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MEMORANDUM

TO Andrew Dooney | Greater Wellington Regional Council
FROM Shelley McMurtrie | EOS Ecology

Audit of the Greater Wellington Flood Protection Department Hutt River global consent application
EOS Job No: 13032-WRC01

Dear Andrew,

Please find below my review of the ecology components of the Greater Wellington Regional Council Flood Protection Department's application for a global consent for flood protection and maintenance activities in the Hutt River and lower portion of four tributary waterways. This most specifically relates to the supporting ecology AEE report (Cameron, 2103) and the ecology sections of the consent application document (Tonkin & Taylor Ltd., 2013), including appendices.

It is my understanding that the consent application is for the following waterway sections, and these are the areas that I refer to in my review:

- Hutt River (from Estuary Bridge upstream to the eastern end of Gillespies Road subdivision at Birchville)
- Stokes Valley Stream (the lower 1.6 km of stream, from the confluence with Tui Glen Stream to the Hutt River)
- Akatarawa River (the lower 100 m of stream)
- Te Mome Stream (the entire length of stream)
- Speedy's Stream (limited to maintenance of the debris arrestor approximately 400 m upstream of the Hutt River confluence)
- Lower Opahu Stream (an isolated arm of the lower Hutt River).

1 STATE OF THE ENVIRONMENT AND ASSESSMENT OF EFFECTS SECTIONS

"Your opinion on the appropriateness of the ecology effects assessment in the applicants report."

"A review of the ecology effects assessment and the validity of the conclusions reached."

1.1 GENERAL COMMENTS

The ecology report titled 'Effects of flood protection activities on aquatic and riparian ecology in the Hutt, Waikanae, Otaki and Wainuiomata Rivers' by Cameron (2013) (referred to in this review as the 'ecology AEE report') appears to be for a wider number of consent applications than the one that forms the basis of this review (which is limited to the Hutt River and four of its tributaries). It makes the report difficult to follow as there may be some sections that are not relevant to the current consent application. The report also notes for other sections (e.g., Section 3.2: Waikanae River, Section 3.3: Otaki River) that they are "to be completed at a later date and will be updated when the [relevant application] is submitted". I find it unusual to therefore submit what is effectively a draft or unfinished report for use in a resource consent application. It would be far more appropriate to produce an ecology AEE report that is specific to the resource consent application that it is being submitted, and produce separate reports for later resource consent applications that cover other areas.

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In general I found the ecology AEE report to be 'muddled', with information included that is not relevant to the current consent application, other information missing that would be expected to be included, and the order of the report hard to follow (e.g., sections that were relevant to the assessment of effects section were actually placed before the state of the existing environment section). There was no overview map included in the report to show the area relevant to the application, and no map showing the location of existing environmental data and how it relates to the scope of the application. It was therefore difficult to ascertain whether some of the ecological and physico-chemical data provided was for the affected reach or not. In several places the author quoted or summarised values that were not adequately referenced - I would prefer to see this data summarised in table form so that the reader can see the relationships and form their own opinions – otherwise there is no ability to check the validity of the statements. The report did not properly characterise the ecological community of the affected reach or adequately compare it within the wider ecological setting of the area, and failed to include any information on tributary systems that form part of the consent. The reference list was not in alphabetical order (which made it more difficult to check for references) and other key references referred to in the report were not included in the reference list (which made it impossible to check the validity of the information). These are dealt with in further detail below.

1.2 STATE OF THE EXISTING ENVIRONMENT

Without an overview map showing the area covered by the consent application and the location of sites where physicochemical or ecological data is available it is hard to ascertain whether the information available on which the author made the assessment of the existing environment is within or outside of the affected area. The report should identify and characterise the river within versus outside of the affected areas.

