow channel from the fanhead to the sea via groynes to protect an opening through the sand dunes. However, it was concluded that the gradient on the fanhead was not sufficient to sustain debris flow movement to the sea and thus deposition on the fanhead was unavoidable.

10.9. Regarding options without the dams, while in some cases clearly cheaper, a greater number of properties would be affected. For those in the path of the expected debris flow there would be a significant risk of damage and to life when an event like 18 May 2005 next occurs.

10.10. It was also recognised that an integral part of developing engineered risk management schemes was the need to maintain these over an extended period. This would require the commitment of the community of interest, and expenditure, over a long period of time (maybe generations) when no significant event will have occurred and understanding of the hazard and attendant risks may be reduced.

10.11. As part of the longer-term debris risk management and stream management strategy that was adopted by Council based on the reporting in August 2005, works were identified in the Awatarariki catchment to:

(a) Arrest and detain future debris flow material from a similar sized event in a debris detention structure in the catchment upstream of the escarpment

(b) Convey the floodwaters and finer material from the retention structure through the Awatarariki Stream system into a floodway through the Te Awa o te Atua lagoon

(c) Manage the sediment carried by the stream from the upper catchment

(d) Ensure adequate drainage from the Clem Elliott area during periods of significant runoff

(e) Upgrade transport corridor bridges

(f) Complete the clearance of debris deposited in the Clem Elliott area in the 2005 event.

10.12. This was an integrated strategy with various elements throughout the Awatarariki catchment and on the fanhead. Part of the overall strategy was to construct a debris detention structure upstream of the railway to stop most of the larger debris material. However, at the time of a future event there would still be significant water and finer debris material conveyed downstream past any detention structure.

10.13. The associated downstream works for the stream and lagoon floodway were designed to convey the estimated peak dilute flow component of the 2005 event (i.e. excluding gravel sized or larger sediments). This was equivalent to 150 % of the theoretical 100 year flood flow from the catchment.

10.14. This was the strategy that underpinned more detailed investigations for consent applications and detailed design of the works that followed. As the investigations proceeded and further information was obtained, the concept of the debris detention structure in the catchment upstream developed from a dam structure to a flexible "ring net" barrier. Mr Hind outlines this in more detail in his evidence.

11. RESPONSE TO SUBMISSIONS

11.1. I have reviewed the submissions from the Awatarariki Residents Society and Mr Keith Sutton as they relate to my evidence. In my view the matters raised therein are appropriately addressed in the evidence of Professor Davies others.

12. CONCLUSION

12.1. In the three month period following the May 2005 debris flows considerable expertise and effort was focussed on information gathering and various technical analyses to identify options for the Whakatāne

District Council and Matatā community to consider a strategy to manage future debris flow risk.

12.2. The summary of these investigations as reported in the Preliminary Infrastructure and Planning Options Report prepared by T+T, and presented by me to Council and the community in August 2005, followed an earlier presentation of the GNS assessment of the debris flow causes and mitigation suggestions at a public meeting in June 2005.

12.3. I consider that the early investigations commissioned by Whakatāne District Council provided a sound basis for assessment of the options available to the community to understand the hazard and to determine the risk.

12.4. Following Council's decision on the preferred approach, the more detailed investigations and detailed design work of various risk management infrastructure components in the Awatarariki catchment that followed were based on the outcomes as reported in the Preliminary Infrastructure and Planning Options report prepared by T+T for Whakatāne District Council.

Tom Bassett

15 January 2020