**BEFORE THE PROPOSED NATURAL RESOURCES PLAN HEARINGS PANEL**

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|---|---|
| **IN THE MATTER** | of the Resource Management Act 1991 |
| **AND** | |
| **IN THE MATTER** | of Wetlands and Biodiversity |
| **AND** | |
| **IN THE MATTER** | of the submissions and further submissions set out in the S42A Officer Report |

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# STATEMENT OF PRIMARY EVIDENCE OF ALTON PERRIE ON BEHALF OF WELLINGTON REGIONAL COUNCIL

## TECHNICAL –Wetlands and Biodiversity

**7 March 2018**

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## 1. SUMMARY

1.1 My name is Alton Perrie. I work as an Environmental Scientist for Greater Wellington Regional Council. I hold a Bachelor of Science and Master of Science degrees from the University of Waikato, majoring in ecology and freshwater ecology, respectively. I am also currently a PhD candidate (part-time) with the University of Waikato undertaking freshwater ecological research. I have 13 years of employment experience in water quality and freshwater ecology resource assessment and management. A full copy of my qualifications and experience is available in **Attachment A** of my evidence.

1.2 I have been asked to provide technical evidence to set the context for and respond to submissions received coded to the topic **Wetlands and Biodiversity** for the following specific matters:

(a) Provide background information on the indigenous fish found in /local to the Wellington Region – species, habitat needs and conservation status;

(b) Explain the basis for identifying rivers and lakes with outstanding indigenous ecosystem values and respond to specific submissions on sites listed in Schedule A;

(c) Explain the criteria for identifying rivers and lakes with significant indigenous ecosystems values and respond to specific submissions on sites listed in Schedule F1;

(d) Explain the basis for identifying known spawning and migration times for indigenous fish species and respond to specific submissions on Schedule F1a;

(e) Respond to specific submissions on Schedule F4 – Ecosystems with significant indigenous biodiversity values in the coastal marine area – where these require freshwater expertise; and

(f) Respond to the evidence of Dr Adam Canning who sets out the criteria used to identify important trout fishery rivers and spawning waters.

1.3 The scope of my evidence includes assessing submissions relating to the matters listed above and making recommendations from a

technical perspective about what response to the relief sought in the submission I consider would be appropriate.

1.4 In Section 12 of my evidence I rely on the evidence of Dr Adam Canning. His qualifications and experience are set out in his evidence.

1.5 My Evidence addresses matters raised in the submissions of; Wellington Recreational Marine Fishers Association (S34/04, S34/040, S34/044), Federated Farmers of NZ (S352/273, S352/282, FS54/095), Fertiliser Association NZ (S302/064, S302/065), Egon Guttke (S14/043, S14/044), DairyNZ and Fonterra (S84/095), Maypole Environmental Limited (S143/004), Ian Benge and Martin Benge (S83/003), Kapiti Coast Airport Holdings (S99/001 and/003), Rural Residents Environmental Society (S125/029), CentrePort (S121/141), Kiwi Rail Holdings (S140/077) and a number of 'Farmer Common Format' submissions.

1.6 In summary, my key conclusions are as follows:

(a) Not to add the Makara Stream to Schedule A1 of the proposed Plan (Rivers with outstanding indigenous ecosystem values),

(b) I support the robustness of Schedule F1 as an appropriate list of rivers and lakes that are significant indigenous ecosystems and I recommend that no changes are required to this schedule,

(c) I consider that inclusion of headwater and tributary reaches as listed in Schedule F1, including for the Waikanae River is appropriate,

(d) While introduced species such as trout can in some situations impact on indigenous fish species, the implications of a river being in both Schedule F and I is unlikely to have a negative impact on indigenous fish communities. I recommend that no changes are required to Schedule F or I,

(e) I consider that inclusion of Ngarara Stream in Schedule F1 is appropriate,

(f) I consider the Taupo Stream catchment has been correctly identified as a significant indigenous ecosystem and included

in Schedule F1,

(g) I consider that the tributaries of the Waikanae River upstream of E1781550.6 N5475221.92 have been correctly identified as a significant indigenous ecosystem,

(h) I consider that inclusion the Wharemauku Stream and its tributaries, as listed in Schedule F1, appropriate,

(i) It is not appropriate to add the Moroa Water Race to Schedule F, and I recommend that no changes are required to Schedule F,

(j) I consider that the spawning periods listed in Schedule F1a are appropriate,

(k) It is appropriate to identify the Kaiwharawhara Stream mouth/Estuary in Schedule F4,

(l) The criteria proposed by Dr Canning are appropriate and transparent for identifying important trout fishing rivers and spawning waters in the Wellington Region. Where submitters have requested either the deletion or addition of a particular site, I consider that these requests should be assessed against the criteria outlined by Dr Canning.

## 2. INTRODUCTION

2.1 My name is Alton Perrie. I work as an Environmental Scientist for Greater Wellington Regional Council. I hold a Bachelor of Science and Master of Science degrees from the University of Waikato, majoring in ecology and freshwater ecology, respectively. I am also currently a PhD candidate (part-time) with the University of Waikato undertaking freshwater ecological research. I have 13 years of employment experience in water quality and freshwater ecology resource assessment and management.

2.2 My expertise is primarily in river, stream and lake water quality and freshwater ecology and, in particular, the monitoring and reporting of the state of these resources. A fuller account of my qualifications and experience is available in **Attachment A** of my evidence.

2.3 My evidence relates to the topic of **Wetlands and Biodiversity**.

## 3. CODE OF CONDUCT

3.1 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note and that I agree to comply with the code. My evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter to detract from the opinions which I express.

## 4. SCOPE

4.1 I have been asked to provide technical evidence to set the context for and respond to submissions received coded to the topic **Wetlands and Biodiversity** for the following specific matters:

(g) Provide background information on the indigenous fish found in /local to the Wellington Region – species, habitat needs and conservation status;

(h) Explain the basis for identifying rivers and lakes with outstanding indigenous ecosystem values and respond to specific submissions on sites listed in Schedule A;

(i) Explain the criteria for identifying rivers and lakes with significant indigenous ecosystems values and respond to

specific submissions on sites listed in Schedule F1;

(j) Explain the basis for identifying known spawning and migration times for indigenous fish species and respond to specific submissions on Schedule F1a;

(k) Respond to specific submissions on Schedule F4 – Ecosystems with significant indigenous biodiversity values in the coastal marine area – where these require freshwater expertise; and

(l) Respond to the evidence of Dr Adam Canning who sets out the criteria used to identify important trout fishery rivers and spawning waters.

4.2 The scope of my evidence includes assessing submissions relating to the matters listed above and making recommendations from a technical perspective about what response to the relief sought in the submission I consider would be appropriate.

4.3 Technical evidence addressing submissions on outstanding and significant wetlands listed in Schedules A3, and F3 is provided in the evidence of Dr Philippa Crisp.

## 5. BACKGROUND: INDIGENOUS FISH IN THE WELLINGTON REGION – SPECIES AND CONSERVATION STATUS

### Indigenous fish of the Wellington Region

5.1 Twenty (extant) indigenous freshwater fish species have been recorded in the Wellington Region. The majority of these species are endemic to New Zealand, meaning they are found nowhere else in the world. In general, New Zealand's indigenous freshwater fishes are poorly known to the public as they are typically small, cryptic (remain hidden) and nocturnal. A list of these 20 species is provided in Table 1.

5.2 Of these 20 species, 16 are diadromous, which means they typically need to migrate between freshwater environments and the sea to complete their life cycles. Diadromy is a key feature of fish communities in the Wellington Region (as it is in New Zealand as a whole) as it influences the distribution of fish throughout the region's

rivers and it also means that maintaining adequate upstream and downstream migratory pathways for these diadromous species is an important requirement to protect these species' habitats[1].

5.3 These 20 indigenous freshwater species have a wide range of habitat requirements that are exhibited at both large and fine spatial scales. These habitat requirements can result in unequal distribution of different species across a catchment, and also across a particular river reach. At larger spatial scales (i.e., at a catchment-scale) species can be readily classified into those most likely to occur in lowland reaches and those most likely to occur in upland reaches (McDowall 2000; Joy & Death 2004). This distribution is thought to reflect differences in a species' innate "migratory drive" to penetrate inland, as well as differing abilities to pass both natural and man-made barriers. It also reflects broader-scale habitat preferences and how these relate to differences in habitat between lowland and upland reaches/rivers. Habitat differences between lowland and upland rivers include a combination of both natural (e.g., steep gradient and fast flowing vs low gradient and slow flowing) and anthropogenic factors (e.g., most indigenous forest is now predominantly located in the upper reaches of rivers, for example, the forested slopes of the Tararua Ranges) that may drive a species' distribution.

5.4 At finer-scales (e.g., a lowland reach of 1 km length), different species will also occupy different parts of a river reach based on their habitat preferences. For example, large eels are more likely to be found in deeper pools with sufficient cover and torrentfish are more likely to be found in swiftly flowing riffle habitat.

[1] Some of these diadromous species - giant kokopu, shortjaw kokopu, banded kokopu, koaro, inanga, common bully and common smelt - can, in certain situations, form land-locked populations that use a lake-like-habitat as a surrogate for the sea for larval/juvenile raring (McDowall 2000). However, in the Wellington Region there is little evidence that this frequently occurs for any species except common smelt and common bully, and even then, only in certain lakes. Therefore it is assumed that both downstream and upstream migratory pathways are still required for the maintenance of diadromous fish populations found in the region.