I do not feel that the report has achieved the requirement of an Assessment of Environmental Effects report, which is to adequately characterise the environment and set it within the context of the wider area (local and regional). Reference on page 1 (Section 2.1: 'Environmental Investigations: Background Environmental Monitoring' section) of the ecology AEE report indicates that there could be a reasonable amount of data available with which to characterise the affected reach, but this does not appear to be used to good effect in the report. This section indicates a reasonable search of existing data has been undertaken, with reference to several years of invertebrate and periphyton data collected by GWRC, and a large amount of fish data available via the New Zealand Freshwater Fish Database (NZFFD). However, the author does not appear to access this data to describe the current condition of the habitat. There also appears to have been a large number of habitat, fish, trout, and macroinvertebrate surveys undertaken by GWRC as part of 'before' surveys for a gravel abstraction study in the Hutt River (referred to by the author in the preceding 'Environmental Investigations' section). While the findings of the fish and invertebrate surveys are not yet available, the raw data could have been used by the author to characterise the existing ecological state of the environment – yet this was not done, nor was there any comment about this data not being accessible due to some form of data moratorium. Consequently the report provides very little information on the composition of the fish, invertebrate, macrophyte, periphyton, or bird life. The particularly short overview summaries (averaging two paragraphs) that are included for each of these ecological criteria does little to adequately characterise the aquatic environment, nor does it adequately set the aquatic system within the wider local and regional context. For example:

- The aquatic invertebrate section consists of two paragraphs in which the species names of the dominant fauna, biotic indices, and any reasonable description of the fauna is completely lacking. There is no associated table that summarises community composition or compares community composition with other areas outside of the affected reach to set the community within a wider context.
- The fish data that is provided in this section appears to be records from the whole of the Hutt River (which is over 50 km long with varied habitat types) and thus are not specific to the affected area. While there appears to be a large amount of data available there is no information presented on the relative abundance of the species or a differentiation between the most widely distributed species and the most abundant (these are not always synonymous). In the previous section (Section 2.2.4) the author talks at length about most surveys in the Hutt River using electrofishing methods which could skew the data for some species, but this information would still be preferable to the complete lack of data in the report. In addition, as shallow riffle habitat does form the main part of the Hutt River morphology, electrofishing would still be the most suitable technique to survey that habitat type. Many of the species that inhabitat these shallow riffle/run habitats (bluegill bullies, juvenile bullies, torrentfish, juvenile eels) would not be caught in fyke nets. Just as important a consideration as sampling technique is the time of year that fish surveys are undertaken, as some species (inanga, adult lamprey, salmon) are only likely to be caught at certain times of year. If there was particular concern about a possible sampling bias than a simple habitat mapping exercise could have been undertaken to

characterise the length of wadeable habitat vs non-wadeable habitat in the river to better ascertain the bias.

- There is no information on inanga spawning (despite the saltwater wedge being within the affected reach) or on brown trout spawning sites; both of which could be adversely affected by flood protection activities.
- The only bird that is listed (pied stilt) is misclassified as 'Nationally Vulnerable' when it is actually 'At Risk – Declining' (Miskelly et al., 2008), while seven other 'at risk' or 'Nationally Vulnerable' species found in the affected reach are not included (cf Table 14 of the consent application).
- There is no information on aquatic plants- nor even a statement saying that there are no aquatic plants within the project area (although this would not be the case for the tributary waterways.
- Finally there is no ecological information of any kind provided for the tributary waterways within the affected area. Where data may have been lacking, such as for the tributary waterways, the Freshwater Ecosystems of New Zealand (FENZ) geodatabase should have been used to obtain predictions of invertebrate and fish community composition (Leathwick et al., 2010).
- Some water quality data is presented for the Hutt River (Table 3.1 of the ecology AEE report), but given the reference in the consent application that sediment-derived effects are 'likely to occur at times of low flow when the suspended solid load of the river is also low' it would be more relevant to present the water quality data for base flow versus flood/rain event flows. Section 2.2.1 of the ecology AEE report refers to suspended sediment loads in the river during 'large' and 'small' flood events, but does not provide any data to quantify the size (discharge) of these events in comparison to base flow conditions.

There is actually more information on water quality and the composition of fish, invertebrate, periphyton, and bird communities in the actual resource consent application than there is in the ecology AEE report. It is commendable that the authors of the resource consent application realised that more information was required and went about sourcing this information. However, they should have been able to source this information from the ecology AEE report – typically the ecology AEE report is a comprehensive report, from which the authors of the resource consent application can then summarise the overall conclusions and findings.

