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Piako catchment ecological monitoring 2012



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Prepared by: Paul Franklin, Brenda Bartels (National Institute of Water & Atmospheric Research Ltd)_

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Authors/Contributors:

Paul Franklin Brenda Bartels

For any information regarding this report please contact:

Dr Paul Franklin Scientist Freshwater Fish +64-7-859 1882 paul.franklin@niwa.co.nz

National Institute of Water & Atmospheric Research Ltd Gate 10, Silverdale Road Hillcrest, Hamilton 3216 PO Box 11115, Hillcrest Hamilton 3251 New Zealand

Phone +64-7-856 7026 Fax +64-7-856 0151

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Waihekau Stream electric fishing. [Paul Franklin, NIWA]

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Reviewed by

David Rowe

Formatting checked by

Approved for release by

David Roper

Executive summary

Water allocation in the Piako catchment exceeds the current limits defined in the Waikato Regional Plan and there are concerns regarding the potential impacts of reduced flows on water quality and the ecological status of streams in the catchment. The aim of this study was to establish a network of baseline ecological monitoring sites to contribute towards supporting the water allocation decision making process in the Piako catchment.

Ten sites in the upper Piako catchment were surveyed for fish, macroinvertebrates, macrophytes and periphyton in February 2012. Flows were above average for that time of year due to the wet summer in 2011-12. A total of eight different fish species, seven native and one exotic, were captured across the ten survey sites. Of those eight species, only shortfin eel (*Anguilla australis*) was present at all ten sites. Fish communities in the Piakoiti/Piakonui sub-catchment were limited by the presence of a natural migration barrier in the Piako River upstream of Morrinsville. This meant that migratory species without the capability to climb, e.g., inanga and torrentfish, were absent from this sub-catchment. The presence of these species in other sub-catchments indicates good downstream connectivity elsewhere in the catchment.

Macroinvertebrate communities were generally poorer in lowland, low gradient sites as evidenced by lower occurrence of desired EPT taxa and lower MCI scores. This reflects differences in habitat structure and water quality. Aquatic macrophytes were also more abundant in these streams. This is a consequence of a greater frequency of soft substrates where they can root, lower water velocities and high light availability. It probably also reflects higher nutrient availability.

The Piako catchment is widely acknowledged as being significantly impacted by land use change and the effects of agricultural development and intensification. The results of this study therefore reflect the consequences of human induced changes on aquatic ecosystem structure and functioning. Establishment of routine monitoring sites is essential for understanding natural variability in ecological communities and for detecting the consequences of human induced changes in the river environment. These results provide a valuable foundation for reassessing environmental flow requirements in the Piako catchment. Key areas of concern for this reassessment are likely to include assimilative capacity, connectivity at migration barriers under low flows, water temperatures, dissolved oxygen dynamics and physical habitat suitability.

1 Introduction

1.1 Background

The Waikato Regional Council (WRC) is responsible for managing the status of water resources in the Waikato Region. WRC's approach to the protection, allocation and use of water resources is set out in the Waikato Regional Plan: Variation No. 6 – Water Allocation (Waikato Regional Council 2012), which became operative on 10 April 2012. As required by the NPS for Freshwater Management (MfE 2011), the Plan defines minimum flows and allocation limits for all catchments in the region (Table 3-5; Waikato Regional Council 2012).

One of the key objectives of the water allocation process is to safeguard the life supporting capacity of freshwater ecosystems (MfE 2011). Water allocation in the Piako catchment exceeds the current limits defined in the Plan and there are concerns regarding the potential impacts on water quality and ecological status in the catchment. As a precursor to the review of flow and allocation limits in the Piako catchment scheduled for 1 July 2014 (Table 3-4A; Waikato Regional Council 2012), WRC have initiated investigations in the catchment to support and inform the review process. The aim of this study was to establish a network of baseline ecological monitoring sites to contribute towards supporting the water allocation decision making process in the catchment.

1.2 Study brief

The scope of this study was to establish ten baseline ecological monitoring sites and undertake monitoring of fish, macroinvertebrates, periphyton and macrophytes in the Piako River catchment, as a pre-cursor to undertaking an evaluation of the status of water resources in the catchment. The ten sites were to be located in the upper Piako catchment (approximately defined as upstream of Morrinsville) and were to encompass representative habitats from the main tributaries of the Piako, excluding the Topehaehae Stream, which is subject to the influence of the Morrinsville water supply reservoir.

2 Methodology

2.1 Sites

Ten monitoring sites were selected throughout the main sub-catchments of the upper Piako catchment on the basis of representativeness of differing habitat types (Table 2-1; Figure 2.1). The Topehaehae catchment was excluded from consideration at the request of WRC due to the known influence of the Morrinsville water supply dam. All sites were sampled between 13 and 17 February 2012.

Land use throughout the catchment is dominated by dairy farming and this has a strong influence on water quality and riparian structure in the majority of streams and rivers. Streams in the eastern sub-catchments (Waihekau and Waitoa) are typically low gradient, slow flowing and macrophyte dominated (Sites 7 and 8). Many of these channels have also been modified by straightening and dredging. The Mangapapa and Piakonui sub-catchments are characterised by steeper gradient streams with more varied morphology and rocky substrates (Sites 4-6). The headwaters of the Piakonui (Site 4) flow through native bush in the Te Tapui Scenic Reserve and represent the most intact and natural stream habitats in the catchment. The Waitakaruru sub-catchment drains the western part of the Piako catchment, joining the Piako River at Morrinsville. The main stem of the Waitakaruru Stream (Site 2) is a medium to low gradient stream, which becomes increasingly heavily modified and macrophyte dominated between Tauwhare and Morrinsville. It has frequent tributaries joining from the true right, draining the Pakaroa Ranges. These higher gradient streams (Sites 1 and 10) typically have more varied morphology and rockier substrates relative to the main stem, but are still strongly influenced by agricultural land use practices.

| Site | Stream | Easting* | Northing* | Comments |
|------|------------------------------|----------|-----------|----------------------------------|
| 1 | Waitakaruru Stream tributary | 2728090 | 6380572 | Upland agricultural stream |
| 2 | Waitakaruru Stream | 2727985 | 6377350 | Mid gradient agricultural stream |
| 3 | Piakoiti Stream | 2746139 | 6379564 | Low gradient agricultural stream |
| 4 | Piakonui Stream | 2741486 | 6371826 | Upland native bush stream |
| 5 | Piakonui Stream | 2742763 | 6376343 | Upland bedrock stream |
| 6 | Mangapapa Stream | 2747006 | 6371508 | Upland rough pasture stream |
| 7 | Waitoa River | 2750045 | 6366003 | Low gradient agricultural stream |
| 8 | Waitoa River | 2742190 | 6365404 | Upland rough pasture stream |
| 9 | Waihekau Stream | 2753911 | 6381502 | Low gradient agricultural stream |
| 10 | Waitakaruru Stream tributary | 2730406 | 6389244 | Mid gradient bush stream |

| Table 2-1: | Ecological | monitoring | site | locations. |
|------------|------------|------------|------|------------|
| | Looiogioai | moning | 0110 | locationor |

*Easting and northing given for downstream limit of survey reach (NZMG coordinates).

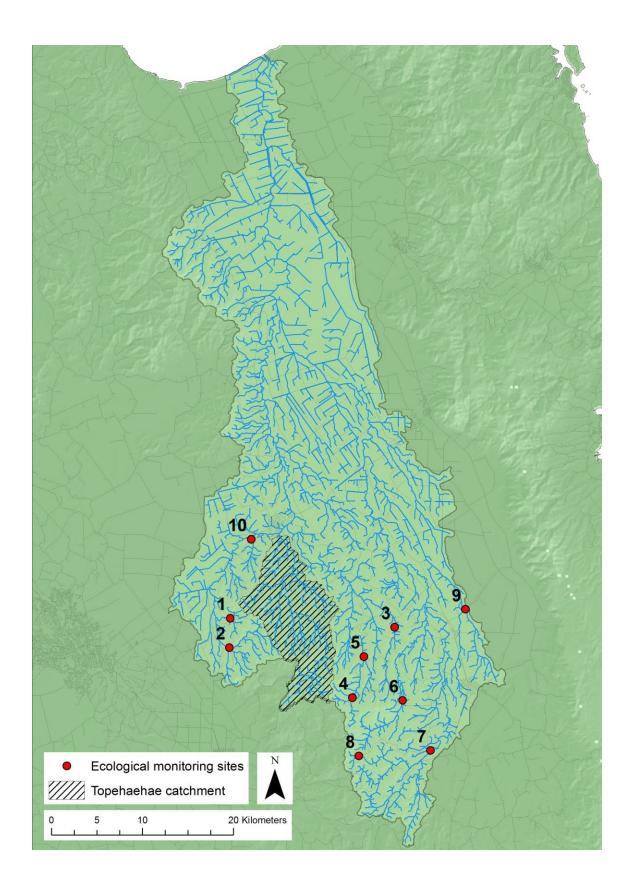


Figure 2.1: Map the Piako catchment showing the location of the ten ecological monitoring sites.

2.2 Fish

Fish surveys were carried out by electric fishing using the standardised methods outlined by WRC (David & Hamer 2010). At each site, a 150m reach was surveyed by single pass electric fishing using an EFM300 with voltage adjusted dependent on local conditions. The number of each species captured, along with fish lengths were recorded for every 15 m sub-reach.

This survey approach is designed to maximise the likelihood of capturing the full diversity of species present by encompassing the full range of habitats present within a stream reach. Results are presented as relative abundance standardised by survey area (number of fish divided by total area sampled).

These values are based on single pass electric fishing, which is a semi-quantitative method, and thus these values are not equivalent to fish density and should not be used for comparison between sites. Interpretation of the relative abundance values are restricted to temporal comparisons at the same site, assuming that the same reach is sampled, with the same level of effort and sampling efficiency on each sampling occasion.

2.3 Macroinvertebrates

Macroinvertebrate sampling was carried out following the standardised procedures for wadeable streams as outlined by WRC (Collier & Kelly 2005). In soft-bottomed streams, woody debris, macrophytes and stream banks were sampled, as appropriate, using a hand net (0.5 mm mesh) following MfE Protocol C2. For hard-bottomed streams, a kick-sampling approach targeting riffle areas and following MfE Protocol C1 was utilised. At each site the WRC REMS habitat assessment protocol was also carried out, with a Field Assessment Cover Form and a Habitat Assessment Field Data Sheet completed. All samples were preserved and returned to the laboratory for processing.

Samples were processed using the recommended MfE Protocol P2 (200 individual fixed count and scan for rare taxa). This provides per cent abundance data suitable for the calculation of most invertebrate parameters (Collier & Kelly 2005). Complete taxonomic lists were compiled and a range of community metrics calculated at the taxa level indicated in (Collier & Kelly 2005).

2.4 Macrophytes & periphyton

Macrophyte and periphyton surveys were carried out following the standardised procedures for wadeable streams as outlined by WRC (Collier et al. 2006). At each of five transects located in the reach, periphyton cover was assessed at five points (10%, 30%, 50%, 70% and 90%) across the wetted width of the stream and the area of macrophyte cover occupying the 1 m wide band upstream of the transect was estimated. Details of the thickness and cover of periphyton were recorded allowing calculation of the Periphyton Enrichment Index (PEI) and a range of periphyton biomass indices (Collier et al. 2006). The percentage cover of different submerged and emergent species of macrophytes was also recorded, allowing calculation of the macrophyte cover indices (Collier et al. 2006).

3 Results

3.1 Site descriptions

3.1.1 Site 1 – Waitakaruru Stream tributary 1

This site is located on a tributary of the Waitakaruru Stream just downstream of Tauwhare, off Tahuroa Road. It is a third order stream and the site lies approximately 90 km from the sea at an elevation of 70 m above mean sea level. Instream habitat was about 60% run, 25% riffle and 15% pools. Mean stream width was 2.5 m and mean depth around 0.3 m. Substrate was a combination of cobbles, gravel and silt. Adjacent land use is pastoral. Some riparian vegetation is intact providing shade to the stream, but a lack of fencing means that stock have access to the stream. Further details on the physical characteristics of this and all the other sites can be found in Appendix A.

3.1.2 Site 2 – Waitakaruru Stream

The second site is located on the Waitakaruru Stream, just upstream from the Waitakaruru Arboretum and adjacent to Scotsmans Valley Road. Land use on the true right bank is a mix of forestry and pasture and primarily pasture on the true left bank. It is a fourth order stream and the site is at an elevation of approximately 70 m and about 93 km from the sea. Mean stream width was 2.5 m and mean depth 0.3 m. Instream habitat was primarily a combination of runs (60%) and riffles (35%), with a gravel substrate. Riparian fencing was absent, but stock only had access to the stream in the upper third of the survey reach. Riparian planting has been carried out in the lower two thirds of the reach providing some cover and shading.

3.1.3 Site 3 – Piakoiti Stream

The Piakoiti Stream survey site was located adjacent to Piakoiti Road approximately 800 m upstream from the Morrinsville-Walton Road. Land use throughout this catchment is strongly dominated by dairying, with riparian vegetation largely absent. High light levels combined with elevated nutrient and sediment inputs contribute to a high abundance of aquatic macrophytes in the stream. Stream order at the survey site is three, at an elevation of approximately 60 m and distance from the sea of 92 km. Instream habitat is primarily run (98%), with occasional small pools present reflecting the effects of channel dredging. Substrate in the channel is dominated by silt and mean width and depth about 2.5 m and 0.5 m respectively.

3.1.4 Site 4 – Piakonui Stream (upstream)

This site is located at the edge of the Te Tapui Scenic Reserve and therefore had intact native riparian cover. Instream habitat was highly varied and constituted approximately equal parts of runs, riffles and pools, with occasional rapids. Consistent with the intact riparian zone, there was also a good supply of woody debris in the stream, providing additional habitat, and the stream was well shaded resulting in notably lower water temperatures than the other sites (15.5 °C). The site is a second order stream and the distance inland is 100 km, with an elevation of 142 m. Mean channel width was 2.4 m and mean depth about 0.4 m. The substrate was 50% cobble, 30% boulders and 20% silt.

3.1.5 Site 5 – Piakonui Stream (downstream)

This site is located 6 km downstream from Site 4 at an elevation of 60 m. Land use adjacent to this site is dairying. Riparian vegetation is absent and there is no fencing in place to prevent stock access to the stream. Average stream width is 3.5 m and depth about 0.3 m. The substrate is primarily bedrock throughout the reach, which has a strong influence on instream habitat which was about 60% run and 40% riffles. The only cover available is provided by overhanging grasses at the stream edge. Water temperature increased from 15.5 °C at Site 4 to 20.7 °C at this site, primarily due to a lack of shading.

3.1.6 Site 6 – Mangapapa Stream

The Mangapapa Stream is a tributary of the Waitoa River. The survey site is located approximately 107 km from the sea at an elevation of 93 m. Substrate at the monitoring site is primarily bed rock. Instream habitat is a combination of riffles (50%), runs (40%) and pools (10%). The adjacent land use is rough pasture and no riparian fencing is present. Riparian vegetation is primarily limited to grasses, but there are small areas where planting has been carried out and a more complex community including flax and small shrubs occur. The mean channel width at the site is 4.1 m and mean depth about 0.25 m.

3.1.7 Site 7 – Waitoa River

The Waitoa River is the main tributary of the Piako, draining the eastern part of the catchment. Land use at this site was dairying, but riparian fencing was in place on both banks preventing access to the stream by stock. At the survey site, the Waitoa River is a fifth order stream with a mean width of 3.9 m and average depth of 0.6 m. Distance inland is approximately 115 km and elevation of the site 80 m above sea level. Instream habitat at the site is dominated by runs (75%), with occasional pools present. The substrate is a combination of sand (60%), gravels (20%) and silt (20%). Marginal emergent macrophytes provided some cover at the stream edges, but overall the river was quite open.

3.1.8 Site 8 – Waitoa River (headwaters)

This site was located in the headwaters of the Waitoa River where they pass under Buckland Road. The survey site is located 125 km from the sea and at an elevation of 145 m above sea level. The gradient in this reach is relatively steep and habitat is a relatively diverse combination of riffles (55%), runs (25%), pools (15%) and the occasional rapid. There is a small chute in the upper part of the reach, which is likely to act as a barrier to migration for some fish species. Substrate was mainly a combination of cobbles (65%) and boulders (15%). Land use was rough pasture, primarily used for sheep grazing. There was no riparian fencing on either bank and riparian vegetation was limited. Instream cover was provided by boulders. Average stream width at the site was 1.5 m and mean depth about 0.2 m.

3.1.9 Site 9 – Waihekau Stream

The Waihekau Stream is another tributary of the Waitoa River and drains the eastern part of the Piako catchment. There is evidence to suggest that this stream has been subject to channel modifications including dredging, straightening and widening, leading to an incised and very uniform channel (99% run). The survey site is located 85 km from the sea at an elevation of 84 m. Stream width averages 3.3 m and mean depth is 0.7 m. Substrate in the stream is primarily sand (90%), with some areas of silt also present. Land use on the adjacent banks is dominated by dairying. Both riparian areas are fenced off from stock, but

riparian vegetation cover is limited to grasses and occasional scrub. Dissolved oxygen was below recommended levels in the reach at 5.5 mg l^{-1} .

3.1.10 Site 10 – Waitakaruru Stream tributary 2

The final site is another tributary of the Waitakaruru Stream, but is located further downstream than Sites 1 or 2, close to Morrinsville. The monitoring site is in an area of mixed bush, providing shading and a good supply of woody debris to the stream. The site is located 75 km inland and its elevation is 37 m. Stream width was 2.6 m and instream habitat relatively varied (57% pool, 31% run, 12% riffle). Substrate was a mix of sand (55%), silt (30%) and gravel (10%). Water temperature was relatively low (17.8°C) compared to the other survey sites, reflecting the high degree of shading.

3.2 Fish

A total of eight different fish species, seven native and one exotic, were captured across the ten survey sites (Table 3-1; Appendix B). Of those eight species, only shortfin eel (*Anguilla australis*) was present at all ten sites. The only exotic species to be captured was gambusia (*Gambusia affinis*), which was recorded at four of the sites. Two species, banded kokopu (*Galaxias fasciatus*) and smelt (*Retropinna retropinna*), were only recorded at a single site (Site 4 and Site 7 respectively).

Shortfin eels were the most abundant species at the majority of sites, with the largest numbers being caught at Site 8 (254) and Site 3 (225). The only site where their abundance was very low was Site 4, where only five were captured. Figure 3.2shows the presence of shortfin eels recorded in this survey, relative to their predicted probability of capture within the catchment (Leathwick et al. 2008). It can be seen that shortfin eels have a high probability of capture throughout the majority of the catchment. In general, the abundance of shortfin eels captured during this survey largely matches the predicted likelihood of capture (Figure 3.2). The most obvious exceptions are Site 8, which had a much higher abundance than expected and Site 9, which had a lower abundance than expected. The reason for the particularly high abundance at Site 8 is unclear, but at Site 9, we suspect that the lower than expected abundance is probably a consequence of eel harvesting in the stream, with the abundance of eels noticeably increasing with distance upstream from the road crossing at the downstream boundary of the survey reach. Relative to the historical records of shortfin eel distribution in the catchment based on records from the New Zealand Freshwater Fish Database (NZFFD), this survey has shown that shortfin eels are present further inland and in a greater number of sub-catchments than previously recorded (Figure 3.3). The size structure of captured shortfin eels shows a dominance of eels <400 mm in length. The 100-200 mm size class accounted for over 30% of the population, with the median length across all sites being 213 mm, and between sites ranging from 107 mm at Sites 3 and 6, to 350 mm at Site 3. It is likely that the higher median length at Site 3 is partially a consequence of the silty substrate and high abundance of macrophytes, which reduces the efficiency of capture for the small size classes.

Longfin eels (*Anguilla dieffenbachii*) were captured in relatively low abundance at seven of the ten survey sites (Table 3-1; Figure 3.4). The highest abundance of longfin eels (26) was at Site 5. It is notable that the seven sites where they were present were those located furthest upstream, which coincides with the areas with the highest predicted probability of capture in the catchment (Figure 3.4). Again, relative to the historical records in the NZFFD,

this survey has shown the distribution of longfin eels to be more widespread than previously recorded in the upper parts of the catchment (Figure 3.4; Figure 3.5). The overall low abundance of longfin eels means that it is difficult to make any definitive comments regarding the size structure of the population. The median length across all sites was considerably larger than for shortfin eels at 550 mm, and the largest proportion (40%) were in the 400-600 mm size range.

Bullies (Gobiomorphus sp.) were captured at all sites except Site 9 (Table 3-1; Figure 3.6). Due to increasing uncertainty over the reliability of consistent morphological differentiation between populations of common bully (Gobiomorphus cotidianus) and Cran's bully (Gobiomorphus basalis) in the region (Bruno David, personal communication), we have also taken consideration of the presence of small size classes (<30 mm) relative to distance from the sea, and the presence of migration barriers, in determining the species present at each site. In the absence of lentic environments suitable for the establishment of non-diadromous (i.e., don't migrate from the sea to freshwater) common bully populations, it has been assumed that the occurrence of small size classes of bully at sites >80 km inland indicates the presence of Cran's bullies, which are known to have a non-diadromous life history. At seven of the nine sites where bully were present in the current survey, there were fish in the <30 mm size classes and it was concluded that these populations were most likely Cran's bully. At Site 4, only a single bully (45 mm) was captured, but based on the presence of Cran's bully at Site 5, which is downstream, and probable barriers to migration between the two sites, it was concluded that this was also most likely a Cran's bully. At Site 3, bullies were only captured down to 30 mm, but sampling efficiency for small fish was relatively poor in this reach due to the abundance of sediment and macrophytes and adjacent subcatchments were all home to Cran's bullies, leading us to conclude that this population is also most likely Cran's bullies. Because genetic work has indicated that in most cases, the common bully and Cran's bully rarely co-occur (Bruno David, personal communication), it has been assumed that all the bully populations identified consisted of a single species. However, it is possible that in some cases there may also be common bully present.

It can be seen that the predicted probability of capture for Cran's bully is relatively low throughout the majority of the catchment (Figure 3.6). Despite this, the sites where Cran's bullies were identified as present largely coincide with reaches having a higher probability of capture. The distribution also generally matches the historical pattern indicated by the NZFFD records (Figure 3.7). Sizes of Cran's bullies ranged from 15 – 84 mm total length, with a median length of 40 mm. It is suggested that this range probably represents three separate year classes, indicating that recruitment and survival of this species is relatively good.

The remaining species that were captured were present in only a limited number of sites and in low abundance. The most common was inanga (*Galaxias maculatus*), which was recorded at five sites (Figure 3.8), but only at one (Site 9) in any abundance (16). Inanga is a short-lived species, typically thought to complete its entire life-cycle within a year. It is also a relatively poor climber and is therefore more susceptible to the effects of migration barriers such as floodgates, weirs and waterfalls. The presence of inanga at these sites therefore indicates good downstream connectivity. It is notable that relative to both the predicted probability of capture and the historical pattern of occurrence indicated by the NZFFD records, the current results are unusual in that they indicate much greater inland penetration

of inanga than may have been expected (Figure 3.8; Figure 3.9). The maximum size recorded (141 mm) suggests that some of these fish are maturing at two or even three years of age, rather than the usual one, giving them greater opportunity to continue their inland migration (Figure 3-1).



