Before the Independent Hearing Panel

In the Matter	of the Resource Management Act 1991 (**RMA**)
And	
In the Matter	of an application to the Central Otago District Council and Otago Regional Council for resource consent to establish and operate a gold mining activity at 1346 – 1536 Teviot Road, Millers Flat
Reference	RC230325 (Central Otago District Council) RM23.819 (Otago Regional Council)

Evidence of Richard Mark Allibone on behalf Hawkeswood Mining Limited

(Freshwater Ecology)

Dated 29 April 2024

Jeremy Brabant

Barrister

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Introduction

1. My full name is Richard Mark Allibone. I am a freshwater ecologist and I hold a BSc (Zoology and Geology), MSC (Zoology) and PhD (Zoology) from the University of Otago. Both my MSC and PhD were studies of New Zealand's native fish, and the PhD was the first study of the biology of rare non-migratory galaxiids restricted to the Otago region.

2. I have over 30 years' experience as a freshwater ecologist and for the last nine and half years I have been a director and the principal ecologist at Water Ways Consulting. I have previously worked as a senior freshwater ecologist for Golder Associates Ltd and Kingett Mitchell Ltd from 2006 to 2014. Prior to that I was the National Services Manager for The Queen Elizabeth II National Trust, a freshwater fisheries specialist at the Department of Conservation and a freshwater fisheries scientist at the National Institute of Water and Atmospheric Research (NIWA).

3. During my career I have worked on many projects including mine projects, hydro-electric schemes, irrigation related projects, threatened fish management and restoration projects and planning, fish passage and fish screen assessment, riverine habitat assessments and habitat modelling, and general freshwater surveys. Amongst the projects I am currently employed on I am conducting freshwater AEEs for two other gold mine projects, a mine rehabilitation project that aims to protect habitat for a rare fish and I am a technical review for the Otago Regional Council reviewing consent application by OceanaGold Macraes gold mine.

4. I have also been a member of the Freshwater Fish Expert Panel that provides the threat rankings for freshwater fish. I was on this panel from 2000 to 2018 and am one of the contributing authors to the current threat rankings (Dunn et al 2018). I am also a member of the New Zealand Freshwater Science Society and par to the Society's Executive Committee and am the manager of the Society's submissions.

5. I was instructed by Hawkeswood Mining Limited in August 2023 to assess the ecological values in the Tima Burn. This was to address concerns raised in the consent application review by Otago Regional Council that the proposed mine may affect the lower Tima Burn due to ground water level lowering. I am familiar with the area to which the application for resource consent relates. I have visited the site in September 2023 to conduct habitat and instream fauna assessments.

6. Although this is not a hearing before the Environment Court, I record that I have read and agree to and abide by the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. This evidence is within my area of expertise, except where I state that I rely upon the evidence of other expert witnesses as presented to this hearing. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

Scope of Evidence

7. My evidence will address the following:

    a. The fauna present in the lower Tima Burn;

    b. The habitat present in the lower Tima Burn; and

    c. An assessment of the ecological state of the lower Tima Burn.

8. This evidence provides the results of fish and eDNA surveys at multiple sites on the Tima Burn. The habitat survey report addresses the quality of the instream habitat and assesses the likelihood the lower Tima Burn naturally dewaters during summer low flows.

Tima Burn

Sampling

9. I undertook sampling at three sites on the Tima Burn (Figure 1). At each site the fish community was assessed by electric fishing, the habitat features

were recorded, including the nature of the stream and riparian zone. Features that may influence the fish community were also noted. In addition, the most of the Tima Burn between the sample sites was walked to note the general habitat and stream condition. Environmental DNA (eDNA) sampling was conducted at the three sites to provide further fish community data and macroinvertebrate community data. The New Zealand Freshwater Fish Database (NZFFD) was also searched to gather data on the upstream fish community and historical fish community information for the lower Tima Burn.

Habitat Assessment

10. The lower Tima Burn flows through farmland with the stream fenced downstream of Teviot Road but not upstream of the road. However, even though it was fenced there was evidence of stock grazing the riparian zone downstream of Teviot Road. Upstream of the road the banks have few trees with old stumps indicating the majority having been removed. Downstream of the road the stream banks are lined with crack willow. Therefore, I would assess the lower Tima Burn as being a stream in an agricultural area with stock access, and the density of crack willow trees downstream of the road reaching nuisance levels.

