BEFORE A BOARD OF INQUIRY
MACKAYS TO PEKA PEKA EXPRESSWAY PROPOSAL

UNDER	the Resource Management Act 1991
IN THE MATTER OF	applications for resource consents and a notice of requirement in relation to the MacKays to Peka Peka Expressway Proposal
BY	New Zealand Transport Agency

STATEMENT OF EVIDENCE OF ASSOCIATE PROFESSOR RUSSELL GEORGE DEATH ON BEHALF OF THE KĀPITI COAST DISTRICT COUNCIL

Freshwater ecology

DATE: 5 October 2012

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1. INTRODUCTION

1.1 My full name is Russell George Death.

1.2 I am an Associate Professor in Freshwater Ecology in the Institute of Natural Resources – Ecology at Massey University where I have been employed since 1993. Prior to that I received a Doctor of Philosophy in Zoology from the University of Canterbury (1991) and was a Foundation for Research, Science and Technology postdoctoral fellow at Massey University (1991-93).

1.3 I have been a Quinney Visiting Fellow at Utah State University. I am a member of the Ecological Society of America, British Ecological Society, New Zealand Ecological Society, the New Zealand Freshwater Sciences Society and the North American Benthological Society. I have refereed scientific manuscripts for seventeen scientific journals and several books. I am on the editorial board of the journal *Marine and Freshwater Research*. I have been commissioned by a number of governmental and commercial organisations to provide scientific advice on matters related to the management of freshwater resources.

1.4 I have had twenty two years' experience in professional ecology research, teaching and management. My area of expertise is the ecology of stream invertebrates and fish. I have 80 peer-reviewed publications in international scientific journals and books, including a number of invited reviews. I have written more than 40 consultancy reports and given over 60 conference presentations. I have been the principal supervisor for 38 post-graduate research students. I have been researching the invertebrates, periphyton and fish of the lower North Island streams and rivers for the past eighteen years.

1.5 I visited many of the streams, rivers and drains potentially affected by the MacKays to Peka Peka Expressway on 13 September 2012.

1.6 I am authorised by the Kāpiti Coast District Council (**Council**) to present this evidence on its behalf.

1.7 I have read and am familiar with the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2011. I agree to comply with that Code. Other than where I state that I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

2. SCOPE OF EVIDENCE

2.1 My evidence will cover:

(a) supported aspects;
(b) consideration of stream ecology;
(c) stream diversions; and
(d) effects on the Waikanae River.

3. EXECUTIVE SUMMARY

3.1 Most of the streams and drains in the vicinity of the proposed MacKays to Peka Peka Expressway (**Expressway**) have low to moderate ecological condition, which does not mean some do not have high ecological value. The exception is the Waikanae River which has high ecological condition and value.

3.2 In my opinion, the assessment and evidence provided for the New Zealand Transport Agency (**NZTA**) fails to give enough consideration to the extremely high quality biological communities upstream of the proposed expressway. Any sediment or chemical discharges during migration of fish to the headwater communities has the potential to cause significant adverse effects on these communities.

3.3 Invertebrate biodiversity has not been assessed in any of the waterbodies. Given the large number of wetlands and seepages in the region it is highly likely there are threatened and endangered freshwater invertebrates present in the surrounding area and footprint of the Expressway.

3.4 It is unclear from Technical report 30 (pages 9-12), but it seems that macrophyte, algal and bryophyte biodiversity of the wetlands and waterbodies of the expressway footprint and surrounding localities has not been assessed or reported in enough detail.

3.5 Native fish biodiversity at the Expressway site locations has been given modest consideration, but the potential impact on and/or mitigation of effects on the quality of the high value trout fishery in the Waikanae River does not appear to have been considered. High biodiversity value native fish caught by trapping (e.g., Short aw and Giant Kokopu) seem to have been ignored.

3.6 Increased deposited and suspended sediment from the construction work for the Expressway are the major environmental changes that have potential to cause significant adverse ecological effects.

3.7 In my opinion not enough safeguards have been put in place to monitor and respond to deposited and suspended sediment levels in the waterways as a result of the Expressway works.