Figure 3-1: Large inanga caught at Site 8.

The next most commonly occurring species was torrentfish (*Cheimarrichthys fosteri*), which was recorded at four sites (Table 3-1; Figure 3.10). This is also a diadromous species and its presence at these four sites further confirms the existence of good downstream connectivity. Torrentfish display a strong preference for fast flowing water in riffles over gravel and cobble. This habitat preference can make them susceptible to the effects of low flows, but also explains the relatively low abundance and low predicted probability of capture (Figure 3.10). There were previously very few records of torrentfish in the Piako catchment (Figure 3.11), particularly this far inland, making this an important finding. The torrentfish captured ranged in size from 25 mm (Site 7) to 136 mm (Site 8), with the average length being approximately 85 mm.

Two further native species were recorded during this survey, smelt (Figure 3.12) and banded kokopu (Figure 3.14). Both species are diadromous, but banded kokopu are capable of much greater inland penetration due to their superior climbing capabilities. Smelt were only recorded in the main stem of the Waitoa River (Site 7), but suitable habitat probably also occurs in the Waihekau Stream at Site 9. This is the furthest upstream that smelt have been recorded in the Piako catchment (Figure 3.13). A single banded kokopu was captured at Site 4, which is also the only location in the upper catchment where this species has previously been recorded (Figure 3.14; Figure 3.15). The predicted probability of capture data indicate that the majority of the catchment is relatively unsuitable for banded kokopu (Figure 3.15). This is most likely because they display a preference for first and second order streams, with intact riparian vegetation and instream cover, which are uncommon in the Piako catchment

due to agricultural development. It is also worth noting that no trout were captured during the surveys and that no trout are recorded in the NZFFD for the catchment.

Overall, species richness at the survey sites was low, with an average of four species. The maximum richness was recorded at Site 7 on the main stem of the Waitoa River, where seven species were recorded. The lowest species richness was recorded at Site 3 on the Piakoiti Stream, where only two species were recorded. Due to the high proportion of diadromous fish species in New Zealand, fish species richness typically falls with distance from the sea and increasing elevation. However, analysis of the data from this survey indicated a positive correlation between fish species richness and distance inland ($r^2 = 0.39$; p = 0.05) and no relationship with elevation ($r^2 = 0.08$; p = 0.42).

Analysis of the catch data indicated that, at the majority of sites, all species were encountered in the first 50 m of the survey reach, and that in all cases the full diversity of species was recorded within 130 m. The relatively short distance required for the majority of sites to capture the full diversity of species is probably a reflection of the relatively low diversity of habitats present in many of the sites.

| Site | Shortfin eel | | ortfin eel Longfin | | gfin eel Cran's bully | | Torrentfish Inan | | anga Smelt | | Banded kokopu | | Gambusia | | Koura | | | |
|-----------------------------|--------------|-------------|--------------------|-------------|--------------------------|-------------|------------------|-------------|------------|-------------|------------------|-------------|----------|-------------|-------|-------------|-----|-------------|
| | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. | Ab. | Rel. Ab. |
| 1. Waitakaruru tributary 1 | 89 | 24.1 | 3 | 0.81 | 114 | 30.8 | - | - | - | - | - | - | - | - | - | - | 2 | 0.54 |
| 2. Waitakaruru Stream | 154 | 41.5 | 8 | 2.15 | 97 | 26.1 | 3 | 0.81 | - | - | - | - | - | - | 5 | 1.35 | 26 | 7.00 |
| 3. Piakoiti Stream | 225 | 70.6 | - | - | 16 | 5.02 | - | - | - | - | - | - | - | - | - | - | 15 | 4.71 |
| 4. Piakonui Stream u/s | 5 | 1.39 | 6 | 1.67 | 1 | 0.28 | - | - | - | - | - | - | 1 | 0.28 | - | - | 106 | 29.4 |
| 5. Piakonui Stream d/s | 116 | 21.9 | 26 | 4.90 | 26 | 4.90 | - | - | - | - | - | - | - | - | - | - | 34 | 6.40 |
| 6. Mangapapa Stream | 116 | 18.8 | 6 | 0.97 | 91 | 14.7 | 2 | 0.32 | 4 | 0.65 | - | - | - | - | - | - | 21 | 3.40 |
| 7. Waitoa River | 209 | 36.1 | 2 | 0.35 | 62* | 10.7 | 4 | 0.69 | 1 | 0.17 | 2 | 0.35 | - | - | 10 | 1.73 | 33 | 5.70 |
| 8. Waitoa headwaters | 254 | 115 | 6 | 2.72 | 62* | 28.1 | 3 | 1.36 | 1 | 0.45 | - | - | - | - | - | - | 44 | 20.0 |
| 9. Waihekau Stream | 79 | 16.2 | - | - | - | - | - | - | 16 | 3.27 | - | - | - | - | 2 | 0.41 | 16 | 3.27 |
| 10. Waitakaruru tributary 2 | 69 | 17.6 | - | - | 178 | 45.5 | - | - | 1 | 0.26 | - | - | - | - | 5 | 1.28 | 54 | 13.8 |

 Table 3-1:
 Results of 2012 electric fishing survey at the ten Piako catchment monitoring sites.
 Ab. = Number caught; Rel. Ab. = Relative abundance (Individuals per 100 m²); * Classified as Cran's bully due to size structure of population and distance inland.

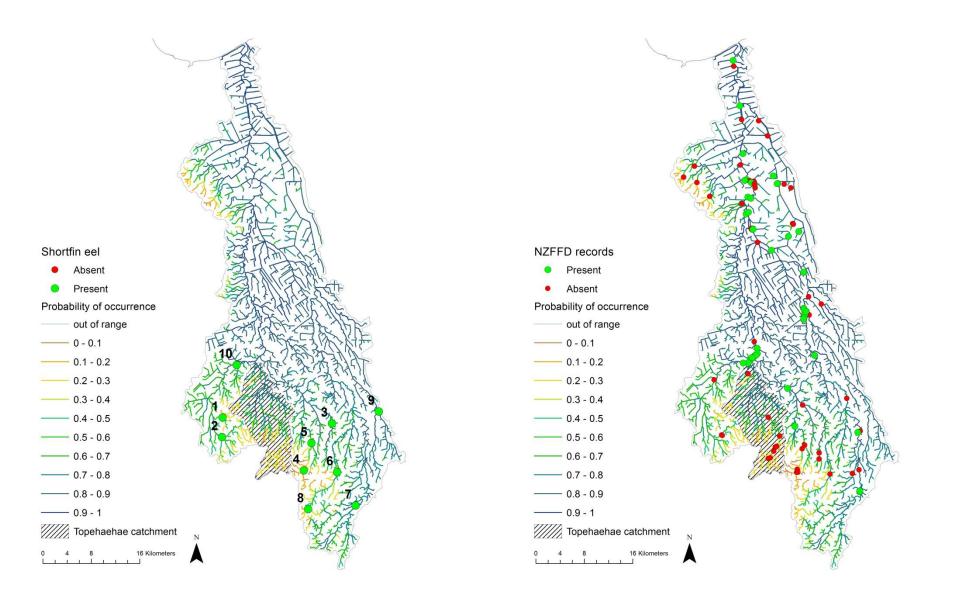
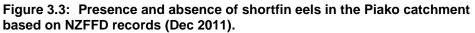


Figure 3.2: Presence and absence of shortfin eels during this survey relative to predicted probability of capture.



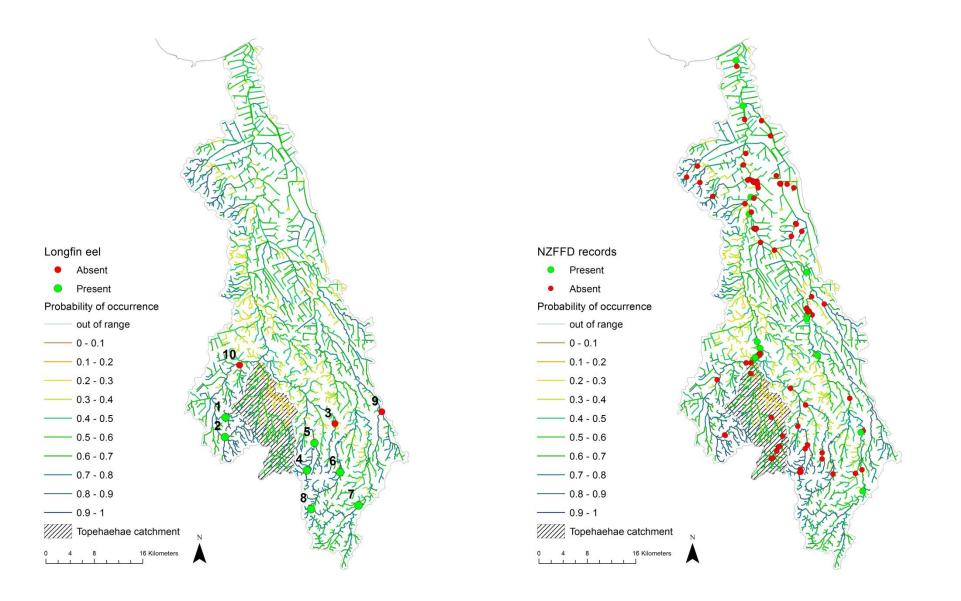
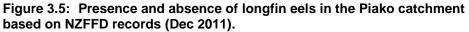


Figure 3.4: Presence and absence of longfin eels during this survey relative to predicted probability of capture.



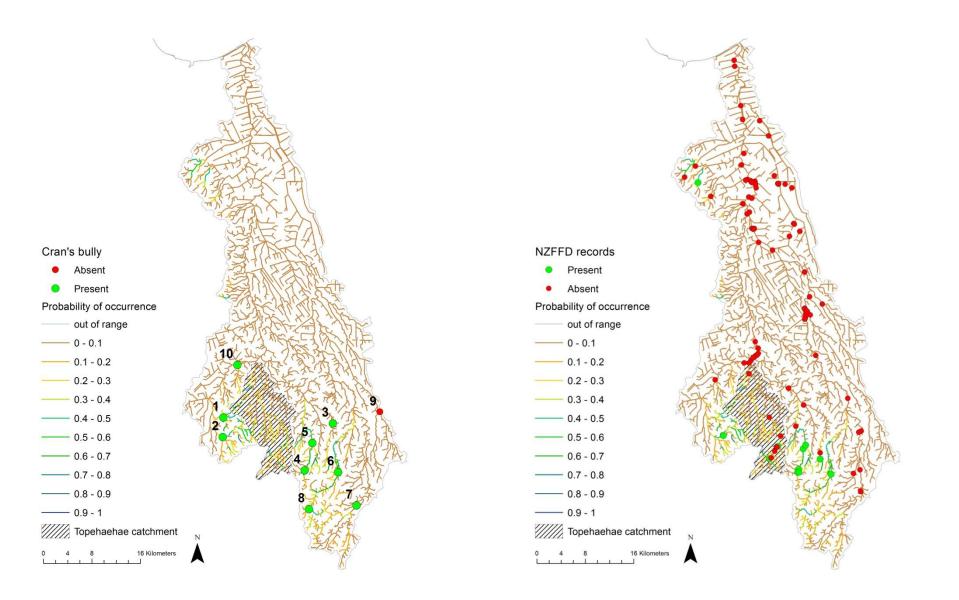
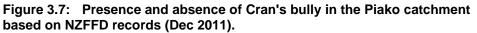


Figure 3.6: Presence and absence of Cran's bully during this survey relative to predicted probability of capture.



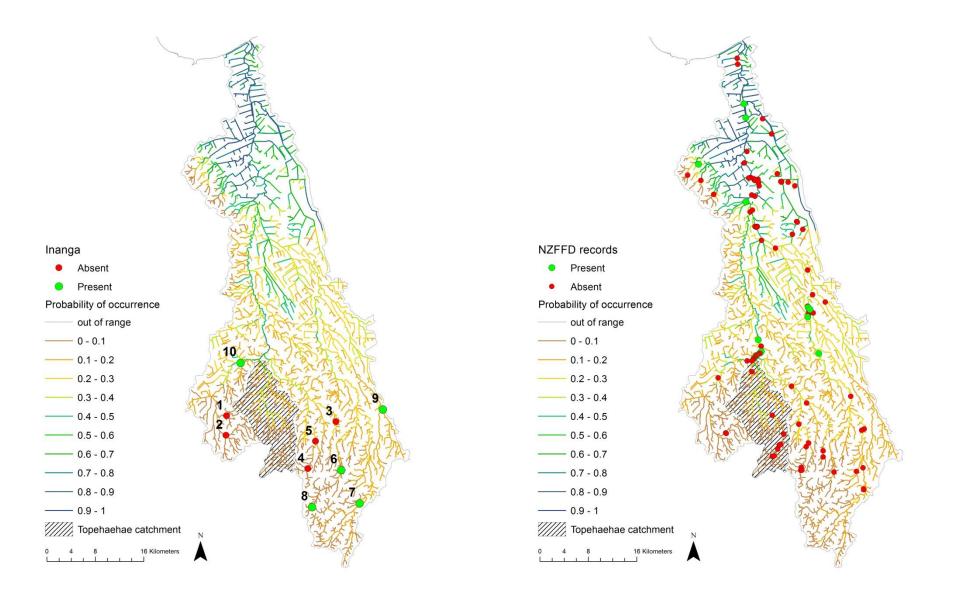
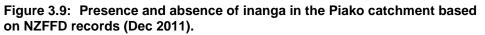


Figure 3.8: Presence and absence of inanga during this survey relative to predicted probability of capture.



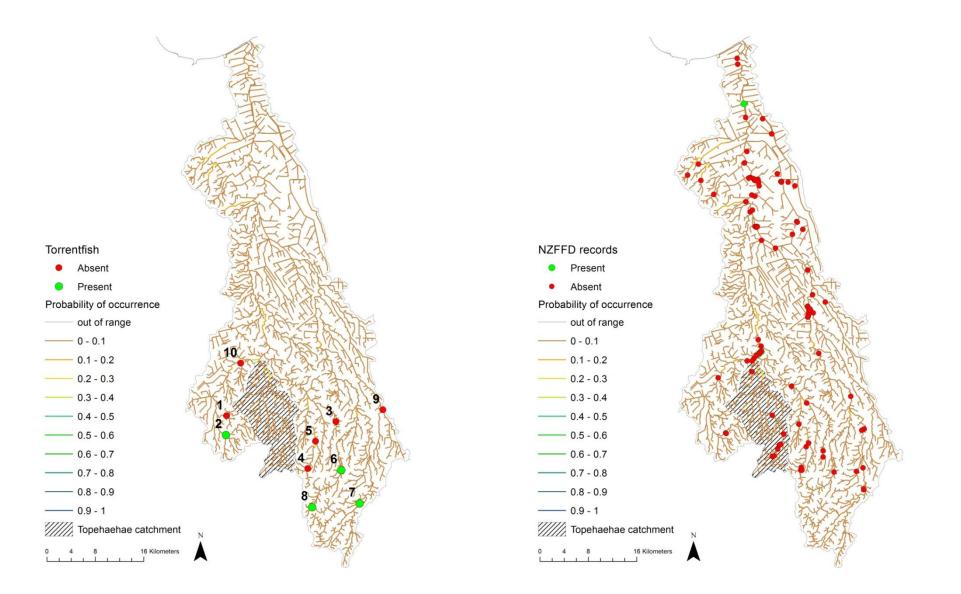
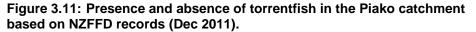


Figure 3.10: Presence and absence of torrentfish during this survey relative to predicted probability of capture.



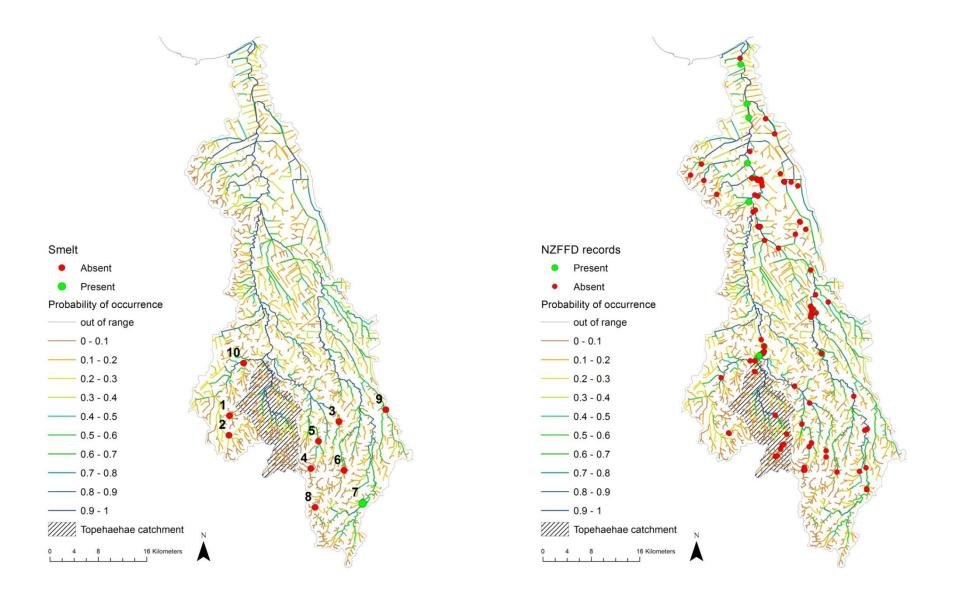
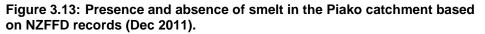


Figure 3.12: Presence and absence of smelt during this survey relative to predicted probability of capture.



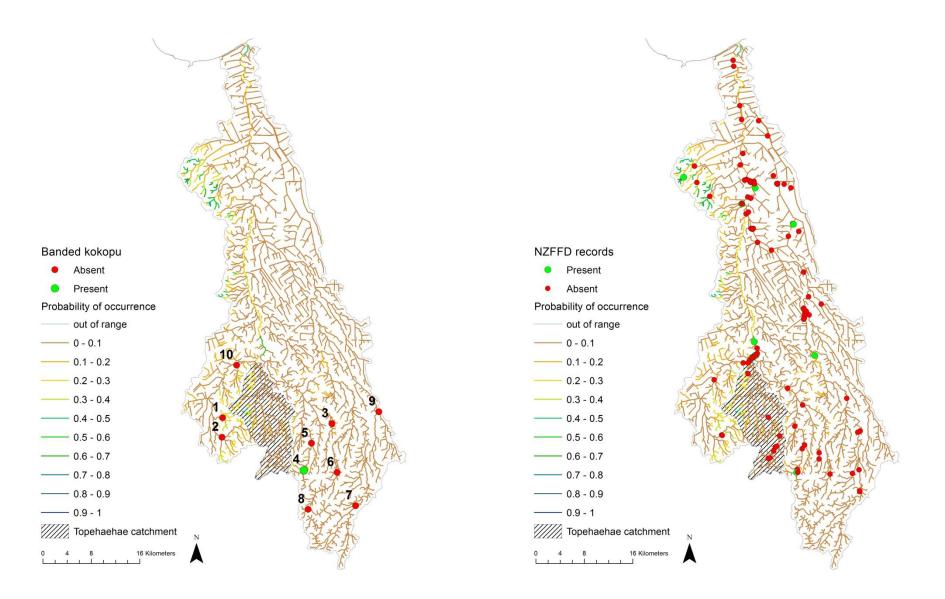
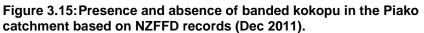


Figure 3.14: Presence and absence of banded kokopu during this survey relative to predicted probability of capture.



3.3 Macroinvertebrates

With the exception of Sites 3, 7, 9 and 10, sites were sampled according to MfE protocol C1 for hard-bottomed streams, with an area of approximately 1 m^2 sampled at each site. Sampling at the remaining sites followed MFE protocol C2 for soft-bottomed streams.

A full taxonomic list for each site is included in Appendix C and is summarised at the taxa level in Table 3-2 according to the methods of (Collier & Kelly 2005). Total taxa richness ranged from 10 at Site 10 to a maximum of 23 at the two Piakonui Stream sampling sites (Sites 4 and 5). Greatest taxa richness tended to occur in higher gradient streams with rocky substrates, whilst lower gradient, agricultural streams typically had lower taxa richness.

The presence and abundance of taxa from the Ephemeroptera, Plecoptera and Trichoptera (EPT) orders is generally considered an indicator of good habitat and water quality. EPT richness and %EPT (Table 3-2) are used to summarise the presence and significance of these taxa at a site. EPT richness varied from only three at Site 10 to sixteen at Site 4 (Table 3-2). Site 4 also had the highest %EPT score (96.6%). This reflects the relatively undisturbed nature of Site 4, which was a headwater stream with varied habitats and an intact, native riparian zone. The lowest %EPT scores were again mainly associated with the lower gradient, slower flowing more impacted streams (e.g., Sites 3, 9 and 10). This was reflected in significant positive correlations between %EPT and stream gradient ($r^2 = 0.39$; p = 0.049) and elevation ($r^2 = 0.48$; p = 0.015).

The Macroinvertebrate Community Index (MCI) was originally developed to indicate the tolerance of macroinvertebrate communities to organic pollution in hard-bottomed streams. Scores of less than 80 are classified as poor, those of 80-100 as fair, those of 100-120 as good and those of greater than 120 as excellent (Stark & Maxted 2007). Sites 3, 7, 9 and 10 were soft-bottomed streams, and thus some caution must be applied to interpreting the MCI scores for these sites.

Of the hard-bottomed sites, the lowest MCI score was recorded at Site 1 (95.8), with Site 6 (98.9) also falling into the 'fair' quality class. Site 4, located in native bush, again has the highest score (140.0) putting it into the 'excellent' quality class, along with Site 8 (121.0) in the headwaters of the Waitoa River. The remaining hard-bottomed sites were all in the 'good' quality class. Each of the four soft-bottomed streams (Sites 3, 7, 9, and 10) had lower MCI scores (Table 3-2), but this is expected to some degree due to the different nature of the habitats in these streams. The lowest score, and only site falling into the 'poor' quality class, was recorded for Site 9 on the Waihekau Stream (75.0). Whilst this was a soft-bottomed stream, it was also probably the most heavily impacted by channel modifications, homogenisation of instream habitats and poor water quality, and thus the MCI appears to give a reasonable indication of disturbance even in the soft-bottomed streams. MCI scores displayed statistically significant positive relationships with stream gradient ($r^2 = 0.65$; p = 0.005) and elevation ($r^2 = 0.59$; p = 0.01).

| Site | Total taxa richness | EPT richness | %EPT | MCI |
|-----------------------------|------------------------|--------------|------|-------|
| 1. Waitakaruru tributary 1 | 19 | 7 | 23.5 | 95.8 |
| 2. Waitakaruru Stream | 13 | 7 | 33.8 | 104.6 |
| 3. Piakoiti Stream | 16 | 5 | 12.8 | 93.8 |
| 4. Piakonui Stream u/s | 23 | 16 | 96.6 | 140.0 |
| 5. Piakonui Stream d/s | 23 | 12 | 57.7 | 103.5 |
| 6. Mangapapa Stream | 19 | 13 | 21.7 | 98.9 |
| 7. Waitoa River | 15 | 8 | 39.1 | 92.0 |
| 8. Waitoa headwaters | 20 | 13 | 67.0 | 121.0 |
| 9. Waihekau Stream | 16 | 4 | 4.70 | 75.0 |
| 10. Waitakaruru tributary 2 | 10 | 3 | 9.60 | 84.0 |

 Table 3-2:
 Summary of macroinvertebrate results for the ten Piako monitoring sites in 2012.