11. The individual site habitat assessment show locally habitat conditions vary. Site 1 was immediately downstream of a series of bedrock sills where the Tima Burn leaves the hill country and starts to flow across the river terrace flats. A riffle, partially constructed for a vehicle ford, provided the only area of riffle habitat with cobble and boulder substrate that can provide good fish habitat. Other areas in this reach had well packed substrate with fine gravel and sand infilling the gaps between large substrate particles. Periphyton was abundant and the stream showed no evidence of any recent flushing events that remove fine sediment and periphyton. Stock had access to this reach. The reach was assessed as having low quality habitat.

12. Site 2 was divided into two parts upstream and downstream of a sequence of small bedrock waterfalls. I considered these waterfalls to be a barrier to upstream movement by small non-climbing native fish. Up and

downstream of the waterfall the stock had access to the stream. Downstream of the waterfall the stream had a large pool created by the Teviot Road bridge. Upstream of the waterfall the stream was predominately riffle and run habitat with a gravel stream bed. Periphyton cover was relatively low, and the substrate was less well packed. Fish cover was provided by deep water in the pool and vegetation along the stream banks. This site was assessed as having low to moderate quality habitat.

13. Site 3 was in a crack willow lined section of stream. Much of the stream bed was covered by willow root mats (Figure 2). These root mats provide no habitat for fish and prevent fish spawning for substrate spawning fish (e.g. trout and upland bullies). The mats also accumulate fine sediment, and the combination of root mats and fine sediment provides very little habitat for macroinvertebrates. In summer the reach would be full shaded by the willow trees. Therefore, the crack willow lined lower reach is assessed as having very poor habitat.

Macroinvertebrates

14. At Site 1 *Potamopyrgus* snails were the common macroinvertebrate. Every rock examined had these snails present. *Hydropsyche* caddisflies (a filter feeding caddisfly) were the next most common macroinvertebrate and were present on most rocks. Two other taxa, Leptophlebiidae mayflies (2 individuals) and a hydrobiosid caddisfly (1 individual) were observed. No stoneflies were present. The only macroinvertebrates observed on the stop net while electric fishing were worms. The worms were also noticeable while electric fishing and could be seen emerging from the stream substrate.

15. At Site 2 *Potamopyrgus* snails were the common macroinvertebrate at Site 2. Every rock examined had these snails present. *Hydropsyche* caddisflies were the next most common macroinvertebrate and were the only caddisfly taxa observed. A single *Physella* snail was also noted. No mayfly or stonefly nymphs were found.

16. The only macroinvertebrates observed on the stop net while electric fishing were worms, and they were also noticeable while electric fishing and could be seen emerging from the stream substrate.

17. *Potamopyrgus* snails were the common macroinvertebrate on rocks at Site 3. No mayfly, caddisfly or stonefly nymphs were found. The only macroinvertebrates observed on the stop net while electric fishing were worms, and they were also noticeable while electric fishing and could be seen emerging from the stream substrate.

18. One notable aspect of the macroinvertebrate fauna is the abundance of taxa tolerant of low flow or no flow. The *Potamopyrgus* snail and the worms can tolerate no flows and at times no water. The lack of other taxa indicates poor stream habitat and/or water quality.

Fish Survey

19. At Site 1 two longfin eels and one upland bully were caught in the 100 m^2 that was fished, and this included good riffle, and run and pool habitat. The longfin eels were estimated to be 700 mm and 500 mm long and the upland bully was a small juvenile fish 39 mm long. The absence of adult upland bullies indicates that the juvenile caught has probably moved into the reach from an upstream adult population. Two small backwater areas were fished for lamprey, but none were found.

20. Site 2 was electric fished in two sections, upstream and downstream of the waterfall sequence. In total an estimated 100 m^2 was fished split roughly 50:50 above and below the waterfalls. Upstream of the waterfalls four longfin eels were caught in riffle and pool habitat. The estimated lengths were 700 mm, 650 mm, 600 mm, and 400 mm. No other fish were seen upstream of the waterfall. Downstream of the waterfalls, pool and riffle habitats were fished and one longfin eel (350 mm), two brown trout and one inanga were collected. Another eel evaded capture. The two trout were juvenile individuals, 117 mm and 132 mm long (Figure 3). The inanga was an adult individual, 94 mm long (Figure 4). It is likely that the waterfalls were of sufficient height to prevent the inanga moving further upstream,

but the waterfalls would not stop brown trout upstream movement. Soft sediment areas of the pool below the waterfalls were fished for lamprey juveniles but none were caught.