1.3 ASSESSMENT OF EFFECTS

Determining the potential adverse effects of any proposed activity must first be premised against a sound understanding of the state of the existing environment. As I have noted in Section 1.2 of this review, I do not believe that the ecology AEE report has adequately characterised the existing state. I have therefore had to use my own knowledge of the Hutt River based on a wider dissemination of reports on this system within the affected reach to adequately answer this question.

The Hutt River is essentially a freely meandering channel that has now been straightened and confined to one side of its valley, and where floods events define the form of the low flow channel, which can dramatically shift and reform during large flood events. In a natural situation the lower flood plain area of such a river system would be particularly wide and allow for the natural aggradation and erosion of gravels across the flood plain. The biota that inhabits such systems are those that are naturally resistant or resilient to such regular flood disturbance. Past development of the Hutt River catchment has resulted in a river channel that is now clearly defined between two stop banks, that has severed the connection between the river and its wider floodplain. This is a process of development similar to in other areas of New Zealand (e.g., the Waimakariri River, Ashley River etc. in the South Island). The result is a system that must be actively managed to remove aggraded gravel and reduce the flood risk to neighbouring communities. The current state of the Hutt River is therefore one that has already been defined by the 100-odd years of gravel extraction and channel management. Thus it is possible that some of the recommended approaches to the flood protection works may serve to improve the ecology of a river system that has (at least prior to 2006) had an ecologically homogenous environment created as a result of the on going river works.

I found Section 2 (Environmental Investigations) of the ecology AEE report, which preceded the state of the existing environment information, to be more relevant to background information for the assessment of effects section, given that it was specific to investigations on the Hutt River to determine the actual impact of the current gravel extraction activities. The data presented on changes in suspended sediment during gravel extraction and other in-river activities is very useful and appropriate to the assessment of effects section. Most of the findings from this work (with the exception of the suspended sediment, habitat mapping, and trout survey) will not be available until later in the year, and thus are not of use to the current application. The fish data referred to in Section 2 of the ecology AEE report was summarised based on a comparison of fish survey methods rather than relating to the fish community of the affected reach versus areas outside, or findings of the gravel abstraction study. I therefore cannot find the relevance of presenting this information in such a way.

The following are comments on the assessment of effects of each of the defined activities as described in the ecology AEE report and consent application, where my opinion differs to that of the reports.