3.4 Macrophytes & periphyton

Macrophyte and periphyton cover varied significantly across the ten sites reflecting the differences in instream habitat, channel morphology and substrate types (Table 3-3; Table 3-4; Appendix D). Lower macrophyte cover (MTC \leq 5) was primarily associated with rocky substrates (e.g., Sites 1, 4, 5, 6 and 8), which limit the capacity for rooted macrophytes to establish. Higher channel shading was also associated with lower macrophyte abundance (e.g., Sites 4 and 10). Higher macrophyte cover typified the lower gradient, slower flowing streams where riparian shading was sparse, for example Sites 3, 7 and 9. In these streams, the most commonly occurring species were *Potamogeton crispus*, *Egeria densa* and the marginal emergent *Persicaria hydropiper*, which are all introduced species. The only native macrophyte species recorded was *Nitella hookeri*, which was most common at Site 3.

The greatest abundance of macrophytes occurred in the Waihekau Stream (Site 9), where the MTC was 56 and MCC 33.5 (Table 3-3). This stream is low gradient, and the channel has been artificially deepened and widened. There is also no riparian shading as a result of the agricultural land use. High light availability, the silty substrate and elevated nutrient concentrations are likely the main drivers of the proliferation of macrophytes in this stream. The Piakoiti Stream also had a relatively high abundance of macrophytes, which is not fully captured by the MTC score of 10.2 (Table 3-3). The low MTC score reflects the need to select reaches with lower macrophyte abundance in order to maximise the efficiency of the electric fishing surveys. The reach that was selected for the survey benefited from a greater degree of shading, as a consequence of riparian planting carried out by the landowner, which resulted in lower instream macrophyte cover.

Periphyton abundance was relatively low at most sites (Table 3-4). The greatest periphyton cover occurred in the Waitoa River at Site 7 (PEI = 76.11), where filamentous algae were prevalent (PFI = 100). PSI is more strongly related to some of the macroinvertebrate indices than the other periphyton indices (Collier & Kelly 2005). The highest values for PPI were recorded for Sites 5 and 6 (30.25 and 30.40 respectively; Table 3-4), but neither site had particularly low %EPT or MCI scores (Table 3-2). It is suggested that the dominance of bedrock substrates at these two sites contributed to the higher PPI scores, due to the suitability of the smooth surface for colonisation by thin mats of algae.

| Site | МТС | MCC | MNC |
|-----------------------------|------|------|-----|
| 1. Waitakaruru tributary 1 | 3 | 2.3 | 0 |
| 2. Waitakaruru Stream | 2 | 1.5 | 0 |
| 3. Piakoiti Stream | 10.2 | 7.7 | 4.2 |
| 4. Piakonui Stream u/s | 0 | 0 | 0 |
| 5. Piakonui Stream d/s | 1.2 | 0.7 | 0 |
| 6. Mangapapa Stream | 0 | 0 | 0 |
| 7. Waitoa River | 19.2 | 13.8 | 3 |
| 8. Waitoa headwaters | 5 | 5 | 0 |
| 9. Waihekau Stream | 56 | 33.5 | 0 |
| 10. Waitakaruru tributary 2 | 2.1 | 1.1 | 2 |

Table 3-3: Summary of macrophyte indices for the ten Piako monitoring sites in 2012. MTC = Macrophyte Total Cover; MCC = Macrophyte Channel Clogginess; MNC = Macrophyte Native Cover.

Table 3-4:Summary of periphyton indices for the ten Piako monitoring sites in 2012.PEI =Periphyton Enrichment Index;PFI = Periphyton Filamentous Index;PMI = Periphyton Mat Index;PPI =Periphyton Proliferation Index;PSI = Periphyton Slimyness Index.

| Site | PEI | PFI | PMI | PPI | PSI |
|-----------------------------|-------|--------|------|--------|-------|
| 1. Waitakaruru tributary 1 | 10.00 | 0 | 0 | 0 | 11.60 |
| 2. Waitakaruru Stream | 10.00 | 0 | 0 | 0 | 3.80 |
| 3. Piakoiti Stream | 0 | 0 | 0 | 0 | 0 |
| 4. Piakonui Stream u/s | 10.00 | 0 | 0 | 0 | 2.50 |
| 5. Piakonui Stream d/s | 35.26 | 7.02 | 0 | 7.02 | 30.25 |
| 6. Mangapapa Stream | 44.94 | 15.10 | 3.27 | 18.37 | 30.40 |
| 7. Waitoa River | 76.11 | 100.00 | 0 | 100.00 | 8.64 |
| 8. Waitoa headwaters | 29.31 | 0 | 0 | 0 | 2.60 |
| 9. Waihekau Stream | 0 | 0 | 0 | 0 | 0 |
| 10. Waitakaruru tributary 2 | 0 | 0 | 0 | 0 | 0 |

4 Discussion

Establishing long-term, regular ecological monitoring sites is critical to developing the understanding of natural variability in freshwater ecological communities that is essential for distinguishing and detecting human induced changes in aquatic ecosystems. The Piako catchment is widely acknowledged as being significantly impacted by land use change and the effects of agricultural development and intensification. The results of this study therefore already reflect the consequences of human induced changes on aquatic ecosystem structure and functioning.

In general, it is the low gradient, lowland streams that are subject to the greatest pressures from land use changes and intensification. This was evident in the structure of stream macroinvertebrate communities in the sites surveyed, with a lower proportion of desirable EPT taxa and lower MCI scores in lower elevation and lower gradient sites. These sites typically had more uniform habitats, more silty substrates, were slower flowing and had a greater abundance of aquatic macrophytes. Some also had warmer water temperatures and lower dissolved oxygen concentrations. The combination of these factors contribute to less species rich communities and lower frequency of occurrence of the more sensitive EPT taxa, which typically prefer faster flowing streams and more stable substrates.

The more mobile and migratory nature of most fish species means that the direct effects of habitat degradation at a site are more difficult to distinguish than for macroinvertebrates. However, they are beneficial as an indicator of the integrated effects of different stressors throughout a catchment. Because the sites included in this survey are all located in the upper catchment, the fish communities present reflect both local and downstream habitat and water quality conditions.

The most distinct pattern in the fish communities across the ten sites was the absence of inanga and torrentfish from the Piakoiti/Piakonui sub-catchment. This is most likely a consequence of a small waterfall on the Piako River just upstream of Morrinsville. Whilst species such as eels and banded kokopu are able to climb the waterfall, it is likely to be a barrier to migration for swimming species such as inanga, torrentfish, smelt and common bullies. The presence of torrentfish and inanga in the two other sub-catchments (Waitakaruru and Waitoa) indicates that downstream connectivity in these catchments is good.

More generally, shortfin eels dominated the fish communities in the upper catchment. This species is considered the most tolerant of modified habitats and lower water quality. Inanga and smelt are more sensitive to reductions in water quality and thus their presence in the Waitoa sub-catchment, albeit at lower abundances than eels, is an indicator that water quality during this summer season, was not a major limiting factor. This must however be considered in the context of the 2011-12 summer being wetter than average, meaning that river flows were higher and water quality potentially better than average due to higher dilution. There are also no reference sites in this catchment to compare the abundance of these species under unimpacted conditions. Smelt in particular were limited in distribution and abundance relative to the predicted probability of capture, which could indicate that with improved water quality, their abundance could be higher. These patterns will only become evident with long-term and regular monitoring.

Overall, instream habitats in the lowland, low gradient reaches were relatively homogenous and as a consequence ecological communities were simplified and dominated by more generalist species. A lack of riparian vegetation also contributes to warmer water temperatures and a greater abundance of instream macrophytes. In the steeper gradient streams, a greater diversity of instream habitats was maintained, but the lack of riparian vegetation means that water temperatures were noticeably higher than in the one site with intact riparian cover. There was also a much lower abundance of woody debris in these streams, which is an important habitat for both macroinvertebrates and native fish species.

It is therefore a combination of stressors, both physical and chemical, that appear to be the main drivers in determining the structure and functioning of ecological communities in the upper Piako catchment. Critical to determining instream flow requirements is developing an understanding of the extent to which these stressors are mediated or influenced by stream flow. Within the Piako catchment, critical issues affected by flow are likely to include assimilative capacity of the stream, connectivity at migration barriers under low flows, water temperatures, dissolved oxygen dynamics and physical habitat suitability.

5 Conclusion

The process of developing water allocation rules must be robust, transparent and based on clear, measureable objectives. The resulting water allocation framework must be sustainable and support adaptive management strategies. Reliable information on the status and dynamics of instream values is a key component in achieving this. Establishing and maintaining a routine ecological monitoring network allows the identification of values and develops an understanding of their status. This can be used to support development of appropriate management policies and as the length of the time series increases, allowing identification of trends and differences in community population dynamics over time and between sites, adaptive management strategies can be implemented.

6 References

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Appendix A Field and habitat assessment forms

| Stream name: Waita | akaruru Stre | am trib | outary | | Assess | or: Pa | ul Frankli | n | | |
|--|--|--|---|----------------------------|---|--|--|---|--|-------------|
| Site number: 1 | | Samp | le number: | | Date: 1 | 3/2/12 | 2 - | Time | : 12.20 | |
| GPS coordinates | | Down | stream: | | E 2728 | 090 | | N 63 | 80572 | |
| | | Upstre | eam: | | E 2728216 N 6380561 | | | | | |
| Channel & riparia | an features | 3 | | | Instre | am h | ydraulic | cor | nditions | |
| Canopy cover: | | | | | | | easured re | | | |
| Open | Partly sl | haded | Very sh | aded | | | | | | |
| Fencing: | Dominant | riparia | n vegetation: | | Stream width (active channel): 2.8m | | | | | |
| None/ineffective | Crops | | Retired ve | getation | Stream | width | (water): 2 | 2.8m | | |
| One side/partial | Pasture | | Native shru | ıb | Stream | depth | n: 0.3m | | | |
| Complete | S | Surface | e veloo | city: 0.2m | s ⁻¹ | | | | | |
| Water quality | | _ | | | | | | | | |
| Temperature: | 18.5 | | °C | | Condu | ctivity: | | 151 | μS | cm |
| Dissolved oxygen: | 95.7 | | % | | 8.96 | | 1 | mg l ⁻ | 1 | |
| Turbidity: | Clear | | Slightly turbid | Highly | turbid | Stai | ned | (| Other | |
| Stream-bottom s | ubstrata | | | | | | | | | |
| Compaction (inorg | anic substra | ata): | | | % surf compo | | | sub | stratum s | ize |
| Assorted sizes tightly | y packed &/c | or over | lapping | | Substra | atum | Dimens | ion | Percent | age |
| Moderately packed | with some | overla | pping | | Bedroc | Bedrock - | | | | |
| Mostly a loose assor | tment with li | ttle ove | erlap | | Boulder >256mr | | >256mm | | 5 | |
| No packing/loose as | sortment eas | sily mo | ved | | Cobble >64-256 | | >64-256m | m | 20 | |
| Embeddedness: | | | | | Gravel >2-64n | | >2-64mm | | 30 | |
| (% gravel-boulder partie | cles covered b | y fine s | ediment) | | Sand >0.06-2 | | | ^{tmm} 15 | | |
| | 6 26-5 | 0% 51-75% >75% | | | Silt 0.004-0 | | 0.004-0.06 | Smm | 30 | |
| <5% 5-25 % | | | | | | | | | | |
| <5% 5-25 % | | | | | Clay | | <0.004mm | ı | | |
| <5% 5-25% | | | | | | at typ | <0.004mm | | | |
| 1 | (% cover) | | | | | | | | | |
| Organic material | (% cover) diameter) | 0% | 51-75% | >75% | Habita | fort) | | oled | | |
| Organic material Large wood (>10cm | (% cover) diameter) % 26-5 | 1 | | | Habita | fort) | es samp | bled | | ۶O % |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 | ks, lea | | | Habita (% of eff Stones Wood: Macrop | fort) : ohyte: | es samp 100% | Ri | ffles: 6 | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 all wood, stic % 26-5 c deposits | ks, lea 0% | ves etc.,. >1mm | n) | Habita (% of eff Stones Wood: Macrop Edges: | fort) : phyte: | es samp 100% % % | Ri Ri | ffles: 6 uns: | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 all wood, stic % 26-5 c deposits | ks, lea 0% | ves etc.,. >1mm | n) | Habita (% of eff Stones Wood: Macrop Edges: | fort) : phyte: | es samr 100% % | Ri Ri | ffles: 6 uns: | 50 % 40% |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 c deposits % 26-5 c deposits % 26-5 c deposits % 26-5 | ks, lea 0% | ves etc.,. >1mm 51-75% | n) >75% | Habita (% of eff Stones Wood: Macrop Edges: | fort) : ohyte: er of in | es samp 100% % % vertebrate | Ri Ri | ffles: 6 uns: turned: | |
| Organic materialLarge wood (>10cm<5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 c deposits % 26-5 over (% street mats: | ks, lea 0% | ves etc.,. >1mm 51-75% 51-75% d area) | n) >75% | Habita (% of eff Stones Wood: Macrop Edges: Numbe | fort) : ohyte: er of in | L es samp 100% % % vertebrate | Ri Ri Ru | ffles: 6 uns: turned: nps: | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 >ver (% street in the stree | ks, lea 0% | ves etc.,. >1mm 51-75% | n) >75% | Habita (% of eff Stones Wood: Macrop Edges: Numbe Koura: Crabs: Other: | fort) : ohyte: er of in rare | L es samp 100% % % vertebrate | Ri Ri Ru es ret | ffles: 6 uns: turned: nps: | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 over (% street mats: % 26-5 | ks, lea 0% 0% eambec 0% | ves etc.,. >1mm 51-75% 51-75% Jarea) 51-75% | n) >75% >75% >75% | Habita (% of eff Stones Wood: Macrop Edges: Numbe Koura: Crabs: Other: Mussel | fort) : phyte: er of in rare | es samp 100% % % vertebrate | Died Ri Ru Ru Shrin Muss | ffles: 6 uns: turned: nps: sels: | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 over (% street mats: % 26-5 | ks, lea 0% 0% eambec 0% | ves etc.,. >1mm 51-75% 51-75% d area) |) >75% >75% | Habita (% of eff Stones Wood: Macrop Edges: Numbe Koura: Crabs: Other: | fort) : phyte: er of in rare | es samp 100% % % vertebrate | Died Ri Ru Ru Shrin Muss | ffles: 6 uns: turned: nps: | |
| Organic material Large wood (>10cm <5% | (% cover) diameter) % 26-5 all wood, stic % 26-5 cdeposits % 26-5 over (% stre mats: % 26-5 over (% stre mats: % 26-5 | ks, lea 0% 0% ambec 0% 0% | ves etc.,. >1mm 51-75% 51-75% Jarea) 51-75% | n) >75% >75% >75% | Habita (% of eff Stones Wood: Macrop Edges: Numbe Koura: Crabs: Other: Mussel | fort) : phyte: er of in rare | es samp 100% % % vertebrate | Died Ri Ru Ru Shrin Muss | ffles: 6 uns: turned: nps: sels: | |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
|--|----|---|--|--|------------------|-----|---------------------------------------|------------------------------------|---|-------------------|------|--|--|--|-----------------|---|--|---|---|----------------|
| Stream name: Waita | | | | | | | | | Site | numl | ber: | 1 | | | | | | | | |
| Sample number: | | | | - | | | Pau | | | | | | Date | e:13/ | 2/12 | | | | | |
| | | | | | | | | | | Cate | gory | / | | | | | | | | |
| Habitat parameter | | С | ptim | al | | | Sub | oopti | mal | | | Ma | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n tinuo | n buff | er | • | vege is <1 | 0m | n buff ntinu | | • | Path and/o Most over | or sto | ck | ent | • | Hun | aks fr nan a ious | | |
| Left bank:8 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank8: | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 8 | | | | | | | 1 | 1 | | | | | | | 1 | | 1 | | 1 | |
| 2. Vegetative protection | • | imm ripar cove vege Tree store non- pres Vege | ediate ian z ered b etation s, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | cove nativ Disru Bank | re veç uptior ks ma red b | nainly getati n evic | on lent | • | Bank cove mixtu grass black & intri spec Vege disru Bare cropp vege comr | red b ure of ses/s berry roduction etation soil/c bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr stre veg high Gra graz Sigr | ss he | by & shru n of ank n very avily avily | ubs y ck |
| Left bank: 9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 9 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failu abse | ent/m of ba | ank inima | I | • | Infre area | quen s of e tly he % of | | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | IS | • | Mar area 60-7 | 100% erosi | of ba | ink |
| Left bank:12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:13 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 12.5 | | | | | | | | | | | | | | 1 | | | 1 | | | |
| 4. Frequency of riffles | • | frequ Dista riffle strea | uent ance s divi am wi ety of | ativel betwe ded k dth= habi | een by 5-7 | • | riffles Dista riffles | ance s divi | ce of equer betwe ded b dth=7 | een by | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe | rs een ey | • | wate riffle Poo Dist riffle | ierally er, sh es r hab ance es divi am w | allow itat betwo ded b | een oy |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Stre | ent/m am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges Iredgi Iredgi Iredgi Iredgi nt | ing ist ing | • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/consive ankm struct ent or s 0% of nelize | ients, cture: n boti f read | /sh s h | • | with gab >80 read cha disr | ion/ce % of : | ement strear ced or habit | m r at |
| Score:18 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | abitat | para | amet | er |
|-------------------------------------|-----|--|---|---|---------|----|---|--|--|----------|-------|--|---|--|-----------------|---------|---|---|--|----|
| 6. Sediment deposition | • | point | bars 6 of t ted b nent | , | ent | • | most | orma ily fro el, sa sedim 0% o ted it dep | tion, m nd or nent f bott | om | • • • | Som of ne sand sedir new 50-8 affec Sedir depo obstr cons bend | w gra or fir nent bars 0% o ted ment sits a cuctio trictic | avel, ne on ol f bott f bott ns, | d & om | • • • • | fine Incrededededededededededededededededededed | vy de matei eased elopm % of t iging uently s alm ent du ment ositior | ial bar ent oottor ost e to | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | | nes p /deej /shall shallo | ow, | | • | regin If fas miss | city/d | iresei Ilow i nen | | • | 2 of 4 veloc regin If fas slow/ miss low | city/de nes p t/shall /shall | reser llow o ow a | or | • | velo regir | inate city/d ne ally de | əptń | |
| Score: 15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank provi abur cove | urable tebra varie dy de s, roc gs/ nerge unde s/cot des dant r not l | te on & ety of bris, ot mat ed rcut obles fish oe ne | S | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | nerge Junde s/colt cove mon erate bitat cons e nev | e for ate on ed rcut obles r varie types ist of | ety | • | 10-30 favor inver color Fish 60-90 easil foot Woo rare smot sedir | urable tebra cove 0% so y mo dy de or ma here | e for te on r pato ubstra ved b ebris ay be | chy ate y | • | favo inve colo Fish abse Subs unst lacki Stab | strate | e for ite on r rare or bitats limite | ed |
| Score:12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le sul aces | n not n han es bstrat rough | d te | • | visib Stab Perip | | ston bstra n | es te | • • | Perip <20% avail subs | 6 cov able | er of | | • • | obvi >209 avai | ohyto ous & % cov able trates | proli er of | |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 118 | 3.5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Waita | karuru | | | | Assess | or: Pa | ul Franklin | | |
|--|--|------------------------|-----------------------------|--------------|---|--------------------------|-------------------------------|--------------------|-------------|
| Site number: 2 | | Samp | ole number: | | Date: 1 | 3/2/12 | 2 Т | ime: | 14.20 |
| GPS coordinates | I | Dowr | nstream: | | E 2727 | 985 | N | l 637 | 7350 |
| | | Upstr | ream: | | E 2728 | 142 | Ν | l 637 | 7272 |
| Channel & riparia | an features | i | | | Instre | am h | ydraulic | con | ditions |
| Canopy cover: | | | | | Estimate | ed or m | easured rea | ich av | /erage: |
| Open | Partly sh | aded | l Very s | haded | | | | | |
| Fencing: | Dominant r | iparia | n vegetation: | | Stream | width | (active ch | anne | el): 3m |
| None/ineffective | Crops | | Retired v | egetation | Stream | width | (water): 2 | .5m | |
| One side/partial | Pasture | | Native shr | ub | Stream | depth | 1: 0.3m | | |
| Complete | Exotic trees | s | Native tree | es | Surface | e veloo | city: 0.4m s | s ⁻¹ | |
| Water quality | | _ | | | | | | | |
| Temperature: | 21.2 | | °C | | Condu | ctivity: | 1 | 54 | µS cm⁻¹ |
| Dissolved oxygen: | 104 | | % | | 9.21 | | n | ng l ⁻¹ | |
| Turbidity: | Clear | | Slightly turbid | Highly | turbid | Stair | ned | С | other |
| Stream-bottom s | ubstrata | | | | | | | | |
| Compaction (inorg | anic substra | ıta): | | | % surf compo | | | subs | tratum size |
| Assorted sizes tight | y packed &/o | r ove | rlapping | | Substra | atum | Dimensio | on | Percentage |
| Moderately packed | with some ov | erlapr | bing | | Bedroc | k | - | | |
| Mostly a loose ass | ortment with | ı little | overlap | | Boulde | r | >256mm | | |
| No packing/loose as | sortment eas | ily mo | oved | | Cobble | | >64-256mm | ı | |
| Embeddedness: | | | | | Gravel | | >2-64mm | | 90 |
| (% gravel-boulder partie | cles covered by | y fine s | sediment) | | Sand | | >0.06-2mm | | 5 |
| <5% 5-25% | % 26-50 |)% | 51-75% | >75% | Silt | | 0.004-0.06r | nm | 5 |
| | | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | | (% of ef | fort) | | | |
| | % 26-50 |)% | 51-75% | >75% | Stones | : | 100% | | |
| <5% 5-259 | | | aves etc., >1mr | n) | Wood: | | % | Riff | fles: 100 % |
| <5% 5-25° Coarse detritus (sma | all wood, sticl | ks, lea | | | | 1 | % | Ru | ns: % |
| | 1 | | 51-75% | >75% | Macrop | onyte: | 70 | | |
| Coarse detritus (sma | % 26-50 | | 51-75% | >75% | Macrop Edges: | - | % | | |
| Coarse detritus (sma <5% 5-25 | % 26-50 c deposits |)% | 51-75% 51-75% | >75% >75% | Edges: | - | | s retu | urned: |
| Coarse detritus (sma <5% 5-25° Fine (<1mm) organic | % 26-50 c deposits % 26-50 |)%)% | 51-75% | | Edges: | er of in | % vertebrates | s retu Shrim | |
| Coarse detritus (sma <5% | % 26-50 c deposits 6 % 26-50 over (% stream) 6 |)%)% | 51-75% | | Edges: Numbe | er of in | % vertebrates ion S | | ps: |
| Coarse detritus (sma <5% | % 26-50 c deposits % % 26-50 Over (% stread mats: | 0% 0% ambe | 51-75% | | Edges: Numbe Koura: | er of in | % vertebrates ion S | hrim | ps: |
| Coarse detritus (sma<5% | % 26-50 c deposits % % 26-50 over (% stread mats: % % 26-50 | 0% 0% ambe | 51-75% d area) 51-75% | >75% >75% | Edges: Numbe Koura: Crabs: Other: Mussel | r of in comm type: | % vertebrates ion S | hrim | ps: |
| Coarse detritus (sma<5% | % 26-50 c deposits % % 26-50 over (% stread mats: % % 26-50 | 0% 0% ambe | 51-75% d area) | >75% | Edges: Numbe Koura: Crabs: Other: | r of in comm type: | % vertebrates on S M | hrim Iusse | ps: |
| Coarse detritus (sma<5% | % 26-50 c deposits 26-50 % 26-50 over (% streaments: 26-50 % 26-50 % 26-50 | 0% 0% ambe 0% | 51-75% d area) 51-75% | >75% >75% | Edges: Numbe Koura: Crabs: Other: Mussel | r of in comm type: | % vertebrates on S M | hrim Iusse | ps: els: |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | ≏t | | | | | | | | | | | | | |
|--|----|---|--|--|------------------|------|--|--|----------------------------------|-------------------|-------|---|---|--|----------------|---|---|--|------------------------------|----------------|
| Stream name: Waita | | | | | Jala | One | | ç | Site i | numt | ber 2 | 2 | | | | | | | | |
| Sample number: | | | | 1 | sses | sor: | Pau | | | - | | - | Date | :13/ | 2/12 | | | | | |
| • | | | | | | | | | | Cate | qorv | | | | - | | | | | |
| Habitat parameter | | С | ptim | al | | | Sub | oopti | | | 0, | | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n tinuoi | n buff us & | er | • | Bank vege is <1 Most | tatior 0m | n buff ntinue | | | Path and/o Most over | or sto | ck | ent | • | | nan a | equei ctivity | |
| Left bank:12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 10.5 | | <u> </u> | <u> </u> | <u> </u> | 1 | | 1 | | 1 | <u> </u> | | | | L | L | | 1 | 1 | 1 | 1 |
| 2. Vegetative protection | • | imm ripar cove vege Tree store non- pres Vege | ediate ian ze ered b etation es, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | nativ Disru Bank | red n e veg iptior is ma red b | nainly getati n evid | on lent | • | Bank cove mixtu grass black & intu spec Vege disru Bare cropp vege comr | red b ure of ses/sl berry roducties etation ption soil/co bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr strea vege high Gras graz Sigr | ered b ses 8 uption am ba etation ss hea ed iificar | shru n of ank n ver | ubs y ck |
| Left bank: 10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 10 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failu abse | ent/mi | ank inima | I | • | Mode Infre- area most over 5-30 erod | quent s of e ly he % of | t, sma erosio aled | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | S | • | Man area 60-1 | 00% erosi | of ba | ınk |
| Left bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 16 | | | | | | | | | | | | | | 1 | | | | | | |
| 4. Frequency of riffles | • | frequ Dista riffle strea | uent ance s divi am wi ety of | ativel betwe ded k dth= habi | een y 5-7 | • | Dista riffles | s infre ince l s divie | equer | een by | • • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe ded b | rs een y | • | wate riffle Poo Dist riffle | s r habi ance s divi | allow | een Dy |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Strea | ent/mi am w | lredgi inima | I | • | Evide chan Rece chan | nel/d ence nel/d ent | redgi of pa redgi redgi | ing ist ing | • • | exter Emba oring | ges/c nsive ankm struc ent or s 0% of nelize | ients, cture: n botl | /sh s n | • | with gabi >80 reac char disru | on/ce % of s h nneliz upted ream | ement strear | m at |
| | | | | | | | | | | | | | | | | - | | | 1 | |