3.8 Some of the statements presented by Boffa Miskell Ltd (**Boffa Miskell**) are, I believe, incorrect, for example that some level of sediment can be good for stream ecology, that sediment does not kill organisms, that Short Jaw Kokopu do not occur at these sites, and that trout are universally detrimental to biodiversity, as outlined further below. These comments undervalue the overall biodiversity value of the sites, the value of trout, and the significant adverse effects even small levels of sediment can have. This creates a level of uncertainty around material that cannot be verified (e.g., what species of fish were collected) that causes me concern about how reliable the assessments are.

3.9 Ecological condition/sediment monitoring for its own sake is not worthwhile as proposed by NZTA. However, if ecological measures or sediment changes by more than 20% of that upstream, conditions should require that works cease until suitable steps can be put in place to mitigate such changes. There should also be a well-coordinated, resourced and documented fish rescue plan.

3.10 The Waikanae River has both a high ecological condition and value. In particular, trout in the Waikanae River play an important role in maintaining the functioning of the ecosystem of the river, and act as a sensitive indicator of effects on declining water quality that in turn can be detrimental to indigenous species. The proposed expressway will potentially increase the sediment levels of the Waikanae River. Because trout can be especially sensitive to increased sediment, the proposed expressway may have a significant adverse effect on the trout fishery of the Waikanae River and the ecosystem of the river as a whole.

3.11 I have recommended several changes to the designation/resource consent conditions to address the matters raised in my evidence. Details of these changes are provided below at paragraphs 5.14, 6.15 and 7.7.

4. SUPPORTED ASPECTS

4.1 I concur with the view of Boffa Miskell that the streams and drains (excluding the Waikanae River) in the area of the Expressway represent habitats potentially of low to moderate ecological condition overall. That is, there is low fish diversity, and macroinvertebrate communities are dominated by low water quality tolerant species. This is not surprising for streams and rivers in this urban and/or agricultural area of New Zealand (Death and Joy 2004). This is not to say that rivers such as the Wharemauku Stream and Whareroa Tributary do not have high native fish value. For example, the presence of one threatened species such as Giant Kokopu represents a high value but does not mean the stream has good ecological condition.

4.2 I agree that the Waikanae River has high ecological value and condition, and that the Wharemauku Stream and Whareroa Tributary should rank as high/moderate ecological value (although condition may be low). This seems consistent with the Greater Wellington Regional Freshwater Plan (**RFWP**) descriptions of these waterways.

5. CONSIDERATION OF UPSTREAM ECOLOGY

5.1 Technical Report 30 produced by Boffa Miskell Ltd is difficult to follow in places because of the way it is written, and it contains a number of factual errors that make objective assessment of the material difficult. Some of the errors do not directly affect the conclusions of their report (although they create an overall level of uncertainty) and will not be discussed further. Others are dealt with directly in my evidence.

5.2 Technical Report 30 fails to highlight the very high ecological values of many of these waterways further upstream in the foothills of the Tararua Ranges. This is of particular concern for freshwater fish, many of which in New Zealand are migratory, spending part of their life in freshwater and part in estuaries or the ocean (McDowall 1990, 1993, Joy et al. 2000, Joy and Death 2001, Leathwick et al. 2008). Physical disturbance of the stream bed or discharge of sediment or chemicals into receiving waterways during this migration time may pose a significant adverse impact to fish upstream (Rowe and Dean 1998, Richardson et al. 2001) and thus on the ecological integrity of the wider ecosystem. Many of these fish communities are likely to be stressed already by the effects of eutrophication, sedimentation and predation from introduced fish (Joy 2009).

5.3 Dr Keesing in response to concerns raised in the Council's submission (SOE 196-201) acknowledges the issue of fish passage to headwater catchments. He lists measures to avoid any adverse effects which are helpful, but I recommend adding trigger levels of turbidity for cessation of works at other times (see below) and refer to Hamer 2007 for the timing of whitebait migrations.