- Rock riprap lining: The ecology AEE report defines this to have a neutral to negative medium to long-term effect, which I am in agreement with. However the consent application states that riverbanks with extensive rock riprap lining have a 'relatively diverse and abundant fish fauna', although there is no evidence of this finding in the consent application (while the document refers to Section 3.7.3 there is no reference in that section to fish surveys around rock riprap banks). While rock riprap can provide habitat for some fish species, long continuous sections can sometimes create a homogenous habitat that is suitable for only a subset of biota, in comparison to a natural morphologically diverse bank edge. There is also no acknowledgement in either report that a rock riprap treatment is particularly deleterious in inanga spawning reaches. A once productive inanga spawning reach is now all but gone in the Hutt River due to the installation of rock riprap banks in the past (Taylor & Kelly, 2001). I would think that this would be important to note given the huge ecological benefit that could be gained if these riprap walls ever need replacing and a more ecologically sensitive design could be used. This will not be possible if even the consent application or ecology AEE report does not acknowledge the impact of this bank treatment on a culturally significant species.
- Other impermeable erosion protection structures (such as gabion baskets and reno mattresses): Both reports feel that these could enhance channel complexity and create new habitat for fish, which I am not convinced of unless they undergo specialised modification to provide some ecological benefit. If the interstitial spaces in the gabion baskets become filled then they will not provide additional habitat, while the uniform vertical edge will not create a hydraulically diverse habitat or mimic a natural flood bank cross-sectional shape. I would be sceptical as to whether they could provide an ecological benefit to the natural banks that would otherwise occur, or in comparison to other impermeable bank treatment options. However, the fact that they take up such a small area of the whole river length is likely to diminish the overall negative effect on a reach scale.
- Construction of other works outside of the riverbed: the ecology AEE report considers there will be no direct effect on the aquatic ecology from any works on berms and stop banks within the river corridor. I find it surprising that the author has not considered sediment runoff from the exposed areas – any area of exposed earth that slopes to the river or drains to the stormwater network will result in localised runoff of sediment. This can be simply mitigated through proper erosion and sediment control measures, but it is important to acknowledge that sediment runoff will be generated in these areas and so mitigation is required. I note that this has been adequately dealt with in the consent application.
- Maintenance of works outside of the river bed: from what I can gather from information provided in the consent application (page 82) this includes drain clearing (mechanical or hand removal of plants and sediment from tributary waterways) and mowing banks (removal of vegetation outside of the river bed). According to the ecology AEE report such things are not expected to have an impact on river ecology or water quality. Once again, I think there needs to be recognition that these activities will have an impact on the tributary waterways included in this consent application. The use of tractors operating in a channel to mow the banks (e.g., Stokes Valley Stream) will of course have a negative impact on the instream biota. This effect will be greater than the use of machinery in the Hutt River due to the small size of the tributary waterway and the large size of the tractor – meaning that all of the waterway will be affected with little habitat left undisturbed to act as a colonisation source to facilitate recovery. This impact could be partially offset against the potentially suboptimal habitat of this heavily engineered stream with shallow water depth and no stream shading – but this statement cannot be substantiated as the ecology AEE report provided no information on the current ecological state of any of the tributary waterways. Additionally, it must be remembered that degraded reaches can still act as migration pathways for a number of fish species (e.g., banded kokopu, redfin bully, lamprey, eels). I am therefore not convinced of the potential argument that because current management practice may limit the ecological health of a system that the continuation of this management approach is considered acceptable without mitigation. The removal of vegetation and sediment within the Lower Opahu Stream could have significant detrimental effects on inanga spawning. This stream is noted in the consent application as having been created in the past as environmental offsetting for riprap work along the Hutt River (which would have removed any inanga spawning habitat in the mainstem), and it is one of probably only two remaining inanga spawning reaches in the catchment. The potential impacts of channel maintenance at the wrong time of year would be substantial and have severe repercussions to the local whitebait fishery, so I am surprised that this has not even been mentioned in either the ecology AEE report or the consent application.
- Development of vegetative bank protection: the ecology AEE report regards the use of willow planting as bank protection measures as largely beneficial to the environment. Unfortunately the effects of willows on aquatic and riparian habitats is not so clear-cut, with temporal and spatial scales, catchment, geomorphology, and hydrology all influencing the magnitude and direction of the effect on the environment. Studies on the effects of willows on aquatic biota have shown both positive and negative effects (refer to Phillip & Daily 2008 and Wagenhoff & Young 2013 for an overview). When considered against and alternative of

pasture there are some obvious benefits, but when considered against the alternative of native vegetation there are more negative effects. The predominance of negative effects (over positive effects) is also clearly the case for riparian ecosystems. Waterway size and discharge also affects the level of positive versus negative effects, but even in large river systems willows are considered by some as 'invasive ecosystem engineers' (Wagenhoff & Young, 2013). Its ability to encroach into permanently wetted habitats, to form a continuous canopy that replaces native vegetation, and its wide distribution along water bodies throughout New Zealand has led to grey and crack willow being listed by half of the Department of Conservation conservancies as one of ten weed species that have the most environmental impact (Froude, 2002). These pest species are now rarely planted for flood protection measures, and are not used as part of the Hutt River flood management works. The willow sawfly (*Nematus oligospilus*) can cause widespread mortality of willows and is now established in New Zealand, posing a greater risk for river protection works that rely solely on the use of willows rather than a mixed species approach (Phillips & Daly, 2008). This illustrates that the use and effect of willows in riverine systems is a complex issue – it is not as simple as the ecology AEE report implies.

» Channel maintenance - removal of vegetation: the ecology AEE report regards the removal of willows to be detrimental to the ecology at a local scale (as a result of loss of cover for fish) but this does not take into account the detrimental effects that could occur at a reach scale should the willows not be removed: as willows are only removed when they become diseased or damaged, to prevent them from colonising the main channel, or to prevent channel constriction during flood events. Ultimately willows are used along the river as the easiest vegetative means of controlling bank erosion, and they are used over native species because of their quick growth and ability to sprout from stakes. If fish habitat is a key feature that is desired from the use of vegetation along the river then options for native trees and plants should be considered along side the use of willows for erosion protection. This is something that is acknowledged in the consent application on page 108, where it states that the GWRC also undertakes significant planting of native trees along the river corridor in accordance with the Hutt River Environmental Strategy.