21. At Site 3 a single 650 mm longfin eel was caught. No other fish were seen. Backwater areas suitable for lamprey were rare and when fished only worms emerged from the stream bed that was predominately willow root mat. For juvenile lamprey, that burrow in fine sediment in backwaters, the willow root mats have smothered their preferred habitat. Given the riffle habitat was also covered by willow roots the absence of riffle dwellers is not unexpected. Fish were also generally absent from the pool habitat despite the good cover amongst the fallen branches with just the single eel caught in this habitat.

22. The NZFFD has eight records for the Tima Burn between Site 1 and the Clutha River/Mata Au confluence. These records date from 1982 (historic) to 2018 (recent). Brown trout and longfin eel are the most frequently reported fish species. Upland bully is the next most frequently reported fish, but it has only been reported in the reach below Site 1 in the 1980s. More recent surveys did not find this fish. Shortfin eel, koaro, common bully, rainbow trout and Chinook salmon were also reported in the 1980s although only in very low numbers. Lamprey juveniles have been reported more recently (2016, 2000) both times upstream of Teviot Road. There are no previous records of inanga in the Tima Burn.

23. In my experience all three sites I fished had very low fish abundance and the fish community was also of very low diversity, both at the site level and for the whole survey area, with only four species found and two of those species only single individuals were caught. We did catch longfin eel and brown trout the two most commonly reported species in the NZFFD but as the other species have been reported rarely and most of those records date from twenty to forty years ago, they are historic rather than presenting a present-day picture of the fish present.

24. Longfin eel and inanga are both classified as at risk declining fish species by Dunn et al (2018). No threatened species were located and the NZFFD has

no records for threatened non-migratory galaxiids, but it does report that lamprey are occasionally present upstream of Teviot Road. Lamprey are considered threatened with a ranking of nationally vulnerable (Dunn et al 2018).

eDNA data

25. The eDNA samples collected at the three sites provide data on fish and invertebrates in the lower Tima Burn and can provide a very useful method for assessing the overall freshwater community. The macroinvertebrate data can also be used to help assess the stream habitat quality.

26. At both Site 1 and 3 the highest eDNA sequence detections were made for three types of worms (sludge worms and blackworms) and a large number of other worm taxa also featured high in the number of sequences detected. At Site 1 and 3 longfin eel also had a high detection rate at both sites. Upland bully eDNA was also collected at both sites, but brown trout eDNA was only detected at Site 3.

27. Caddisfly and midge species were the most common insect group detected in the eDNA samples, but the sequence detection rate was low. There were very low detections of two mayflies, *Neozephlebia scita* at Site 1 and *Coloburiscus humeralis* at Site 3. There were no stonefly eDNA detections. The low diversity of the mayfly and caddisfly detections and the low number of sequence detections mirror the observations that these taxa were rare at all sites.

28. The eDNA did not detect any fish species not collected by the electric fishing but did indicate that upland bully is likely to be more widespread along the Tima Burn.

29. The eDNA did not detect lamprey at any site. This provides good evidence that lamprey are not present in the lower Tima Burn at the time of sampling.

30. The macroinvertebrate eDNA detections were dominated by worms and this is a very good indicator that instream habitat is poor. This is further supported by the very low detection rates for mayflies, caddisflies and

stoneflies (EPT taxa) that are all indicators of good habitat and/or good water quality. The EPT taxa are also common riffle inhabitants preferring fast flowing water and using the interstial space amongst cobbles and boulders as habitat. At Site 3 the dominance of willow root mat across the stream bed means the preferred habitat for EPT taxa is nearly completely absent.

31. These eDNA results support the habitat observations that assessed the instream habitat as poor, and the fish diversity is low and threatened fish and macroinvertebrates are not currently present in the lower Tima Burn.