5.4 Boffa Miskell's perception of low ecological condition of the waterways in the region of the Expressway should not be seen as evidence that preventing significant adverse ecological effects is not important. Low ecological condition does not mean that a waterway has low ecological value; a number of threatened fish species such as Giant Kokopu (which has a high ecological value) can live in low condition waterways. This in turn may impact on upstream catchments, as fish, invertebrates and flora in these regions may all act as colonists for upstream. A degraded ecosystem is not a license to degrade it further. In addition, the high ecological condition of the upstream catchment might be affected by barriers to migration of fish (such as the Expressway) from the marine or estuarine environments, from the Expressway. This should also be considered, and any potential upstream effects mitigated.

5.5 It is of concern that Boffa Miskell staff only appear to have used electrofishing to assess river and stream fish assemblages. For some fish species (e.g., Short Jaw Kokopu, Giant Kokopu) electrofishing is not an appropriate sampling method. It is thus difficult to know if the fish are really absent from those sites, or were simply not caught because the wrong technique of sampling was used. They have been seen in these streams by others (Mike Joy, Massey University, personal communication). I therefore do not believe it is appropriate for Dr Keesing to place weight on the fact that these species were not found during the survey and therefore exclude them from his assessment of values for mitigation. This is of particular concern as both Kokopu species are of significant conservation status and a finding that they were not present significantly lowers the biodiversity value of these streams. Furthermore, it is highly likely many of these populations are interconnected and may act as sources or sinks for communities further upstream.

5.6 Table 4 of Dr Keesing's evidence is in my opinion a more accurate representation of the ecological value of each of the waterways in the scheme potentially affected by the expressway based on the data collected by Boffa Miskell. However, I still have major concerns (see below) that the biodiversity values of these waterbodies have not been appropriately assessed, and this in turn may mean the ecological valuation of Table 4 is not accurate.

5.7 Two stated goals of Technical Report 30 (at page 9) were to: "Identify rare and threatened species within waterways" and to "Allow an evaluation of the conservation/regional significance (value) of the species/communities and habitat present". In my opinion, this has not been done adequately, especially for invertebrates.

5.8 The invertebrate sampling and processing protocols adopted will not meet either of the above stated goals. The 'C2' / MCI approach used evaluates water quality based on biology and is not appropriate for the stated biodiversity assessment goals. Again it is difficult to know without appropriate sampling how this will impact on upstream communities.

5.9 For the identification of crustacea the authors would need to reference Chapman et al. 2011. For the identification of Mollusca they would need to reference Haase 2008.

5.10 For appropriate sampling of insect biodiversity, the collection of adult life forms would be necessary. An example approach for this can be found in the NIWA work around the proposed Mokihinui Dam study, where instream sampling found no taxa of conservation status but very limited adult sampling found a large number of rare and endangered taxa (Suren and Kilroy 2007). Again starting on page 50 of Technical Report 30 there is considerable discussion of invertebrate species richness and composition of the streams and drains. However, this is not an appropriate way to assess biodiversity given that only the juvenile stages of aquatic invertebrates were sampled. Boffa Miskell has not considered aquatic invertebrate biodiversity at all.

5.11 In my opinion, the lack of evaluation of invertebrate biodiversity is a major oversight given the large number of wetlands and seepages in the region. These habitats have been shown to have unique and often threatened taxa in other parts of New Zealand (Collier and Smith 2006, Suren and Kilroy 2007). Without this knowledge it is difficult to predict the effects on upstream communities.

5.12 On page 11 of Technical Report 30 the authors state there was not enough water for sampling invertebrates in the wetlands. Usual practice would have been to return at a more suitable time to sample, but this did not occur.

5.13 It is stated in report 30 that macrophyte and periphyton were recorded. However, it is not stated whether there were any of conservation value or whether bryophytes were also assessed. Given the spring-fed nature of many of these waterbodies it seems likely that rare and/or threatened bryophytes may occur here. One has been found in similar urban waterways in Masterton (Perrie 2010). On page 12 of report 30, mosses and liverworts are mentioned (these are bryophytes), but they are listed under macrophytes and periphyton. This is confusing. It is not clear whether bryophytes were assessed. Again, without this information it is difficult to know how upstream communities may be affected.

