Internal Correspondence

Department of Conservation
Te Papa Atawhai

Our ref:

Your ref:

To: PRSG Concessions – Di Clendon

Date: 13/03/15

From: Martin Rutledge Technical Adviser ARU

Subject: **Waitaha Hydro Scheme Concession Application: Aquatic Ecology Impacts**

Background

Since March 2012 I have been providing advice on the potential impact of the proposed run of river hydroscheme on the aquatic ecology of the Waitaha River. My advice to date is contained in correspondence between myself and Di Clendon who is coordinating the concession application. My involvement has included a site visit and liaising with the consultants who have provided an assessment of impacts on the aquatic ecology. This has included IFIM modelling and hydrological and sediment studies. These consultants have assisted in developing the mitigation and monitoring measures proposed in the draft Concession application to manage impacts on the aquatic ecosystem – ie mainstem and tributary habitats. I have sought further information from consultants in order to provide clarification on particular issues and this latest advice from me takes their responses into account. I have not assessed impacts on blue duck, as Tim Shaw (?) has dealt with this. I have highlighted in yellow the additional monitoring that I recommend.

Michel Dedual (DOC Fishery Science Advisor Turangi) provided some early peer review advice on particular aspects of effects on aquatic ecology.

Reports/information assessed:

Assessment of environmental effects (Part A): Fish Modelling for the Proposed Waitaha Hydro Scheme. By Hans Eikaas, EOS Ecology Draft Report No. 06003-ELE01-July 2007

Aquatic plants and invertebrates of the Waitaha Catchment Interim Draft Report by EOS Ecology: Draft Report No. 06003-ELE01-REP02 Shelley McMurtrie and Alistair Suren(NIWA) April 2009.

Proposed Waitaha hydro scheme: Fish of the Waitaha Catchment Interim Draft Report by EOS Ecology: Draft Report No. 06003-ELE01-REP03 by Hans Eikaas and Shelley McMurtrie reviewed by Jon Harding (Canterbury University) September 2010

Proposed Waitaha Hydro Scheme: Assessment of Environmental Effects: Fish of the Waitaha Catchment. McMurtrie and Suren 2014, 106 p (reviewed by David Rowe NIWA)

Instream Habitat Flow Assessment for the Waitaha River, Morgan Gorge to Douglas Creek by Allen and Hay 2013 . Reviewed by John Hayes Cawthron Institute

Hydrology of the Waitaha Catchment. A report for Electronet Services Ltd September 2013: prepared by Martin Doyle. Reviewed by Alistair McKerchar NIWA

Sediment investigations relating to a proposed HEP scheme on the Waitaha River Prepared for Westpower Ltd. June 2013 by Murray Hicks NIWA

WestPower : Waitaha Hydroscheme Application for Concessions and Assessment of Environmental Effects July 2014

Written responses provided by Westpower and consultants to further information requests from Martin Rutledge.

Assessment of aquatic ecosystem values

I have summarised the main features of the scheme below using information provided by the consultant ecologists and in the Concession application. In my opinion the information provides an adequate description of the aquatic environment and its ecological values including the underlying hydrological and sediment regime.

Mainstem

The main features of this run of river scheme are the diversion of up to 23 cumecs of water from the mainstem Waitaha (mean flow of about 35 cumecs at Kiwi Flat)) into a tunnel located just upstream of Morgan Gorge. The water is conveyed into a power station and exits via a tailrace located approximately 2.6km downstream. The primary effect of the scheme is the reduced flow in the river through the diversion reach of 2.6km, where it is proposed that a residual flow of 3.5cumecs is maintained. However, the frequent flood and fresh events (every 8.6 days on average) and high sediment load typical of the existing regime will remain a primary influence on the rivers ecology in the diversion reach post construction. Downstream of the tailrace discharge, where water is returned to the mainstem, the flow regime will be very similar to the existing natural regime under a run of river scenario.

The habitat type in the reduced flow diversion reach consists of a very steep, turbulent bedrock slot and large boulder gorge with a boulder bed reach (boulder garden) below this and finer sediments -sand, gravel and cobble substrates predominating further downstream. Fine sediment deposited on surface substrates generally, reflects the input of fine glacial material from the upper catchment glaciers.