Crack Willow Impacts

32. Crack willow can be a major habitat modifier in small streams and as noted above the root mats smother the rocky instream habitat that is the preferred habitat for many macroinvertebrates and small fish. Small streams or streams subject to low flows in summer, either natural or due to water abstraction, are especially vulnerable to this smothering effect. While the flow is low the water velocity is insufficient to prevent the root mats extending across the stream bed. During the high tree growth period in summer this leads extensive root matt growth. Once these root mats have become established, in my experience they are hard to remove and generally require the crack willow trees to be killed. In Otago it is common to find this issue in small streams. For fish such as non-migratory galaxiids and the introduced salmonids, it not only smothers fish habitat but also the spawning habitat that is amongst the boulder, cobbles or gravels on the stream bed. For this reason, I consider crack willow infested riparian zones along small streams to be a major detrimental issue for stream health.

Tima Burn Ecology Summary

33. The lower Tima Burn fish, macroinvertebrate and habitat assessments found the stream has low habitat quality and the freshwater fauna is also of low quality and dominated by species, eels and worms, that tolerate relatively poor water and/or habitat quality. This low-quality habitat and fauna was most severe at Site 3 where the crack willow root mats have

smothered much of the natural stream bed and this is likely to be one of the causes for the almost complete absence of fish at this site.

Assessment of the Proposed Mine Effects

34. I was requested to assess the effects of potential dewatering of the lower Tima Burn around the Site 3 reach.

35. I have been told by the applicant that the reach at Site 3 can dry during summer low flow periods. I have considered this possibility in the assessment below.

36. Stream draw down effects can be divided into three categories:

    - lower flows but still a flowing stream with fish passage possible:
    - continuous flow, remnant pools remain but fish passage through the reach is blocked; or
    - all water lost from the reach.

37. An additional consideration is the duration of any dewatering effect. As the mine will work progressively along the mine area, any dewatering effect is only possible when the mine is close to the Tima Burn. Therefore, if there is any effect, I expect this would be for the period when the mine is close to the Tima Burn.

38. In addition, fish and macroinvertebrate fauna of the lower Tima Burn indicates this reach is subject to low summer flows and the instream fauna is already forced to survive low and no flow periods. The presence of very few fish and a low/no flow tolerant macroinvertebrate fauna (snails and worms) at Site 3 demonstrates the effect of these low flow periods. The willow root mats are also indicator that low flows occur allowing these root mats to extend across the streambed.

39. However, assessing the possible flow reduction effects, the first category of lower flow has a limited effect that is associated with a reduction in habitat, but habitat and fish passage are still provided, and the instream community

can be expected to remain intact. This is especially so if the duration of the draw down effect is short, e.g., less than three weeks.

40. The second category has effects on fish passage as it prevents passage during the draw down period. However, as different fish species and life history stages migrate at different times of the year there are species specific and time specific effects. For instance, no fish migrate through the reach in winter. Whereas late spring and summer there will be an upstream elver migration. However, this occurs over a three-month period and would only be completely halted if the stream was dry for the full migration period. The remanent pool habitat also provides refuge habitat for resident fish and macroinverterbrates. Therefore, stream life will be depleted, but some will use the refuge pools to survive the low flow period.

41. For the Tima Burn the fish passage effect is also somewhat limited. The presence of the small waterfalls immediately upstream of Teviot Road means that fish passage is naturally impeded at this point. These waterfalls are still climbable by eels and salmonids will jump them but native fish such as inanga and common bully are naturally restricted to the lower Tima Burn. Any temporary loss of fish passage will not reduce upstream recruitment of the non-climbing species.

42. The third category causes the same fish passage issues as category 2 but as there is a loss of refuge habitat the resident fish and macroinvertebrates are eliminated from the dry reach. However, in this case at Site 3 the *Potamopyrgus* snails and worms can survive if they avoid desiccation during the dry period. Their present abundance in this reach indicates that they currently survive the summer low flows that are reported to include low flow periods.

43. The assessment by Mr Heller indicates that mine dewatering will not cause any reduction in flow in the Tima Burn. Accepting this, then my assessment of effect on the Tima Burn ecosystem is that the mine will have no effect on the Tima Burn and its ecosystem. In fact, none of the scenarios apply as the mine is not expected to influence the flow in the Tima Burn at all.

44. Therefore, I do not expect the proposed mine and associated pit dewatering to have an effect on the Tima Burn. In the event that some additional dewatering does occur, it would occur in the reach already subject to low or no flows. This reach has very low ecological value and is occupied by low/no flow, low oxygentolerant species. The macroinvertebrate taxa can be expected to survive the flow reduction and fish can reoccupy the reach if the few present are lost.

45. I also note that the proposed consent conditions include a flow augmentation conditions to provide water for the lower Tima Burn. This consent conditions provides further insurance that stream drying does not occur.

