**BEFORE THE INDEPENDENT COMMISSIONERS**

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| **IN THE MATTER** | of the Resource Management Act 1991 |
| **AND** | |
| **IN THE MATTER** | Resource consent application by Waihi Gold AUTH139551.05.01 |

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**EVIDENCE OF DR ADAM DANIEL ON BEHALF OF AUCKLAND WAIKATO FISH AND GAME COUNCIL**

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## QUALIFICATIONS AND EXPERIENCE

1. My name is Dr Adam Daniel and I am employed as the Fisheries Manager for the Auckland/Waikato Fish and Game Council a position I have held since 2012. I have a BSc degree in Biology from Washington State University (USA) and a PhD in freshwater ecology from the University of Waikato. I have been a freshwater ecologist since 1999 working to improve both fish habitat and migration outcomes in the United States and New Zealand. My PhD was based on fish movements and habitat on the lower Waikato River. After completing my PhD I worked as a biologist investigating both water quality and fish passage issues on the Columbia River for the U.S. Army Corps of Engineers. In 2011 I returned to New Zealand to become the principal investigator for the pest fish section of the University of Waikato's Lake Biodiversity Restoration Outcome Based Investment serving under Professor David Hamilton. During my employment with Fish & Game I have been responsible for representing the Auckland/Waikato Fish and Game Council in the statutory planning process. This involves assessing notified resource consent applications, regional policy statements, regional and district plans for their effect on game and trout populations and recreational hunting and angling values. In addition, I have done extensive habitat monitoring in the Waikato region including surveys of trout and native fish habitat.

2. I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

3. In preparing my evidence, I have reviewed the following relevant documents and reports:

    a. Applicants AEE
    b. Waikato Regional Plan
    c. See reference section for additional citations

**SCOPE OF EVIDENCE**

4. My evidence will cover the following points:
    a. Background
    b. AEE & Consultation
    c. Impacts of habitat loss
    d. Increased water temperatures
    e. Response to evidence from Boothroyd
    f. Relief sought
    g. Attached letter from applicant

**BACKGROUND**

5. The Ohinemuri River is the closest significant trout fishing stream to Auckland and has hosted several regional and notational fly fishing companions. The natural beauty of the Ohinemuri and its scenic beauty have made the river one of the most important trout fisheries in the Auckland/Waikato Fish & Game Region. However, extreme water temperatures and degraded water quality have greatly reduced the trout population and frustrated anglers. Temperatures in the Ohinemuri regularly breach 25°C during the summer months posing a threat to native fish and completely excludes trout from most available habitat.

6. The Ohinemuri trout population crashes frequently and Sport Fly Fishing NZ stopped using the river for fly fishing competitions in 2013 due to a lack of fish. Fish and Game attempted to stock the Ohinemuri river with 500 tagged yearling trout in 2015 but despite extensive fishing no tagged fish were ever recovered indicating very low survival compared to normal recovery rate of 6.5%. After the exceptionally wet conditions and sustained high flows over the last two years competitions have resumed due to a recovery in the trout population.

7. The Ohinemuri River trout population suffers from multiple stressors including extreme water temperatures, degraded water quality, migration barriers and degraded habitat. In my professional opinion the Ohinemuri River ranks a 2 out of 10 in terms of the stability of the trout population. This low ranking is largely due to the extremely hot water temperatures. Any increase in stream temperatures would harm the trout population and potentially the native fish population. Additionally, it is critical for trout to maximise their feeding potential to survive in this harsh and modified environment. In ideal South Island conditions trout populations have additional resilience they do not have in the Ohinemuri where they are often in survival mode.

8. The applicant has indicated (PDF letter attached) that based on historic flows granting the new consent would allow them to abstract 20% of the Ohinemuri River 61% of the time (223 days per year on average) for about a decade. I do not consider this a short term or minor abstraction and applicant has proposed water harvesting where the use is to fill a lake rather than irrigation. Regardless of how the prolonged and substantial abstraction is classified the ecological impact below the abstraction point is highly likely to impact trout habitat and will significantly impact torrentfish habitat.

**AEE & CONSUTATION**

9. The applicant has failed to quantify the loss of habitat or potential for increased river temperatures due to the effects of the proposed water take in the AEE. Data gaps are generally identified in consultation prior to lodging a consent but no such consultation took place in this case. As a result submitters were not given adequate information to determine the impacts of the proposed water take despite the data being available to the Regional Council and the applicant who both had temperature data, flow data and fish habitat requirements (Jowett, 2014). I informed the regional council and the applicant of data gaps prior to submissions closing but the request for adequate information to be presented to the public prior to submissions closing was ignored and the hearing expedited.