**Table 1: Freshwater fish recorded in the Wellington Region and their current conservation status. Whether a species is diadromous (migratory) or not is also indicated.**

| Species | Conservation status Goodman et al. (2014) | Diadromous (migratory) |
|---|---|---|
| Longfin eel | At Risk | Yes |
| Shortfin eel | Not Threatened | Yes |
| Lamprey | Nationally Vulnerable | Yes |
| Giant kokopu | At Risk | Yes |
| Shortjaw kokopu | Nationally Vulnerable | Yes |
| Banded kokopu | Not Threatened | Yes |
| Koaro | At Risk | Yes |
| Inanga | At Risk | Yes |
| Dwarf galaxias | At Risk | No |
| Brown mudfish | At Risk | No |
| Redfin bully | At Risk | Yes |
| Bluegill bully | At Risk | Yes |
| Common bully | Not Threatened | Yes |
| Upland bully | Not Threatened | No |
| Cran's bully | Not Threatened | No |
| Giant bully | Not Threatened | Yes |
| Torrentfish | At Risk | Yes |
| Common smelt | Not Threatened | Yes |
| Black flounder | Not Threatened | Yes |
| Grey Mullet | Not Threatened | Yes |

**Conservation Status of indigenous fish of the Wellington Region**

5.5 The New Zealand Threat Classification System assesses the risk of extinction that a species faces and assigns a conservation status (Townsend et al. 2008). The three main conservation statuses are "Threatened", "At Risk", and "Not Threatened". Based on the most recent classification available (Goodman et al, 2014) , two of the 20 freshwater fish species found in the Wellington Region are currently classified as threatened, nine are classified as at risk and nine are classified as not threatened (Table 1).

5.6 Over the last decade, the proportion of species in the Wellington Region that have a "conservation status" has increased from 30% to

55% (Hitchmough et al. 2007; Allibone et al. 2010; Goodman et al. 2014). The increase in number of species with a conservation status reflects a better understanding of population size/habitat occupancy and genetic knowledge, as well as a better understanding of the impacts that competition and predation by exotic species, declining water quality, water abstraction, river morphological modifications and loss of habitat via land-use change and land-use activities are having on freshwater fish populations (Allibone et al. 2010; Goodman et al. 2014).

## 6. REQUIREMENT TO MANAGE SITES OF SIGNIFICANCE IN THE PROPOSED PLAN

6.1 Section 6 of the Resource Management Act recognises the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna as a matter of national importance.

6.2 Policy A2 of the National Policy Statement - Freshwater Management requires protection of the significant values of outstanding freshwater bodies. Outstanding freshwater bodies are defined as those water bodies identified in a regional policy statement or regional plan as having outstanding values, including ecological, landscape, recreational and spiritual values.

6.3 Policy 24 of the Regional Policy Statement for the Wellington Region (RPS) states that district and regional plans shall include policies, rules and methods to protect indigenous ecosystems and habitats with significant indigenous biodiversity values from inappropriate subdivision, use and development. The policy framework set out in the proposed Plan to manage these areas is described in the Section 42A report: Wetlands and Biodiversity prepared by Ms Pam Guest. The RPS allocates responsibility for managing biodiversity across the region. The Council is responsible for managing aquatic indigenous biodiversity, including biodiversity in the coastal marine area, lakes, rivers, and wetlands, while biodiversity on land is addressed by district and city councils.

6.4 Policy 23 of the RPS states that district and regional plans shall identify and evaluate indigenous ecosystems and habitats with

significant indigenous biodiversity values; these ecosystems and habitats will be considered significant if they meet one or more of the following criteria:

(a) Representativeness: the ecosystems or habitats that are typical and characteristic examples of the full range of the original or current natural diversity of ecosystem and habitat types in a district or in the region, and:

  i. are no longer commonplace (less than about 30% remaining); or

  ii. are poorly represented in existing protected areas (less than about 20% legally protected).

(b) Rarity: the ecosystem or habitat has biological or physical features that are scarce or threatened in a local, regional or national context. This can include individual species, rare and distinctive biological communities and physical features that are unusual or rare.

(c) Diversity: the ecosystem or habitat has a natural diversity of ecological units, ecosystems, species and physical features within an area.

(d) Ecological context of an area: the ecosystem or habitat

  i. enhances connectivity or otherwise buffers representative, rare or diverse indigenous ecosystems and habitats; or

  ii. provides seasonal or core habitat for protected or threatened indigenous species.

(e) Tangata whenua values: the ecosystem or habitat contains characteristics of special spiritual, historical or cultural significance to tangata whenua, identified in accordance with tikanga Māori.

## 7. SCHEDULE A: OUTSTANDING WATER BODIES

### Criteria for inclusion

7.1 Including rivers in the proposed Plan as outstanding for indigenous ecosystems values is supported by Policy 19 of the RPS and meets the requirements of the National Policy Statement- Freshwater Management Policy A2 which requires protection of the significant values of outstanding freshwater bodies. The RPS policy includes criteria for identifying significant rivers and based on these criteria, an outstanding river was considered one that met all off the following criteria:

- High macroinvertebrate health (MCI greater than 120) in areas with indigenous forest covering more than 80% of the upstream catchment; and
- Indigenous fish diversity (habitat for six or migratory indigenous fish species); and
- Threatened fish species (habitat for nationally threated fish species); and
- Large (5th order) rivers

7.2 These criteria were identified and applied by a Council expert panel to determine outstanding rivers.

### Responses to submissions on Schedule A1

### Submission S34/04 – Makara Stream

7.3 Wellington Recreational Marine Fishers Association S34/04 requests that the Makara Stream be included in Schedule A1 which recognises outstanding rivers/streams in the Wellington Region. The submission states that this inclusion is warranted because of this stream's "unique ecosystem" and that it provides habitat for mysid shrimp (*Tenagomysis novae-zealandiae*) which are an important food source for marine species, including yelloweye mullet.

7.4 While the Makara Stream is a 5th order stream (i.e., a larger water way) and provides habitat for indigenous threatened/at risk species and habitat for six or more migratory species, it is a highly modified catchment with only around 27% of the catchment remaining in indigenous forest/scrub cover. Hence it does not meet the high macroinvertebrate health criteria described in paragraph 7.1 and was therefore not considered outstanding. However, I note that the

Makara Stream is identified in both Schedules F1 and F4 as a river and estuary that supports significant indigenous ecosystems, respectively.

7.5 I acknowledge that mysid shrimp can be a particularly important food resource for both marine and freshwater fishes in estuaries and the lower reaches of rivers across the Wellington Region. However, the presence of mysid shrimp was not included in the criteria used for identifying outstanding rivers and streams. The proposed Plan does recognise that rivers being protected for their outstanding values are at an interim stage and that further work on appropriate criteria may be needed. This further work is provided for in Method M7 of the proposed Plan.

7.6 Based on my evaluation I do not consider that it is appropriate to add the Makara Stream to Schedule A1 of the proposed Plan (Rivers with outstanding indigenous ecosystem values).

## 8. SCHEDULE F1: RIVERS AND LAKES WITH SIGNIFICANT INDIGENOUS ECOSYSTEMS

### General background

8.1 Schedule F1 identifies rivers and lakes with significant indigenous ecosystems, which meet the RPS Policy 23 criteria (a) - (d). Sites which meet criterion (e) tangata whenua values are set out in Schedule C of the proposed Plan. Warr et al. (2009) established four criteria for identifying rivers, streams and lakes with significant indigenous biodiversity values that met at least one of the overarching criteria set out in (a) – (d) of Policy 23 of the RPS. These were:

(a) Rivers and streams with high macroinvertebrate health;

(b) Rivers, streams and lakes that provide habitat for indigenous threatened/at risk fish species;

(c) Rivers, streams and lakes that provide habitat for six or more migratory indigenous fish species; and

(d) Rivers and streams that provide inanga spawning habitat.

8.2 These criteria were originally established and applied in Warr et al.

(2009) to identify rivers, streams and lakes with significant indigenous biodiversity values for Table 16 of the Regional Policy Statement (RPS; GWRC 2013).

8.3 Perrie et al. (2014) then updated the rivers, streams and lakes that were listed in Table 16 of the RPS for inclusion in Schedule F1 of the draft, and subsequent, proposed Natural Resources Plan (PNRP; GWRC 2015). This update did not review the criteria previously developed in Warr et al. (2009) but re-applied them using the latest information for the macroinvertebrate community health criterion and providing additional information for the rivers, streams and lakes already listed for two of the indigenous fish species criteria (habitat for indigenous threatened/at risk species and habitat for six or more migratory species). Several corrections to errors in the original list in Table 16 of the RPS were also made (see Attachment B for these changes and Perrie et al. 2014 for details).

8.4 Full details on the methodology used to apply these criteria can be found in Warr et al. (2009) and Perrie et al. (2014) and are briefly summarised below. Table 2 summarises the links between Policy 23 criteria (a) - (e) and the four criteria applied in Warr et al. (2009). Technical details supporting the development of the table of known spawning and migration times for indigenous fish species listed in Schedule F1a are documented separately in Perrie (2014) and Rowe (2013).