Aquatic community

The investigation work showed the mainstem aquatic community in the diversion reach to be strongly structured by the harsh flow regime, high sediment load and low nutrient environment. Low densities of macroinvertebrate, fish and aquatic plant populations reflected this and likewise the pattern of limited species diversity. Survey work in the mainstem gorge habitat was not possible, however, it seems likely that macroinvertebrate, fish and plant communities will be similar to those in the survey reaches lower down but variable in species and density depending on local habitat conditions- ie water depths, velocities, substrate and cover regimes. Advice from a national expert (response to question 26 Further information request, Benthic ecology January 2015) was that the torrential and highly abrasive conditions within Morgan Gorge would not allow the development of threatened species of bryophytes and lichens. No threatened species of macroinvertebrates or freshwater plants were detected in the mainstem reaches surveyed downstream of the gorge habitat. The range of species found was considered typical for West Coast rivers of similar type.

Three "At Risk" native fish were found in the mainstem diversion reach including koaro (*Galaxias brevipinnis*), longfin eel (*Anguilla dieffenbachii*) and torrentfish (*Cheimarrichthys forsteri*) and were present in very low densities . These species are widespread throughout New Zealand and while classified as "At Risk" declining (Goodman et al 2014) are still relatively common. Populations of these native fish in the diversion reach or elsewhere in the Waitaha catchment affected by the scheme are not recognised as national stronghold populations or otherwise unique in character.

The steepness of the gorge section and its torrential nature impact on the fish community by limiting the species present above Morgan Gorge to koaro which has the strongest upstream migratory ability of the New Zealand fish fauna. Koaro were present in low numbers in the Kiwi Flat reach above Morgan Gorge. The absence of trout upstream of the gorge and ensuring they remain absent is recognised as a value to benefit the koaro population. Trout were present in the mainstem diversion reach in very low densities and do not provide a significant recreational fishery.

Tributary aquatic communities

The tributary environments potentially impacted by the scheme have been thoroughly surveyed and well described in the information provided. Tributaries entering the true right bank where scheme infrastructure and roading are proposed vary in type – from Alpha Creek which is ephemeral and subject to considerable disturbance to the "Stable Tributary" found to be a biodiversity hotspot because of its extreme stability. Compared with the mainstem the tributary habitats were found overall to support much more diverse and abundant communities of aquatic plants- including algae and bryophytes, macroinvertebrates and native fish. This is attributed to their greater hydrological and sediment stability and higher productivity.

With respect to native fish the following species additional to those found in the mainstem were recorded: lamprey (*Geotria australis*), redfin bully (*Gobiomorphus huttoni*) common bully (*Gobiomorphus cotidianus*) and shortfin eel (*Anguilla*

australis), with koura (*Paranephrops planifrons*) also recorded from one tributary. Of the aforementioned species koura, redfin bully and lamprey are all considered "At Risk "species with declining populations but commonly found in West Coast rivers. Koaro were the most abundant species in the tributaries overall.

"Stable Tributary" supported the highest abundance and biomass of instream flora and fauna. Koaro were abundant along with lamprey ammocoetes and koura plus a diverse assemblage of bryophytes. This was recognised by the consultant ecologists as a biodiversity hotspot in their values assessment (which I agree with) and they proposed particular measures to protect these values.

Assessment of environmental effects on aquatic values

The draft concession application proposes a number of draft conditions in order to protect mainstem and tributary aquatic values during the construction and operational phases of the scheme, this includes proposed monitoring to ascertain that aquatic values are adequately protected. An Environmental Monitoring Plan will deal with the detailed requirements. These plans will be subject to independent audit and prepared in accordance with best practice (Condition 1.4) and require departmental approval. This process will provide opportunity to discuss deficiencies or changes to proposed conditions that protect aquatic and other values including monitoring requirements.

It also needs to be recognised that the local consent authority will have its own particular planning rules and standards relating for example to water quality, abstraction, fish passage and monitoring under scheme impacts. These may overlap with concession conditions, however, the application is yet to go through the RMA consenting process so the final requirements and overlap or conflicts with concession conditions is unknown.

I have set out my opinion on the assessment of effects and the adequacy of proposed conditions to avoid, remedy or mitigate adverse effects under the topic headings below and referred to responses to additional information requests as necessary.

Construction effects

In general, the draft conditions and monitoring proposed in the concession recognise the mainstem and tributary values at risk during construction and reflect the recommendations of the applicants ecological advisers on what is needed to protect aquatic ecological values. The main concern is that sediment and other potential contaminants entering the mainstem are adequately managed throughout the construction phase. In this respect I support the role of the Liaison Officer and other provisions proposed under Condition 3- 3.1-3.6 as a key requirement to ensure that conditions established under any concession and resource consent are complied with – such as prescribed levels of suspended sediment.