ORC Section 42A Report

46. I have read the technical review provided by Mark Hamer of E3 Scientific and noted that we are in general agreement that the lower Tima Burn is in poor ecological health.

47. There is one factor that Mr Hamer has incorrectly assessed in his review. He notes the presence of longfin eel and inanga in my fish survey and refers to these two species as threatened species. This is incorrect. The Department of Conservation threat classification manual (Townsend et al 2008) outlines the threat rankings and defines what threatened species are. In Figure 1 from Townsend et al (2008) (reproduced below as Figure 5) it shows three threat ranking classifications in the wider threatened species category. These are the classifications: Nationally Critically, Nationally Endangered and Nationally Vulnerable.

48. In New Zealand Freshwater Sciences Society's 2019 submission on the National Policy Statement – Freshwater Management we also submitted that the National Policy Statement clarify what was meant by the term 'threatened species' to avoid confusion amongst the various threat rankings in Department of Conservation method (Townsend et al 2008). The final version of the National Policy Statement-Freshwater Management on Page 7 defines threatened species as

a. *threatened species means any indigenous species of flora or fauna that:*

   i. *relies on water bodies for at least part of its life cycle; and*

   ii. *meets the criteria for nationally critical, nationally endangered, nationally vulnerable species in the New Zealand Threat Classification System Manual.*

49. Therefore, as longfin eel and inanga are both classified as Declining and sit in the At Risk group, they are not considered threatened species, either by the Department of Conservation nor in the National Policy Statement – Freshwater Management.

50. Mr Hamer concludes that due to the presence of the threatened species, longfin eel and inanga, the Tima Burn has high values. As this assessment is based on an incorrect understanding of the Department of Conservation threat ranking system and not in line with the National Policy Statement Freshwater Management, in my opinion, this conclusion regarding threatened species and the Tima Burn's high value is incorrect.

51. This error in the presence of threatened species has been carried over into the S42A report where in several parts of the analysis it is incorrectly stated that the Tima Burn supports populations of threatened species and therefore the stream values are high.

52. It is my opinion that Mr Hamer and I agree on the degraded state of the lower Tima Burn and when the correct threatened species classifications are used it has low ecological value.

53. I also note that the S42A report refers to Schedule 1A of the Regional Plan: Water for Otago and notes that the Schedule states the Tima Burn is significant habitat for koaro and has indigenous fish threatened with extinction.[1] In my opinion Schedule 1A of the RPW is outdated and the values its records are often no longer appropriate. The fish and eDNA

[1] S42A Report, at [4.1.1], [6.1.8].

surveys I undertook did not locate or detect koaro and while there are two Declining species, inanga and longfin eel, these are not threatened with extinction. Therefore, based on that evidence I would disregard these Schedule 1A values.

54. In my opinion, the proposed consent condition for a flow augmentation of 21 L/s for the Tima Burn provides an assurance that any mine dewatering effects will not lead to an induced drying event in the lower Tima Burn that is due to the mining activity.

55. I have some concerns regarding the requirement to maintain a dissolved oxygen level of 8 mg/L in the lower Tima Burn. I would recommend that the dissolved oxygen requirement of 8 mg/L is applied to the augmented water. The dissolved oxygen level downstream of the discharge point will be subject to daily fluctuations due to plant and animal respiration (day and night) and photosynthesis (day only) that reduces and increases oxygen levels respectively. At night respiration leads to a reduction in dissolved oxygen, often referred to as a DO sag. The abundance of periphyton and macrophytes in the Tima Burn will be a major controlling factor on nighttime respiration and I would expect in summer this night-time respiration will naturally reduce the dissolved oxygen level to below 8 mg/L. Furthermore, the eels and macroinvertebrate fauna (worms and snails) at my site 3 in the lower Tima Burn are a low dissolved oxygen tolerant fauna indicating that this reach even if not dry is subject to natural low dissolved oxygen conditions indicating the at Tima Burn does not naturally maintain an 8 mg/L dissolved oxygen level.