**Table 2: Summary of links between Policy 23 criteria (a) - (e) and the criteria applied in Warr et al. (2009)**

| Criteria used to identify significant sites | Rationale and RPS Policy 23 (a) – (e) criteria met |
|---|---|
| (a) Rivers and streams with high macroinvertebrate health | This criterion was used to identify rivers and streams that are at, or close to, their natural state. This relates to the representativeness criterion (e) of Policy 23 because rivers and streams that are in, or close to, their natural state have been significantly reduced from their former extent in the Wellington Region. Hence, they are no longer common place. |
| (b) Rivers, streams and lakes that provide habitat for indigenous threatened/at risk fish | This criterion relates directly to the rarity criterion (b) of Policy 23 which specifies that a significant ecosystem can have biological or physical features that are scarce or threatened in local, |

| | |
|---|---|
| species | regional or national context. Application of this criterion used the presence of selected threatened/at risk species that had been identified through a national process (Hitchmough et al. 2007).<br><br>This criterion was also applied at a catchment (or sub-catchment) scale in order to protect the migratory pathways of the diadromous threatened species. Protection of the downstream migratory pathways relates to criterion (d)(i) of Policy 23 in terms of enhancing connectivity. |
| (c) Rivers, streams and lakes that provide habitat for six or more migratory indigenous fish species | This criterion relates to the diversity (c) criterion of Policy 23 in that its application identifies an area (in this case a catchment or sub catchment) that has a natural diversity of species. As with the habitat for threatened/at risk fish species, application of this criterion at the catchment scale to protect the migratory pathways of these diadromous species relates to criterion (d)(i) of Policy 23, enhancing connectivity. |
| (d) Rivers and streams that provide inanga spawning habitat | Potential inanga spawning habitat is only located in the tidal reaches of rivers, streams and lakes. Thus this habitat is naturally rare in terms of the wider region. Furthermore, these tidal reaches are often highly modified and degraded by both urban and agricultural land use activities. These factors relate to both the representativeness (a) and rarity (b) criteria of Policy 23 as the habitat suitable for spawning is naturally rare but also reduced in extent (through modification). Application of this criterion is also linked with the ecological context (d) criterion as this habitat provides core habitat required for the maintenance of inanga populations. |

**Significance criterion A: Rivers and streams with high macroinvertebrate health**

8.5 Thresholds representing high macroinvertebrate health that were considered to indicate how close a river is to its natural state were identified for two macroinvertebrate metrics (MCI and the percentage of EPT taxa) (Table 3). The relationship between these macroinvertebrate metrics and the indigenous forest and scrub cover in the upstream catchment were then used to identify indigenous forest and scrub cover thresholds corresponding to high macroinvertebrate health (Table 3).

**Table 3: Macroinvertebrate metric thresholds and corresponding catchment indigenous forest and scrub cover thresholds used to**

**identify rivers and streams with high macroinvertebrate health (from Warr et al. 2009)**

| Invertebrate metric | Significant river ecosystem threshold | Corresponding catchment indigenous forest and scrub cover threshold (%) | |
|---|---|---|---|
| | | West of Ruamahanga River | East of Ruamahanga River |
| MCI | 115 | 70 | 60 |
| Proportion of EPT taxa (%) | 50 | 70 | 60 |

8.6 Because rivers and streams in the eastern Wairarapa tend to have less indigenous forest and scrub cover remaining (cf. western Wairarapa), a lower vegetation cover threshold was identified to ensure that some of these rivers and streams were identified as significant ecosystems (Warr et al. 2009). Adequate representation of rivers and streams in the eastern Wairarapa was considered important as these rivers and streams tend to have distinctive water quality and habitat characteristics due to the dominance of marine sedimentary geology (Warr et al. 2009).

8.7 The indigenous forest and scrub cover thresholds were then used to predict rivers and streams with high macroinvertebrate community health across all river and stream catchments in the Wellington Region. This was applied at the fourth order or greater catchment scale. The exception is for streams draining directly to the coast or to lakes in which case indigenous forest and scrub cover was calculated for each catchment regardless of size. The fourth order or greater catchment scale was chosen as it was considered to represent the appropriate river size to be targeted by the PNRP provisions.

**Significance Criterion B and C: Rivers, streams and lakes that provide habitat for indigenous threatened/at risk fish species (B); and rivers, streams and lakes that provide habitat for six or more migratory indigenous fish species (C)**

8.8 The indigenous fish criteria (excluding inanga spawning habitat) were applied at the same catchment scale as the macroinvertebrate community health criterion (fourth order stream or greater). Given that the majority of the indigenous fish present in the Wellington

Region are diadromous (i.e., they typically need to migrate between freshwater environments and the ocean to complete their lifecycles), the entire downstream reach of any catchment (or sub-catchment) identified was also considered to be significant in order to protect the migratory pathways of these species. Protection of the downstream migratory pathways is considered to be significant under Policy 23 (d)(i) of the RPS in terms of enhancing ecological connectivity. See Table 1 for details on which species are diadromous.

8.9 In addition to migratory pathways, the catchment-scale application is considered appropriate because both of these criteria involve multiple species and different species have different habitat requirements. These different habitat requirements occur at both large and fine spatial scales which means that different species are unequally distributed across a catchment. For example, at larger spatial scales (i.e., catchments) species can be readily classified into those most likely to occur in lowland reaches and those most likely to occur in upland reaches (McDowall 2000; Joy & Death 2004). This distribution is thought to reflect differences in a species' innate "migratory drive" to penetrate inland, as well as differing abilities to pass both natural and man-made barriers. It also reflects broader-scale habitat preferences and how these relate to differences in habitat between lowland and upland reaches/rivers. Habitat differences between lowland and upland rivers include a combination of both natural (e.g., steep gradient and fast flowing vs low gradient and slow flowing) and anthropogenic factors (e.g., most indigenous forest is now predominantly located in the upper reaches of rivers, for example, the forested slopes of the Tararua Ranges).

8.10 At the finer-scale (e.g., a lowland reach of 1 km length) different species will occupy different parts of a river reach based on their habitat preferences (e.g., presence of pools, undercut banks, riffles, etc.). Where river habitat between neighbouring river reaches differs, the fish species present will also likely differ. Hence, application of these criteria at the catchment-scale is appropriate to ensure the protection of habitat, at both fine and larger scales, for the multiple species that they support.

8.11 Catchments supporting threatened fish species and/or six or

migratory species were identified based on data held within NIWA's New Zealand Freshwater Fish database (NZFFD)[2]. Threatened species are those identified in Hitchmough et al. (2007) that occur in the Wellington Region. These include the two "At Risk - Sparse" species (lamprey and shortjaw kokopū) as well as two "Chronically Threatened - Gradual Decline" species (the giant kokopū and dwarf galaxias). Note that two "Chronically Threatened - Gradual Decline" species, brown mudfish and longfin eel, were excluded from this criteria. This was because:

(a) Brown mudfish are considered to be wetland specialists and are not commonly found in rivers, streams and lakes (Significant wetlands were identified under a separate process and are identified in Schedule F3); and

(b) Longfin eel, despite being classified as threatened, are still the most widespread indigenous fish in the Region (e.g., Perrie et al. 2012) and their inclusion would have resulted in almost every waterbody being identified as significant.

8.12 It is worth reiterating that, since Warr et al. (2009), the conservation status of New Zealand freshwater fish has been updated in Allibone et al. (2010) and then again in Goodman et al. (2014). This has resulted in the proportion of indigenous freshwater fish species that have a "conservation status" in the Wellington Region increasing significantly from 30% (based on Hitchmough et al. 2007) to 55% of the total 20 species. The current conservation status of freshwater fish in the Wellington Region can be found in Table 1 and Table 4 provides a summary of the changes that have occurred between the older classifications carried out in Hitchmough et al. (2007) and the most recent classifications available in Goodman et al. (2014). It is important to note that despite changes to the conservation status of many species, these new threat classifications did not factor in the updates undertaken in Perrie et al. (2014) (i.e., only the original four species used in Warr et al. (2009) were used when

[2] The New Zealand Freshwater Fish Database (NZFFD) is administered by NIWA. It contains extensive information on the spatial and temporal distribution of freshwater fishes in New Zealand. It is an "open resource" in that anyone can input and download data. It contains over 1,200 fish survey records for the Wellington Region.

applying/checking the "habitat for indigenous threatened/at risk fish species" criterion in Perrie et al. 2014).

**Table 4: Summary of changes in "conservation status" of freshwater fish in the Wellington Region between 2007 and 2014. Species that are classified as "Not Threatened" are not shown here (but see Table 1)**

| Species | Conservation status | |
|---|---|---|
| | Hitchmough et al. (2007) as used in Warr et al. (2009) to identify significant sites | Goodman et al. (2014) |
| Longfin eel | Chronically Threatened – Gradual Decline | At Risk |
| Lamprey* | At Risk – Sparse | Nationally Vulnerable |
| Giant kokopu* | Chronically Threatened – Gradual Decline | At Risk |
| Shortjaw kokopu* | At Risk – Sparse | Nationally Vulnerable |
| Koaro | No Status | At Risk |
| Inanga | No Status | At Risk |
| Dwarf galaxias* | Chronically Threatened – Gradual Decline | At Risk |
| Brown mudfish | Chronically Threatened – Gradual Decline | At Risk |
| Redfin bully | No Status | At Risk |
| Bluegill bully | No Status | At Risk |
| Torrentfish | No Status | At Risk |

* indicates species that were used during the application of habitat for indigenous threatened/at risk fish species criterion undertaken in Warr et al. (2009)

**Significance criterion D: Rivers and streams that provide inanga spawning habitat**

8.13 The fourth indigenous fish criterion - inanga spawning habitat - that was used in Warr et al. (2009) and Schedule F1 of the PNRP to identify rivers with significant indigenous ecosystems was based on the inanga spawning habitat surveys documented in Taylor and Kelly (2001& 2002).

## 9. RESPONSES TO SUBMISSIONS ON SCHEDULE F1

**Submission S352/273 - Schedule F1 criteria**

9.1 Federated Farmers of NZ (S352/273) requests clarification of how many of the criteria need to be met to identify the rivers and lakes listed in schedule F1 as having a significant indigenous ecosystem. The submitter also considers that the criteria used in Schedule F1

are indicative of healthy ecosystems rather than significant ecosystems and that this has resulted in too many sites listed in the Schedule. The submitter calls for a further prioritization exercise (to reduce the extent/number of significant sites) and proposes some criteria that could be used during this exercise.