A range of other proposed conditions deal with potential effects on water quality arising from construction including condition 4 which proposes preconstruction activities and route planning intended to minimise vegetation disturbance and tree

removal which will assist in reducing sediment runoff generally. Notably an extended corridor width is promoted around Stable Tributary (4.4) which is supported.

Likewise Conditions 5.1 – 5.17 (Disturbance Areas) includes measures to limit disturbance of soil and vegetation and sediment runoff into waterways such as 5.14 and 5.16. These conditions are supported subject to the development of suitable methods and standards to give protection to the aquatic ecology. The proposed Rehabilitation Management Plan (RMP) (11) will address re-establishment of vegetation communities which will promote riparian protection and benefit tributary habitats, therefore I support the RMP utilising best practice techniques to promote quick re-establishment of vegetation with appropriate eco-sourced species.

The Construction Management Plan (CMP) (conditions 7.1- 7.5) provides the key higher level direction for the measures needed to protect water quality and the aspects identified for management (7.3) I think the identified aspects under 7.3 A- L are likely to adequately cover the key matters to address by way of more detailed plans either under the CMP or under separate plans or under the Wastewater, Groundwater, Erosion and Sediment Management Plan (Condition 8.1).

Under the CMP Condition 7.3 (e) "in river works" and as discussed in correspondence with S McMurtrie and Westpower (p 8 further information request) fish salvage protocols for the construction phase of development will be developed and also a monitoring component incorporated into the EMP.

I note that protection of the Stable tributary and other tributaries is addressed by way of standalone consent conditions 8.6 and 8.7 and 8.8-8.9 relating to waterway crossings generally including the requirement for a bridge across Granite Creek. These proposed measures when provided in a more detailed way are likely to be adequate to manage impacts and will presumably detail fish passage and sediment related management where relevant.

I support the proposed monitoring of water quality for the stable tributary(18.9 of the Environmental Monitoring Plan) I promoted that native fish also be monitored in the Stable Tributary to demonstrate that the At Risk fish species present are being adequately conserved during construction . My opinion is that the community in this stream is the most valuable and vulnerable to construction impacts. The applicants ecologist advises that it is preferred that native fish are not surveyed in the Stable Tributary as water quality sampling will allow a more direct response to water quality exceedances. However, I consider that semi quantitative electric fishing done by the qualified ecologist who undertakes the water quality sampling will not require a large amount of effort and this will confirm that the fish population is being adequately protected. I recommend that a sampling protocol for fish – e.g an annual survey during the 3 year construction phase be developed for the Stable Tributary in consultation with the applicants ecologist .

I note that in response to questions (question 13 further information request fish and instream habitat) regarding koaro passage it has been suggested that fish monitoring occur in tributaries within the abstraction reach, within the Kiwi flat area and in

control sites, with further detail to be developed when scheme design and operation are finalised. Collectively this monitoring should provide a good indication of the general health of the koaro populations.

S.McMurtrie advised that a suite of water quality monitoring measures will also be designed for other tributaries within the construction footprint which I support- with their further detailed development in the appropriate sections of the EMP.

Monitoring of water quality in the mainstem during construction is also required and currently is without details of location, methods frequency or limits for sediment or other contaminants, however the applicant has advised that these will be developed. I am unclear to what extent in- river works will incorporate fish monitoring in places in the mainstem other than the weir during construction. My opinion is that the requirement and methodology for such monitoring should also be included in the EMP. If the applicant consulted with the consent authority to establish its Plan rules /Policy requirements for managing sediment or other contaminant levels it should assist in comprehensively addressing water quality issues under the concession and RMA processes.

I support proposed conditions 8.10- 8.20 which propose measures to manage contaminants arising from in river works, construction infrastructure, concrete containing materials, sediment from surface runoff and tunnel spoil and other human waste and rubbish.

I note that under 8.15 in – river works associated with weir construction will be managed to minimise their duration and effects on koaro migration. This provision will benefit from further advice from consultant ecologists regarding the likely timing of migration – presumably the spring time run of koaro whitebait around August-November.

There is some degree of overlap of the construction phase related plans as well the proposed EMP which will eventually be the location for details of all scheme related monitoring requirements. I think that the applicant could rationalise the location for particular content of these plans to add some clarity and comprehensiveness to what is proposed. I am advised that this is intended further down the track. It is acknowledged that detail under the various plans would need to be developed with more discussion with DOC and other relevant parties.