5.14 In relation to the points raised above, in my opinion:

(a) From data in Technical Report 30 and the RFWP I would judge that the Wharemauku Stream, Whareroa Stream/tributary and Waikanae River should all rank as of "significant" fish value.

(b) Conditions should be included to prevent or reduce migration barriers from chemical or sediment discharge to waterbodies during construction. This should include a requirement that no works take place during whitebait migration times (see Hamer 2007). There should also be no greater than 20% change in visual clarity to any receiving waterbody at other times. This should be assessed with continuous turbidity meters upstream and downstream of any activities affecting waterbodies.

(c) Invertebrate biodiversity of the expressway footprint and locality needs to be assessed properly (e.g. sampling of adult insects, sampling seepages, use of most recent keys) and the consequences for upstream communities evaluated. I consider that the conditions should require the development and implementation of suitable mitigation for the potential loss of any threatened taxa that are identified.

(d) Macrophyte, algal and bryophyte biodiversity of the expressway footprint and surrounding localities needs to be assessed correctly (e.g. a clear list of taxa found and their conservation status need to be provided) and the consequences for upstream communities need to be evaluated. The conditions should require the development and implementation of suitable mitigation of the potential loss of any threatened taxa (e.g. protection of micro-habitats, relocation of taxa, culturing of particular taxa).

(e) From the results of conducting actions c) and d) it may also be necessary to ensure that a no more than 20% change in deposited sediment occurs at places in the scheme. This can be assessed with quorers upstream and downstream.

6. STREAM DIVERSIONS

6.1 Proposed waterway diversions do offer the potential opportunity to improve the ecological condition/value of some of the streams and rivers affected by the Expressway. However, this will need to be conducted appropriately, particularly with regard to deposited sediment. Many of the stream segments targeted for movement have high levels of deposited fine sediment. Measures will need to be put in place to ensure that large sediment slugs do not end up in larger receiving waterbodies as these can have more detrimental effects than the constant slow release over a long time period of the same volume of sediment (Death et al. unpublished). Furthermore, a recovery plan for fish trapped in dewatered stream sections will also need to be instigated.

6.2 With respect to the ecological valuations, the Wharemauku Stream, Whareroa Stream/tributary and Waikanae River should all rank as of “significant” value. Such a ranking would be consistent with the RFWP and personal communication with Mike Joy.

6.3 Generally, planned restorations of waterways to compensate for potential adverse effects on streams and rivers is an appropriate response. The types of watercourses proposed on NZTA's maps are as follows:

(a) Type A: New diversions

(b) Type B: Bank modifications to existing watercourses to facilitate overflow into flood storage areas or to provide additional flood capacity to offset the effects of the planting; and

(c) Type C: Other diversions and connecting drainage swales without a specific ecological focus.

6.4 Types A and B both provide ecological offset. There is no difference between them in terms of ecological offsetting.

6.5 However, the targets of those restoration activities need to be considered carefully and my assessment of these differ from those originally proposed. See below for details of my comments:

(a) South of Poplar – Not suitable as ecological offset because water quality issues (stormwater of road & railway); not great potential for ecological benefits.

(b) Drain 7 north of Leinster Ave – okay.

(c) Drain 7 north of Rata Rd – looks good.

(d) South of WWTP drain – this drains the water treatment plant and any mitigation would be redundant.

(e) Muaupoko Stream south of Waikanae River – looks okay as mitigation for Muaupoko.

(f) South west of Te Moana interchange – looks okay.

(g) Kakariki stream – looks okay.

(h) Smithfield /Nga Manu – improvement on original proposal, but reservations about suitability, appropriateness for offsets.

(i) Greenhill road – looks okay.

(j) South of Peka Peka interchange – probably not great ecological benefits but okay. Question remains about whether NZTA should be doing this anyway.

(k) Peka Peka interchange – looks okay.