9.2 Under the over-arching criteria set out in the RPS and the criteria developed and applied in Warr et al. (2009) – see Sections 6 and 8 of this evidence – a waterbody is considered to support a significant indigenous ecosystem if it meets one or more of the criteria listed in Schedule F1. I recommend that the preamble to Schedule F1 be amended to clarify this point.

9.3 As outlined in Section 8, the criteria used to identify rivers and lakes with significant indigenous ecosystems were originally established and applied in Warr et al. (2009) to populate Table 16 of the Regional Policy Statement (RPS; GWRC 2013). The establishment of these criteria in Warr et al. (2009) was to meet the overarching criteria of Policy 23 of the RPS to identify significant indigenous biodiversity values; specifically, those criteria related to representativeness, rarity, diversity and ecological context.

9.4 The RPS, including the criteria for defining significant habitats and ecosystems, and Table 16 which lists the rivers and lakes identified as meeting these criteria, has been subject to a RMA Schedule 1 process. This process included early consultation with the public and key stakeholders, such as mana whenua iwi, local and central government agencies, industry, community and interest groups, followed by a formal process of policy review involving public submissions and Council hearings.

9.5 The rivers and lakes identified in Schedule F1 are almost identical to those listed in Table 16, with only a few changes in sites related to application of the macroinvertebrate health criterion (See Attachment B) and some additional detail to aid the usability of the Schedule (e.g., inclusion of a list of fish species recorded in each catchment).

9.6 I disagree with the submitter's comment that the sites identified in

Schedule F1 are more indicative of “healthy ecosystems” rather than “significant ecosystems”. I believe the criteria established and used originally in Warr et al. (2009) do meet the intent of the overarching criteria set out in Policy 23 of the RPS for identifying significant indigenous ecosystems. The individual criteria used in Warr et al. (2009) and how they relate to representativeness, rarity, diversity and ecological context criteria of Policy 23 of the RPS are outlined in Table 2 of this evidence.

9.7 The macroinvertebrate criterion is intended to represent sites that are at, or close to, their natural state. This relates to the representativeness criteria in Policy 23 as rivers and streams that in or close to their natural state have been significantly reduced from their former extent and are no longer common place.

9.8 As stated in Warr et al. (2009), macroinvertebrate community data were used to identify landcover thresholds to represent rivers and streams that are at, or close to, their natural state. These thresholds were calculated from macroinvertebrate data collected from rivers and streams in the Wellington Region using the same method Stark and Maxted (2007) used to calculate their ‘excellent’ threshold from a national data set.

9.9 As the submitter has noted, the MCI threshold of 115 determined during this process to identify significance in Warr et al. (2009) is lower than that used in Stark & Maxted (2007) to indicate “excellent” community health (120 MCI units). However, this reflects differences in the data sets used (regional vs national) and, given that this was a regional process to identify regionally significant sites, utilising a regional dataset was considered appropriate.

9.10 The habitat for indigenous threatened/at risk species directly relates to the rarity criterion of Policy 23 of the RPS which specifies that a significant ecosystem can have biological or physical features that are scarce or threatened in local, regional or national context. For this criterion, the presence of selected threatened /at risk fish species were the biological feature used to identify significant rivers and streams (see Section 8 for further background information).

9.11 It is worth reiterating that since Warr et al. (2009) was completed, the threat status of New Zealand's freshwater fish has been updated twice. This has resulted in the proportion of indigenous freshwater fish species that have a "conservation status" in the Wellington Region increasing significantly from 30% (based on Hitchmough et al. (2007)) to 55% of the total 20 species (Goodman et al. 2014).

9.12 The increase in concern for native fish populations is due to a better understanding of population size/habitat occupancy and genetic knowledge, as well as from a range of impacts including the competition and predation of exotic species, declining water quality, water abstraction, river morphological modifications and loss of habitat via land-use change and land-use activities (Allibone et al. 2010; Goodman et al. 2014).

9.13 The habitat for six or more migratory species directly relates the diversity criterion in Policy 23 of the RPS, in particular the diversity of species present within an area.

9.14 Both of these fish-based criteria were applied at catchment scales (or sub-catchment scales for the larger catchments) and this relates to the RPS Policy 23 criterion of ecological context – specifically, enhancing connectivity of habitats (see paragraphs 8.8 to 8.10 for why this is important and necessary).

9.15 The inanga spawning habitat criterion relates to the representative criterion of Policy 23. Inanga spawning habitat is located in the tidal reaches of rivers and streams, these reaches are often highly modified and degraded by both urban and agricultural land use activities. Thus inanga spawning habitat is no longer common place and given that this occurs in lowland areas it rarely occurs in areas that have existing protection. Given that inanga spawning habitat generally only occurs in the reach of tidal influence the areas identified in Schedule F are of limited regional extent.

9.16 The process undertaken to identify rivers and lakes with significant indigenous ecosystems began prior to 2009 to inform the RPS. I acknowledge that there are other approaches that could be undertaken, such as the use of models to predict the occurrence of

different species, and combinations of model outputs and real data. However, the criteria established and applied in Warr et al. (2009) and Perrie et al. (2014) are transparent and have been subject to a formal review as part of the statutory process of making the RPS operative. Furthermore, I believe the identification of sites in Schedule F1 and, indeed the current list of rivers and lakes identified, give effect to the intent of Policy 23 of the RPS.

9.17 While I acknowledge that, as requested by the submitter, further prioritisation of these ecosystems could occur (for example, to identify rivers with outstanding fish values), this is not the intent of Schedule F1. Based on the information and evidence presented, I support the robustness of Schedule F1 as an appropriate list of rivers and lakes that are significant indigenous ecosystems and I recommend that no changes are required to this schedule.

**Submission S302/064 - Extent of Schedule F1**

9.18 The Fertiliser Association NZ (S302/064) is concerned about the number and extent of the streams, rivers and lakes included in Appendix F and the implications of this as the rules generally apply a more stringent regime to activities in Schedule F sites. The submitter seeks that the Council acknowledge this concern with the streams, rivers and lakes listed in Schedule F1 that are additional to those in Table 16 in the RPS.

9.19 As outlined in Section 8, the criteria used to identify rivers and lakes with significant indigenous ecosystems were originally established and applied in Warr et al. (2009) to populate Table 16 of the Regional Policy Statement (RPS; GWRC 2013). The establishment of these criteria in Warr et al. (2009) was to meet the overarching criteria of Policy 23 of the RPS to identify significant indigenous biodiversity values; specifically, those criteria related to representativeness, rarity, diversity and ecological context.

9.20 While I acknowledge that there are a large number of rivers and streams listed in Schedule F, the criteria established and applied in Warr et al. (2009) and Perrie et al. (2014) for identifying these sites are transparent and have been subject to a formal review as part of the statutory process of making the RPS operative.

9.21 Furthermore, the list of rivers and streams in Schedule F of the proposed Plan are almost identical to those listed in Table 16 of the RPS (See Attachment B for a summary of the few changes), and as such, this list was also subject to this RMA Schedule 1 process. This process included early consultation with the public and key stakeholders, such as mana whenua iwi, local and central government agencies, industry, community and interest groups, followed by a formal process of policy review involving public submissions and Council hearings.

9.22 Based on the information and evidence presented, I support the robustness of Schedule F1 as an appropriate list of rivers and lakes that are significant indigenous ecosystems and I recommend that no changes are required to this schedule.

**Submission S14/043 - Schedule F1 criteria**

9.23 Egon Guttke (S14/043) states that:

I. It is not clear how the criteria in Schedule F1 have been derived from Policy 23 of the Regional Policy Statement (RPS);

II. All hill country streams are considered significant and hence, at least the criterion for “representativeness” is not met; and,

III. The minimum flows required to provide habitat for species listed in Schedule F1 will not be achieved in these headwater hill country streams and thus a minimum flow criterion should be included (that would allow for the exclusion of headwater streams).

9.24 Background on the criteria used by Warr et al. (2009) to identify rivers and lakes with significant indigenous ecosystems in Schedule F1, including how these criteria relate to the overarching criteria in Policy 23 of the RPS, can be found in Section 8 and are not addressed again here.

9.25 I disagree with the submitters’ point that a high proportion of hill country streams identified as significant means that the criterion for “representativeness” is not met. The macroinvertebrate criterion, for

example, was developed to identify river and stream habitat that is close to its natural state (i.e., a state that has been minimally impacted by anthropogenic activities). River and stream habitat representative of natural state has been significantly reduced in extent across the region (and across New Zealand). Hence this criterion identifies habitats that are “no longer common place” and “scarce” across the Region. I believe this aligns well with the representativeness criterion listed in Policy 23 of the RPS.

9.26 A large number of hill country rivers and streams met the criterion for high macroinvertebrate health in Schedule F1 simply because indigenous forest and scrub cover (on which the macroinvertebrate criterion is based) tends to be far higher in hill country areas than in lowland areas. Across the region, lowland areas have largely been modified for urban and/or agricultural land uses which has greatly reduced the proportion of indigenous forest/scrub cover in these areas. Therefore rivers and streams that remain at, or close to, their natural state tend to occur in hill country.

9.27 In regards to the submitter’s request for a minimum flow criterion to exclude smaller headwater streams from Schedule F1, I believe this might be a misunderstanding or misapplication of the Waikanae River minimum flow (and the methods that sit behind its development).

9.28 The submitter has indicated that a flow of 810 L/s is required to support fish values in the Waikanae River as per the minimum flow set by GWRC (although note the actual minimum flow of the Waikanae River is 750 L/s), and that this flow will never be achieved in the headwater streams and hence these streams will not support significant fish values.