56. For reasons identified above, I am of the opinion that objectives and policies[2] directed toward management of ecosystems and indigenous biological diversity in freshwater environments, and maintenance or enhancement of freshwater ecosystems, are achieved by the proposal. I do

[2] Operative Regional Policy Statement, Policy 3.1.9; Proposed Otago Regional Policy Statement (ORPS 2021) and Proposed Otago Regional Policy Statement – Freshwater Instrument Components 2021, Land and Freshwater LF–FW–O8 – Fresh water and LF-FW-P7 Fresh water.

not believe that the proposal will result in further loss of taoka species (which is a concern expressed in the Aukaha submission).

Conclusion

57. The lower Tima Burn is a stream with poor ecological condition with low diversity and abundance fish and macroinvertebrate communities. Only poor habitat quality taxa, snails and worms are common. These are low flow and low oxygen tolerant species. Overall, the lower Tima Burn can be assessed as having low ecological value.

58. The present assessment is that dewatering of the mine will not impact on the Tima Burn and therefore there will be not effects on the Tima Burn and its flora and fauna.

59. In the event there is some reduction in flow this will occur in the area already subject to low or no flow. This reach has a small low/no flow and low dissolved oxygen tolerant fauna and any further induced low flow will not impact on any significant ecological values and the drought and low oxygen tolerant fauna will not be lost. Furthermore, as flow augmentation is proposed in specified circumstances (if they arose) to prevent dewatering due to the mine dewatering this protects the lower Tima Burn fauna from any induced drying.

Richard Mark Allibone

Dated 29 April 2024

References

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Townsend AJ, de Lange P, Duffy CAJ, Miskelly CM, Molloy J, Norton D 2008. New Zealand threat classification system manual. 35 p.

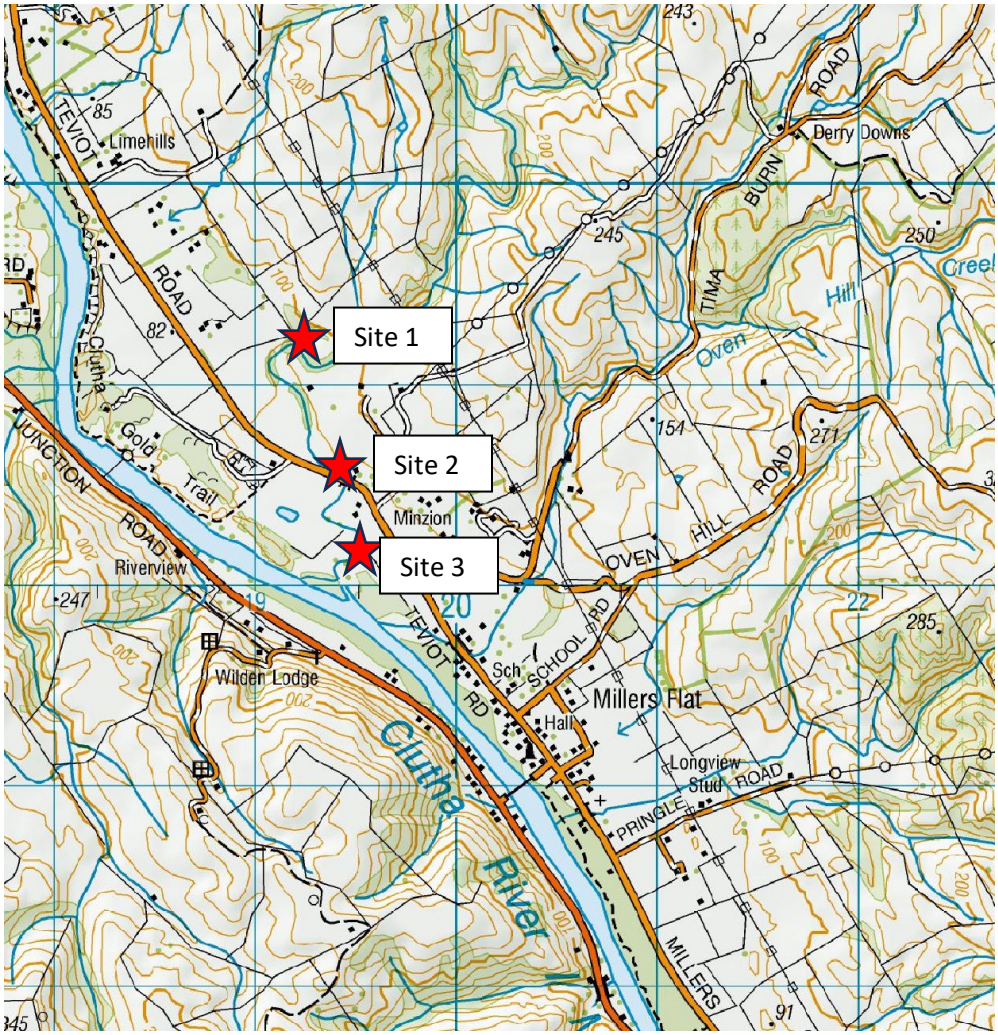

Figure 1: The Tima Burn survey locations.