The applicant has provided the schedule of conditions relating to didymo management for the Amethyst hydro scheme and conditions 12.4 , 12.6 and 12.7 of the draft concession application apply. The Amethyst schedule provides an indicative approach, however, as discussed in the response from the applicants ecologist once more detail is known on the construction works more targeted site specific protocols can be developed. These could be incorporated into the Pest and Weed Control Management Plan. The applicant considers that scouring from ongoing floods will assist in removing didymo and has not proposed that flushing flows be used as a management tool. However, I see benefit in the use of flushing flows if didymo growths become problematic especially under extended low flows (ie held at the 3.5

cumec residual flow under a dry weather scenario. I think the option of using a flushing flow in this situation may be beneficial and could be further discussed with the applicant.

Condition 14 relating to fuel use, storage, leakage and spill management and reporting seem to be appropriate and are supported including the provision for the use of vegetable based hydraulic fluids to minimise adverse effects. This will require the development of specifications for the type of fluid that is considered fit for purpose in an appropriate management plan/protocol. Likewise additional detail is required to manage the specifics of the various fuel related risk management scenarios.

My opinion is that the variety of conditions relating to the construction phase are generally appropriate to avoid, remedy and mitigate adverse effects on the aquatic ecology in the mainstem and tributaries. The outcomes are not fully certain however until the details and environmental bottom lines are prescribed in the variety of management plans that will need approval under the concession application and any potential overlapping resource consent conditions are clarified.

Scheme design features and operational activities affecting instream values

Design of intake weir and fish passage monitoring

The applicant has provided additional information and I consider adequately recognises the potential issues associated with the establishment of the weir and the need for a fit for purpose design that maintains upstream passage for koaro and juvenile blue duck movements but prevents potential trout and eel invasion. I think the applicant has properly acknowledged the importance of ensuring the trout and eel free status upstream of the Morgan Gorge. Condition 15.7 encapsulates the general principles to be achieved with a collaborative design process with the department which is supported and a 5 year monitoring plan for koaro at the weir. In addition Condition 18.11 (b) directs a monitoring programme to determine that longfin eels and trout have not gained access to Kiwi Flat.

Design of tailrace

I think the proposed monitoring and adaptive management plan under Condition 18.13 for investigating the entrainment of fish into the tailrace and recognition of the potential need for a trap and transfer system and the management of predation by trout (Condition 15.9) provide adequately for the management of these potential risks.

Potential turbine induced mortality of koaro larvae

The proposed monitoring programme under Condition 18.2 to investigate larval koaro entrainment into the scheme and potential larval mortality provides adequately for the investigation and management of this risk. Although the final details of such a programme are yet to be developed, the involvement of the department and a collaborative approach allow for its design and mitigation processes to be developed and agreed to.

Instream habitat conditions at Kiwi Flat

The weir will eventually accumulate sediment behind it for some distance into the Kiwi Flat reach and I was concerned that this may affect the koaro population in the mainstem by changing habitat conditions. However, it has been advised that typical surface substrate conditions will re-establish behind the weir once the bed level behind the weir has readjusted so that habitat conditions for koaro should be similar to the current condition.

Following a further information request (question 13) concerning koaro passage at the weir it has been proposed that koaro populations will be monitored in the tributaries in the Kiwi Flat area along with monitoring for the presence of longfin eel and trout. The age structure results from this work should reflect the condition of the mainstem reach for koaro passage and habitat. Detail of such a programme is yet to be developed but is likely to be within the Environmental Monitoring Plan. As part of this programme I recommend that monitoring also include a site in the mainstem reach upstream from the weir to check for the presence of koaro. This should not add a lot of additional effort as monitoring in the tributaries will presumably target periods of stable or low flows to optimise the effectiveness of electric fishing when mainstem conditions will also be favourable. I envisage a semi quantitative methodology covering optimal marginal habitat for koaro to confirm the ongoing presence of koaro in the reach of accumulated sediment behind the weir, details to be set out within the EMP.

Post construction sediment accumulation in the diversion reach

Further information was sought regarding the management of sediment in the mainstem diversion reach. It is proposed that flushing of the settling basin through an outfall into the mainstem during flood flows should avoid accumulation of the sediment in the reach and seems a good approach. The final details of this approach will need to address the optimal flow range for the dispersal and effective downstream mobilisation of sediment.

Regarding fine sediment accumulation potentially induced during periods of extended low flows in the diversion reach additional information provided by Mr Hicks is helpful and has suggested a monitoring methodology and trigger criterion of 20% accumulation compared with a reference site and the provision of a flushing flow to mobilise sediment. I agree that the guidance on sediment effects and monitoring provided in Clapcott et al 2011 would provide useful guidance in developing details of the monitoring and flushing protocol.