» Gravel extraction and bed recontouring: I feel that the coverage of the assessment of effects regarding gravel extraction and bed recontouring is adequate. I also note that while the below-water 'wet' gravel extraction (undertaken to create a more natural riffle-pool sequence) generates more sediment than would otherwise occur if gravel extraction as limited to beach areas (above the low flow channel), there are considerable long-term benefits to such an approach, which ultimately results in a more diverse channel morphology than was resulting from more traditional beach extraction approaches. I agree that the fauna of the Hutt River should be well evolved to cope with the short-term disturbance created by the machinery and sediment release.

2 MANAGEMENT OF POTENTIAL EFFECTS

"An assessment of whether you consider the potential adverse ecological effects can be avoided, remedied or mitigated using the methods suggested in the application report and those mentioned in Cameron 2013."

The consent application notes that the main positive effect is increased security from the risks of flooding and flood damage for the Hutt Valley community. Based on the early development of the Hutt River catchment, the necessity of these on-going river works to reduce flooding risk to this community is clear. It therefore becomes a matter of undertaking these works in a way that creates the least environmental impact.

2.1 PROPOSED MITIGATION

There is no proposed mitigation section within the ecology AEE report, with any suggested mitigation measures scattered throughout the Assessment of Effects section. The consent application has a mitigation section (Section 9) but it is not a complete list of mitigation measures, and only obliquely refers to including 'where appropriate' those measures proposed in the ecology AEE report as part of the final Code of Practice – I therefore do not feel that the consent application is sufficiently clear on the proposed mitigation measures. The mitigation measures as raised in the ecology AEE report are discussed below:

» The three mitigation measures suggested in the ecology AEE report to reduce any negative effect of rock riprap lining (planting, creating additional fish refuge, and creating a very rough/variable rock edge to break up the otherwise uniform flow), has great potential to mitigate any negative affect of the rock riprap bank treatment. In particular the third option (creating a rough rock edge and using boulders to protrude well into the main flow to break up the otherwise uniform flow) has the greatest change of improving habitat condition. However I do not feel that these are clearly enough defined in the consent application (Section 6.2.2, page 105). It should also be noted that these mitigation measures will do nothing to lessen the impact of rock rip rap in inanga spawning areas, and thus mitigating against this effect would be to not install rock rip rap or any other hard edge solution within any inanga spawning areas, or in the case of the Hutt River main stem to look at alternative options if and when the existing rip rap bank needs replacement or repair.