10. I have not been presented with any reasonable explanation that would explain the need to rush this consent process considering there is an existing consent for the abstraction and the applicant does not plan to exercise the consent for several decades. I believe that the applicant should quantify the damage that will be caused in terms of modelling the downstream impact of the increased water temperatures and model habitat degradation caused by reduced flow. Additionally, if the applicant plans to use existing plantings to offset the impact of the water take then they must quantify the improvements made in terms of stream cooling (% shade achieved, and length of stream bank shaded). In short, the basic work needed to evaluate or justify the proposed consent have not been done despite the data being available. Considering there is ample time to conduct a proper impact assessment prior to the existing consent expiring I would like to see it done so all parties can make an informed decision.

**IMPACT OF HABITAT LOSS**

11. In the absence of known physical habitat requirements for the life sustaining capacity of a river 2xMALF is a meaningful starting point in terms of protecting rivers from the harm caused by abstractions. It is far too common in the absence of solid data specific to a river reach to make the profession opinion “effects are no more than minor” without conducting the work to justify such a statement. However, in this case there are detailed models of optimal habitat for known each species based on habitat use curves for native and introduced fish measured at over 5000 locations in 124 rivers (Jowett, 2014) so guessing is not necessary.

12. Minimum flow limits should be set to safeguard the life sustaining capacity of a river for the most sensitive native species. Torrentfish are the species with the highest flow requirements, and therefore are the most sensitive to reductions in flow (Storey, 2015). Torrentfish require a minimum flow for the take to be set at approximately **2250 L/s** (1800 L/s after abstraction) for optimal habitat protection (Jowett, 2014) and a level below **1100 L/s** would cause habitat to “decline sharply” for Torrentfish (Jowett, 2014). The minimum flow for a take proposed

by the applicant (845 L/s) will not adequately safeguard the life sustaining capacity of the river for torrentfish.

13. I acknowledge that filling the pit lake without the river abstraction would be time consuming and costly, so a practical solution needs to be found. However, the applicant has failed to justify the increased in water take (10% to 20%) in terms of the benefit as opposed to the additional harm.

14. Table 1. Cost benefit analysis of consent condition scenarios using flow data provided by the applicant from 1/1/2013-30/7/2018 or 2038 days of daily total discharge converted to L/s. The data is raw and uncorrected but as all scenarios are applied to the same data set they can be used for a rough comparison. Scenarios include "Existing 10% 850 L/s" representing the existing consent of a 10% take with a minimum flow of 850 L/s, "Proposed 20% 850 L/s" representing the proposed consent of a 20% take with a minimum flow of 850 L/s, "20% 1000 L/s" representing a 20% take with a minimum flow of 1000 L/s, "20% 1400 L/s" representing a 20% take with a minimum flow of 1400 L/s and "20% 2250 L/s" representing a 20% take with a minimum flow of 2250 L/s. "Days" shows the number of days the water take can occur under each scenario, "Reduced over existing" is the percent reduction in days the take would occur over the exiting consented minimum take, "Harm torrentfish" is the total days of suboptimal flows that would occur under each scenario for torrentfish based on Jowett (2014), "% additional harm tor" is the percent of additional days over no take suboptimal conditions would occur for torrentfish, "Harm RBT" is the total days of suboptimal flows for rainbow trout (averaged 1200 L/s) that would occur under each scenario based on Jowett (2014) and "% additional harm" is the percent of additional days over no take the suboptimal conditions would occur for rainbow trout.

| | Days | Reduced over existing | Harm torrentfish | % additional harm tor | Harm RBT | % additional harm RBT |
|---|---|---|---|---|---|---|
| No take | 0 | na | 1260 | na | 976 | na |
| Existing 10% 850 L/s | 1330 | na | 1318 | 4.60% | 1044 | 6.97% |
| Proposed 20% 850 L/s | 1330 | 0% | 1399 | 11.03% | 1127 | 15.47% |
| 20% 1000 L/s | 1210 | -9% | 1399 | 11.03% | 1127 | 15.47% |
| 20% 1400 L/s | 986 | -26% | 1399 | 11% | 1032 | 6% |
| 20% 2250 L/s | 639 | -52% | 1260 | 0.00% | 976 | 0.00% |

15. It is important to keep in mind that the Jowett (2014) data used to justify the minimum flow for the take is based on a site well upstream of the impacted habitat and should be considered an underestimate of the flows required in the impacted reach. For example, the optimal flow for torrentfish at Golden Cross Road is 1800 L/s as opposed to 6000 L/s at the Karangahake site downstream. The flow calculation provided by the applicant includes data from Ruahorehore Stream that makes up about 20% of the Ohinemuri at the abstraction point and in my understanding was not factored into the Jowett (2014) models. The harm or suboptimal conditions predicted should be considered an underestimation of the impacted reach in my opinion. To properly protect the impacted habitat similar modelling should be done at the torrentfish habitat downstream of the abstraction point (flagged sites shown in Figure 1). Additionally, it should be noted that due to the degraded nature of the Ohinemuri trout must

optimise their feeding to survive because they do not have added resilience as they would in colder cleaner streams.