Figure 2: Site 3 with crack willows lining the channel and root mats extending across the streambed.

Figure 3 A brown trout from Site 2.

Figure 4: The adult inanga caught at site 2.

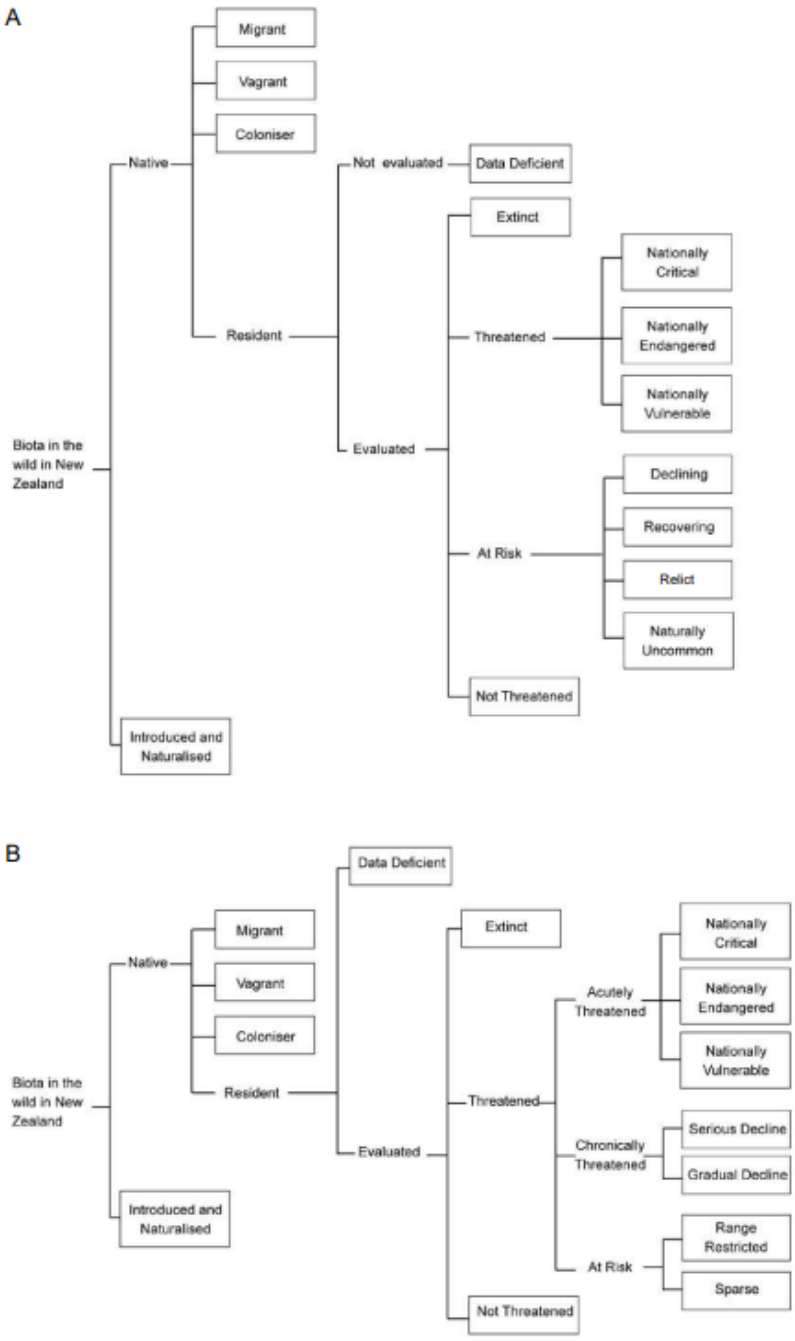

Figure 1. A. Revised (2007) and B. original (2002) structure of the New Zealand Threat Classification System.

Figure 5: The Department of Conservation threat classification from Townsend et al (2008).