- The ecology AEE report recommends that because willow planting can benefit the aquatic ecology and due to the paucity of information about the effects of willow removal on fish habitat, that it may be appropriate for a condition of consent to require "a targeted study to be undertaken in a selected watercourse where this activity is likely to be required on a larger scale" (page 21). I suggest that the author first read the recent literature review by Wagenhoff & Young (2013) on the effects of willow removal on New Zealand stream ecosystems. In addition, as noted in Section 1.3 of this review, the author has failed to identify the detrimental effect that willows can have on river and riparian systems, and the rising interest throughout New Zealand to look to native vegetation options for providing bank protection measures (Phillips & Daly, 2008). I would therefore suggest that a mitigation measure worthy of consideration would be to investigate options for a multi-tiered approach, such as combining the use of willows as a front-line defence with natives planted behind, and/or under-planting willows with native tree species, allowing for the native vegetation to remain when the willows are removed in later years (e.g., when the willows reach the end of their life or when their growth becomes excessive) (refer to Phillips & Daly, 2008 for further information). I understand that Greater Wellington Regional Council already uses sterile male cultivars (*S. matsudana*), which mitigates against the effects of using problem pest or invasive species). Another mitigation measure to avoid the localised disturbance created by the removal of willows could be to leave the tree stumps intact (after having poisoned the tree to prevent it regrowing) – this will retain bank integrity and fish cover and limit sediment release, and by the time the stump rots away other vegetation may have become well enough established to replace its ecosystem service. This method would of course only be suitable in areas where the willows and their root structure are not causing constriction issues during flood events. Given the approach of an Environmental Code of Practice and adaptive management plan that is influenced by a wider monitoring programme, I believe that there is opportunity to trial some of these options to see if there are some workable alternatives to the current bank protection practices. It is possible that some of these measures may already being undertaken, as the consent application (on page 108 and page 130) does state that the GWRC also "undertakes significant planting of native trees along the river corridor in accordance with the Hutt River Environmental Strategy", but it does not clarify whether this is within the willow bank protection works zone or not.
- I agree with the approach proposed in page 22 of the ecology AEE report to leave flood debris in the river where it presents no immediate flood risk, in order to keep the adverse effects on fish habitat to a minimal level. This should be written into the Environmental Code of Practice, with a clear definition of 'flood debris that presents no immediate flood risk', to ensure a consistent management approach is achieved by all subcontractors who may be working in the river.
- I agree with the proposed measures outlined on page 23 of the ecology AEE report to mitigate against the effect of beach gravel extraction/beach recontouring on riverine bird populations. While there are currently not many pied stilts nesting in the Hutt River there are other river species in residence and it is possible that undertaking these measures may help to encourage the breeding of pied stilt (which according to both the AEE report and consent application are found along the Hutt River) in the area, providing there are no other overarching environmental constraints.
- A continuation of the existing mitigation measures to limit works in the actively flowing channel to periods outside of the key native fish upstream migration period, peak angling time, or on weekends (as noted on page 24 of the ecology AEE report) is a good means of minimising the impact of high suspended sediment yields on fish species.
- The proposed continuation of creating a more natural meander pattern with pools and riffles as part of the wet gravel extraction/bed recontouring process (itself a refinement of original meander channel design proposed and undertaken since 2006) is noted in the ecology AEE report (page 27) as long-term mitigation to the bed recontouring of the Hutt River. While the creation of a 'more natural' channel will release more sediment during the gravel works (because it involves gravel extraction below the water), I agree that the long-term ecological benefits (in terms of creating more varied habitat for aquatic biota) outweigh the short-term impacts. This is further premised against the short duration of the in-channel works combined with the return of ambient suspended sediment levels within several hours of ceasing in river works, as well as the naturally high disturbance regime of the river. As this system regularly experiences bed-moving floods, the fauna is more likely to cope with the localised disturbance created by the gravel extraction and should readily colonise the affected areas through upstream-downstream dispersal (provided that many kilometres of channel are not cleared in one go).

The ecology AEE report and consent application provide no consideration of mitigation measures for the tributary waterways that form part of the application. The following are mitigation measures that I feel should be included in the consent application.

- Both the ecology AEE report and the consent application did not consider the potential impact of bank and channel maintenance works on the last remaining inanga spawning reaches within the Hutt River catchment. An obvious mitigation measure would be to ensure that the timing of maintenance works in the Lower Opahu Stream (a backwater arm of the Hutt River) and Sladden

Park[1] to avoid the inanga spawning and egg development season (according to Taylor & Kelly, 2001 these are the only spawning areas in the Hutt River, although the consent application also includes a section around the Ava Rail Bridge). According to page 53 of the consent application, whitebait habitat was created in the Lower Opahu Stream as 'extensive offsetting for the Ava to Ewen works'. Thus it should be a condition of the consent that any works and maintenance undertaken in Lower Opahu Stream should be done to improve the inanga habitat (spawning and rearing) and not impinge on these values. At a minimum mitigation would be in the form of ensuring inchannel and bank works to occur outside of the inanga spawning and egg development period, but could also require timing of bank vegetation maintenance to occur at an optimal time preceding the spawning period. Research at the University of Canterbury has indicated that cutting of spawning grasses at the right time prior to the spawning season may help with egg survival as a result of the thicker (rather than tall and thin) vegetative growth, which helps to retain humidity.

- There may also be the opportunity to naturalise Stokes Valley Stream to mitigate against the impacts of regular channel and bank maintenance (which involves a tractor driving down the channel to mow the banks – see Appendix F: photo labelled '22 reach mowing'), and to serve as long term environmental offsetting for other effects of the proposed works. While maintaining storm flow capacity may be necessary, planting of carefully spaced native shade trees and soft low-growing (and overhanging) native plants would help to shade the stream but should still provide for storm flow capacity. Even a single layer of plants along the lower banks would help considerably to improve habitat values and reduce water temperatures. Additional benefit could be gained by the addition of roughness attributes into the channel. Ultimately what can be achieved would have to be weighed against the flooding issues of this catchment, but it could be worth investigating further.