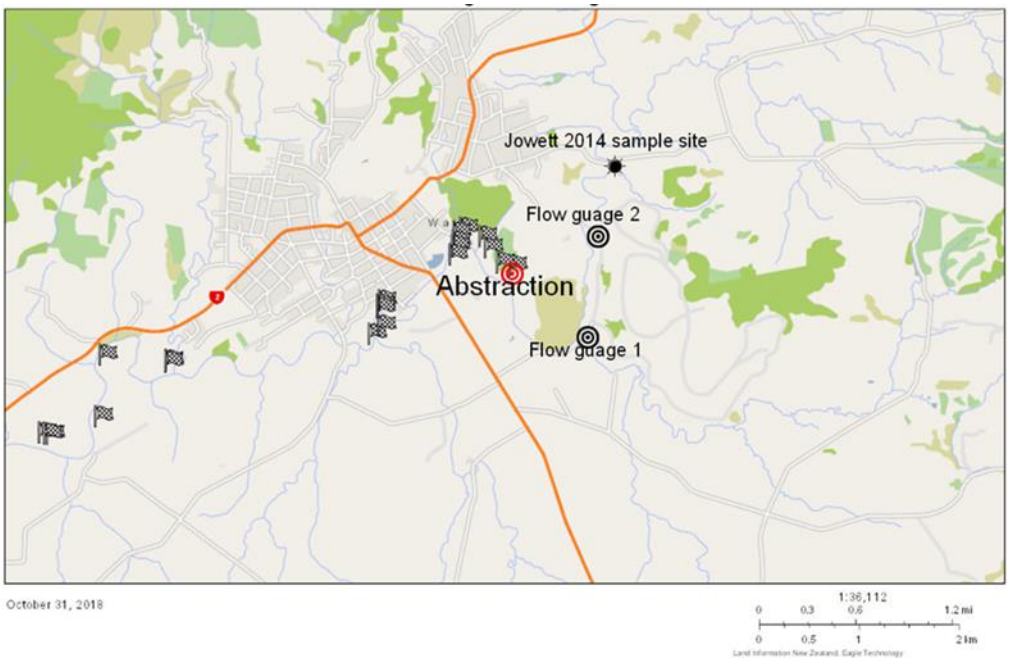


Figure 1. Potential torrent fish habitat (flags, n=25) below the abstraction point (red circle).

16. I have extensive backpack and boat electrofishing experience in the Waikato and torrentfish are notoriously hard to locate in mainstem systems as they require swift habitat that is nearly impossible to sample using electrofishing. Do to the difficulty of sampling deep swift torrentfish habitat they are often only recoded in tributaries that are shallow enough to effectively sample the swift riffle habitat. Figure 1 shows potential torrent fish habitat downstream of the abstraction point.

**Increased water temperatures**

17. Trout in the Ohinemuri River are subject to extreme temperatures and according to data provided by the applicant are severely impacted by warm water temperatures (>19°C) 26% of the time and lethal temperatures (>24°C) occur 2% of the time. Conditions downstream in the lower Ohinemuri are far worse resulting in the complete collapse of the trout population in hot dry years.

18. In the absence of the modelling data that should have been conducted to evaluate the impact of the abstraction it is difficult to quantify the impact of the water take other than to say there is very little resilience in this already stressed population of trout and reducing the volume of water will increase the rate the remaining flow will heat up during warmer months.

**Response to evidence from Boothroyd**

19. (25 p.4) Boothroyd's evidence states **"(at 2xMALF) will always meet at least 90% optimum habitat flows (or greater) for all fish species (including trout spawning and trout rearing)**" is misleading. First the 90% optimum habitat flows for torrent fish are not met by the current 2xMALF and are based on a site upstream that likely requires less flow than the impacted reach. Additionally, the water take that would lower flows to 677 L/s when the 2xMALF threshold is breached this would result in 70% optimum habitat flows for torrent

fish and fall well below the 90% optimum habitat flows for the rainbow trout population that is already heavily impacted.

20. (49-53 p.7) Boothroyd's evidence claims 28.8 ha of riverbank was planted by the applicant. I would agree plantings can offset increased temperatures caused by the water takes but the applicant has not quantified the extent of stream shaded in the plantings (just total area). This could be a large area of trees adjacent to a short section of riverbank. To evaluate the usefulness of the plantings the applicant needs to estimate the cooling that has been achieved, and verify the plantings were not part of other mitigation. Additionally, the tree planting that has been conducted cannot directly offset the loss of habitat caused by reducing the flow of the river by 20% at the point of abstraction. If this consent is not anticipated to be used for multiple decades there is time to achieve substantial shading prior to starting the extraction if the required planting plan is implemented.