| Habitat parameter | - | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | abitat | para | amet | er |
|-------------------------------------|-----|--|---|--|----------|----|---|---|--|----------|----|---|---|---|------------------|----|---|--|--|----|
| 6. Sediment deposition | • | point | bars 6 of t ted b nent | , | ent | • | bar f most | 0% o ted it dep | tion, m nd or nent f bott | om | • | of ne sand sedir new 50-8 affec Sedi depc obstr | ew gra l or fir ment bars 0% o ted ment osits a ructio trictic | ne on ol f bott at | d & om | • | fine Incrededededededededededededededededededed | vy de mate easec elopm % of t nging uently s alm ent du ment osition | rial I bar Jent Dottor Most Je to | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | | nes p /dee /shall shallo | low, | | • | regin If fas miss | city/d | iresei Ilow i nen | | • | If fas | city/de nes p t/shall /shall | iresei llow o ow a | or | • | velo regir | iinate city/d ne ally d | epth | |
| Score: 15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank provi abur cove | urable tebra nisati varie dy de s, roc gs/ nerge unde s/col ides idant r : not l | ate on & ety of bris, of mate ed ercut obles fish be ne | ts | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | herge junde s/col cove mon erate bitat cons e nev | e for ate on ed rcut obles r varie types ist of | ety | • | favor inver color Fish 60-9 easil foot Woo | urable tebra cove 0% si y mo dy de or ma | ite on ubstr ved b ebris ay be | chy ate yy | • | favo inve colo Fish abse Sub unst lack Stab | strate able (| e for ate on r rare or bitats | ed |
| Score:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le su aces | n not n han es bstra rougł | id te | • | visib Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | • | | 6 cov able | n visi ver of s | | • | obvi >20° avai | phyto ous 8 % cov lable strates | oroli ver of | |
| Score: 17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 126 | 6.5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Piako | iti Stream | | | | Assess | or: Pa | ul Franklir | 1 | |
|--|--|-------------|--------------------|--------------|---------------------------|----------|--------------|--------------------|--------------------|
| Site number: 3 | | Sam | ple number: | | Date: 1 | 4/2/12 | 2 Т | ïme: | 10.00 |
| GPS coordinates | | Dow | nstream: | | E 2746 | 139 | Ν | 1 6379 | 9564 |
| | | Upst | ream: | | E 2746 | 113 | Ν | 16379 | 9455 |
| Channel & riparia | an features | 5 | | | Instre | am h | ydraulic | conc | litions |
| Canopy cover: | | | | | Estimate | ed or m | easured rea | ach av | erage: |
| Open | Partly sl | hadeo | d Very | shaded | | | | | |
| Fencing: | Dominant | riparia | an vegetation: | | Stream | width | (active ch | annel |):4m |
| None/ineffective | Crops | | Retired v | regetation | Stream | width | (water): 3 | .5m | |
| One side/partial | Pasture | | Native sh | nrub | Stream | depth | i: 0.5m | | |
| Complete | Exotic tre | es | Native tre | ees | Surface | e veloo | city: 0.3m s | s ⁻¹ | |
| Water quality | | | | | | | | | |
| Temperature: | 18.7 | | °C | | Condu | ctivity: | 1 | 96 | µS cm ⁻ |
| Dissolved oxygen: | 83 | | % | | 7.7 | | n | ng l ⁻¹ | |
| Turbidity: | Clear | | Slightly turbi | d Highly | turbid | Stai | ned | Ot | ther |
| Stream-bottom s | ubstrata | | | | | | | | |
| Compaction (inorg | anic substra | ata): | | | % surf compo | | | subst | ratum size |
| Assorted sizes tightl | y packed &/c | or ove | rlapping | | Substra | atum | Dimensi | on | Percentage |
| Moderately packed | with some ov | /erlap | ping | | Bedroc | k | - | | |
| Mostly a loose asso | rtment with li | ttle ov | verlap | | Boulde | r | >256mm | | |
| No packing/loose a | ssortment | easily | moved | | Cobble | | >64-256mn | ı | |
| Embeddedness: | | | | | Gravel | | >2-64mm | | 5 |
| (% gravel-boulder parti | cles covered b | y fine : | sediment) | | Sand | | >0.06-2mm | | 25 |
| <5% 5-25% | % 26-5 | 0% | 51-75% | >75% | Silt | | 0.004-0.06 | nm | 70 |
| | | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | | (% of ef | fort) | | | |
| <5% 5-25° | % 26-5 | 0% | 51-75% | >75% | Stones | : | % | | |
| Coarse detritus (sma | all wood, stic | ks, lea | aves etc., >1m | ım) | Wood: | | % | Riffl | es: % |
| i | % 26-5 | 0% | 51-75% | >75% | Macrop | hyte: | 50% | Run | is: 100% |
| <5% 5-25° | | | | | Edges: | | 50% | | |
| <5% 5-25 Fine (<1mm) organie | caeposits | | 51-75% | >75% | Numbe | r of in | vertebrate | s retu | rned: |
| | - I | 0% | 51-7570 | | | | ional S | Shrimp | os: |
| Fine (<1mm) organi | % 26-5 | | | | Koura: | occas | | | 1 |
| Fine (<1mm) organio <5% 5-25% | % 26-5 | | | | Koura: Crabs: | occas | | lusse | IS: |
| Fine (<1mm) organi <5% 5-25 Instream plant co | % 26-5 over (% stre | ambe | | >75% | | occas | | lusse | IS: |
| Fine (<1mm) organio <5% 5-25° Instream plant co Filamentous algae 8 | % 26-5 over (% stre | ambe | ed area) | >75% | Crabs: | | | lusse | IS: |
| Fine (<1mm) organio | % 26-5 Over (% stresson a mats: % % 26-5 | eambe 0% | ed area) | >75% >75% | Crabs: Other: | type: | N | | nerunio |
| Fine (<1mm) organion | % 26-5 Over (% stresson a mats: % % 26-5 | eambe 0% | ed area) 51-75% | | Crabs: Other: Musse | type: | N | | |

| Wadeable Soft-Be | otto | med | St | rear | ns | | | | | | | | | | | | | | | |
|---|--------|--|--|---|--------------------|-------|---------------------------------------|--|----------------------------------|----------------|--------|--|--|--|---------------|-------|--|--|-------------------------------|---------|
| Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
| Stream name: Piako | iti St | ream | ۱ | | | | | 5 | Site r | numt | ber: 3 | 3 | | | | | | | | |
| Sample number: | | | | A | sses | ssor: | Pau | l Fra | nklin | l | | | Date | e: 14 | /2/12 | 2 | | | | |
| liekitet neveneter | | | | | | | | | | Cate | gory | , | | | | | | | | |
| Habitat parameter | | 0 | ptim | al | | | Sub | oopti | mal | | | M | argir | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | Bank vege >10r Cont dens | tation n inuou | n buff | fer | • | vege is <1 | kside etatior Om tly co | | | • | Path and/o Most over | or sto | | ent | • • | | nan a | equer ctivity | |
| Left bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 13 | | | | | | | | I | | | | | | | | | - | | | |
| 2. Vegetative protection | • | imme ripari cove vege Tree store non- prese Vege | ediate ian ze red b station s, un ey shi wood ent etativ | ones by nat n der- rubs o ly pla | tive or ints | • | cove nativ Disru Bank | c surfa red n re veg uptior cs ma red b stry | nainly getation nevid | on ent | • | cove mixtu grass black & intr spec Vege disru | ure of ses/s (berry roduc ies etation ption soil/o ped tatior | hrubs y, will ced n obvi | ow | • • • | cove gras Disru strea vege high Gras graz Sign | ered b ses 8 uption am ba etation ss hea ed uificar | shru n of ank n very | y ck |
| Left bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:6 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 7.5 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Bank Eros failur abse <5% affec | ion/b e nt/mi of ba | ank inima | I | • | Infreater areater most over | % of | t, sma rosio aled | all n | • | react of er High | able 0% o n has osion eros ntial c | f ban area | IS | • | Man area 60-1 | 00% erosi | of ba | nk |
| Left bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 11 | | | | | | | | | | | | | | | | | | | | |
| 4. Channel sinuosity | • | strea times | ım lei s long | creasingth a ger th traigh | 3-4 ian | • | strea times | ds inc am ler s long vas st | ngth 2 ger th | 2-3 an | | strea times | m ler s long | reasength ger th traigh | 1-2 an | • | Cha | nnel | straig | ht |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | abse Strea | nel/d nt/mi am w | lredgi inima | l | • | chan Evide chan Rece chan | e cha inel/d ence inel/d ent inel/d presei | redgi of pa redgi redgi | ng st ng | • | exter Emb oring prese bank 40-80 Char | ges/o nsive ankm struc ent or s 0% o nneliz | dredg nents/ cture: n botl f read ced & | /sh s h | • | with gabi >80% reac char disru | on/ce % of s h nneliz upted ream | ement strear | n at |
| | | | | | | | | | | | | disru | pieu | | | | | | | |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | ibita | t par | amet | er |
|-------------------------------------|----|---|---|--|---------|----|---|--|--|-----------|----|---|---|---|-----------------|----|---|---|---|------|
| 6. Sediment deposition | • | <pre>point <20% affect seding </pre> | t bars | | ent | • | New bar fe most grave fine s 20-50 affec Sligh in po | orma ily fro el, sa sedim 0% o ted it dep | tion, m nd or nent f bott | om | • | of ne sand sedir new 50-8 affec Sedi depc obstr | w gra or fin hent bars 0% o ted ment sits a cuctio trictic | ne on ol f bott at | d & om | • | fine lncr dev >80 cha freq Poc abs sed | avy de mate eased elopm % of nging uently ols aln ent du iment ositio | rial d bar hent bottor / nost ue to | |
| Score: 10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Pool variability | • | mixe Larg large smal | - | allow, p, llow, | | • | Majo large Very pools | /dee few : | p | | • | Prev shall | alenc ow p | | | • | | ority o all/sha | | |
| Score: 9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank prov abur cove | urable tebra nisati varie dy de s, roc gs/ nerge únde s/col ides ndant | te on & ety of bris, of mat ed rcut obles fish | ts | • | 30-50 favou inver color Snag subn logs/ bank Fish comr Mode of ha can some | urable tebra nisations gs/ nerge unde s/cot cove mon erate ubitat cons e nev | e for ate on ed rcut obles r varie types ist of | ety 5. | • | favor inver color Fish 60-9 easil foot Woo rare | urable tebra cove 0% s y mo dy de or ma here | ite on ubstr ved b ebris ay be | chy ate y | • | favo inve colo Fish abs Sub uns lack Stal lack | strate table | e for ate on er rare or bitats r limite | e or |
| Score: 8 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held (mac wood | ent or subs croph | ,) or 1 | id S | • | Perip visibl subs obvio | le on trates | s but | | • | | 6 cov able | n visi ver of s | | • | obv >20 ava | iphyto ious & % co ilable strate | k proli ver of | |
| Score: 18 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE:102 | .5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Piako | nui Stream u | u/s | | | Assess | or: Pa | ul Franklir | ۱ | |
|--|--|----------|-------------------|--------------|---------------------------|--------------------|-------------|-------------------|--------------|
| Site number: 4 | | Sam | ple number: | | Date: 1 | 4/2/12 | 2 T | īme | : 14.00 |
| GPS coordinates | | Dowr | nstream: | | E 2741 | 486 | Ν | 1 63 | 71826 |
| | | Upsti | ream: | | E 2741 | 328 | Ν | 1 63 | 71750 |
| Channel & riparia | an features | 5 | | | Instre | am h | ydraulic | cor | ditions |
| Canopy cover: | | | | | Estimate | ed or m | easured rea | ach a | verage: |
| Open | Partly sl | haded | Very | shaded | | | | | |
| Fencing: | Dominant | riparia | an vegetation: | | Stream | width | (active ch | ann | el):3m |
| None/ineffective | Crops | | Retired v | egetation/ | Stream | width | (water): 2 | .5m | |
| One side/partial | Pasture | | Native sl | hrub | Stream | depth | i: 0.4m | | |
| Complete | Exotic tree | es | Native to | rees | Surface | e veloo | ty: 0.3m | s ⁻¹ | |
| Water quality | | | | | | | | | |
| Temperature: | 15.5 | | °C | | Condu | ctivity: | 8 | 9 | µS cm⁻¹ |
| Dissolved oxygen: | 97 | | % | | 9.7 | | n | ng l ⁻ | 1 |
| Turbidity: | Clear | | Slightly turbi | id Highly | turbid | Stai | ned | (| Other |
| Stream-bottom s | ubstrata | | | | | | | | |
| Compaction (inorg | anic substra | ata): | | | % surf | icial in sition | norganic : | subs | stratum size |
| Assorted sizes tightl | y packed &/c | or ove | rlapping | | Substra | atum | Dimensi | on | Percentage |
| Moderately packed | with some | overla | apping | | Bedroc | k | - | | |
| Mostly a loose asso | tment with li | ttle ov | erlap | | Boulde | r | >256mm | | 30 |
| No packing/loose as | sortment ea | sily mo | oved | | Cobble | | >64-256mm | n | 50 |
| Embeddedness: | | | | | Gravel | | >2-64mm | | |
| (% gravel-boulder parti | cles covered b | y fine s | sediment) | | Sand | | >0.06-2mm | 1 | |
| <5% 5-25% | % 26-5 | 0% | 51-75% | >75% | Silt | | 0.004-0.06 | mm | 20 |
| | | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | | (% of ef | fort) | | | |
| <5% 5-25 ° | % 26-5 | 0% | 51-75% | >75% | Stones | : | 100% | | |
| Coarse detritus (sma | all wood, stic | ks, lea | aves etc., >1m | nm) | Wood: | | % | Ri | ffles: 100% |
| | % 26-5 | 0% | 51-75% | >75% | Macrop | ohyte: | % | Rι | ins: % |
| <5% 5-25 ° | c deposits | | | | Edges: | | % | | |
| <5% 5-25 Fine (<1mm) organi | | | 51-75% | >75% | Numbe | er of in | vertebrate | s ret | urned: |
| | i | 0% | 017070 | | | | on S | Shrin | nps: |
| Fine (<1mm) organi | % 26-5 | | | | Koura: | comm | | | |
| Fine (<1mm) organic <5% 5-25 % | % 26-5 | | | | Koura: Crabs: | | | luss | seis. |
| Fine (<1mm) organic <5% 5-25 Instream plant co | % 26-5 over (% stre | ambe | | >75% | | | | /luss | ieis. |
| Fine (<1mm) organic | % 26-5 over (% stre | ambe | d area) | >75% | Crabs: | | | /luss | eis. |
| Fine (<1mm) organic | % 26-5 OVEr (% stresson a mats: % 26-5 | eambe | d area) | >75% >75% | Crabs: Other: | type: | Ν | | imerunio |
| Fine (<1mm) organic<5% | % 26-5 Over (% street a mats: % % 26-5 | eambe | d area) 51-75% | | Crabs: Other: Musse | type: | Ν | | |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
|--|----|---|---|--|------------------|------|---------------------------------------|----------------------------------|---|-------------------|--------|---|---|--|-----------------|---|---|---|---|----------------|
| Stream name: Piako | | | | | | | | | Site ı | numl | ber: 4 | 4 | | | | | | | | |
| Sample number: | | | | A | sses | sor: | Pau | l Fra | | | | | Date | e: 14 | /2/12 | 2 | | | | |
| Habitat parameter | | С | ptim | al | | | Sub | oopti | | Cate | egory | | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n inuo | n buff | er | • | is <1 | tatior 0m | n buff ntinu | | • | Path and/o Most over | or sto | ck | ent | • | | aks fro nan ao ous | • | |
| Left bank:20 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 18 | | <u> </u> | | | | | | | | <u> </u> | | <u> </u> | | | | | <u> </u> | <u> </u> | | |
| 2. Vegetative protection | • | imm ripar cove vege Tree store non- pres Vege | ediate ian z red b etation s, un ey she wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | cove nativ Disru Bank | e veo uptior s ma red b | nainly getati n evic | on lent | • | Bank cove mixtu grass black & intr spec Vege disru Bare cropp vege comr | red b ure of ses/s berry roducties etation ption soil/c bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr strea vege high Gras graz Sigr | ss he | by & shru ank n very avily avily | ubs y ck |
| Left bank:20 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 18.5 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failu abse | ent/m of ba | ank inima | I | • | Infreater areat most over | quen s of e ly he % of | ly sta t, sm erosic aled bank | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of n has osion erosi ntial c | f ban area | IS | • | Man area 60-1 | 00% erosi | of ba | nk |
| Left bank:19 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:19 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 19 | | | | <u> </u> | | | | | <u> </u> | <u> </u> | | | | | | | <u> </u> | <u> </u> | | |
| 4. Frequency of riffles | • | frequ Dista riffle strea | uent ance s divi am wi ety of | ativel betwe ded k dth={ | een y 5-7 | • | riffles Dista riffles | s infre ance s divi | ce of equer betwe ded b dth=7 | nt een by | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe ded b | rs een yy | • | wate riffle Poo Dist riffle | erally er, sha s r habi ance s divi am wi | allow itat betwe ded b | een Dy |
| Score: 20 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Strea | ent/m am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges Iredgi Iredgi Iredgi Iredgi nt | ing ist ing | • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/c nsive ankm struc ent or s 0% of nelize | ients, cture: n botl | /sh s h | • | with gabi >80' reac chai disru Instr | on/ce % of s | ement strear ed or habita | m at |
| Score:20 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | abitat | para | amet | er |
|-------------------------------------|-----|---|---|--|---------|----|---|---|---|-----------|-----|--|--|--|------------------|----|---|---|--|----|
| 6. Sediment deposition | • | <pre>point <20% affect seding </pre> | bars | , | ent | • | bar f most | 0% o ted | tion, om ind or nent f bott | om | • | of ne sand sedir new 50-8 affec | l or fir ment bars 0% o ted ment sits a ructio trictic | avel, ne on ol f bott at ns, | d & om | • | fine Incrededededededededededededededededededed | vy de mater eased elopm % of t nging uently s alm ent du ment ositior | rial l bar ent pottor nost lie to | |
| Score: 10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | | nes p /dee /shall shallo | low, | | • | regin If fas miss | city/d nes p | oresei Illow i nen | | • • | 2 of 4 veloc regin If fas slow/ miss low | city/de nes p t/shall /shall | iresei llow o ow a | or | • | velo regir | inate city/d ne ally de | epth | |
| Score: 17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank prov abur cove | urable tebra isati varie dy de s, roc gs/ nerge unde s/col ides idant r | ate on & ety of bris, ot mate ed ercut obles fish be ne | S | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | nerge /unde ss/col cove mon erate abitat cons e nev | e for ate on ed ercut obles r varie types ist of | ety 5. | • | favou inver color Fish 60-9 | tebra cove 0% si y mo dy de or ma | e for ate on r pato ubstr ved b ebris ay be | chy ate yy | • | favo inve colo Fish abse Subs unst lacki Stab | strate able o | e for ate on r rare or bitats limite | ed |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le su aces | n not n han es bstrat rough | d te | • | visib Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | • • | | | er of | | • | obvi >209 avai | ohyto ous & % cov able strates | proli ver of | |
| Score: 15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 153 | 3.5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Plako | nui Stream d/s | | | Assess | or: Pa | ul Franklir | ۱ | |
|--|--|------------------|------------|--------------------------------------|----------------|---------------------|--------------------|--------------|
| Site number: 5 | Sa | mple number: | | Date: 1 | 4/2/12 | 2 T | ïme | : 17.20 |
| GPS coordinates | Do | wnstream: | | E 2742 | 763 | Ν | 63 | 76343 |
| | Up | stream: | | E 2742 | 808 | Ν | 1 63 | 76201 |
| Channel & riparia | an features | | | Instre | am h | ydraulic | con | ditions |
| Canopy cover: | | | | Estimate | ed or m | easured rea | ach a | verage: |
| Open | Partly shad | ed Very | shaded | _ | | | | |
| Fencing: | Dominant ripa | rian vegetation: | | | | (active ch | | el):4.5m |
| None/ineffective | Crops | | regetation | | | (water): 4 | m | |
| One side/partial | Pasture | Native sl | | Stream | | | -1 | |
| Complete | Exotic trees | Native tr | ees | Surface | e veloo | city: 0.4m s | 5' | |
| Water quality | | | | 1 - | | | | |
| Temperature: | 20.7 | °C | | Condu | ctivity: | | 07 | µS cm⁻́ |
| Dissolved oxygen: | 96 | % | | 8.7 | | | ng l ⁻¹ | |
| Turbidity: | Clear | Slightly turbi | d Highly | turbid | Stai | ned | (| Other |
| Compaction (inorg | | | | compo | sition | : | 1 | stratum size |
| Assorted sizes tight | | | | Substra | | Dimensi | on | Percentage |
| Moderately packed | | | | Bedroc | | - | | 95 |
| Mostly a loose assor | | • | | Boulde | | >256mm >64-256mn | | |
| No packing/loose a | ssortment eas | lly moved | | Cobble | | >2-64mm | | |
| Embeddedness: | aloo opygrad by fir | a adimant) | | Gravel | | >2-04mm | | |
| <pre>(% gravel-boulder partie <5% 5-25%</pre> | 1 | 1 1 | >75% | Sand Silt | | 0.004-0.06 | | 5 |
| <3 /8 5-25 | /0 20-30% | 51-75% | >15% | Clay | | <0.004 0.001 | | 5 |
| Organic material | (% cover) | | | , | at two | es samp | hal | |
| Large wood (>10cm | | | | (% of eff | | es samp | ieu | |
| <5% 5-259 | , , | 51-75% | >75% | Stones | , | 100% | I | |
| Coarse detritus (sma | | 1 1 | | Wood: | - | % | Rif | fles: 100% |
| | 1 | 1 1 | , >75% | Macrop | hvte: | % | Ru | ins: % |
| <5% 5-25° | I | 1 1 | | Edges: | , | % | | |
| <5% 5-259 | c deposits | | | | r of in | vertebrate | s ret | urned: |
| | - | 51-75% | >75% | Numbe | | | | 000 |
| <5% | % 26-50% | | >75% | Koura: | | ional S | Shrin | ips. |
| <5% | % 26-50% | | >75% | - | | | Shrin Nuss | • |
| <5% | % 26-50% | bed area) | >75% | Koura: | | | | • |
| <5% | % 26-50% Over (% stream mats: | bed area) | | Koura: Crabs: | occas | | | • |
| <5% | % 26-50% over (% stream a mats: % 26-50% | bed area) | | Koura: Crabs: Other: | occas type: | Ν | luss | • |
| <5% | % 26-50% over (% stream a mats: % 26-50% | bed area) | >75% | Koura: Crabs: Other: Mussel | occas type: | Ν | luss | els: |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
|--|----|---|--|--|------------------|------|---------------------------------------|------------------------------------|---|-------------------|----------|---|---|--|-----------------|---|--|--|---|----------------|
| Stream name: Piako | | | | | Jana | One | | 9 | Site i | numl | oer: | 5 | | | | | | | | |
| Sample number: | | | | - | sses | sor: | Pau | | | - | | - | Date | : 14 | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | aor∖ | , | | | | | | | | |
| Habitat parameter | | С | ptim | al | | | Sub | oopti | | | <u> </u> | | argin | al | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n tinuot | n buff | er | • | vege is <1 | 0m | n buff ntinu | | • | Path and/o Most over | or sto | ck | ent | • | | aks fr nan a ous | | |
| Left bank:6 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:6 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 6 | | | | | | | | | | | | | | | | | | <u> </u> | | <u> </u> |
| 2. Vegetative protection | • | imm ripar cove vege Tree store non- pres Vege | ediate ian ze ered b etation es, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | cove nativ Disru Bank | re veç uptior ks ma red b | nainly getati n evic | on lent | • | Bank cove mixtu grass black & intu spec Vege disru Bare cropp vege comr | red b ure of ses/s berry roducties etation ption soil/c bed tatior | y hrubs , will ed n obvi close | ow | • | cove gras Disr stre veg high Gra graz Sigr | ss he | by a shru n of ank n very avily at stoo | ubs y ck |
| Left bank:2 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:5 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 3.5 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failu abse | ent/mi | ank inima | I | • | Infre area | quen s of e tly he % of | | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | IS | • | Mar area 60-7 | 00% erosi | of ba | ink |
| Left bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 16 | | | <u>.</u> | <u>.</u> | | | 1 | | <u>.</u> | <u> </u> | | 11 | | | | | | <u> </u> | | <u> </u> |
| 4. Frequency of riffles | • | frequ Dista riffle strea | uent ance s divi am wi ety of | ativel betwe ded k dth= habi | een y 5-7 | • | riffles Dista riffles | ance s divi | ce of equer betwe ded b dth=7 | een by | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome oetwe | rs een ey | • | wate riffle Poo Dist riffle | erally er, sh s r hab ance s divi am w | allow itat betwo ded b | een oy |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Strea | ent/mi am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges Iredgi Iredgi Iredgi Iredgi nt | ing ist ing | • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/o nsive ankm struc ent or s 0% of nelize | ients, cture: h boti | /sh s h | • | with gab >80 read cha disr Inst | on/ce % of : | ement strear ed or habit | m r at |
| Score:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | . 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | bitat | para | amet | er |
|-------------------------------------|----|--|---|--|---------|----|---|---|--|----------|-----|--|--|---|-----------------|----|---|---|--|----|
| 6. Sediment deposition | • | point | bars 6 of t ted b nent | , | ent | • | bar for most grave fine s 20-5 affect | t dep | tion, m nd or nent f bott | om | • | of ne sand sedir new 50-8 affec | l or fir ment bars 0% o ted ment sits a ructio trictic | avel, ne on ol f bott f bott at ns, | d & om | • | fine Incrededededededededededededededededededed | vy de matei eased elopm % of k iging uently s alm ent du ment ositior | ial bar ent oottor ost e to | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | | nes p /dee /shall shallo | low, | | • | regin If fas miss | 4 nes p t/sha ing th e low | iresei Ilow i nen | | • • | 2 of 4 veloc regin If fas slow/ miss low | city/de nes p t/shall /shall | reser llow o ow a | or | • | velo regir | inate city/d ne ally de | əptń | |
| Score:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank provi abur cove | urable tebra nisati varie dy de s, roc gs/ nerge unde s/col ides idant r : not l | ate on & ety of bris, ot mate ed ercut obles fish be ne | S | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | herge junde s/col cove mon erate bitat cons e nev | e for ate on ed rcut obles r varie types ist of | ety | • | favou inver color Fish 60-9 | tebra cove 0% si y mo dy de or ma | e for ite on r pato ubstra ved b ebris ay be | chy ate y | • | favo inve colo Fish abse Subs unst lacki Stab | strate able o | e for ite on r rare or bitats limite | ed |
| Score: 13 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le su aces | n not n han es bstrat rough | d te | • | visib Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | • • | | | er of | | • | obvi >209 avai | ohyto ous & % cov able trates | proli er of | |
| Score: 10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE:100 | .5 | | | | | | | | | | | | | | | | | | | |