9.29 However, the submitter has not acknowledged that a minimum flow is typically set at and applied to specific reaches of a river. Likewise, the submitter’s reference to flow-habitat relationships developed for individual species to provide an indication of optimum habitat (based on flow) are also specific to a particular river reach.

9.30 So, while in a holistic sense, a minimum flow is expected to provide

protection of the values of both upstream (including headwater tributaries) and downstream reaches, the minimum flow set is not transferable across the catchment – it applies to a specific location (i.e., it is not appropriate to expect a flow of 810 L/s to be required in the headwater tributaries of the Waikanae as it has been set for the mainstem of the Waikanae River which has a significantly different size and physical habitat).

9.31 Similarly, it would be inappropriate to conclude that the 500 L/s determined to provide optimum redfin bully habitat in the Waikanae River at Water Treatment Plant reach (Watts 2003) is necessary to provide optimum habitat for this species in smaller headwater tributaries.

9.32 Small streams, including headwater tributaries with low summer base flows can still provide significant habitat value for both macroinvertebrate and indigenous fish communities. While not all species of indigenous fish listed in Schedule F1 will be found in all headwater streams, many of these species – including longfin eel, lamprey, banded kokopu, koaro, redfin bully, and dwarf galaxias – can be present as long as other habitat requirements are also met.

9.33 Based on my review of this submission and the evidence presented above I consider that inclusion of headwater and tributary reaches as listed in Schedule F1, including for the Waikanae River is appropriate.

**Submission FS54/095 - Interplay between Schedule F and Schedule I**

9.34 The Fertiliser Association NZ (S302/065) (supported by Federated Farmers (FS54/095) and DairyNZ and Fonterra (S84/095) is concerned that Schedule I (trout habitat) also includes rivers listed in Schedule F1 (rivers/lakes) as habitat for indigenous fish species, which highlights the need to balance protection of trout with the need to protect indigenous species, given the threat presented to indigenous species by introduced species. The submitter FANZ seeks that consideration is given to the potential conflict between Schedule F1 and Schedule I.

9.35 As the submitter suggests, introduced fish species, such as brown

and rainbow trout which both occur in the Wellington Region, have been shown to have significant impacts on some freshwater fish species in some environments in New Zealand. Much of the existing research into the effects of trout on indigenous fish species focuses on indigenous galaxiid fishes and there seems to be little available information on the potential impacts of trout on other indigenous species (e.g., bully and eel species) (McDowall 2006; McIntosh et al. 2010).

9.36 While there is evidence in New Zealand that both migratory and non-migratory galaxiid species can be negatively impacted by the presence of introduced trout, non-migratory species appear to be particularly at risk (McDowall 2006; McIntosh et al. 2010). Research has also shown that the strength of the impact from introduced trout is highly variable (on both migratory and non-migratory species) and that this impact is species and location specific (i.e., there are many examples where an indigenous galaxiid species appears to co-occur with trout and there are examples where they do not) (McIntosh et al. 2010).

9.37 In the Wellington Region, there are five species of migratory galaxiid (inanga, banded kokopu, giant kokopu, shortjaw kokopu and koaro) and two species of non-migratory galaxiid – dwarf galaxias and brown mudfish. However, brown mudfish are regarded as a wetland specialist and are less likely to occur in the river and stream environments that are favoured by trout. As far as I am aware, there is little quantitative data available for the Wellington Region on the effects of trout on galaxiids except in the case of the Wainuiomata River where Death and Death (2005) have shown two to six times the abundance of dwarf galaxias above an instream barrier that excludes trout when compared to their abundance below the barrier (where trout are present). Similarly, I have observed another population of dwarf galaxias in the Wellington Region (in the Waihora Stream) that appear to be very abundant above an instream barrier that is likely excluding trout.

9.38 With a general lack of region/river-specific information, and based on research from across New Zealand, I can only infer that it is likely that in the Wellington Region there will be some indigenous species

that in some locations are significantly impacted by the presence of trout and that in other locations the same species will be minimally impacted, and that this will vary for the indigenous species present – the extent to which these situations occur across the region is unknown.

9.39 In regards to the potential conflict between the same river being identified in Schedule F (significant indigenous ecosystems) and Schedule I (important trout habitat), it is important to recognise that the Council has statutory responsibilities for managing river, stream and lake habitat for both indigenous fishes and introduced trout (RMA s5 and s6(c) and (f)). Furthermore, in terms of a river being in Schedule F or I, or in both, the actual implications are likely to provide benefits for – or at least not negatively impact on - all fish species present (both indigenous and exotic species like trout).

9.40 In the two dwarf galaxias examples outlined above, the Waihora Stream is only identified in Schedule F whereas the Wainuiomata River, including the upper reaches where dwarf galaxias are predominantly found, is identified in both Schedule F and I. However, in this latter case the population of dwarf galaxias is located largely within the Wainuiomata Water Catchment Area and is unavailable for trout fishing (i.e., no access) and has limited numbers or no trout present. In this case, the extent of the Wainuiomata River currently identified in Schedule I could be modified to exclude the section of river upstream of the Water Treatment Plant and associated dams. However, this modification would largely be for administration purposes than as a benefit to the dwarf galaxias population.

9.41 Lastly, the management of indigenous fish and trout <u>populations</u> is the responsibility of the Department of Conservation (DOC) and Fish and Game, respectively. Where a perceived or real conflict between indigenous fish values and trout values is identified, management intervention regarding fish populations and habitat should be dealt with via a multi-agency approach involving DOC, Fish and Game and the Council.

9.42 While introduced species such as trout can in some situations

impact on indigenous fish species, the implications of a river being in both Schedule F and I is unlikely to have a negative impact on indigenous fish communities. I recommend that no changes are required to Schedule F or I.

**Submission S143/004 – Removal of Ngarara Stream and tributaries**

9.43 Maypole Environmental Limited (S143/004) opposes the inclusion of the Ngarara Stream and its tributaries within the Waimeha Stream catchment in Schedule F1 as a significant indigenous ecosystem.

9.44 In particular, the submitter has noted that in the operative Regional Freshwater Plan for the Wellington Region the Ngarara Stream and its tributaries are classified as "a river needing enhancement", whereas in the proposed Plan this stream is identified as a "significant indigenous ecosystem". They consider the classification of the Ngarara Stream as a significant ecosystem to be a significant upgrade from the earlier classification identified in the Freshwater Plan. While the submitter supports the inclusion of the Waimeha Stream in Schedule F1, they request further consideration of the appropriateness of including the Ngarara Stream.

9.45 The submitter also mentions that they have collected water quality and ecological information (via a consultant SKM 2006) that suggests the water quality and ecosystems of the Ngarara Stream do not meet the same standards as the Waimeha Stream and hence do not meet the requirements of Schedule F1.

9.46 The Waimeha and Ngarara Streams converge about 400 metres upstream of Waikanae Beach before flowing into the sea (Figure 1). The Ngarara Stream sub-catchment is significantly larger than the Waimeha sub-catchment (~27.8 km of stream length Vs. ~1.5 km of stream length respectively, based on lengths in the FENZ database[3]).

9.47 The Waimeha Stream and its tributaries – with the Ngarara Stream specifically mentioned to ensure there was no confusion around whether it was included or not – are identified in the proposed Plan

[3] FENZ = Freshwater Environments of New Zealand – a GIS based information system (Leathwick et al. 2010)

as a catchment with a significant indigenous ecosystem. The Waimeha/Ngarara Stream catchment meet all three of the fish-based criteria:

i. Habitat for indigenous threatened/at risk fish species

ii. Habitat for six or more migratory species

iii. Inanga spawning habitat

**Figure 1: Locations of NIWA's New Zealand freshwater fish database records in the Waimeha and Ngarara Stream catchments.**

9.48 I acknowledge the submitter's point that there appears to be some disconnect between the classifications of the Ngarara Stream in the Regional Freshwater Plan for the Wellington Region and the proposed Plan. I also acknowledge that the water quality, and some aspects of the aquatic ecology, are degraded in the Ngarara Stream. For example, routine monitoring undertaken by the Council from one location on the lower reaches of the Ngarara Stream regularly reports that it is one of the poorest sites monitored across the Wellington Region in terms of water quality and macroinvertebrate community health (e.g., Perrie et al. 2012; Morar et al. 2016) .

9.49 However, as outlined above, the criteria that identified the Waimeha and Ngarara Stream as a significant indigenous ecosystem in Schedule F1 are fish-based and not water quality-based. Furthermore, two of these criteria – habitat for indigenous

threatened/at risk fish species and habitat for six or more migratory species – are applied at the catchment scale and when these criteria were applied, there was no obvious reason to split this catchment into sub-catchments (of the Ngarara and Waimeha).

9.50 The use of fish-based criteria to identify sites in Schedule F1 in the proposed Plan is very different from that used previously in the operative Regional Freshwater Plan which used water quality-based criteria. Given the quite different criteria used (water quality Vs. fish presence), it is not surprising that the classifications of the Ngarara Stream are different between the two plans. This is because the responses of water quality variables and fish species to catchment pressures can be quite different (e.g., Perrie et al. 2012). For example, habitat and connectivity are key drivers that can influence fish communities that are not captured by monitoring water quality. Furthermore, linkages between water quality variables (and thresholds) commonly used to classify water quality as "poor" are not necessarily based on cause and effect relationships with fish species (i.e., they may relate to other instream values such as the proliferation of nuisance periphyton growth).