6.6 My biggest concern in the expressway construction is an increase in deposited sediment through stream diversions and other works in and around streams. Deposited sediment can smother animals directly (Fig. 1A and 1B) and/or motivate them to leave. It can also smother and bind with the periphyton on rock surfaces that is the food for many aquatic invertebrates, and lower the nutritional quality of this food. It fills in the interstitial spaces between rocks (Fig. 1C) where many of the fish and invertebrates live during the day (most are nocturnal) or during flood events. Stream invertebrates and many fish (e.g., eels) can live a metre under the stream bed if there are suitable interstitial spaces (Williams and Hynes 1974, Stanford and Ward 1988, Boulton et al. 1997, McEwan 2009).

Figure 1A. Koura struggling in deposited sediment.

Figure 1B. Banded Kokopu struggling in deposited sediment.

Figure 1C. Stream substrate with interstitial spaces partly clogged with deposited sediment.

6.7 I disagree with Dr Keesing's assessment of adverse effects in paragraph 96 of his evidence. Works on the Waikanae River and diversion of the Muaupoko Stream will, I believe, represent potentially significant adverse ecological effects. The Muaupoko

Stream has a thick sediment laden substrate. I would expect the diversion of this stream to lead to dramatically increased sediment levels in the Waikanae River. Similarly, the diversion of the Wharemauku Stream (again with a high sediment laden stream bed) may also result in dramatically increased deposited sediment layers and a decline in ecological condition/value.

6.8 It is incorrect to suggest that sediment input into waterways is needed to maintain ecological integrity (Keesing SOE 100), that TSS (Keesing SOE 101) rarely kills fauna or that slowly accumulating sediments are managed by the biota (Keesing SOE 102).

6.9 Deposited sediment, and to a lesser extent suspended sediment are the major detrimental ecological drivers for stream ecological condition in this region of New Zealand (Clapcott et al. 2011a, Clapcott et al. 2011b, Schallenberg et al. 2011, Clapcott et al. 2012, Collier et al. in press). Increased levels of suspended and deposited sediment can have dramatic effects on stream ecosystems. Increased sediment loads can:

(a) smother natural benthos;
(b) reduce water clarity and increase turbidity;
(c) decrease primary production because of reduced light levels;
(d) decrease dissolved oxygen;
(e) cause changes to benthic fauna;
(f) kill fish;
(g) reduce resistance to disease;
(h) reduce growth rates; and
(i) impair spawning, and successful egg and alvein development.

(Ryan 1991, Waters 1995, Matthaei et al. 2006, Townsend et al. 2008, Clapcott et al. 2011b, Collins et al. 2011).

6.10 In my opinion, measures need to be put in place to reduce deposited sediment (measured with Quorers) to a level not greater than 20% higher than that upstream in the waterways. Suspended sediment (measured with turbidity loggers) should not be greater than 20% higher than that upstream.

6.11 I am not convinced that the adverse ecological effects in many of the affected waterways will be low (Keesing SOE 109). In some cases I believe the stream works have the potential to cause significant adverse ecological effects even though many of the waterbodies have been classed as of “low” ecological condition. This relates particularly to the potential for large increases in deposited and suspended sediment and the potential loss of habitat for pool dwelling fish such as Short Jaw and Giant Kokopu. This is of concern so as to prevent worsening ecological condition at directly affected Expressway sites and at linkages with upstream communities.

6.12 I am also unsure how the ECR can be 1:0.99 if a large sediment slug is introduced to a waterway and/or individual threatened fish are killed in pools (Keesing SOE 112). In my view this undervalues the mitigation needed to compensate for the potential adverse effects.

6.13 Table 10 (Keesing SOE) mentions fish rescue but there do not seem to be any details provided in relation to this. Details are needed, including specifics of who will do this fish rescue. Previous experience with such plans is that they have resulted in very last minute calls for help as the fish lie dying in the drying stream bed. Fish rescue, particularly for many of these threatened fish needs to be detailed in a well-coordinated, resourced and documented plan.

6.14 It is also unclear how the sediment and macroinvertebrate monitoring protects ecological condition/value. Resource consent conditions detailed in paragraph 6.15 below need to be adopted to ensure this monitoring is effective in its achieved outcomes.