| Stream name. Many | japapa Stream | | | Assess | or: Pa | ul Franklin | 1 | |
|--|---|---|----------------------------|---|---------------------------|----------------------------------|------------------------|------------------------|
| Site number: 6 | Sa | mple number: | | Date: 1 | 5/2/12 | 2 T | ïme | : 11.00 |
| GPS coordinates | Do | wnstream: | | E 2747 | 006 | Ν | 637 | 71508 |
| | Up | stream: | | E 2746 | 973 | Ν | 637 | 71378 |
| Channel & riparia | an features | | | Instre | am h | ydraulic | con | ditions |
| Canopy cover: | | | | Estimate | ed or m | easured rea | ach a | verage: |
| Open | Partly shade | ed Very | shaded | | | | | |
| Fencing: | Dominant ripa | rian vegetation: | | Stream | width | (active ch | ann | el):4m |
| None/ineffective | Crops | Retired v | egetation | Stream | width | (water): 3 | .5m | |
| One side/partial | Pasture | Native sh | nrub | | | n: 0.25m | | |
| Complete | Exotic trees | Native tre | ees | Surface | e veloo | city: 0.35m | S ⁻¹ | |
| Water quality | | | | | | | | |
| Temperature: | 18.9 | °C | | Conduc | ctivity: | | 11 | µS cm ⁻ |
| Dissolved oxygen: | 93 | % | | 8.7 | r | n | ng l ⁻¹ | |
| Turbidity: | Clear | Slightly turbi | d Highly | turbid | Stai | ned | C | Dther |
| Stream-bottom s | | | | % surf | icial in | norganic s | subs | stratum size |
| Compaction (inorg Assorted sizes tight | | | | compo Substra | sition | | | Percentage |
| Moderately packed | | | | Bedroc | | - | 511 | 95 |
| Mostly a loose asso | | | | Boulde | | >256mm | | 00 |
| No packing/loose a | | • | | Cobble | | >64-256mm | ı | |
| Embeddedness: | | ., | | Gravel | | >2-64mm | | |
| (% gravel-boulder partie | cles covered by fir | ne sediment) | | Sand | | >0.06-2mm | | |
| < 5% 5-259 | 1 | 51-75% | >75% | Silt | | 0.004-0.06r | nm | 5 |
| I | I | 1 1 | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | Habita | at typ | es samp | led | |
| • | | | | (% of eff | | • | | |
| Large wood (>10cm | | 1 1 | >75% | Stones | | 100% | | |
| Large wood (>10cm <5% 5-25% | % 26-50% | 51-75% | >15% | | | | Rif | fles: 100% |
| < 5% 5-259 | | 1 1 | | Wood: | | % | | |
| Large wood (>10cm <5% 5-25% Coarse detritus (sma <5% 5-25% | all wood, sticks, | 1 1 | | Wood: Macrop | hyte: | % % | Ru | ins: % |
| <5% 5-25 Coarse detritus (sma <5% 5-25 | all wood, sticks, % 26-50% | leaves etc., >1m | m) | | hyte: | | Ru | ins: 🥍 |
| <5% 5-25° | all wood, sticks, % 26-50% c deposits | leaves etc., >1m | m) | Macrop Edges: | , | % | | |
| <5% | all wood, sticks, % 26-50% c deposits % 26-50% | leaves etc., >1m 51-75% | m) >75% | Macrop Edges: | r of in | % % vertebrates | | urned: |
| <5% | all wood, sticks, % 26-50% c deposits % 26-50% over (% stream | leaves etc., >1m 51-75% | m) >75% | Macrop Edges: Numbe | r of in | % % vertebrates ional S | s ret | urned: nps: |
| <5% | all wood, sticks, % 26-50% c deposits % 26-50% over (% stream & mats: | leaves etc., >1m 51-75% 51-75% bed area) | m) >75% | Macrop Edges: Numbe Koura: | r of in | % % vertebrates ional S | s ret Shrim | urned: nps: |
| <5% | all wood, sticks, % 26-50% c deposits % 26-50% over (% stream & mats: | leaves etc., >1m 51-75% 51-75% bed area) | m) >75% >75% | Macrop Edges: Numbe Koura: Crabs: | r of in | % % vertebrates ional S | s ret Shrim | urned: nps: |
| <5% 5-25° Coarse detritus (sma <5% 5-25° Fine (<1mm) organic <5% 5-25° Instream plant co Filamentous algae 8 | all wood, sticks, % 26-50% c deposits % 26-50% Dver (% stream a mats: % 26-50% | leaves etc., >1m 51-75% 51-75% 51-75% bed area) 51-75% | m) >75% >75% | Macrop Edges: Numbe Koura: Crabs: Other: | r of in occas type: | % vertebrates ional S M | s ret Shrim Nuss | urned: nps: |
| <5% | all wood, sticks, % 26-50% c deposits % 26-50% Dver (% stream a mats: % 26-50% | leaves etc., >1m 51-75% 51-75% 51-75% bed area) 51-75% | m) >75% >75% >75% | Macrop Edges: Numbe Koura: Crabs: Other: Mussel | r of in occas type: | % vertebrates ional S M | s ret Shrim Nuss | urned: nps: els: |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | ot | | | | | | | | | | | | | |
|--|-------|--|--|--|------------------|------|---------------------------------------|--|--|-----------------|-------|---|---|--|----------------|---|---|---|---|--|
| Stream name: Mang | | | | | Jala | One | | | Site i | numt | her (| ŝ | | | | | | | | |
| Sample number: | المطم | | | T | sses | sor: | Pau | | | | | - | Date | e: 15 | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | gory | / | | | | | | | | |
| Habitat parameter | | О | ptim | al | | | Sub | oopti | | | , | | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n tinuoi | n buff us & | er | • | is <1 | tation 0m | n buff ntinue | | • | Path and/o Most over | or sto | ck | ent | • | | aks fro nan ao ous | | |
| Left bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 9.5 | | <u> </u> | <u>.</u> | <u>.</u> | <u> </u> | | 1 | 1 | 1 | 1 | | 11 | | L | L | | | 1 | L | <u>. </u> |
| 2. Vegetative protection | • | imme ripar cove vege Tree store non- pres Vege | ediate ian ze ered b etation es, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | nativ Disru Bank | ered n re veç uptior ks ma red b | nainly getati n evid | on lent | • | Bank cove mixtu grass black & intr spec Vege disru Bare cropp vege comr | red b ure of ses/sl berry roducties etation ption soil/co bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr strea vege high Gras graz Sign | ss he | by a shru n of ank n very avily at stoo | ubs y ck |
| Left bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 9 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failui abse | ent/mi | ank inima | I | • | Infreater areat most over | quen s of e tly he % of | ly sta t, sma erosio aled bank | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | S | • | Man area 60-1 | 00% erosi | of ba | ink |
| Left bank:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 14 | | | <u> </u> | <u> </u> | <u> </u> | | | | | | | | | | | | | | | <u> </u> |
| 4. Frequency of riffles | • | frequ Dista riffles strea | uent ance s divi am wi ety of | ativel betwe ded k dth= habi | een by 5-7 | • | Dista riffles | s infre ance s divi | ce of equer betwe ded b dth=7 | een 9y | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe ded b | rs een y | • | wate riffle Poo Dista riffle | erally er, sha s r habi ance s divi am wi | allow itat betwo ded b | een oy |
| Score: 18 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Strea | ent/mi am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges iredgi iredgi iredgi nt | ng Ist ng | • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/consive ankm struct ent or s 0% of nelize | ients, cture: n botl | /sh s n | • | with gabi >80° reac char disru | on/ce % of s | ement strear ed or habit | m r at |
| | | | | | | | | | | | | | | | | | | | | |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | • | | Ha | abitat | para | amet | er |
|-------------------------------------|-----|---|---|---|---------|----|--|--|--|----------|-------|---|---|---|-----------------|----|---|---|--|------------|
| 6. Sediment deposition | • | <pre>point <20% affect seding </pre> | t bars | , | ent | • | bar for most | 0% o ted it dep | tion, m nd or nent f bott | om | • • • | Some of ne sand sedir new 50-80 affec Sedir depo obstr cons bend | w gra or fir nent bars 0% o ted ment sits a ructio trictic | avel, ne on ol f bott at ns, | d & om | • | fine Incrededededededededededededededededededed | vy de matei eased elopm % of t nging uently s alm ent du ment ositior | ial bar ent oottor ost e to | |
| Score: 18 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | regin Slow slow | nes p //dee /shall shallo | ów, | | • | regin If fas miss | city/de | iresei Ilow i nen | | • | 2 of 4 veloc regin If fas slow/ missi low | t/shall | resei llow o ow a | or | • | velo regir | ninate city/de ne ally de | epth | |
| Score: 17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank prov abur cove | urable rtebra nisati varie dy de s, roc gs/ nerge funde s/col ides idant | te on & ety of bris, of mat rcut obles fish oe ne | S | • | favou inver color Snag subm logs/ bank Fish comm Mode of ha Can | herge junde s/cot cove mon erate bitat consi e new | e for ate on ed rcut obles r varie types ist of | ety | | 10-30 favou inver color Fish 60-90 easily foot Woo rare o smot sedir | urable tebra isatio cove 0% so y mo y mo dy de or ma hereo | e for ite on r pato ubstrived b ebris ay be | chy ate y | • | favo inve colo Fish abse Subs unst lacki Stab | strate able o | e for ite on r rare or bitats limite | e or ed |
| Score: 9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le su aces | n not n han es bstrat rough | d te | • | visibl Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | • • | Perip <20% availa subs | able | er of | | • | obvi >209 avai | phyto ous & % cov lable strates | proli er of | |
| Score: 12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 125 | 5.5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Waite | a River | | | | Assess | or: Pa | ul Franklir | <u>۱</u> | |
|---|--|-----------|--------------------|--------------|------------------|----------|-------------|--------------------|------------|
| Site number: 7 | | Sam | ple number: | | Date: 1 | 5/2/12 | 2 T | ïme: | 13.00 |
| GPS coordinates | | Dow | nstream: | | E 2750 | 045 | ١ | 1 6366 | 6003 |
| | | Upst | ream: | | E 2749 | 929 | ٢ | 1 636 | 5888 |
| Channel & riparia | an feature: | s | | | Instre | am h | ydraulic | conc | litions |
| Canopy cover: | | | | | Estimate | ed or m | easured rea | ach av | erage: |
| Open | Partly s | haded | Very | shaded | | | | | |
| Fencing: | Dominant | riparia | an vegetation: | | Stream | width | (active ch | anne |):5m |
| None/ineffective | Crops | | Retired | vegetation | Stream | width | (water): 4 | m | |
| One side/partial | Pasture | | Native s | hrub | Stream | depth | n: 0.6m | | |
| Complete | Exotic tree | es | Native tr | ees | Surface | e veloo | city: 0.3m | s ⁻¹ | |
| Water quality | | | | | | | | | |
| Temperature: | 19.4 | | °C | | Condu | ctivity: | 1 | 55 | µS cm⁻¹ |
| Dissolved oxygen: | 90 | | % | | 8.3 | | n | ng l ⁻¹ | |
| Turbidity: | Clear | | Slightly turb | id Highly | turbid | Stair | ned | Ot | ther |
| Stream-bottom s | ubstrata | | | | | | | | |
| Compaction (inorg | anic substr | ata): | | | % surf | icial ir | norganic : | subst | ratum size |
| Assorted sizes tightl | y packed &/ | or ove | rlapping | | Substra | atum | Dimensi | on | Percentage |
| Moderately packed | with some o | verlap | ping | | Bedroc | k | - | | |
| Mostly a loose ass | ortment wit | h little | e overlap | | Boulde | r | >256mm | | |
| No packing/loose as | sortment ea | sily m | oved | | Cobble | | >64-256mm | n | |
| Embeddedness: | | | | | Gravel | | >2-64mm | | 20 |
| (% gravel-boulder parti | cles covered b | by fine : | sediment) | | Sand | | >0.06-2mm | | 60 |
| <5% 5-25 | % 26-5 | 50% | 51-75% | >75% | Silt | | 0.004-0.06 | nm | 20 |
| | | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) |) | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | | (% of ef | fort) | | _ | |
| <5% 5-25 | % 26-5 | 50% | 51-75% | >75% | Stones | : | 100% | | |
| Coarse detritus (sma | all wood, stic | cks, lea | aves etc., >1m | nm) | Wood: | | % | Riffl | es: % |
| | % 26-5 | 50% | 51-75% | >75% | Macrop | hyte: | % | Run | is: 100% |
| <5% 5-25 | c deposits | | | | Edges: | | % | | |
| <5% 5-25 Fine (<1mm) organi | | 50% | 51-75% | >75% | Numbe | r of in | vertebrate | s retu | rned: |
| | % 26-5 | /0 /0 | | | Koura: | comm | ion S | Shrimp | os: |
| Fine (<1mm) organi | | | ed area) | | | | | lusse | ls: |
| Fine (<1mm) organi <5% 5-25 | over (% stre | | ed area) | | Crabs: | | Ν | | |
| Fine (<1mm) organi <5% 5-25 Instream plant co | over (% stre a mats: | eambe | ed area) 51-75% | >75% | Crabs: Other: | | N | | |
| Fine (<1mm) organi | over (% stre | eambe | | >75% | | type: | N | | |
| Fine (<1mm) organic<5% | over (% stre a mats: % 26-5 | eambe | | >75% >75% | Other: | | | Cucun | nerunio |
| Fine (<1mm) organi | over (% stre a mats: % 26-5 | eambe | 51-75% | | Other: Mussel | | | Cucun | nerunio |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
|--|----|--|--|--|------------------|------|---------------------------------------|----------------------------------|---|-------------------|------|---|---|--|-----------------|---|---|--|---|----------------|
| Stream name: Waito | | | | | | | | | Site | numl | ber: | 7 | | | | | | | | |
| Sample number: | | - | | A | sses | sor: | Pau | l Fra | nklir | 1 | | | Date | e: 15 | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | gory | / | | | | | | | | |
| Habitat parameter | | О | ptim | al | | | Sub | popti | mal | | | Ma | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | Bank vege >10r Cont dens | tation n inuou | n buff | er | • | is <1 | tatior 0m | n buff ntinu | | • | Path and/o Most over | or sto | ck | ent | • | | aks fr nan a ous | | |
| Left bank:13 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:13 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 13 | | | | | • | | • | | | | | | | | | | | | | |
| 2. Vegetative protection | • | imme ripar cove vege Tree store non- pres Vege | ediate ian ze red b station s, un ey shi wood ent etativ | ones by nat der- rubs d ly pla | ive or nts | • | cove nativ Disru Bank | e veo uptior s ma red b | nainly getati n evic | on lent | • | Bank cove mixtu grass black & intr spec Vege disru Bare cropp vege comr | red b ure of ses/s berry roducties etation ption soil/c bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr streavege high Gras graz Sigr | ss he | by a shru n of ank n very avily at stoo | ubs y ck |
| Left bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 10 | | <u> </u> | | <u> </u> | | | | | <u> </u> | <u> </u> | | · | | | | | <u> </u> | <u> </u> | | <u> </u> |
| 3. Bank stability | • | Banł Eros failur abse <5% affec | ion/b e nt/mi of ba | ank inima | I | • | Infre area | quen s of e ly he % of | | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | IS | • | Mar area 60-1 | 00% erosi | of ba | ink |
| Left bank:17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 17 | | | | <u> </u> | | | | | <u> </u> | <u> </u> | | | | | | | <u> </u> | <u> </u> | | <u> </u> |
| 4. Frequency of riffles | • | frequ Dista riffles strea | ient ance s divi im wi ety of | ativel betwe ded b dth=5 habit | een y 5-7 | • | Dista riffles | s infre ance s divi | ce of equer betwe ded b dth=7 | een by | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe | rs een ey | • | wate riffle Poo Dist riffle | erally er, sh s r hab ance s divi am w | allow itat betwo ded b | een oy |
| Score: 11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | abse Strea | nel/d nt/mi am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges Iredgi Iredgi Iredgi Iredgi nt | ing ist ing | • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/c nsive ankm struc ent or s 0% of nelize | ients, cture: n boti f read | /sh s h | • | with gabi >80 read chai disru | on/ce % of : | ement strear ed or habit | m r at |
| | 1 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Habitat parameter | | | atego ptim | | | Ha | bitat | para | amet | er | | | itego ptim | | | Ha | abitat | para | amet | er |
|-------------------------------------|----|---|---|--|---------|----|---|---|--|----------|-----|--|--|---|-----------------|----|--|---|--|----|
| 6. Sediment deposition | • | <pre>point <20% affect seding </pre> | bars | , | ent | • | most grav | orma ily fro el, sa sedim 0% o ted it dep | tion, m nd or nent f bott | om | • | Som of ne sand sedir new 50-8 affec Sedir depo obstr cons bend | w gra or fir nent bars 0% of ted ment sits a ructio trictic | avel, ne on ol f bott f bott at ns, | d & om | • | fine Incrededeve >809 char frequ Pool abse sedii | vy de matei eased elopm % of k uging uently s alm ent du ment ositior | ial bar ent oottor ost e to | |
| Score:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | regin Slow slow | nes p /deej /shall shallo | low, | | • | regin If fas miss | city/denes p | iresei Ilow i nen | | • • | 2 of 4 veloc regin If fas slow/ miss low | t/shall | reser llow o ow a | or | • | velo regir | inate city/d ne ally de | əptń | |
| Score: 13 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank prov abur cove | urable tebra isati varie dy de s, roc gs/ nerge unde s/cot ides idant r | ate on & ety of bris, ot mate ed ercut obles fish be ne | S | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | herge junde s/col cove mon erate bitat cons e nev | e for ate on ed rcut obles r varie types ist of | ety | • | 10-30 favou inver color Fish 60-90 easil foot Woo rare smot sedir | urable tebra nisatio cove 0% so y mov dy de or ma hereo | ite on ubstra ved b ebris ay be | chy ate y | • | favo inver color Fish abse Subs unst lacki Stab lacki | strate able o | e for ite on r rare or bitats limite | ed |
| Score: 12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le sul aces | n not n han es bstrat rough | d te | • | visib Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | •• | Perip <20% avail subs | 6 cov able | | | • | obvi >209 avail | ohyto ous & % cov able trates | proli er of | |
| Score: 6 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 107 | , | | | | | | | | | | | | | | | | | | | |