9.51 In fact, some of the indigenous freshwater fish found in the Ngarara Stream show a reasonable degree of tolerance to "poor water quality" (e.g., the elevated levels of nutrients in the Ngarara Stream are unlikely to be affecting the distribution of freshwater fish in this catchment). Contrasting pictures of "stream health" provided by water quality and fish communities are not uncommon and another example on the Kapiti Coast is the Whareroa Stream. This stream is also regularly classified as having some of the poorest water quality (and macroinvertebrate community health) in the region, but fish surveys show that it has some of the highest fish values in the region (Perrie et al. 2012).

9.52 It is also worthwhile noting that recent routine water quality monitoring data (collected by the Council) is available for only one location in the lower reaches of the Ngarara Stream. Water quality at this point reflects the cumulative impacts from all activities in the upstream Ngarara catchment. Hence, upstream of this point there will likely be locations where water quality is better than that

recorded in the lower reaches of this stream.

9.53 Fish survey records held within NIWA's New Zealand Freshwater Fish Database (NZFFD) were used when applying the two criteria, habitat for indigenous threatened/at risk fish species and habitat for six or more migratory species. Thirteen fish survey records are held within the NZFFD for the Ngarara/Waimeha catchment and a summary of the fish recorded in each sub-catchment is presented in Table 5.

**Table 5: A summary of fish species recorded in NIWA's National Freshwater Fish Database (NZFFD) for the Ngarara and Waimeha Stream sub-catchments**

| Species | Year of NZFFD record | |
|---|---|---|
| | Sub-catchment | |
| | Ngarara | Waimeha |
| Shortfin eel# | 1992, 1997, 2002, 2007 | 1990, 1992 |
| Longfin eel#* | 1992, 1997, 2002, 2007 | 1990, 1992 |
| Giant kokopu#*● | 1992 | - |
| Banded kokopu# | 1997, 2007 | - |
| Inanga#* | 1992, 2002, 2006, 2007 | 1990, 1992 |
| Cran's bully | 2002 | - |
| Common bully# | 1992, 2006, 2007 | 1992 |
| Giant bully# | - | 1990 |
| Redfin bully#* | 1992, 2007 | 1992 |
| Common smelt# | - | 1959 |
| Koura (freshwater crayfish) | 2002, 2007 | 1992 |

#Indicates diadromous (migratory) species

*Indicates species that are classified as either "At Risk" or "Nationally Vulnerable" as per Goodman et al. (2014)

●Indicates species that were used in Warr et al. (2009) during the application of the "threatened species criterion"

9.54 Table 5 shows that even at the sub-catchment scale, both Ngarara Stream and Waimeha Stream have six or more migratory species and Ngarara Stream also has a record for giant kokopu – one of the threatened species used by Warr et al. (2009) to determine significance for the threatened species criterion. Thus, even when analysed at the sub-catchment scale, both the Ngarara and Waimeha Streams meet the criteria for significant indigenous

ecosystems.

9.55 While some of the data held within the NZFFD and presented in Table 5 are becoming dated, a more recent survey of a reach of the Ngarara Stream was undertaken in 2011. While this survey information has not been entered in to the NZFFD it is documented in Joy et al. 2013. This survey recorded eels (not separated into species), giant kokopu, banded kokopu, inanga, common bully, giant bully and redfin bully as well as koura (freshwater crayfish). From the results of this survey, the Ngarara Stream continues to meets the criteria for habitat for indigenous threatened/at risk fish species and habitat for six or more migratory species.

9.56 Lastly, on reviewing the water quality and ecological information presented in a report prepared by Sinclair Knight Merz (SKM; 2006) which is mentioned in this submission, I see no evidence to dissuade me from concluding that this catchment provides significant values for indigenous fish species. Of relevance is that the information provided in this report was of limited spatial extent (i.e., from only one part of the catchment) and, as stated earlier, the identification of significant indigenous ecosystems in Schedule F1 is based on fish based criteria (rather than water quality) applied at the catchment scale.

9.57 Based on the information and evidence provided above I consider that inclusion of Ngarara Stream in Schedule F1 is appropriate.

**Submission S83/003 – Removal of Plimmerton Farm Streams**

9.58 Ian Benge and Martin Benge (S83/003) oppose the inclusion of streams that are located within the Plimmerton Farm site as rivers that have significant indigenous ecosystems (Schedule F1) in the PNRP because they are unaware of any detailed ecological assessments that have been undertaken on Plimmerton Farm that support the presence of significant ecological values.

9.59 Plimmerton Farm falls within the Taupō Stream catchment. Taupō Stream, including all tributaries, was identified in the proposed Plan as a catchment with a significant indigenous ecosystem as it meets all three fish-based criteria:

i. Habitat for indigenous threatened/at risk fish species

ii. Habitat for six or more migratory species and

iii. Inanga spawning habitat.

9.60 I am not aware of any ecological assessments that have been undertaken specifically to assess the ecological values of stream reaches within Plimmerton Farm. However, I note that there are four fish survey records held in NIWA's National Freshwater Fish Database (NZFFD) that are located on tributaries of Taupo Stream that flow through Plimmerton Farm (Figure 2; discussed in more detail below). More importantly, the application of two of the fish-based criteria – habitat for indigenous threatened/at risk fish species and habitat for six or more migratory species – are applied at a catchment scale and hence Taupo Stream and all its tributaries have been identified. Justification of the application of this criterion at a catchment-scale is provided in Section 8 of this evidence.

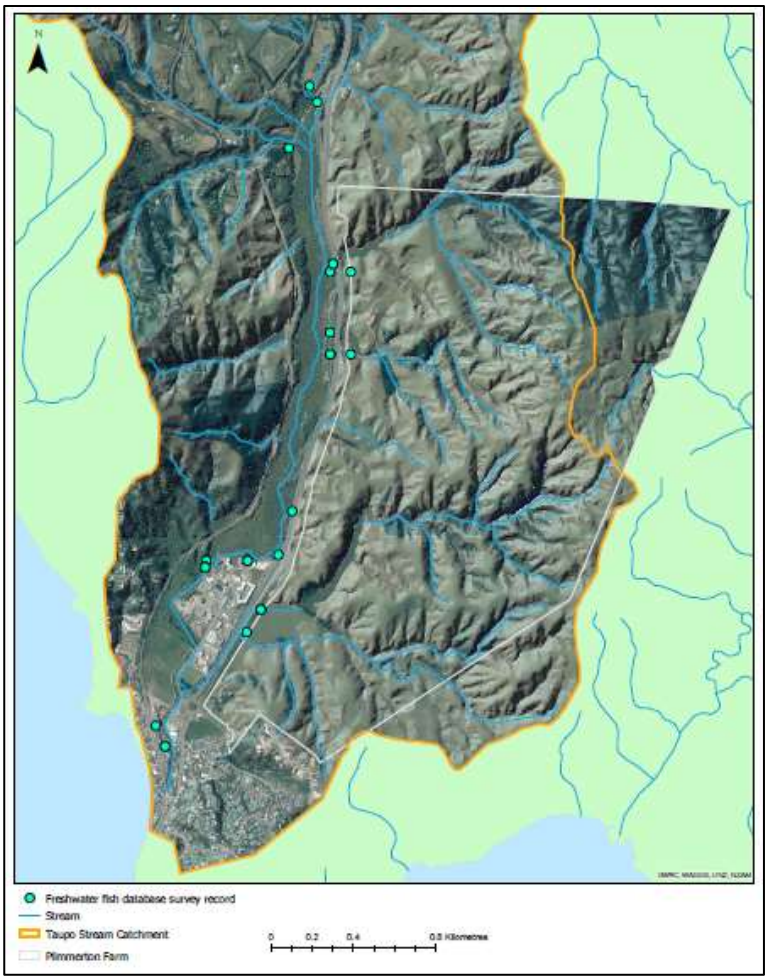


**Figure 2: Locations of NIWA's New Zealand freshwater fish database records in the Taupo Stream catchment. Plimmerton Farm boundary is also indicated.**

9.61 Twenty one fish survey records are held within NIWA's NZFFD for the Taupo Stream catchment and a summary of the species recorded is presented in Table 6.

**Table 6: A summary of fish species recorded in NIWA's National Freshwater Fish Database (NZFFD) for Taupo Stream**

| Species | Year recorded |
|---|---|
| Shortfin eel# | 1979, 1980, 2000, 2005 |
| Longfin eel#* | 1979, 1980, 2002, 2005x4 |
| Unidentified eel | 2005 |
| Giant kokopu#*● | 1979, 2000, 2005 |
| Banded kokopu# | 1980, 2000x5, 2002, 2005x6 |
| Inanga#* | 2005 |
| Redfin bully#* | 1980, 2005 |
| Koura (freshwater crayfish) | 2002 |

#Indicates diadromous (migratory) species

*Indicates species that are classified as either "At Risk" or "Nationally Vulnerable" as per Goodman et al. (2014)

●Indicates species that were used in Warr et al. (2009) during the application of the "threatened species criterion"

9.62 Six species were present across these records and they are all migratory species. Additionally, one threatened species (as per the definition used in Warr et al. (2009)) – giant kokopu – was also recorded (Table 6). While some of the NZFFD records are now dated (e.g., none since 2005), surveys undertaken in autumn 2017 (and yet to be entered in the NZFFD) in the Taupo Stream catchment recorded all six of these species previously recorded, and also one additional (migratory) species – giant bully (McEwan, In Prep). In some cases "at risk" species like giant kokopu, were recorded in relatively high numbers compared to other records in the Region.

9.63 A survey of inanga spawning habitat undertaken in autumn 2016 confirmed that the tidal reaches are still actively used for inanga spawning. However, this survey also recommended that some restoration of spawning habitat would be beneficial (Taylor & Marshall 2016).