Finally, I note that the mitigation section (Section 9) of the consent application includes the funding of annual trout surveys as mitigation. I do not regard monitoring as a mitigation measure, but more of an acknowledgement that the impacts are uncertain and thus require on-going monitoring.

2.2 ADAPTIVE MANAGEMENT UNDER AN ENVIRONMENTAL CODE OF PRACTICE

The consent application states in Section 9 (Mitigation) that any mitigation is to "largely sit in the Code of Practice" which will include additional mitigation measures raised by the ecology AEE report "where appropriate", and that the "monitoring plan and its five-yearly iterations will also provide mitigation". The consent application also notes that the proposed "Code of Practice will provide specific detail and direction on the methodology to be adopted for individual activities, rather than the conditions of the resource consent". I have not seen the proposed Code of Practice, and so cannot comment further on the validity of the mitigation measures contained in that document. However, based on these statements it can be concluded that the main mitigation is based on the premise that the long-term monitoring that is being developed as part of the Science Group will provide all the information needed on the impact of the proposed works, and will provide recommendations for future management – meaning that if the monitoring finds that there is an impact then adaptive management (via the Code of Practice) will enable this impact to be mitigated. In theory this approach should allow for a better environmental outcome in the long-term – but this will ultimately be determined by whether the monitoring programme is designed and carried out well, and whether any recommendations from the monitoring programme or technological advancements are able to be incorporated into the Code of Practice in a timely manner. These two provisos are best discussed based on the proposed consent conditions (Appendix J of the consent application) that are related to the monitoring programme and Code of Practice.

In the proposed consent conditions, Condition 12 requires that a monitoring plan be submitted within two months of the granting of the consent, but does not define the attributes that would be covered in this monitoring plan. I would expect the final consent condition to at least outline a set of criteria/attributes that should be covered in the monitoring plan so that the consenting authority can be sure that at least a minimum level of work will be met under the monitoring plan, and so that the applicant can be more certain of the minimum amount of work that is required. The fact that the applicant and the consenting authority are the same should not preclude this from occurring. The resource consent application notes that the applicant is currently working on a monitoring plan with the Science Group, and thus there is the opportunity to clearly establish a set of criteria that should be covered in the monitoring programme prior to the official finalising and submission of that plan. If there are issues with not wanting to be so prescriptive in the

[1] I recognise that Sladden Park may not be part of this consent application, but given that it is the only other area of inanga spawning in the Hutt River catchment I think it is worth including it in this statement.

consent conditions as to limit the ability to update the Code of Practice and monitoring programme over time, there are still ways to include more general criteria in the consent condition to make sure any monitoring undertaken will achieve the desired outcomes. Of particular importance is that the success of an Environmental Code of Practice that allows for adaptive management (and thus adaptive mitigation) relies primarily on the monitoring programme to be able to detect environmental change (to a prescribed level). This comes down to whether the work undertaken is sufficient to actually identify a percentage change in the community to an acceptable level of detection (e.g., power analysis), and whether the work was undertaken following a suitable design (such as BACI: before-after, control-impact) to elucidate natural variation from other (e.g., anthropogenic) changes. If these factors have not been met then it will be difficult for the monitoring work to actually pick up on change and help to provide for better adaptive management.

Condition 14 specifies the time frame for submitting a monitoring report (referred to in the consent application as the 'Monitoring Report') is the same five-yearly interval as is proposed for the 'Consent Holders Report', which is supposed to take into account the results and recommendations of the monitoring report, liaise with iwi and other key stakeholders over the findings of the monitoring report, and provide recommended updates to the Environmental Code of Practice as a result. I find it difficult to see how the Consent Holders Report can achieve any of these things if it is due at the same time as the monitoring report. There should be a minimum of six months to a year between the due date of the 'Monitoring Report' and the due date of the 'Consent Holders Report' if there is any real commitment to achieving the desired outcomes of this adaptive management process. I would suggest the reporting timeframe for the monitoring is shortened rather than the time frame for the Consent Holders Report is lengthened.