| Stream name: Waite | ba headwate | rs | | | Assess | or: Pa | ul Frankli | n | |
|--|--|---------------------------------|--|---------------------------|---|--|---|---|--|
| Site number: 8 | | Samp | ole number: | | Date: 1 | 5/2/12 | 2 - | Time | e: 17.00 |
| GPS coordinates | | Dowr | nstream: | | E 2742 | 190 | | N 63 | 65404 |
| | | Upstr | eam: | | E 2742 | 003 | 1 | N 63 | 65272 |
| Channel & riparia | an feature | S | | | Instrea | am h | ydraulic | cor | nditions |
| Canopy cover: | | | | | | | easured re | | |
| Open | Partly s | haded | Very sh | naded | | | | | |
| Fencing: | Dominant | riparia | in vegetation: | | Stream | width | (active cl | hann | nel):3m |
| None/ineffective | Crops | | Retired veg | getation | Stream | width | (water): 2 | 2m | |
| One side/partial | Pasture | | Native shru | ıb | Stream | depth | 1: 0.2m | | |
| Complete | Exotic tree | es | Native tree | s | Surface | e veloc | ty: 0.4m | s ⁻¹ | |
| Water quality | | | | | | | | | |
| Temperature: | 18.3 | | °C | | Conduc | ctivity: | | 130 | µS cm ⁻ |
| Dissolved oxygen: | 88 | | % | | 8.3 | | I | mg l ⁻ | 1 |
| Turbidity: | Clear | | Slightly turbid | Highly | turbid | Stair | ned | | Other |
| Stream-bottom s | ubstrata | | | | | | | | |
| Compaction (inorg | anic substr | ata): | | | % surfi compo | | | sub | stratum size |
| Assorted sizes tightl | y packed &/ | or ovei | rlapping | | Substra | atum | Dimens | ion | Percentage |
| Moderately packed | with some | overla | apping | | Bedroc | k | - | | 5 |
| Mostly a loose asso | rtment with I | ittle ov | erlap | | Boulde | r | >256mm | | 15 |
| No packing/loose as | sortment ea | sily mo | oved | | Cobble | | >64-256m | m | 65 |
| Embeddedness: | | | | | Gravel | | >2-64mm | | 10 |
| | | | | | Giuvei | | | | |
| (% gravel-boulder parti | cles covered b | by fine s | sediment) | | Sand | | >0.06-2mr | n | |
| (% gravel-boulder parti <5% 5-25 % | 1 | - | sediment) 51-75% | >75% | | | - | | 5 |
| · - · · | 1 | - | | >75% | Sand | | >0.06-2mr | Smm | 5 |
| | % 26-5 | 0% | | >75% | Sand Silt Clay | it typ | >0.06-2mr | ອີmm າ | |
| <5% 5-25 | % 26-5 | 0% | | >75% | Sand Silt Clay | | >0.06-2mr 0.004-0.06 <0.004mm | ອີmm າ | |
| <5% 5-25 Organic material | % 26-5 (% cover) diameter) | 0% | | >75% | Sand Silt Clay Habita | ort) | >0.06-2mr 0.004-0.06 <0.004mm | omm | |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stice | i0% i0% | 51-75% | >75% | Sand Silt Clay Habita (% of eff Stones Wood: | ort) | >0.06-2mr 0.004-0.06 <0.004mm es samp | omm Died | |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic % 26-5 | 0% 0% cks, lea | 51-75% | >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop | ort) hyte: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % | | |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic 26-5 % 26-5 c deposits 26-5 | 0% 0% cks, lea | 51-75% 51-75% | >75%) >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: | ort) : hyte: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % | Died | iffles: 100% uns: % |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic 26-5 % 26-5 c deposits 26-5 | 00% 00% cks, lea | 51-75% 51-75% | >75%) | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: | ort) : hyte: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % | Died | iffles: 100% uns: % |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % % 26-5 | 00% 0% cks, lea 0% | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% | >75%) >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: | ort) hyte: r of in | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate | Died | iffles: 100% uns: % turned: |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 Over (% stress & mats: | 00% 00% 00% 00% | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% d area) | >75%) >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: Numbe Koura: Crabs: | ort) hyte: r of in | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate ional | Died Ri Ri Shrir | iffles: 100% uns: % turned: |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 Over (% stress & mats: | 00% 00% 00% 00% | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% | >75%) >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: Numbe Koura: Crabs: Other: | ort) hyte: r of in occas | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate ional | Died Ri Ri Shrir | iffles: 100% uns: % turned: nps: |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stic % 26-5 c deposits % 26-5 cover (% strest & mats: % 26-5 | 0% 0% 0% 0% ambe | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% d area) 51-75% | >75%) >75% >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: Numbe Koura: Crabs: Other: Mussel | ort) hyte: r of in occas type: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate ional | Somm Died Ri Ri Ri Shrir Muss | iffles: 100% uns: % turned: nps: sels: |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stice % 26-5 c deposits % 26-5 Over (% stress % 26-5 wrats: 26-5 | 0% 0% 0% 0% ambe | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% d area) | >75%) >75% >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: Numbe Koura: Crabs: Other: | ort) hyte: r of in occas type: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate ional | Somm Died Ri Ri Ri Shrir Muss | iffles: 100% uns: % turned: nps: |
| <5% | % 26-5 (% cover) diameter) % 26-5 all wood, stice % 26-5 c deposits % 26-5 c deposits % 26-5 2000000000000000000000000000000000000 | 00% 00% 00% 00% 00% | 51-75% 51-75% aves etc., >1mm 51-75% 51-75% d area) 51-75% | >75%) >75% >75% | Sand Silt Clay Habita (% of eff Stones: Wood: Macrop Edges: Numbe Koura: Crabs: Other: Mussel | ort) hyte: r of in occas type: | >0.06-2mr 0.004-0.06 <0.004mm es samp 100% % % vertebrate ional | Somm Died Ri Ri Ri Shrir Muss | iffles: 100% uns: % turned: nps: sels: |

| Wadeable Hard-E Qualitative Habitat A | | | | | | She | ot | | | | | | | | | | | | | |
|--|----|--|--|--|------------------|------|---------------------------------------|--|---|-----------------|--------|---|---|--|----------------|---|---|--|------------------------------|----------------|
| Stream name: Waito | | | | | Julia | One | | 9 | Site i | numt | per: 8 | 3 | | | | | | | | |
| Sample number: | | aam | | - | sses | sor: | Pau | | | | | - | Date | e: 15 | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | gory | , | | | | | | | | |
| Habitat parameter | | О | ptim | al | | | Sub | oopti | | | | | argin | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | vege >10r | n tinuoi | n buff us & | er | • | is <1 | tatior 0m | n buff ntinue | | • | Path and/o Most over | or sto | ck | ent | • | | nan a | equei ctivity | |
| Left bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 10 | | <u> </u> | <u> </u> | <u> </u> | <u> </u> | | 1 | 1 | 1 | 1 | | <u> </u> | | L | L | | | 1 | 1 | 1 |
| 2. Vegetative protection | • | imme ripar cove vege Tree store non- pres Vege | ediate ian ze ered b etation es, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | nativ Disru Bank | ered n re veç uptior ks ma red b | nainly getati n evid | on lent | • • • | Bank cove mixtu grass black & intu spec Vege disru Bare cropp vege comr | red b ure of ses/sl berry roducties etation ption soil/co bed tatior | y hrubs , will ced n obvi | ow | • | cove gras Disr strea vege high Gras graz Sigr | ered b ses & uption am ba etatio ss he ed uificar | shru n of ank n ver | ubs y ck |
| Left bank:7 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:7 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 7 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Eros failui abse | ent/mi | ank inima | I | • | Infreater areat most over | quen s of e tly he % of | ly sta t, sma erosio aled bank | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of has osion erosi ntial c | f ban area | S | • | Man area 60-1 | 00% erosi | of ba | ınk |
| Left bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 12.5 | | | | | | | | | | | | | | | | | | | | |
| 4. Frequency of riffles | • | frequ Dista riffles strea | uent ance s divi am wi ety of | ativel betwo ded b dth= habi | een by 5-7 | • | Dista riffles | s infre ance s divi | ce of equer betwe ded b dth=7 | een 9y | • | Occa or run Botto provi habit Dista riffles strea 25 | n om co de so at ince l s divio | ontou ome betwe ded b | rs een y | • | wate riffle Poo Dist riffle | s r hab ance s divi | allow | een Dy |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | char abse Strea | ent/mi am w | lredgi inima | I | • | chan Evide chan Rece chan | inel/d ence inel/d ent | anges redgi of pa redgi redgi nt | ng Ist ng | • • • | Char chan exter Emba oring prese bank 40-80 chan disru | ges/o nsive ankm struc ent or s 0% of nelize | ients, cture: n botl | /sh s n | • | with gabi >80 read char disru | on/ce % of : h nneliz upted ream | ement strear | m at |
| | | | | | | | | | | | | | | | | | | | | |

| Habitat parameter | - | | atego ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | abitat | para | amet | er |
|-------------------------------------|-----|--|---|---|---------|----|---|---|--|-----------|----|--|--|---|------------------|----|---|---|--|----|
| 6. Sediment deposition | • | point | bars 6 of t ted b nent | , | ent | • | bar for most grave fine s 20-5 affect | nt dep | tion, m nd of nent f bott | om | • | of ne sand sedir new 50-8 affec | l or fir ment bars 0% o ted ment sits a ructio trictic | avel, ne on ol f bott at ns, | d & om | • | fine Incrededededededededededededededededededed | vy de mater eased elopm % of t nging uently s alm ent du ment ositior | rial l bar ent pottor nost lie to | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Velocity/depth regimes | • | | nes p /dee /shall shallo | ow, | | • | regin If fas miss | 4 nes p st/sha ing th e low | irese Ilow nen | | • | 2 of 4 veloc regin If fas slow/ miss low | city/de nes p t/shall /shall | iesei llow o ow a | or | • | velo regir | iinate city/d ne ally de | epth | |
| Score: 15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favor inver color wide wood riffles Snag subn logs/ bank provi abur cove | urable tebra isati varie dy de s, roc gs/ nerge unde s/col des idant r not | te on & ety of bris, of mat ed frcut obles fish | S | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | nerge /unde ss/col cove mon erate abitat cons e nev | e for ate on ed rcut obles r varie type: ist of | ety 5. | • | 10-30 favou inver color Fish 60-90 easil foot Woo rare smot sedir | tebra cove 0% si y mo dy de or ma | e for ite on r pato ubstruved b ebris ay be | chy ate yy | • | favo inve colo Fish abse Subs unst lacki Stab | strate | e for ite on r rare bitats limite | ed |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evide held Stab | ent or stone le su aces | n not n han es bstrat rough | d te | • | visib Stab Perip | ohyto le on le sul ohyto ous to | ston bstra n | es te | • | | | er of | | • | obvi >209 avai | ohyto ous & % cov able strates | proli er of | |
| Score: 10 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 116 | 6.5 | | | | | | | | | | | | | | | | | | | |

| Stream name: Waih | ekau Stream | | | Assess | or: Pa | ul Franklir | ۱ | |
|---|--------------------|--------------------|------------|----------|----------|-------------|--------------------|-------------|
| Site number: 9 | S | ample number: | | Date: 1 | 6/2/12 | 2 T | ïme: | 11.00 |
| GPS coordinates | D | ownstream: | | E 2753 | 911 | Ν | 1 638 | 1502 |
| | U | pstream: | | E 2753 | 991 | Ν | 1 638 | 31373 |
| Channel & riparia | an features | | | Instre | am h | ydraulic | con | ditions |
| Canopy cover: | | | | Estimate | ed or m | easured rea | ach av | verage: |
| Open | Partly shad | ded Very | shaded | | | | | |
| Fencing: | Dominant rip | arian vegetation: | | Stream | width | (active ch | anne | el):4m |
| None/ineffective | Crops | Retired v | regetation | Stream | width | (water): 3 | .5m | |
| One side/partial | Pasture | Native sh | hrub | Stream | depth | i: 0.7m | | |
| Complete | Exotic trees | Native tre | ees | Surfac | e veloo | city: 0.35m | s ⁻¹ | |
| Water quality | | | | | <u>.</u> | | | |
| Temperature: | 17.5 | °C | | Condu | ctivity: | | 45 | µS cm⁻ |
| Dissolved oxygen: | 56 | % | | 5.5 | | n | ng l ⁻¹ | |
| Turbidity: | Clear | Slightly turbi | d Highly | turbid | Stair | ned | С | Other |
| Stream-bottom s | ubstrata | | | | | | | |
| Compaction (inorg | anic substrata | ı): | | % surf | | | subs | tratum size |
| Assorted sizes tightl | y packed &/or (| overlapping | | Substra | atum | Dimensi | on | Percentage |
| Moderately packed | with some over | apping | | Bedroo | k | - | | |
| Mostly a loose asso | rtment with little | e overlap | | Boulde | r | >256mm | | |
| No packing/loose a | assortment eas | sily moved | | Cobble | | >64-256mn | n | |
| Embeddedness: | | | | Gravel | | >2-64mm | | |
| (% gravel-boulder parti | cles covered by f | ne sediment) | | Sand | | >0.06-2mm | I | 90 |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Silt | | 0.004-0.06 | nm | 10 |
| | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | (% of ef | fort) | | _ | |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Stones | : | % | | |
| Coarse detritus (sma | all wood, sticks | , leaves etc., >1m | ım) | Wood: | | % | Rif | fles: % |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Macrop | hyte: | 50% | Ru | ns: 100% |
| Fine (<1mm) organi | c deposits | | | Edges: | | 50% | | |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Numbe | r of in | vertebrate | s reti | urned: |
| Instroom plant of | over (% stream | nbed area) | | Koura: | occas | ional S | Shrim | ps: |
| instream plant co | mats: | | | Crabs: | | Ν | luss | els: |
| Filamentous algae & | | 51-75% | >75% | Other: | | | | |
| - | % 26-50% | | | Musse | type: | | | |
| Filamentous algae 8 | % 26-50% | | | | | | - | |
| Filamentous algae & | | 51-75% | >75% | Hyride | la | C | Cucu | merunio |
| Filamentous algae 8 <5% 5-25 Macrophytes: | | 51-75% | >75% | Hyride | la | 0 | Cucu | merunio |

| Wadeable Soft-B | otto | med | St | rear | ns | | | | | | | | | | | | | | | |
|---|------|--|--|--|--------------------|-------|---------------------------------------|--|----------------------------------|-----------------|--------|--|--|---|---------------|---|--|---|---------------------------------------|---------|
| Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
| Stream name: Waihe | ekau | Stre | am | | | | | 5 | Site r | numl | ber: 9 | 9 | | | | | | | | |
| Sample number: | | | | A | sses | ssor: | Pau | l Fra | nklin | 1 | | | Date | e: 16 | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | gory | , | | | | | | | | |
| Habitat parameter | | 0 | ptim | al | | | Sub | oopti | mal | | | M | argir | nal | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | Bank vege >10n Cont dens | tation n inuou | n buff | fer | • | is <1 | tatior | | | • | Path and/o Most over | or sto | | ent | • | | nan a | equer ctivity | |
| Left bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 11 | | | | | | | 1 | 1 | | 1 | | | | | 1 | | 1 | 1 | 1 | |
| 2. Vegetative protection | • | imme ripari cove vege Tree store non- prese Vege | ediate ian ze red b station s, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | tive or ints | • | cove nativ Disru Bank | c surfa red n re vec uptior cs ma red b stry | nainly getation nevid | on lent | • | cove mixtu grass black & intr spec Vege disru | ure of ses/s (berry roduc ies etation ption soil/o ped tatior | y hrubs , will ced n obvie close | ow | • | cove gras Disru strea vege high Gras graz Sign | uptior am ba etation ss hea ed iifican | by & shru n of ank n very | y ck |
| Left bank:9 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:8 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 8.5 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Bank Eros failur abse <5% affec | ion/b e nt/mi of ba | ank inima | I | • | Infree areas most over | % of | t, sma rosio aled | all n | • | react of er High | able 0% o n has osion eros ntial c | f ban area | IS | • | Man area 60-1 | 00% erosi | of ba | nk |
| Left bank:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 12.5 | | | | | | | | | | | | | | | | | | | | |
| 4. Channel sinuosity | • | strea times | ım lei s long | reasingth a ger th traigh | 3-4 ian | • | strea times | ds inc am ler s long vas st | ngth 2 ger th | 2-3 an | • | strea times | m ler s long | rease ngth 2 ger th raigh | 1-2 an | • | Cha | nnels | straigl | ht |
| Score: 2 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 5. Channel alteration | • | abse Strea | nel/d nt/mi am w | lredgi inima | l | • | chan Evide chan Rece chan | e cha inel/d ence inel/d ent inel/d prese | redgi of pa redgi redgi | ng Ist ng | • | exter Emb oring prese bank 40-80 Char | ges/o nsive ankm struo ent or s 0% o | dredg nents/ ctures n both f reac ed & | /sh s h | • | with gabi >809 reac char disru | on/ce % of s h nneliz upted ream | ement strean | n at |
| | | | | | | | | | | | | uisiu | piou | | | | | | | |

| Habitat parameter | | | atego)ptim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | bita | t par | amet | er |
|-------------------------------------|----|---|---|---|---------|----|---|---|--|-----------|----|---|---|---|-----------------|----|---|--|---|------|
| 6. Sediment deposition | • | poin <209 affect sedir | e/no is t bars % of t ted b ment osition | ottor by | ent | • | bar for most grave fine s 20-5 affect | ted t dep | tion, m nd or nent f bott | om | • | of ne sand sedir new 50-8 affec Sedi depc obstr | w gra or fin hent bars 0% o ted ment sits a cuctio trictic | ne on ol f bott | d & om | • | fine lncr dev >80 cha freq Poc abs sed | avy de mate eased elopm % of uently ols aln ent du iment ositio | rial d bar hent bottor / nost ue to | |
| Score: 12 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Pool variability | • | mixe Larg large sma | s eve ed e/sha e/dee II/sha II/dee | allow, p, llow, | | • | large | rity o /deej few s | p' | | • | Prev shall | alenc ow p | | | • | | ority o all/sha | | IS |
| Score: 2 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favo invei color wide wood riffle Snag subr logs/ bank prov abur cove | nerge /unde (s/col ides ndant | e for ate on & ety of bris, ot mate ed frout obles fish be ne | ts | • | favor inver color Snag subn logs/ bank Fish com Mode of ha Can | nerge unde s/cot cove mon erate bitat consi e new | e for ite on ed rcut obles r varie types ist of | ety 5. | • | favor inver color Fish 60-9 easil foot Woo rare | urable tebra cove 0% s y mo dy de or ma here | ite on ubstr ved b ebris ay be | chy ate y | • | favo inve colo Fish abs Sub uns lack Stal lack | strate table | e for ate on er rare or bitats r limite | e or |
| Score: 8 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evid held (mad woo | ohyto ent or subs croph d etc. ments | n han trates ytes, ,) or f | id S | • | visib subs | ohyto le on trates ous to | s but | | • | | 6 cov able | n visi ver of S | | • | obv >20 ava | iphyto ious & % co ilable strate | k proli ver of | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 83 | | | | | | | | | | | | | | | | | | | | |

| Stream name: Waita | akaruru Stream | tributary | | Assess | or: Pa | ul Franklir | 1 | |
|---|-----------------------|--------------------|--------------|------------------|----------|-------------|--------------------|------------|
| Site number: 10 | S | ample number: | | Date: 1 | 6/2/12 | 2 Т | ïme: 1 | 3.10 |
| GPS coordinates | D | ownstream: | | E 2730 | 406 | Ν | I 63892 | 244 |
| | U | pstream: | | E 2730 | 470 | Ν | l 6389′ | 144 |
| Channel & riparia | an features | | | Instre | am h | ydraulic | condi | tions |
| Canopy cover: | | | | Estimate | ed or m | easured rea | ach avei | rage: |
| Open | Partly shad | ded Very s | shaded | | | | | |
| Fencing: | Dominant rip | arian vegetation: | | Stream | width | (active ch | annel): | :4m |
| None/ineffective | Crops | Retired ve | egetation | Stream | width | (water): 2 | .5m | |
| One side/partial | Pasture | Native sh | rub | Stream | depth | i: 0.4m | | |
| Complete | Exotic trees | Native tr | ees | Surface | e veloo | city: 0.15m | s⁻¹ | |
| Water quality | | | | | | | | |
| Temperature: | 17.8 | °C | | Conduc | ctivity: | 2 | 18 | µS cm⁻́ |
| Dissolved oxygen: | 83 | % | | 7.9 | | n | ng l ⁻¹ | |
| Turbidity: | Clear | Slightly turbic | d Highly | turbid | Stair | ned | Oth | ner |
| Stream-bottom s | ubstrata | | | | | | | |
| Compaction (inorg | anic substrata | ı): | | % surf compo | | | substra | atum size |
| Assorted sizes tight | y packed &/or o | overlapping | | Substra | atum | Dimensi | on F | Percentage |
| Moderately packed | with some over | lapping | | Bedroc | k | - | 5 | ; |
| Mostly a loose asso | rtment with little | e overlap | | Boulde | r | >256mm | | |
| No packing/loose a | assortment eas | sily moved | | Cobble | | >64-256mm | ı | |
| Embeddedness: | | | | Gravel | | >2-64mm | 1 | 0 |
| (% gravel-boulder parti | cles covered by fi | ine sediment) | | Sand | | >0.06-2mm | 5 | 5 |
| <5% 5-25 | % 26-50% | 5 1-75% | >75% | Silt | | 0.004-0.06r | nm 3 | 80 |
| | | | | Clay | | <0.004mm | | |
| Organic material | (% cover) | | | Habita | at typ | es samp | led | |
| Large wood (>10cm | diameter) | | | (% of eff | ort) | | | |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Stones | : | % | | |
| Coarse detritus (sm | all wood, sticks | , leaves etc., >1m | m) | Wood: | | 50% | Riffle | s: % |
| <5% 5-25 | % 26-50% | 51-75% | >75% | Macrop | hyte: | % | Runs | s: 100% |
| Fine (<1mm) organi | c deposits | | | Edges: | | 50% | | |
| | % 26-50% | 51-75% | >75% | Numbe | r of in | vertebrate | s returr | ned: |
| <5% 5-25 | | nbed area) | | Koura: | comm | ion S | Shrimps | 3: |
| <5% 5-25 | over (% stream | | | Crabs: | | N | lussels | 6: |
| | | | | | | | | |
| Instream plant co | mats: | 51-75% | >75% | Other: | | | | |
| Instream plant co Filamentous algae & | mats: | 51-75% | >75% | Other: Mussel | type: | | | |
| Instream plant co Filamentous algae & <5% | a mats: % 26-50% | | >75% >75% | | | c | Cucume | ərunio |
| Instream plant cr Filamentous algae & <5% | a mats: % 26-50% | | | Mussel | | c | Cucume | erunio |