9.64 In regards to the four records in the NZFFD that are located on the lower reaches of tributaries of the Taupo Stream that flow through Plimmerton Farm, banded kokopu, giant kokopu and inanga were recorded (in 2000 and/or 2005). An assessment of the potential fish habitat value of these tributaries based on aerial photos also indicates that the habitat value of these tributaries for a number of fish species is likely to be moderate to good (e.g., riparian and/or

wetland vegetation is present to some degree in some reaches).

9.65 Furthermore, predictions of fish occurrence using the Freshwater Environment of New Zealand model (FENZ; Leathwick et al. 2010) also indicate that these tributaries are likely to provide reasonable habitat for several species. For example, four migratory species have modelled predictions of capture in these tributaries of >0.5: longfin eel, shortfin eel, banded kokopu and inanga. The modelled outputs indicate that there is a greater than 50% chance of capturing these species in these reaches of stream.

9.66 To examine the potential habitat available for these four species in the tributaries that flow through Plimmerton Farm, the modelled probability of capture was multiplied by the length of stream reach (available in FENZ stream network GIS layer). Undertaking this reveals that these tributaries provide approximately 2.3 km of shortfin eel habitat, 3.4 km of longfin eel habitat, 4.2 km of banded kokopu habitat and 2.0 km of inanga habitat.

9.67 Lastly, and while not a factor considered when applying the criteria used to identify sites with significant ecological ecosystems, Taupo Stream flows through Taupo Swamp. With greater than 97% of wetlands drained in the Wellington Region (Ausseil et al. 2008), freshwater environments with extensive interactions between swamp and stream habitat are extremely rare. Surveys have shown that this wetland habitat is widely used by species such as banded kokopu that are also recorded in the stream (McEwan, In Prep). There are few, if any, other records of high numbers of banded kokopu occurring in wetland/swamp habitat in the Wellington Region. Thus the species/habitat interactions between the stream and wetland further add significance to the indigenous fish values in this catchment.

9.68 Based on the information available and the evidence outlined above, I believe the Taupo Stream catchment has been correctly identified as a significant indigenous ecosystem and included in Schedule F1.

**Submission S14/044 – Removal of the headwaters of the Waikanae River**

9.69 Egon Guttke (S14/044) requests that the headwaters of the

Waikanae River upstream of the point E1781550.6 N5475221.92 be removed from Schedule F1 as this reach does not have sufficient:

1) Indigenous forest/scrub cover required to meet the macroinvertebrate criterion (the submitter also requests that consideration be given to removing the Waikanae River, upstream of where it crosses the Mangaone Walkway for the first time, from Schedule F1 for the same reason); and

2) Habitat (mainly in terms of flow volume and stream size) to support the indigenous fish species required to meet the fish criteria (used to identify schedule F1)

9.70 The submitter also notes that the closest NIWA National Freshwater Fish Database (NZFFD) record is approximately 2 km downstream of this headwater tributary (upstream of E1781550.6 N5475221.92) and that this is not close enough to prove that there are sufficient fish species present to meet the criteria, especially given the smaller stream size at this upstream point. The submitter also notes that there is a dam blocking fish passage 500 m downstream of this point (E1781550.6 N5475221.92).

9.71 The calculation of indigenous forest and scrub cover associated with the macroinvertebrate criterion was undertaken at the fourth order or greater catchment scale. The exception is for streams draining directly to the coast or to lakes in which case indigenous forest and scrub cover was calculated for each catchment regardless of size. The fourth order or greater catchment scale was chosen as it was considered to represent the appropriate river size to be targeted by the PNRP provisions.

9.72 Using this catchment-scale to assess significance means that some sub-catchments (within the larger catchment) may not meet this criterion at their sub-catchment level - such as the headwater catchment raised by the submitter - but that at the overall fourth order or greater catchment scale the criterion is met. In these cases it is important that they these sub-catchments be covered by the same provisions to allow protection of the larger water body/catchment downstream (i.e., they are part of a larger

catchment and what occurs in a sub-catchment can impact on the wider catchment).

9.73 Therefore, while the indigenous forest/scrub cover in sub-catchment identified by the submitter (i.e., the catchment upstream of E1781550.6 N5475221.9) is not sufficient to meet the 70% cover threshold used by Warr et al. (2009), the threshold is met at the larger catchment-scale that this criterion was applied at. In this case this was based on the catchment upstream of the confluence of the Waikanae and Ngatiawa rivers. Upstream of this point includes both the small sub-catchment identified by the submitter as well as the reach of this river between this point and where the Mangaone Walkway crosses the Waikanae River for the first time. Hence, these sections of the Waikanae River have been correctly identified during the application of this criterion.

9.74 I agree that there appear to be no records in NIWA's NZFFD upstream of the tributary in question and that the closest record is approximately 2km downstream of this point. Based on an assessment of aerial photographs I also agree that this tributary is of a smaller size (i.e., width and likely flow) than compared to the downstream location of the nearest NZFFD record. However, in my opinion (and based on the aerial photographs), this tributary is not of such a small size that it would preclude providing habitat for a range of indigenous species. In fact many indigenous species can thrive in small streams and the physical habitat present (stream morphology and riparian plants) appears, along with the submitters estimate of a MALF (Mean Annual Low Flow) of 30L/s, easily sufficient to support a range of indigenous fish species (see paragraphs 9.27 to 9.32 for further discussion of fish and flow requirements in relation to this submission).

9.75 I also consider that the nearest fishing record held within NIWA's NZFFD (Card 14842) is located sufficiently close to provide an indication of potential fish values for the headwaters stream in question. This record shows that in 2002 the following species were caught: shortjaw kokopu, lamprey, longfin eel, redfin bully, koaro, and dwarf galaxias as well as koura (freshwater crayfish). This is a particularly high value fish fauna, with all fish species either

classified as “Threatened -Nationally Vulnerable” or “At Risk-Declining” by Goodman et al. (2014) (See Table 1 for details on conservation status for individual species).

9.76 Most of these fish species are diadromous (the exception being dwarf galaxias) and most are considered to be excellent negotiators/climbers of reasonable barriers. However, whether these species can negotiate the instream barrier noted in the submission would require a site-specific investigation. There is the potential that this barrier could impede the passage of some or all of these species. It’s worth noting that dwarf galaxias, a non-diadromous (non-migratory) species, does not require migrations to maintain populations and a resident population could occur above this barrier. In fact, in some situations instream barriers are often beneficial for this species as the barrier helps minimise the occurrence of other species that can compete with and prey on dwarf galaxias.

9.77 Based on the fishing records in the NZFFD and an assessment of aerial photographs, I can see no reason why the headwaters in question would not provide suitable habitat for a range of fish species (notwithstanding the comments about the instream barrier made above in paragraph 9.76) .On a regional scale, headwater streams often provide significant value for indigenous ecosystems as they are often the only remaining rivers and streams that remain in, or close to, their natural state. Furthermore, these two native fish criteria were applied at the catchment-scale which was considered necessary to protect the habitat for a range of species (see paragraphs 8.8 to 8.10 for justification).

9.78 Based on the information available and the evidence outlined above, I believe that the tributaries of the Waikanae River upstream of E1781550.6 N5475221.92 have been correctly identified as a significant indigenous ecosystem.

**Submission S99/001 and/003– Removal of the tributaries of the Wharemauku Stream within the Kapiti airport site**

9.79 Kapiti Coast Airport Holdings (S99/001 and/003) opposes the inclusion of the tributaries of the Wharemauku Stream that are located within the Kapiti airport site in Schedule F1 as they do not

consider that these tributaries have significant indigenous biodiversity values. The submitter is concerned that as a consequence they are subject to stringent objectives, policies and rules which may undermine the effective operation, maintenance, use and development of the Airport that represents a significant part of District and Regional transport infrastructure. There is no sound or balanced resource management justification to include the Wharemauku Stream and its tributaries on the Airport in Schedule F1.

9.80 The Wharemauku Stream is identified in the proposed Plan as a catchment with a significant indigenous ecosystem as it meets two of the fish-based criteria used:

- Habitat for indigenous threatened/at risk fish species; and
- Habitat for six or more migratory species.

9.81 In the Wharemauku Stream catchment, NIWA's New Zealand Freshwater fish database has records for six diadromous (migratory) species: long and shortfin eel, banded kokopu, shortjaw kokopu, koaro and redfin bully. Shortjaw kokopu were also one of the species used to identify habitat for indigenous threatened/at risk fish species and this species is currently classified as "nationally vulnerable" (Goodman et al. 2014).

9.82 As discussed in paragraphs 8.8 to 8.10 it is necessary to apply these two fish criteria at the catchment scale. As a result of this catchment scale application, there could be sections of the river/stream catchment identified, including some tributaries, that do not necessarily meet these criteria. However, keeping in mind that fish community is largely diadromous and have varied habitat requirements, I believe a catchment scale application is appropriate.

9.83 Based on my review of this submission and the evidence presented above I consider that inclusion the Wharemauku Stream and its tributaries, as listed in Schedule F1, appropriate.

**Submission S125/029 – Inclusion of the Moroa Water Race**

9.84 Rural Residents Environmental Society (S125/029) requests that the Moroa Water Race be included in Schedule F as it contains eels and

koura and probably other vertebrates and invertebrates.

9.85 I agree with the submitter that water races, such as the Moroa, contain aquatic ecological values and that, in some cases, it is likely that these water races, or sections of, might have ecological values that would meet the criteria used to identify sites in Schedule F. However, Schedule F only applies to natural rivers, streams and lakes. Water races are often man-made and/or contain a mixture of both natural and man-made channels. The Moroa Water Race, in particular, is considered to be largely man-made.