21. (58 p.9) Boothroyd's evidence states "**The application for the new consent is therefore principally concerned with understanding the effects of the proposed increase in the rate/volume of take above 175 l/s."** This is incorrect as the effects are those over the natural flow not just the previous consent. See Table 1 above for a comparison to a no take scenario.

22. (70-71 p.11) Boothroyd's evidence states "**the proposed modification to the take will not result in this situation occurring as it is not intended to abstract when the river reaches these low flow conditions**" when discussing the many negative impacts of low flow conditions. Although technically the abstraction cannot cause low flow conditions taking 20% of a river will:
    a. cause the river to retreat from its margins (thus exposing and drying out the margins and decrease the wetted area of substrate available as habitat).
    b. Reduce the depth of the river reducing habitat available for all aquatic life.
    c. Increase the rate the river warms up.

23. (76 p.12) Boothroyd has justified not including torrentfish when considering minimum flows by saying he did not notice them in the recent monitoring reports. Although omitting torrent fish could help justification lowing the flow requirements it is contradicted by several detections of torrentfish in the system by other surveys (Jowett 2014; NZ Freshwater Fish Database). I would argue that if the fish are present in the tributaries they will be present in the main stem if habitat exists and according to Jowett (2014) the habitat does exist. In my opinion there is no evidence to exclude torrent fish or disregard the impact of the water take on their optimal habitat.

24. (80 p.13) Boothroyd's evidence states "**In my opinion, the increase in proposed abstraction will have a less than minor impact on useable habitat".** I would disagree and suggest that trout and torrent fish will clearly be impacted by the take unless the minimum flow level for the take is lifted to 1400 L/s and alternatively the take could be limited to 10% of the river as per the previous consent to reduce the impact on aquatic life.

25. (81-85 p.10) Boothroyd singles out a FRE3 parameter as being a primary focus of the abstraction impact. I would agree the FRE3 value is one of many useful tools to look at the impact of a water take in the absence of good ecological modelling and that the applicant has shown the proposed water take will reduce the FRE3. However, in this case there is flow

based modelling that quantifies the impact of water takes near this location for all known fish species that would be far more useful than a single metric that indicates the frequency of flushing. Estimating the impact of the proposed water take on fish should have been done based on Jowett (2014).

26. (125 p.20) Boothroyd stated **"this highlights that, even without the proposed abstraction, at times, water temperatures within the Ohinemuri River are elevated beyond the stated temperature threshold for trout habituation. What is evident is that trout continue to survive and reproduce in the Ohinemuri River, despite the elevations in temperature."** This is like saying that humans can survive famine so further degrading a famine-stricken region's food supply will have no significant impact. Trout are often found in rivers that exceed 19°C but they are required to migrate (Wilson & Boubee, 1996; Gabrielsson & Knight, 2014) or to shelter in inferior habitat to seek thermal refuge at a considerable cost in terms of energy expenditure. This is a key point and it is known that trout are highly disadvantaged by high water temperatures and struggle to survive in the Ohinemuri River without the proposed abstraction reducing their habitat or further heating the river. Boothroyd's evidence does highlight the Ohinemuri River regularly exceeds the limit set for trout habitat but his evidence and the AEE fail to estimate the impact of the abstraction on river temperatures downstream. Reducing flow can increase the rate rivers warm up due to the reduced volume.

27. (128 P.21) The evidence quoted from Dr John Hayes describing river heating caused by water extractions would be accurate for cold rivers on the South Island but even one or two degrees increase can exclude trout from habitat or cause lethal water temperatures on the North Island like the Ohinemuri.

28. (136 p.22) Boothroyd refers to the riparian planting program required by the Waikato Regional Plan and seems to suggest that the applicant has done adequate planting already. I would agree that if the planting was voluntary that the **riparian portion** of the planting should be included as part of the required riparian planting plan, but the applicant has not quantified the impact of the water take or the shading provided by the existing planting to determine its value in relation to the proposed take.

**RELEIFE SAUGHT**

29. Considering that the take will occur for an extended period taking 20% of the Ohinemuri River for 223 days a year exacerbating already poor conditions Fish and Game would like the minim flow for extraction to be set at 1.4 $m^3$/s during the trout spawning season (May-Sep) and 1.0 m3/s during the remaining portion of the year. Alternatively, Fish & Game would agree to a renewal of the existing consent conditions. The required planting plan should be required in addition to appropriate offset or mitigation based modelling the impact on river temperatures (Nov-May) and the impact on fish habitat.

## REFERANCES

Jowett, I. G. (2014). *Flow requirements for fish habitat in the Ohinemuri River , Waihou River and selected tributaries* (Vol. 4355). Hamilton, New Zealand.

Storey, R. G. (2015). *Predicting the effects of water abstraction and land use intensification on gravel bed rivers a Bayesian network approach*.