6.15 NZTA's proposed adaptive management approach lacks detail and is therefore difficult to comment on. I have therefore endeavoured to provide practical solutions to the issues I have identified above. In relation to those issues, I recommend the following:

(a) I am not sure what can be done about the potential for sediment slugs, but I recommend that further consideration is given to this issue, backed up by a requirement to develop and implement mitigation measures.

(b) Resource consent conditions are required to prevent a greater than 20% change in visual clarity to any receiving waterbody and/or no more than a 20% change in deposited sediment levels. These should be assessed with continuous turbidity meters (water clarity) and quorer sampling (deposited sediment) upstream and downstream of any activities affecting waterbodies. Instream activities should be restricted during critical times in fish life history (e.g., whitebait migrations; see Hamer 2007).

(c) In the ecological freshwater monitoring plan more emphasis is required on monitoring any changes in suspended or deposited sediment and a response if there is a greater than 20% change. This would improve my confidence in the ability of the adaptive management regime to produce suitable ecological outcomes.

(d) There also need to be details of how collected data will be analysed and what actions will be taken if adverse effects are identified. It is not worthwhile calculating MCI or QMCI metrics to assess sediment effects (they are not designed or appropriate for monitoring such effects). Rather appropriate multivariate analysis (e.g., Permutation Analysis of Variance (Anderson 2001)) should be used.

(e) There needs to be a documented fish rescue plan, allocating clear responsibilities for fish rescue.

(f) Suspended and deposited sediment samples at all sites need to be monitored during works (see above for methodology). If suspended or deposited sediment exceeds 20% of that upstream, works should cease until measures can be put in place to mitigate the effect to below the 20% change.

7. EFFECTS ON THE WAIKANAE RIVER

7.1 I disagree with Dr Keesing's assessment of adverse effects in paragraph 96 of his evidence. Works on the Waikanae River and diversion of the Muaupoko Stream will, I believe, represent potentially significant adverse ecological effects. The Muaupoko Stream has a thick sediment laden substrate. I would expect the diversion of this stream to lead to dramatically increased sediment levels in the Waikanae River.

7.2 The ecological condition and value of the Waikanae River is high for both indigenous and introduced biota. Resource consent conditions should be instigated to ensure these are maintained. The principal effects of the Expressway will be increases in sediment. Conditions should be included to prevent or reduce migration barriers from chemical or sediment discharge to waterbodies during construction. This should include a requirement that no works take place during whitebait migration times (see Hamer 2007). There should also be no greater than 20% change in visual clarity to any receiving waterbody at other times. This should be assessed with continuous turbidity meters upstream and downstream of any activities affecting waterbodies. There should also be a no greater than 20% increase in deposited sediment levels over those downstream. These should be assessed with continuous turbidity meters (water clarity) and quorer sampling (deposited sediment) upstream and downstream of any activities affecting waterbodies.

7.3 Maintenance of the trout fishery in the Waikanae River is important to maintaining ecosystem functioning of this river in its current high ecological condition and continuing to provide recreational angler opportunity to locals. Furthermore, protection of ecological conditions suitable for trout will in turn preserve environmental conditions that a number of indigenous organisms also require. Thus, although it is not always the case, in the Waikanae River trout are useful indicators of any potential impacts on the quality of the river and any potential impacts on indigenous species, as discussed below.

7.4 Although the presence of trout is acknowledged in streams and rivers of the region (Technical Report 30) there appears to have been little regard given to the importance of the Waikanae River as a trout fishery. Of all the rivers monitored by Wellington Fish and Game in the lower North Island the Waikanae is amongst the best with up to 20 trout per km in the area of the Expressway and it provides a great opportunity for local fisherman. It is incorrect of Dr Keesing (146) to state that trout are “generally” held to be adverse to indigenous biodiversity. In addition Salmonids are specifically referenced in the RMA and should be given careful consideration in regards to any potential Expressway effects on the Waikanae River.