9.86 The proposed Plan does include Method M13: Wairarapa water races. This method includes provision for the Council to work with Wairarapa district councils and landowners to characterise the hydrology, water quality, ecology, and the social, heritage and cultural values of the Wairarapa water races to develop management options for the water race systems. This includes identifying options for retaining ecological values.

9.87 While the Moroa Water Race may contain significant aquatic values, it is not appropriate to add it to Schedule F. The ecological values of the Moroa Water Race, as well as options for retaining these values, should be progressed via the existing Method M13 in the proposed Plan. I recommend that no changes are required to Schedule F.

## 10. RESPONSES TO SUBMISSIONS ON SCHEDULE F1a

### Submission S32/040 and S32/044 – Additional species and spawning times in Schedule F1a

10.1 Wellington Recreational Marine Fishers Association S32/040 and S32/044 has asked that yellow eyed (referred hereafter as yelloweye) and grey mullet spawning habitat and spawning times are added to Schedule F1a and that the spawning time of inanga be corrected to 1st of January to 31st May.

10.2 Schedule F1a was developed from an existing “spawning and migration” calendar for freshwater fish that was produced by Hamer (2007) for the Waikato Region. The spawning and migration times and spawning habitats in Hamer (2007) were reviewed by Dr David Rowe of NIWA for their applicability in the Wellington Region and to incorporate any updates in scientific understanding in spawning and

migration times and spawning habitats that occurred since 2007.

10.3 Based on recommendations from Dr David Rowe, some changes and updates were made to the times listed in Hamer (2007) to be more appropriate for the Wellington Region (Rowe 2013; Perrie 2014) and these were included in Schedule F1a.

10.4 In regards to yelloweye and grey mullet, these two species are still typically regarded as marine/estuarine species rather than freshwater species (McDowall 1990; 2000). In the case of yelloweye mullet, this species is known to penetrate upstream in low elevation rivers and can be very abundant in coastal/brackish lakes (e.g., Lake Onoke). However, it is generally considered that this species does not go much further inland than the zone of tidal influence and, when it does, this is typically for a short duration (McDowall 2000).

10.5 The spawning and migration times and spawning habitats presented in Schedule F1a are for freshwater indigenous fish and given that yelloweye mullet is considered primarily a marine species that does not spend a significant amount of time in freshwater it was not included in Schedule F1a. This does not mean that yelloweye mullet are not, at times, a significant component of the freshwater fish fauna in low elevation coastal rivers and lakes, but simply reflects that this primarily marine species was outside of the scope /purpose of Schedule F1a.

10.6 Upstream migration times for juvenile grey mullet are included in Schedule F1a. Grey mullet are considered to spend far longer (at least months) in freshwater environments than yelloweye mullet and have been recorded further inland in the Wellington Region (i.e., at least 34 km inland in the Ruamahanga River system (McEwan 2010). Thus this species was considered appropriate for inclusion in Schedule F1a, although the timing of downstream migrations is not known. Like the yelloweye mullet, spawning is believed to occur in marine environments (McDowall 1990; 2000).

10.7 Current spawning times for inanga are listed in Schedule F1a as ranging from February to July with a peak period of March to May. The submitter has requested that spawning times be corrected to 1st

January to 31st May based on observations of a “ripe” fish in the Makara Stream. The submitter also comments that fish do not spawn based on “man’s calendar” but on water temperature and water conditions.

10.8 I agree with the submitter’s statement that environmental cues, such as water temperature and flow conditions, are more important drivers for determining when spawning and migrations will occur (cf. “mans calendar”). However, from a practical point of view, calendar dates are required for Schedule F1a. I also acknowledge that spawning has been observed outside of the range stated in Schedule F1a (e.g., McDowall 1995) and that accumulation of adult inanga preparing to spawn will occur prior to this period. Nonetheless, I believe the range and peak spawning times presented in Schedule F1a for inanga capture the “main range” and the “main peak” spawning periods that are appropriate for the purpose of this schedule and are based on current scientific understanding relevant to the Wellington Region.

10.9 Based on the information provided above, I consider that the spawning periods listed in Schedule F1a are appropriate.

## 11. RESPONSES TO SUBMISSIONS ON SCHEDULE F4 (SITES WITH SIGNIFICANT INDIGENOUS BIODIVERSITY VALUES IN THE COASTAL MARINE AREA

11.1 CentrePort (S121/141) and Kiwi Rail Holdings (S140/077) would like the Kaiwharawhara Estuary removed from Schedule F4. They consider there to be potential conflict between the operation and maintenance of regionally significant infrastructure of the operational Port and the values of the Estuary. They note that the lower reaches of the stream leading to the estuary environment are highly modified with sections of the stream culverted or passing through concrete channels and therefore the stream has limited ecological values.

11.2 In contrast, the Trelissick Park Group (S88/015) support the inclusion of the Kaiwharawhara Estuary in Schedule F4 as it recognises the indigenous biodiversity values of the estuary.

11.3 The Kaiwharawhara Stream mouth/Estuary is listed in Schedule F4 as providing seasonal or core habitat, specifically passage to and

from the catchment, for seven diadromous (migratory) fish species with conservation rankings: longfin eel, giant kokopu, shortjaw kokopu, koaro, inanga, redfin bully and bluegill bully. Background on the supporting information used to evaluate estuaries with significant indigenous values can be found in Oliver (2014). The Kaiwharawhara Stream is also listed in Schedule F1 as meeting the criteria for habitat for indigenous threatened/at risk fish species and habitat for six or migratory indigenous fish species.

11.4 In addition to the seven species listed above, the Kaiwharawhara Stream provides habitat for several indigenous species that are not considered threatened: banded kokopu, common bully, giant bully and shortfin eel. Thus, a total of eleven freshwater indigenous fish species have been recorded in the catchment. Surveys undertaken in recent years have observed most of these eleven species (GWRC unpublished data) indicating the high fish values are still present.

11.5 While I agree with the submitters that the lower reaches of the Kaiwharawhara Stream are highly modified, this stream still provides habitat for a range of indigenous fish species. All of these fish species are diadromous (migratory) and hence the maintenance of fish passage through the estuary environment is critical to maintain these significant fish values. Furthermore, a survey undertaken in 2017 of the lower tidal reaches of the Kaiwharawhara Stream discovered that inanga spawning is still occurring in these reaches (Marshall and Taylor, In prep). The presence of inanga spawning habitat adds further value to the Kaiwharawhara Stream mouth/Estuary.

11.6 Based on the information presented above I believe it is appropriate to identify the Kaiwharawhara Stream mouth/Estuary in Schedule F4.

## 12. RESPONSES TO SUBMISSIONS ON SCHEDULE I (IMPORTANT TROUT FISHING RIVERS AND SPAWNING WATERS)

12.1 Federated Farmers (S352/282), and a large number of submitters using a common submission template e.g., Pip Tocker (S331/002) have requested clarification of the criteria used to identify important trout fishing rivers and spawning waters in the proposed Plan, along with a reassessment of the water bodies listed in Schedule I against these criteria. Several submitters have also requested the removal or addition of water ways to Schedule I.

12.2 Technical evidence detailing the criteria used to identify important trout fishing rivers and spawning waters in Schedule I has been provided by Mr Adam Canning of the Wellington Fish and Game Council. Dr Canning describes six key criteria that have been used to identify sites as an important fishing river, these are:

i. Contains a trout population;

ii. Provides a pristine/wilderness experience;

iii. Frequently used fishery;

iv. Close to home;

v. High catch rate; and

vi. Chance of a trophy fish capture.

12.3 An important trout fishing river was identified if it contained a trout population and at least two of other criteria listed above (See Dr Canning's evidence for full details).

12.4 In regards to trout spawning waters, Dr Canning considers a river to be important if it is located within the catchment of an important trout fishing river and has either 1) confirmed spawning or 2) habitat identified as suitable for spawning (See Dr Canning's evidence for full details).

12.5 I believe that the criteria proposed by Dr Canning are appropriate and transparent for identifying important trout fishing rivers and spawning waters in the Wellington Region. Where submitters have requested either the deletion or addition of a particular site, I

consider that these requests should be assessed against the criteria outlined by Dr Canning.

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**Attachment A**
**Qualifications and experience**

## Qualifications

*Doctor of Philosophy* – Candidate. 2017-present. University of Waikato, New Zealand.
*Master of Science* 2004. University of Waikato, New Zealand.
*Bachelor of Science* 2002. University of Waikato, New Zealand.

## Employment history & relevant experience:

2004-present

Greater Wellington Regional Council. *Environmental Scientist – water quality and freshwater ecology*

State of Environment and issue-based reporting relating to river, stream and lake water quality and ecology.

Technical input to whaitua committee processes, Plan processes, etc.

Advice to regulatory arm of Council relating to river, stream and lake water quality and ecology resources and impact assessments.

## Attachment B

## Changes to sites listed in Schedule F1 made in Perrie et al. (2014)

**Key changes/corrections to the list of rivers with high macroinvertebrate health in Schedule F1 of the proposed NRP compared to Table 16 of the RPS**

| River/stream catchment | Nature of change | Reason for change |
|---|---|---|
| Oteranga Stream | Addition | Increase in indigenous forest/scrub cover |
| Gollans Stream | Addition | Increase in indigenous forest/scrub cover |
| Wainuiomata River below Black Stream confluence | Deletion | Error in Table 16 – this river has >5% urban land use in catchment |
| Waingawa River | Addition | Increase in indigenous forest/scrub cover |
| Ruamahanga River above Kopuaranga River confluence | Deletion | Decrease in indigenous forest/scrub cover |
| Tauanui River | Deletion | Decrease in indigenous forest/scrub cover |
| Oterei River | Deletion | Decrease in indigenous forest/scrub cover |