| Wadeable Soft-Bo | otto | med | 1 54 | rear | ne | | | | | | | | | | | | | | | |
|---|---------|--|---|--|------------------|--------------|---|---|---|-----------------------------------|--------------|---|---|---|---------------------------|-------------|--|---|-------------------------------------|---------|
| Qualitative Habitat A | | | | | | She | et | | | | | | | | | | | | | |
| Stream name: Waita | karu | ru St | trear | n trik | outar | y | | ŝ | Site r | numt | ber: 1 | 10 | | | | | | | | |
| Sample number: | | | | Α | sses | sor: | Pau | l Fra | nklin | ľ | | | Date | : 16/ | /2/12 | 2 | | | | |
| | | | | | | | | | | Cate | gory | / | | | | | | | | |
| Habitat parameter | | 0 | ptim | al | | | Sub | oopti | mal | | | Ma | argin | al | | | | Poo | r | |
| 1. Riparian vegetative zone width | • | Bank vege >10n Cont dens | etation n tinuou | n buff us & | er | • | is <1 | tatior | | | • | Path and/o Most over | or sto | ck | ent | • | | ian a | equer | |
| Left bank:16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:19 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 17.5 | | | I | I | I | | I | | | I | | | | | | | I | I | I | I |
| 2. Vegetative protection | • | imme ripari cove vege Tree store non- prese Vege | ediate ian ze etation s, un ey shi wood ent etativ | ones by nat der- rubs o ly pla | ive or nts | • | cove nativ Disru Bank | c surfa red n e veg uptior cs ma red b stry | nainly jetati i evid iy be | on lent | • | Bank cove mixtu grass black & intu spec Vege disru Bare cropp vege comr | red b ire of ses/sl berry oduction es etation ption soil/c bed tatior | y hrubs /, will æd n obvid closel | ow | • • • • | cove gras Disre strea vege high Gras graz Sign | uptior am ba etation as hea ed ifican | oy shru n of ank n very | / :k |
| Left bank:17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:17 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 17 | | | | | | | | | | | | | | | | | | | | |
| 3. Bank stability | • | Bank Eros failur abse <5% affec | ion/b re ent/mi of ba | ank inima | I | • | Infreater areat most over | eratel quent s of e ly he % of ed | , sma rosio aled | all n | • | Mode unsta 30-60 reach of ero High poter flood | able 0% of n has osion erosi ntial c | f banl area | S | • | Man area 60-1 | 00% erosio | of ba | nk |
| Left bank:11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Right bank:14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Mean: 12.5 | | | | | | | | | | | | | | | | | - | | | - |
| 4. Channel sinuosity | • | | am le | reas | 3-4 | • | strea | ds inc im ler s long | ngth 2 | 2-3 | | Benc strea | m ler | | 1-2 | • | Cha | nnel s | straig | ht |
| a | | times | | ger th traigh | | | | /as st | raigh | | | if it w | as st | raigh | t | | | | | |
| Score: 11 | 20 | times | | | | 15 | | /as st | raigh 12 | | | | as st | raigh 7 | t 6 | 5 | 4 | 3 | 2 | 1 |
| Score: 11 5. Channel alteration | 20 • | times if it w 19 Char chan abse Strea | vas si 18 nges inel/d ent/mi | traigh 17 to Iredgi inima | 16 Ing | 15 • • | if it w 14 Som chan Evide chan Rece chan | 13 e cha nel/d ence nel/d | 12 inges redgi of pa redgi redgi | t 11 s to ng st ng | 10 • • | if it w | 8 ges/c nsive ankm struc ent or s 0% of neliz | 7 dredg ients/ ctures n both | 6 ing ish s n | 5 • • | Banl with gabi >80 ^o reac char disru Instr | ks sho on/ce % of s h neliz upted eam | ored ment strean | n at |

| Habitat parameter | | | atego Optim | | | Ha | bitat | para | amet | er | | | atego ptim | | | Ha | bita | t para | amet | er |
|-------------------------------------|----|--|--|---|---------|----|---|--|--|-----------|----|---|---|---|-----------------|----|---|--|---|------|
| 6. Sediment deposition | • | poin <20 affect sedi | e/no is t bars % of t cted b ment osition | ottor by | sent | • | New bar fi grave fine s 20-5 affec Sligh in po | orma ly fro el, sa sedim 0% o ted t dep | tion, m nd or nent f bott | om | • | of ne sand sedir new 50-8 affec Sedi depc obstr | w gra or fin hent bars 0% o ted ment sits a cuctio trictic | ne on ol f bott | d & om | • | fine lncr dev >80 cha freq Poc abs sed | avy de mate eased elopm % of l nging uently is alm ent du iment ositio | rial d bar hent bottor / nost ue to | |
| Score: 11 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 7. Pool variability | • | mixe Larg large sma | ls eve ed ge/sha e/dee ill/sha ill/dee | allow, p, llow, | | • | Majo large Very pools | /deej few s | p' | | • | Prev shall | alenc ow p | | | • | | ority o all/sha | | ls |
| Score: 14 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 8. Abundance & diversity of habitat | • | favo inve colo wide woo riffle Sna subr logs banl prov abui cove | nerge /unde ks/col vides ndant | e for ate on & ety of bris, ot ma ed frcut obles fish be ne | ts | • | 30-5 favor inver color Snag subn logs/ bank Fish com Mode of ha can some mate | urable tebra nisatio gs/ nerge unde s/cot cove non erate bitat consi e new | e for ite on ed rcut obles r varie types ist of | ety 5. | • | favor inver color Fish 60-9 easil foot Woo rare | urable tebra cove 0% s y mo dy de or ma here | ite on ubstr ved b ebris ay be | chy ate y | • | favo inve colo Fish abs Sub uns lack Stal lack | strate table | e for ate on er rare or bitats r limite | e or |
| Score: 15 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 9. Periphyton | • | evid held (ma woo | phyto ent or subs croph d etc. ments | n har trate: ytes, ,) or i | id s | • | Perip visib subs obvio | e on trates | s but | | • | | 6 cov able | n visi ver of s | | • | obv >20 ava | iphyto ious & % cov ilable strate | k proli ver of | |
| Score: 16 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| TOTAL SCORE: 129 |) | | | | | | | | | | | | | | | | | | | |

Appendix B Fish surveys

| Team members: Paul Franklin (NIWA |) | | | GPS (d/s): | E2728090 | N6 | 380572 | Sit | e: Wai | takaruru S | Stream trib | outary | | | | Date: | 13/02 | 2/12 | |
|--------------------------------------|-----------------|-----------------|--------------|-----------------|----------|-------------------------|--------------------|----------|------------------|---------------|------------------|--------|--------------------|-------------|------------------|----------------|--------------------|------------|----------------------------------|
| Josh Smith (NIWA); | Brenda / | Aldridge | e (NIWA) | GPS (u/s): | E2728216 | N6 | 380561 | | Not fished | | ed none ected | | d 10 sub- aches | - | ed 5-9 eaches | | d <5 sub- aches | | FLAG for fished/not fished |
| Fish sample id: | Total time (| shock (min): | 65 | Fishin time: | Finish | 9:45 12:10 | Sample distance | e (m): | 150 | Wette (m): | d width | A B | 2.9 C 3.1 D | 1.4 | 1 F | 4.3 1.6 | Н | 2.3 2.5 | l 2.4 J 1.0 |
| Sampling gear: | Spotlig | ght | EFM | | | ength (m) /lesh (mm) | | | ater ibility: | Good | Averag | е | Poor | Water temp. | | 18.5 | Conc (µS): | ductivit | ^y 151 |
| EFM anode: | Big Small | EFM | volts (x100) |): 3 | | EFM puls | se rate (Hz | or pps): | 60 | EFM p | ulse width | (ms): | 2 | | Spot | ight (watt | is): | | |
| Species | | А | В | | D | Sub-rea | ach tally F | G | н | | | J | Total count | San cou | • | Length Min. | (mm) Max | ζ. | FLAG |
| Shortfin eel | | 10 | 12 | 12 | 10 | 8 | 5 | 14 | 5 | 4 | 9 | | 89 | | | 84 | 680 | | |
| Longfin eel | | | 1 | | | | | 1 | | 1 | | | 3 | | | 480 | 110 | 0 | |
| Cran's bully | | 27 | 21 | 10 | 11 | 8 | 11 | 9 | 5 | 11 | 1 | | 114 | | | 22 | 81 | | |
| Koura | | | 1 | | | | 1 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | + | | | | | | | | | | |
| FLAG Comment | | | Cali | | | | | FL | AG Cor | nment | | | | | | | | | |
| 1 Reach I: 2 2 Reach J: 4 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

| Fish collection | forn | n – Wad | leable | streams/ | rivers | | | | | | | | | | | |
|---------------------------------------|------------|-------------------|-------------|------------------|-----------------|----------------------|-----------------|--------------|-----------|---------------------|-------------------|----------------------|---------------------------|------------------|--------------------|----------------------------------|
| Team members: Paul Franklin (NIWA) | | | | GPS (d/s): E | 2727985 | N63 | 377350 | Site | Waita | akaruru Strea | am | | | Date: | 13/2/12 | |
| Josh Smith (NIWA); Br | enda | Aldridge (1 | NIWA) | GPS (u/s): E | 2728142 | N6; | 377272 | No | ot fished | Fished no collected | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished read | | FLAG for fished/not fished |
| Fish sample id: | | l shock (min): | 65 | Fishing time: | Start Finish | 13:20 15:40 | Sample distance | (m): | 50 | Wetted wi (m): | dth <u>A</u> B | 3.2 C 2.4 D | 2.8 E 1.4 F | | G 2.5 H 2.2 | l 2.5 J 2.4 |
| Sampling gear: | Spotli | ght | EFM | Sein | | ngth (m) esh (mm) | | Wat visib | | Good A | verage | Poor | Water temp. (°C): | 21.2 | Conductiv (µS): | ^{rity} 154 |
| | ig nall | EFM vo | olts (x100) | 2 | | EFM puls | se rate (Hz | or pps): | 60 | EFM pulse | width (ms) |): 2 | Spotl | ight (watts) |): | |
| Species | | А | В | C | D | Sub-rea E | ach tally F | G | н | 1 | J | Total count | Sample count | Length (Min. | mm) Max. | FLAG |
| Cran's bully | | 9 | 7 | 5 | 15 | 9 | 20 | 8 | 12 | 2 6 | 6 | 97 | | 24 | 65 | |
| Shortfin eel | | 25 | 13 | 20 | 15 | 15 | 14 | 15 | 14 | 12 | 11 | 154 | | 85 | 720 | |
| Torrentfish | | 1 | | | | 2 | | | | | | 3 | | 65 | 115 | |
| Koura | | | 2 | 2 | 2 | 2 | | 3 | 3 | 6 | 6 | 26 | | | | |
| Longfin eel | | | | | 1 | 5 | | | 1 | 1 | | 8 | | 186 | 900 | |
| Gambusia | | | | | | | | | 1 | 1 | 3 | 5 | | 22 | 36 | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| FLAG Comment | | | | | | | | FLA | G Com | ment | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

| Team me | | | | | GPS E | 2746139 | N63 | 379564 | Site: | Piał | koiti | Stream | | | | Date: | 14/2/12 | |
|------------------|-----------------------|----------------------|-------------------|--------------|------------------|-----------------|-----------------------|-----------------|----------------|----------|-------|-------------------------|-------------------|----------------------|------------------------|------------------|--------------------|----------------------------------|
| | nklin (NIW) | , | | | (d/s): | | | | | | | | | | | | | = + 0 / |
| Josh Sm | hith (NIWA) | Brenda | Aldridge (I | NIWA) | GPS (u/s): E | 2746113 | N63 | 379455 | No | t fished | | Fished nor collected | | ed 10 sub- eaches | Fished 5-9 sub-reaches | | <5 sub- ches | FLAG for fished/not fished |
| Fish sample i | d: | | l shock (min): | 81 | Fishing time: | Start Finish | 9:53 12:10 | Sample distance | (m): 1 | 50 | | Wetted wid | lth <u>A</u> B | 2.8 C 1.8 D | 2.4 E 1.8 F | | G 1.6 H 1.8 | l 1.7 J 3.2 |
| Sampling | g gear: | Spotli | ght | EFM | Sein | | ength (m) esh (mm) | | Wate visibi | | Goo | od Av | verage | Poor | Water temp. (°C): | 18.7 | Conductiv (µS): | ^{/ity} 196 |
| EFM and | ode: | Big Small | EFM v | olts (x100): | 2 | | EFM puls | se rate (Hz | or pps): | 60 | E | FM pulse | width (ms) | : 2 | Spot | light (watts |): | |
| Species | | | А | В | C | D | Sub-rea | ach tally F | G | н | | I | J | Total count | Sample count | Length (Min. | mm) Max. | FLAG |
| Shortfin | eel | | 17 | 34 | 34 | 21 | 19 | 23 | 24 | | 9 | 15 | 29 | 225 | | 110 | 660 | |
| Cran's b | ully | | 8 | 5 | 1 | 1 | 0 | 0 | 0 | | 1 | 0 | 0 | 16 | | 30 | 66 | |
| Koura | | | | 3 | 2 | 2 | | 1 | 2 | | 2 | 1 | 2 | 15 | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | _ | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| FLAG F1 | Comment Fished rea | ach A (co | orner by roa | ad -u/s) the | en skipped c | .50m befor | e Reach B. | Too deep | FLAC | G Cor | mme | ent | | | | | | |
| F1 F2 | | | o water pe | oper cover | * 20 missed | SF 100-65 | 50mm | | | | | | | | | | | |
| F3 F4 | Water pep | per miss sed 200- | sed 8 SF | | | | | | | | | | | | | | | |