Fish stranding and management of ramping

The applicant has provided some further information on ramping and how a programme would be implemented to monitor and manage this potential adverse effect on fish stranding (question 5 further information request Benthic ecology) . Ramping is discussed in page 45 of the concession and proposes a programme of monitoring (Condition 18.14) to both check for fish stranding and to develop operational guidelines to ensure that stranding does not eventuate. Such work is

anticipated to occur during the commissioning of the scheme (response to question 5) but further details of the programme will be developed once more information on scheme design and operation is available. This work will also develop flow management methods and rules should unforeseen outages occur and address matters of public safety as well as ecological effects.

Adequacy of the proposed residual flow regime

Additional information on the hydrograph induced by the scheme under various climatic scenarios (Martin Doyle response) and further clarification of the predicted ecohydraulic effects on instream communities(S. McMurtrie and C. Allen responses) have been helpful in further understanding potential effects and the adequacy and reliable delivery of the 3.5 cumec residual flow release from the weir (S. Matheson response).

While the mainstem reach of river affected by the diversion represents a relatively small amount of the overall river length, it is clear that while floods will persist, within the diversion itself the natural hydrograph is subject to more extended periods of unnaturally low flows compared with the natural flow regime. Reduced wetted width, and altered mix of habitat and microhabitat afforded by the flow velocity, water depths and substrate regime are the consequence. IFIM modelling while useful in providing insights into habitat availability responses under changed flow has not been subject to robust validation of its predictive power in terms of the abundance of fish, macroinvertebrates or algal abundance under modelled scenario's- particularly in a physically dominated river such as the Waitaha.

Therefore, while I agree that it is likely that a similar range of species of instream flora and fauna will persist in the diversion reach, it is not possible to predict the extent to which the natural patterns of abundance and diversity will be conserved (sensu Conservation Act). In particular I am concerned that the albeit naturally low density populations of At Risk native fish present in the diversion reach- koaro, longfin eel and torrentfish are conserved to a level consistent with general conservation purposes. In the face of uncertainty my opinion is that monitoring of the mainstem native fish populations should be undertaken to confirm they are being adequately conserved.

I note the response of S.McMurtrie (question 19) that demonstrating a change in macroinvertebrate,periphyton and fish populations in the diversion reach is a consequence of scheme effects as opposed to flood disturbance effects would not be possible. I agree that this is likely to be the case, however, I propose that semi – quantitative methods are used during periods of suitably safe stable flows to confirm the presence and relative abundance of native fish with the dataset supplemented by monitoring of algae and macroinvertebrates. The details of such a programme- timing, location, method, frequency, reporting requirements including review criteria should be discussed and agreed to as a part of the EMP.

Compensation for residual effects on aquatic habitat and natural functioning in the diversion reach

If approved the ongoing operation of the scheme changes the flow regime in the diversion reach for the life of the concession licence and RMA consent, a period likely to be around 30-40 years?. While flood events are not affected in the diversion reach, the removal of 23.5 cumecs from the reach and imposition of a residual flow of 3.5 cumecs are an ongoing unavoidable effect of the scheme and represent a significant change to the natural flow regime, processes and connectivity that support the instream biota. The impact of the abstraction on the diversion reach is most notable under low flow conditions (e.g see hydrograph modelled for a winter dry spell in attachment A page 3 provided by Martin Doyle).

Freshwater related conservation values are compromised as a consequence and my opinion is that compensatory measures in order to balance losses are needed. Compensatory actions that provide benefit to freshwater habitats and species conservation elsewhere in the catchment are appropriate. An annual quantum (I am thinking 100k per annum) and range of projects need to be developed and negotiated with the applicant then and detailed and approved under the concession as a part of a biodiversity compensation plan or something similar.

Local biodiversity and partnership staff may have some ideas about existing or new opportunities to achieve positive freshwater species and habitat outcomes. Possibilities might be whitebait spawning ground enhancement – such as fencing and planting or enhancements for native fish generally (using fencing and planting type approach) or targeted species habitat enhancement for giant kokopu (Ellis Creek), mudfish(?), longfin eel(?) .

Conclusion

The application adequately describes and values the instream freshwater communities that may be affected by the schemes construction and ongoing operation. Provided that the indicative draft conditions are underpinned by management plans that specify detailed methods and performance measures satisfactory to the department I consider that freshwater values can be adequately protected. The conditions development and refinement under management plans will need to take into account my comments on what additional measures and the recommended additional monitoring I consider necessary to achieve the level of certainty of freshwater conservation needed. These requirements can be discussed with the applicant as needed. Additionally I have recommended compensation for the scheme induced impact on freshwater conservation values and proposed that it be directed at enhancements local to the Waitaha catchment.