The proposed consent Conditions 14 and 15 are misleading as to when changes to the Code of Practice can be undertaken, and implies a more fluid document than what is likely possible. Condition 14 requires to a five-year return period for reporting on the monitoring, which will include proposed changes to the Code of Practice that then must be borne out via engagement with key stakeholders and included in the Consent Holders Report before any changes to the Code of Practice can occur. However, Condition 15 states that changes to the Code of Practice can occur as 'new technologies and methods of providing flood protection come to the fore, or monitoring results indicate the need for an altered methodology' or when 'the Consent Holders five-yearly report may incorporate changes to the code of practice as a result of engagement with iwi and key stakeholders'. This implies that the findings from the monitoring can elucidate changes to the Code of Practice outside of the defined approach required in Condition 14, which given the definition of Condition 14, should not be allowable. The inconsistency of Condition 14 and 15 therefore needs to be resolved.

3 INFORMATION GAPS

"Identification of any further information that should be provided to complete the assessment of environmental effects"

Any information gaps are identified in the relevant sections above. In summary these include the following:

- An overview map outlining the area of Hutt River and tributaries that forms the basis of the consent application is required. This map should include the names of key areas and features (roads, bridges, place names, etc.) referred to in the reports, and in the ecology AEE report should also illustrate the location of environmental data referred to, so that it is clear what information is from the affected reach or from other areas. This would be a minimum expectation for an ecology AEE report, and would also be of benefit to the overall resource consent application (the latter has detailed aerial photos but not an overview map).
- Information presented in the ecology AEE report on the composition of the fish, periphyton, macrophyte, invertebrate community and bird life in the affected area compared to reference (unaffected) areas is insufficient. There is more information contained in the actual resource consent application than there is in the ecology AEE report, which is unusual as AEEs typically contain the detailed information, which is then summarised in the consent application document.
- There is no information in the ecology AEE report or the consent application on the ecological condition of tributary waterways included in the consent application (e.g., Stokes Valley Stream, Akatarawa River, Te Mome Stream, Speedy's Stream, and Lower Opahu Stream).
- The ecology AEE report and consent application do not include an assessment of effects of channel maintenance practices on the tributary waterways that form part of the application. Their habitat and ecosystem processes are dissimilar to a large gravel river and thus should be dealt with separately.
- Key references are missing from the reference list of the ecology AEE report. With today's bibliography software I find such a basic mistake to be unacceptable. It also makes it very difficult to check the validity of some statements made in the report that are based on these missing references.

4 REFERENCES

Cameron, D. 2013. Effects of flood protection activities on aquatic and riparian ecology in the Hutt, Waikanae, Otaki and Wainuiomata Rivers. MWH, Wellington. 311 pp (excl appendices).

Froude, V. A. 2002. Biological control options for invasive weeds of New Zealand protected areas. *Science for Conservation 199*. Department of Conservation, Wellington. 68 pp.

Leathwick, J.R., West, D., Gerbeaux, P., Kelly, D., Robertson, H., Brown, D., Chadderton, W.L. & Ausseil, A.-G. 2010. Freshwater Ecosystems of New Zealand (FENZ) Geodatabase: Version One – August 2010 - User Guide. Department of Conservation. 57 pp.

Phillips, C. & Daly, C. 2008. Willows or natives for stream bank control: a survey of usage in New Zealand regional councils. Motueka Integrated Catchment Management (Motueka ICM) Programme Report Series. Landcare Research, Lincoln. 25 pp.

Tonkin & Taylor Ltd. 2013. Resource consent applications Hutt River/Te Awa Kairangi. Tonkin & Taylor Ltd. 149 pp (excl appendices).

Taylor, M.J. & Kelly, G. R. 2001. Inanga spawning habitats in the Wellington Region and their potential for restoration. NIWA Client Report No. CHC01/67. NIWA, Christchurch. 65 pp

Wagenhoff, A. & Young, R. 2013. Effects of willow removal on Australian and New Zealand stream ecosystems – A literature review of the potential risks and benefits. Cawthron Report No. 2315. Cawthron, Nelson. 37 pp.

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