7.5 Trout can be especially sensitive to an increase in suspended and deposited sediment. They require cold, well oxygenated water with low sedimentation levels. This is especially important during the trout spawning period, where cold, well oxygenated water and gravels and minimal sedimentation are essential to spawning success and egg survival. Direct impacts include:

(a) mechanical abrasion to the body of the fish and more significantly its gill structures,
(b) death,
(c) reductions in growth rate,
(d) lowered resistance to disease,
(e) prevention of successful egg and larval development, and
(f) impediments to migration.

Indirect impacts include:

(a) displacing macroinvertebrate communities that provide food, and

(b) reducing visual clarity so finding prey is more difficult.

(Peters 1967, Acornley and Sear 1999, Argent and Flebbe 1999, Suttle et al. 2004, Hartman and Hakala 2006, Fudge et al. 2008, Scheurer et al. 2009, Sternecker and Geist 2010, Collins et al. 2011, Herbst et al. 2012).

7.6 Trout are also visual feeders, thus any increase in suspended sediment or corresponding reduction in water clarity reduces their ability to feed efficiently. The reduced water clarity results in visual feeding fish spending more time and energy foraging which in turn reduces growth rates, general heath, and causes potential reductions in reproductive fitness (Kragt 2009).

7.7 In my opinion, mitigation measures need to be developed with Wellington Fish and Game and Greater Wellington Regional Council around minimising the impact to trout and indigenous organisms during construction. This relates to sediment deposition and increased turbidity in particular. The conditions should require no greater than 20% change in visual clarity to any receiving waterbody during works and no greater than 20% increase in deposited sediment at the conclusion of all works.

7.8 Mitigation measures also need to be coordinated with the Greater Wellington Regional Council flood control team to ensure that sediment levels in the Waikanae River do not increase and geomorphological (natural) character is not altered.

8. CONCLUSION

8.1 Most of the streams and drains in the vicinity of the Expressway have low to moderate ecological condition, although some have high native fish value. The exception is the Waikanae River which has high ecological condition and value.

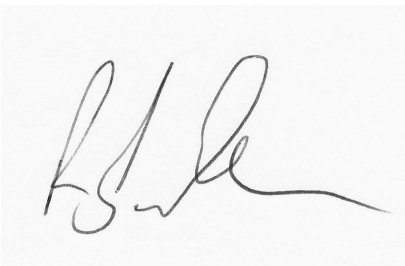
8.2 In my opinion, Dr Keesing’s evidence gives insufficient consideration to the extremely high quality biological communities upstream of the Expressway. Any sediment or chemical discharges during migration of fish to the headwater communities has the potential to cause significant adverse effects on these communities. I consider that protection thresholds for turbidity need to be adopted and works restricted to outside whitebait migration times (Hamer 2007).

8.3 Invertebrate biodiversity has not been assessed in any of the waterbodies. Given the large number of wetlands and seepages in the region it is highly likely there are threatened and endangered freshwater invertebrates present in the surrounding area and footprint of the Expressway. This could be addressed by sampling seepages, still water habitats and adult insects and by considering the implications for upstream communities.

8.4 It is unclear from the NZTA Technical Report, but it seems that macrophyte, algal and bryophyte biodiversity of the wetlands and waterbodies of the expressway footprint and surrounding localities has not been adequately assessed or reported. These taxa and their conservation status need to be gathered or provided.

8.5 Native fish biodiversity at the Expressway site locations has been given modest consideration, but the potential impact and/or mitigation on the quality of the high value trout fishery in the Waikanae River does not appear to have been considered. Surveys for Short Jaw and Giant Kokopu need (or a collection of observations needs) to be made. Resource consent conditions to avoid adverse effects on the Waikanae trout fishery and fishing (e.g., minimisation of sediment discharge) need to be put in place.

8.6 Increased deposited and suspended sediment are the major environmental changes of ecological concern that may arise from the construction work for the Expressway. I do not believe adequate measures/re-actions have been put in place to monitor and respond to deposited and suspended sediment levels in the waterways as a result of the Expressway works. If ecological condition or sediment changes by more than 20% of that upstream, works should cease until suitable steps can be put in place to mitigate such changes.



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5 October 2012

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