| Team m | | | | | GPS (d/s): | E2741486 | N6 | 371826 | Site | Piako | onui Strea | m u/s | | | | | Date: | 14/2/12 | |
|-------------------|---------------------------------------|--------------|-------------------|--------------|------------------|-----------------|-----------------------|-----------------|--------------|-----------|------------------|-----------|--------|----------------------|-------------|------------------|------------------|--------------------|----------------------------------|
| | nklin (NIWA); hith (NIWA); | | Aldridge | e (NIWA) | | E2741328 | N6 | 371750 | N | ot fished | Fished colled | | | ed 10 sub- eaches | | ed 5-9 eaches | | <5 sub- ches | FLAG for fished/not fished |
| Fish sample i | d: | | l shock (min): | 58 | Fishing time: | Start Finish | 13:15 15:10 | Sample distance | (m): 1 | 50 | Wetted (m): | width | A B | 2.4 C 2.4 D | 1.8 2.2 | | | G 2.1 H 1.2 | l 3.1 J 3.7 |
| Samplin | g gear: | Spotli | ght | EFM | Se | | ength (m) esh (mm) | | Wat visib | | Good | Average |) | Poor | Water temp. | | 15.2 | Conductiv (µS): | ^{/ity} 89 |
| EFM and | ode: | Big Small | EFN | volts (x100) | : 3 | | | se rate (Hz | or pps): | 60 | EFM pu | lse width | (ms) | : 2 | | Spotli | ght (watts | | |
| Species | | | А | В | С | D | E | ach tally F | G | н | | | | Total count | San cou | | Length (Min. | mm) Max. | FLAG |
| Koura Shortfin | eel | | | 9 10 2 2 | | - | 20 0 | 10 | 5 | 10 | | 6 | 12 | 106 | | | 100 | 180 | |
| Banded | | | | 1 | | Ŭ | Ŭ | | | | | | | 1 | | | 192 | | |
| Longfin | eel | | | 1 | | 1 | 2 | | | | | 1 | 1 | 6 | i | | 530 | 1000 | |
| Cran's b | oully | | | | 1 | | | | | | | | | 1 | | | 45 | | |
| | | | | | | | | | | | | | | | | | | | |
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| FLAG | Comment | | | | | 1 | İ | 1 | FLA | G Com | mont | | | | 1 | | | 1 | İ |
| FLAG | Comment Reach I: s at next riff | topped a | at 130m | and skipped | c.15m due | to deep poo | ol not fishab | le, restarted | | G Com | ment | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
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| | | | n — vva | adeable | streams | s/rivers | | | | | | | | | | | |
|---------------------------------------|------------------------|--------------|-------------------|--------------|------------------|-----------------|-----------------------|--------------------|--------|---------------|-----------------------|--------------------|------------------------|---------------------------|----------------|-----------------|----------------------------------|
| Team me Paul Frar | embers: nklin (NIWA | ۹) | | | GPS (d/s): | E2742763 | N6 | 376343 | Site | : Piako | onui Stream | d/s | | | Date: | 14/2/12 | |
| Josh Smi | ith (NIWA); | ; Brenda | Aldridge | (NIWA) | GPS (u/s): | E2742808 | N6 | 376201 | N | ot fished | Fished no collecte | | hed 10 sub- reaches | Fished 5-9 sub-reaches | | <5 sub- ches | FLAG for fished/not fished |
| Fish sample io | d: | | l shock (min): | 67 | Fishing time: | Start Finish | 16:00 17:10 | Sample distance | e (m): | 50 | Wetted w (m): | idth <u>A</u> B | 4.5 C 3.5 D | | | G 4.0 H 3.0 | |
| Sampling | | Spotli | ght | EFM | Se | Le Le | ength (m) esh (mm) | 1 | Wat | er oility: | 1 | Verage | Poor | Water temp. (°C): | 20.7 | Conduc (µS): | |
| EFM ano | ode: | Big Small | EFM | volts (x100) | : 3 | | | se rate (Hz | | 60 | EFM pulse | e width (ms | s): 2 | | ight (watts | / | |
| Species | | | А | В | С | D | Sub-re E | ach tally F | G | Н | | J | Total count | Sample count | Length Min. | (mm) Max. | FLAG |
| Longfin e | el | | 2 | | 1 | 3 | | 1 | 2 | 1 | 4 | 12 | 26 | | 106 | 900 | |
| Shortfin e | | | 21 | 19 | 3 | 6 | 7 | 14 | 10 | 12 | 14 | 10 | 116 | | 83 | 600 | |
| Cran's bu | ullv | | 3 | 2 | 5 | 1 | 3 | 5 | 3 | 1 | 1 | 2 | 26 | | 20 | 79 | |
| Koura | | | 1 | 3 | 7 | | 1 | 1 | 6 | 2 | 10 | 3 | 34 | | - | - | |
| Shrimp - | occasional | | | | | | | | | 1 | | | | | | | |
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| FLAG | Comment | | | | 1 | 1 | 1 | 1 | FLA | G Com | nment | I | 1 | 1 | 1 | 1 | 1 |
| , | C SHITTOIL | | | | | | | | | 0 0011 | | | | | | | |
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| Fish collection for | n – Wad | leable s | streams/ | rivers | | | | | | | | | | | |
|---------------------------------------|--------------------|--------------|------------------|-----------------|----------------------|-----------------|----------------|----------|--------------------|--------------------|----------------------|---------------------------|-------------------|--------------------|----------------------------------|
| Team members: Paul Franklin (NIWA) | | | GPS E: (d/s): | 2747006 | N63 | 371508 | Site: | Mang | gapapa Stre | am | | | Date: | 15/2/12 | |
| Josh Smith (NIWA); Brenda | Aldridge (N | NIWA) | (u/s): | 2746973 | N63 | 371378 | No | t fished | Fished no collecte | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished - reac | | FLAG for fished/not fished |
| | al shock (min): | 75 | Fishing time: | Start Finish | 9:45 12:10 | Sample distance | (m): 1 | 50 | Wetted w (m): | idth <u>A</u> B | 3.7 C 4.3 D | 3.2 E 3.6 F | | G 3.9 H 4.3 | l 4.0 J 4.8 |
| Sampling gear: Spotl | ight | EFM | Sein | | ngth (m) esh (mm) | | Wate visibi | | Good A | verage | Poor | Water temp. (°C): | 18.9 | Conductiv (µS): | ^{/ity} 111 |
| EFM anode: Big Small | EFM vo | olts (x100): | 3 | | | se rate (Hz | or pps): | 60 | EFM pulse | e width (ms) |): 2 | Spotli | ight (watts) |): | |
| Species | A | В | С | D | Sub-rea E | ach tally F | G | Н | | J | Total count | Sample count | Length (I Min. | mm) Max. | FLAG |
| Shortfin eel | 5 | 4 | 10 | 10 | 9 | 20 | 12 | 14 | 18 | 14 | 116 | | 76 | 550 | |
| Koura | 2 | 1 | 4 | 6 | 2 | | 1 | | 2 | 3 | 21 | | | | |
| Cran's Bully | 2 | 11 | 9 | 11 | 6 | 3 | 13 | 5 | 11 | 20 | 91 | | 23 | 69 | |
| Torrentfish | | | 1 | | | 1 | | | | | 2 | | 69 | 114 | |
| Longfin eel | 1 | | | 1 | 1 | 1 | | | 1 | 1 | 6 | | 152 | 600 | |
| Unidentified eel | | | | 2 | | | | | | | 2 | | | | |
| Inanga | 2 | | | | 1 | 1 | | | | | 4 | | 64 | 134 | |
| | | | | | | | | | | | | | | | |
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| FLAG Comment | | | | | | | FLAC | G Com | ment | | | | | | |
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| Fish collection for | m – Wa | deable | streams/ | rivers | | | | | | | | | | | |
|---------------------------------------|----------------------|--------------|------------------|-----------------|-----------------------|-----------------|----------------|----------|------------------------|--------------------|----------------------|---------------------------|-------------------|--------------------|----------------------------------|
| Team members: Paul Franklin (NIWA) | | | GPS E | 2750045 | N63 | 366003 | Site: | Waito | a River | | | | Date: | 15/2/12 | |
| Josh Smith (NIWA); Brenda | a Aldridge (| NIWA) | (u/s): | 2749929 | N63 | 365888 | No | t fished | Fished no collecter | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished - reac | | FLAG for fished/not fished |
| | al shock e (min): | 89 | Fishing time: | Start Finish | 13:00 14:24 | Sample distance | (m): 15 | 50 | Wetted wi (m): | idth <u>A</u> B | 3.3 C 4.8 D | 3.2 E 3.2 F | | G 3.8 H 4.3 | l 3.6 J 3.1 |
| Sampling gear: Spot | light | EFM | Seir | | ength (m) esh (mm) | | Wate visibi | | Good A | verage | Poor | Water temp. (°C): | 19.4 | Conductiv (µS): | ^{/ity} 155 |
| EFM anode: Big Small | EFM v | olts (x100): | 3 | | EFM puls | se rate (Hz o | or pps): | 60 | EFM pulse | e width (ms) |): 2 | Spot | ight (watts) |): | |
| Species | А | В | С | D | Sub-rea | F | G | Н | | J | Total count | Sample count | Length (I Min. | mm) Max. | FLAG |
| Shortfin eel | 17 | 21 | 14 | 23 | 35 | 16 | 15 | 26 | 22 | 20 | 209 | | 70 | 800 | |
| Cran's bully | 13 | 10 | 4 | 2 | 6 | 9 | 3 | 8 | 5 | 2 | 62 | | 15 | 70 | |
| Koura | 4 | 1 | 1 | 5 | 3 | 6 | 4 | 5 | 1 | 3 | 33 | | | | |
| Longfin eel | 1 | | 1 | | | | | | | | 2 | | 450 | 700 | |
| Gambusia | 1 | 1 | 2 | | | 1 | 3 | | | 2 | 10 | | 20 | 45 | |
| Smelt | | 2 | | | | | | | | | 2 | | 80 | 80 | |
| Torrentfish | | | | | | 3 | | 1 | | | 4 | | 25 | 60 | |
| Inanga | | | | | | | | | 1 | | 1 | | 75 | | |
| Shrimp - present | | | | | | | | | | | 0 | | | | |
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| FLAG Comment | | | | | | | FLAC | G Comr | nent | | | | | | |
| F1 2*4m not fished, | | | | | | | | | | | | | | | |
| F2 4*6m not fished, | | | | | | | | | | | | | | | |
| F3 50-100m approx. | skipped | | | | | | | | | | | | | | |
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| Team members: Paul Franklin (NIWA) | | | GPS (d/s): E | 2742190 | N6 | 365404 | Site: | Waito | a River | | | | Date: | 15/2/12 | |
|---------------------------------------|----------------------|-------------|------------------|-----------------|-----------------------|-----------------|---------------|-----------|---------------------|-------------------|----------------------|---------------------------|------------------|--------------------|----------------------------------|
| Josh Smith (NIWA); Brenda | a Aldridge (| NIWA) | GPS (u/s): E | 2742003 | N6 | 365272 | No | ot fished | Fished no collected | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished read | | FLAG for fished/not fished |
| | al shock e (min): | 51 | Fishing time: | Start Finish | 15:00 17:00 | Sample distance | (m): 1 | 50 | Wetted wi (m): | dth <u>A</u> B | 1.9 C 1.5 D | 1 E 1.9 F | | G 1.2 H 1.6 | l 1.1 J 1.3 |
| Sampling gear: Spot | light | EFM | Sein | | ength (m) esh (mm) | | Wate visib | | ood A | verage | Poor | Water temp. (°C): | 18.3 | Conductiv (µS): | ^{rity} 130 |
| EFM anode: Big Small | EFM v | olts (x100) | 2 | | EFM puls | se rate (Hz | or pps): | 60 | EFM pulse | width (ms) | : 2 | Spot | light (watts) |): | |
| Species | А | В | С | D | Sub-rea | ach tally F | G | Н | | J | Total count | Sample count | Length (Min. | mm) Max. | FLAG |
| Shortfin eel | 26 | 34 | 38 | 33 | 33 | 18 | 21 | 16 | 3 | 32 | 254 | | 80 | 600 | |
| Koura | 9 | 3 | 4 | 1 | 14 | 3 | 2 | 2 | 3 | 3 | 44 | | | | |
| Longfin eel | 2 | | 1 | 1 | 1 | | | | 1 | | 6 | | 150 | 980 | |
| Cran's bully | 12 | 8 | 18 | | 24 | | | | | | 62 | | 20 | 84 | |
| Inanga | | | 1 | | | | | | | | 1 | | 141 | 141 | |
| Torrentfish | | | | 2 | 1 | | | | | | 3 | | 85 | 136 | |
| | | | | | | | | | | | | | | | |
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| FLAG Comment | | | | | | | FLA | G Comn | nent | | | | | | |
| F1 Fished 75m d/s of | bridge A-E | and 75m | u/s (F-J) of v | vaterfall jus | st above bri | dge. | | | | | | | | | |
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| Fish collection form – Wadeable | streams/rivers | | | | | | | | | | | |
|---|-------------------------------|------------------------|------------------------|-------------------|-------|----------------------|-------------------|----------------------|---------------------------|-------------------|--------------------|----------------------------------|
| Team members: Paul Franklin (NIWA) | GPS (d/s): E2753911 | N6 | 381502 | Site: | Waihe | kau Stream | | | | Date: | 16/2/12 | |
| Josh Smith (NIWA); Brenda Aldridge (NIWA) | GPS (u/s): E2753991 | N6 | 381373 | Not fish | hed | Fished non collected | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished - reac | | FLAG for fished/not fished |
| Fish Total shock sample id: 92 | Fishing Start time: Finish | 09:30 10:50 | Sample distance (m) | | | Wetted wid (m): | lth <u>A</u> B | 3.3 C 2.9 D | 3.5 E 3.2 F | | G 3.3 H 4.0 | l 3.1 J 2.7 |
| Sampling gear: Spotlight EFM | Seine <u>L</u> | ength (m) Iesh (mm) | | Water visibility: | Go | ood Av | verage | Poor | Water temp. (°C): | 17.5 | Conductiv (µS): | ^{rity} 145 |
| EFM anode: Big Small EFM volts (x100) | : 2 | | se rate (Hz or p | ops): 60 | | EFM pulse | width (ms) | | - | ght (watts) | | |
| Species A B | C D | E | ach tally F | G | Н | | J | Total count | Sample count | Length (ı Min. | Max. | FLAG |
| Shortfin eel 5 1 | 3 9 | 11 | 13 | 10 | 11 | 10 | 6 | 79 | | 90 | 700 | |
| Koura 2 4 | | 1 | 2 | 2 | 1 | | | 16 | | | | |
| Inanga 2 | | 1 | | 1 | 5 | 2 | 2 | 11 | | 69 | 130 | |
| Gambusia | 1 | | | | 1 | | | 2 | | 20 | 25 | |
| | | | | | | | | | | | | |
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| FLAG Comment | | | | FLAG | Comm | nent | | | | | | 1 |
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| Fish collection for | n – Wao | deable | streams/ | rivers | | | | | | | | | | | |
|---------------------------------------|--------------------|--------------|------------------|-----------------|-----------------------|-----------------|----------------|----------|-----------------------|--------------------|----------------------|---------------------------|-------------------|--------------------|----------------------------------|
| Team members: Paul Franklin (NIWA) | | | GPS (d/s): E | 2730406 | N6 | 389244 | Site: | Waita | karuru Strea | am tributar | ý | | Date: | 16/2/12 | |
| Josh Smith (NIWA); Brenda | Aldridge (I | NIWA) | GPS (u/s): E | 2730470 | N6 | 389144 | No | t fished | Fished no collecte | | ed 10 sub- eaches | Fished 5-9 sub-reaches | Fished - reac | | FLAG for fished/not fished |
| | al shock (min): | 50 | Fishing time: | Start Finish | 12:00 13:20 | Sample distance | (m): 1 | 50 | Wetted wi (m): | idth <u>A</u> B | 2.8 C 3.2 D | 3.3 E 1.8 F | | G 2.5 H 2.5 | l 3.1 J 2.2 |
| Sampling gear: Spotl | ight | EFM | Seir | | ength (m) esh (mm) | | Wate visibi | | Good A | verage | Poor | Water temp. (°C): | 17.8 | Conductiv (µS): | ^{/ity} 218 |
| EFM anode: Big Small | EFM v | olts (x100): | 2 | | | se rate (Hz | or pps): | 60 | EFM pulse | e width (ms) |): 2 | | ight (watts) |): | |
| Species | A | В | С | D | Sub-rea | ach tally F | G | Н | | J | Total count | Sample count | Length (I Min. | mm) Max. | FLAG |
| Shortfin eel | 1 | 8 | 6 | 5 | 6 | 10 | 12 | 8 | 7 | 6 | 69 | | 60 | 680 | |
| Koura | 4 | 7 | 5 | 7 | 7 | 5 | 4 | 7 | 6 | 2 | 54 | | | | |
| Cran's Bully | 7 | 27 | 18 | 19 | 35 | 9 | 20 | 28 | 11 | 4 | 178 | | 15 | 70 | |
| Gambusia | | 2 | | - | | | 2 | 1 | | | 5 | | 15 | 60 | |
| Inanga | | | | | 1 | | | | | | 1 | | 75 | 75 | |
| 5 | | | | | | | | | | | | | | | |
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| FLAG Comment | | | | | | | FLAC | G Comr | ment | | | | | | |
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Appendix C Macroinvertebrate taxa list

| Species | | | | | S | Sites | | | | |
|--------------------------|----|----|----|-----|----|-------|----|-----|---|----|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| ODONATA | | | | | | | | | | |
| Austrolestes colensonis | | | 1 | | | | | | | |
| Xanthocnemis zealandica | 1 | | 35 | | | 1 | | | 4 | 1 |
| HEMIPTERA | | | | | | | | | | |
| <i>Microvelia</i> sp. | 1 | | 1 | | 1 | | | | | |
| <i>Sigara</i> sp. | | | | | | | | | 6 | |
| COLEOPTERA | | | | | | | | | | |
| Elmidae | 1 | 34 | 1 | 1 | 10 | 9 | 61 | 15 | 1 | |
| Hydraenidae | | | | 1 | | | | | | |
| Hydrophilidae | | | | | | | | 1 | | |
| <i>Liodessus</i> sp. | | | | | | | | | 3 | 1 |
| Ptilodactylidae | | | | 2 | | | | | | |
| Rhantus sp. | | | | | | | | | 1 | |
| EPHEMEROPTERA | | | | | | | | | | |
| Acanthophlebia cruentata | | | | 1 | | | | | | |
| Austroclima sepia | 25 | 16 | 8 | 96 | 51 | 9 | 42 | 42 | | |
| Coloburiscus humeralis | | | | 101 | | | | | | |
| Deleatidium spp. | | 1 | | 101 | 2 | | 1 | 300 | | |
| Ichthybotus hudsoni | | | | 1 | | | | | | |
| Mauiulus luma | | | | | | 3 | 1 | | | |
| Neozephlebia scita | | | | 1 | | | | | | |
| Nesameletus sp. | | | | 9 | | | | | | |
| Zephlebia borealis | | | | 5 | | | | | | |
| Zephlebia dentata | 3 | 8 | 12 | 105 | 14 | 3 | 57 | 112 | | 5 |
| Zephlebia inconspicua | | | | | | 1 | | | | |
| PLECOPTERA | | | | | | | | | | |
| Austroperla cyrene | | | | 3 | | | | | | |
| Megaleptoperla diminuta | | | | 7 | | | | | 1 | |
| TRICHOPTERA | | | | | | | | | | |
| Aoteapsyche catherinae | | | | | | 2 | | | | |

| Species | | | | | | ites | | | | |
|---------------------------------|-----|----|-----|----|-----|------|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Aoteapsyche colonica | 100 | 38 | 1 | | 3 | 2 | 17 | 23 | 1 | |
| Aoteapsyche raruraru | | | | | 150 | 2 | | 1 | | |
| Costachorema sp. | | | | 1 | 2 | 2 | | 2 | | |
| Hudsonema alienum | | | | | 3 | 4 | | | | |
| Hudsonema amabile | 2 | | | | 9 | 7 | | 1 | | |
| Hydrobiosella stenocerca | | | | 14 | | | | | | |
| Hydrobiosis sp. | 8 | 1 | 3 | 3 | 8 | 1 | 2 | 8 | | 1 |
| Neurochorema sp. | | | | | 5 | 2 | | | | |
| Oecetis unicolor | | | | | | | 1 | | | |
| Olinga feredayi | | | | | | | | 37 | | |
| Orthopsyche sp. | | | | 34 | 1 | | | | | |
| Oxyethira albiceps | | 3 | | 1 | 8 | 92 | 42 | | 8 | |
| Paroxyethira sp. | | | | | | 1 | | | | |
| Polyplectropus sp. | | | | | | | | 1 | | |
| Psilochorema sp. | | | | | | | | 1 | | |
| Pycnocentria evecta | | | | | | 3 | | 1 | | |
| Pycnocentrodes sp. | 6 | 28 | | | 136 | 50 | 49 | 57 | | |
| Triplectides obsoletus/dolichos | 39 | | 77 | | 5 | 20 | | 2 | 1 | 27 |
| Zelolessica cheira | | | | 2 | | | | | | |
| MEGALOPTERA | | | | | | | | | | |
| Archichauliodes diversus | | 1 | | | 1 | | | 8 | | |
| DIPTERA | | | | | | | | | | |
| Aphrophila neozelandica | 7 | 2 | | 1 | 8 | 2 | | 3 | | |
| Austrosimulium sp. | 20 | 40 | 136 | 1 | 3 | | 12 | 10 | 23 | 51 |
| Chironominae | | 1 | | 5 | 12 | 225 | 1 | | 43 | 4 |
| Lobodiamesa sp. | | | | | 1 | 32 | | | | |
| Maoridiamesa sp. | 1 | 2 | | | 171 | 240 | 3 | 2 | 1 | |
| Muscidae | | | | | 3 | | | | | |
| Orthocladiinae | 4 | 3 | | 4 | 60 | 816 | 9 | | 29 | 1 |
| Paradixa sp. | 1 | | 1 | | 1 | | | | | |
| Psychodidae | | | | | | | | | 1 | |
| Sciomyzidae | 1 | | | | | | | | | |

| Species | | | | | S | lites | | | | |
|--------------------------|-----|-----|-----|---|----|-------|----|----|-----|----|
| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Tanyderidae | | | | | | | | | | 1 |
| Tanytarsini | 1 | 1 | | | | | 3 | | | |
| Zelandotipula sp. | 1 | | | | | | | | | |
| LEPIDOPTERA | | | | | | | | | | |
| Hygraula nitens | | | | | | | 2 | | | |
| OLIOGOCHAETA | 60 | | | | | 1 | 2 | | 20 | 1 |
| HIRUDINEA | | | 6 | | | | | | 3 | |
| MOLLUSCA | | | | | | | | | | |
| <i>Gyraulus</i> sp. | | | | | | | | | 1 | |
| Latia neeritoides | | | | | 1 | | | 2 | | |
| Physa acuta | | | 4 | | | | 1 | | 9 | |
| Potamopyrgus antipodurum | VVA | 108 | VVA | 6 | VA | VVA | VA | VA | 105 | VA |
| Sphaeridae | 3 | | 1 | | | | | | | |
| CRUSTACEA | | | | | | | | | | |
| Ostracoda | | | 1 | | 1 | | | | 5 | |
| Paracalliope fluviatilis | 57 | 7 | 180 | | 93 | 6 | 2 | | | 3 |
| ACARI | 1 | | | | | | | | | 1 |

Appendix D Macrophytes and periphyton

| Periphyton Assessm | nent | | | | | | |
|-------------------------------------|-----------------------------|----------|---------|----|----|----|---------------|
| Stream: Waitakaruru Strea | am tributary | Date: 13 | /2/12 | | | | |
| Sample Number: Piako Si | te 1 | Located | number: | | | | |
| Thickness category | Colour category | A | в | с | D | Е | Mean cover |
| Thin (<0.5mm) Mat/Film | NA | 15 | 30 | 20 | 20 | 30 | 23 |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 |
| | Light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | 10 | 10 | 15 | | 11.6 |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | | | | | 0 |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Submerged bryophytes | NA | | | | 2 | | 2 |
| Iron Bacteria growths | NA | | | | | | 0 |

| Macrophyt | e recording | sheet | | | | | | | | |
|---------------|----------------|---------------|------------------|-----------------|---------------|---------------------------|-----------|-------------------|-----------------|--------------|
| Stream: Waita | akaruru Stream | tributary | Located r | number: | | Sample Number | : Piako S | Site 1 | Date: 13/2/1 | 2 |
| | | | | | | Vegetation co | ver (% w | etted area) | | |
| | Wetted | Channel width | Submerged plants | | | | | | Emergent plants | |
| Transect | width (m) | (m) | Total | | face-reaching | ce-reaching Below surface | | | | |
| | | | cover | Total submerged | Species | Sub- total | Species | Total emergent | Species | |
| 1 | 2.6 | 3 | 0 | | | | | | | |
| 2 | 2.5 | 4 | 10 | 7 | | | 7 | Pk | 3 | 2 Na 1 Ph |
| 3 | 1.4 | 1.6 | 2 | | | | | | 2 | Ph |
| 4 | 2.2 | 2.2 | 3 | | | | | | 3 | Ph |
| 5 | 2.3 | 2.8 | 0 | | | | | | | |

| Periphyton Assessm | nent | | | | | | |
|-------------------------------------|-----------------------------|----------|---------|---|---|----|---------------|
| Stream: Waitakaruru Strea | am | Date: 13 | /2/12 | | | | |
| Sample Number: Piako Si | te 2 | Located | number: | | | | |
| Thickness category | Colour category | A | в | с | D | Е | Mean cover |
| Thin (<0.5mm) Mat/Film | NA | 5 | 0 | 0 | 5 | 10 | 4 |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 |
| | Light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | | | | 5 | 5 |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | | | | | 0 |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Submerged bryophytes | NA | | | | | | 0 |
| Iron Bacteria growths | NA | | | | | | 0 |

| Macrophyt | e recording | sheet | | | | | | | | |
|--------------|----------------|---------------|-----------|--|---------|---------------|-----------|-------------------|--------------|-----------------|
| Stream: Wait | akaruru Stream | | Located r | number: | | Sample Number | : Piako S | Site 2 | Date: 13/2/1 | 2 |
| | | | | | | Vegetation co | over (% w | vetted area) | 1 | |
| | Wetted | Channel width | | Submerged plants | | | | | | Emergent plants |
| Transect | width (m) | (m) | Total | Surface-reaching Below surface Total submerged Sub- Sub- | | | | | | |
| | | | cover | Total submerged | Species | Sub- total | Species | Total emergent | Species | |
| 1 | 1.3 | 2.1 | 0 | | | | | | | |
| 2 | 1.0 | 2.0 | 0 | | | | | | | |
| 3 | 2.4 | 3.5 | 0 | | | | | | | |
| 4 | 2.4 | 2.6 | 0 | | | | | | | |
| 5 | 2.3 | 2.8 | 10 | 10 | 5 | Ed | 5 | Ed | | |

| Periphyton Assessm | nent | | | | | | |
|-------------------------------------|-----------------------------|----------|---------|---|---|---|---------------|
| Stream: Piakoiti Stream | | Date: 14 | /2/12 | | | | |
| Sample Number: Piako Si | te 3 | Located | number: | | | | |
| Thickness category | Colour category | A | в | с | D | Е | Mean cover |
| Thin (<0.5mm) Mat/Film | NA | | | | | | 0 |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 |
| | Light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | | | | | 0 |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 |
| | Black/dark brown (% cover) | | | | | | 0 |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 |
| | Brown/Reddish (% cover) | | | | | | 0 |
| Submerged bryophytes | NA | | | | | | 0 |
| Iron Bacteria growths | NA | | | | | | 0 |

| Macrophy | te recording | sheet | | | | | | | | |
|--------------|--------------|---------------|-----------|------------------|---------------|-----------------------------|---------------|-------------------------|-------------------|-----------------|
| Stream: Piak | oiti Stream | | Located r | number: | : | Sample Number | : Piako S | ite 3 | Date: 14/2/1 | 2 |
| | | | | | | Vegetation co | over (% w | etted area) | 1 | |
| | Wetted | Channel width | | Submerged plants | | | | | | Emergent plants |
| Transect | width (m) | (m) | Total | | Surfa | face-reaching Below surface | | | | |
| | | | cover | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species |
| 1 | 2.75 | 3 | 21 | 16 | | | 16 | Nh 15 Ed <1 Pk <1 | 5 | Ph |
| 2 | 1.8 | 2.5 | 12 | 2 | | | 2 | Pk | 10 | Ph |
| 3 | 2.4 | 2.8 | 6 | 1 | | | 1 | Nh | 5 | Ph |
| 4 | 2.4 | 3.0 | 8 | 3 | | | 3 | Nh 2 Pk 1 | 5 | Ph |
| 5 | 3.2 | 3.5 | 4 | 3 | | | 3 | Nh | 1 | Ph |

| Periphyton Assessm | nent | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|---|---|---------------|----|------|--|--|
| Stream: Piakonui Stream | u/s | Date: 14/2/12 | | | | | | | |
| Sample Number: Piako Si | te 4 | Located number: | | | | | | | |
| Thickness category | Colour category | С | D | Е | Mean cover | | | | |
| Thin (<0.5mm) Mat/Film | NA | 10 | | 5 | 5 | 30 | 12.4 | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | |
| | Light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Submerged bryophytes | NA | 5 | 2 | 5 | 10 | 5 | 5.4 | | |
| Iron Bacteria growths | NA | | | | | | 0 | | |

| Macrophy | te recording | | | | | | | | | |
|--------------|---------------------|-----|----------------------------------|-----------------|---------------|--------------------------------|---------------|------------|-------------------|-----------------|
| Stream: Piak | onui Stream u/s | | Located number: Sample | | | Sample Number | : Piako S | Site 4 | Date: 14/2/1 | 2 |
| | | | Vegetation cover (% wetted area) | | | | | | | |
| | Wetted Channel widt | | | | Sub | merged plants | | | | Emergent plants |
| Transect | width (m) | (m) | Total cover | | Sur | Surface-reaching Below surface | | ow surface | | |
| | | | cover | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species |
| 1 | 2.4 | 3.5 | 0 | | | | | | | |
| 2 | 2.35 | 3.0 | 0 | | | | | | | |
| 3 | 0.95 | 1.5 | 0 | | | | | | | |
| 4 | 4.3 | 5.5 | 0 | | | | | | | |
| 5 | 1.15 | 4.0 | 0 | | | | | | | |

| Periphyton Assessm | nent | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|----|----|----|----|---------------|--|--|
| Stream: Piakonui Stream | d/s | Date: 14/2/12 | | | | | | | |
| Sample Number: Piako Si | te 5 | Located number: | | | | | | | |
| Thickness category | Colour category A B C D E | | | | | | Mean cover | | |
| Thin (<0.5mm) Mat/Film | NA | 30 | 30 | 15 | | 10 | 21.25 | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | |
| | Light brown (% cover) | | | 30 | 10 | 20 | 20 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Filaments short (<2cm) | Green (% cover) | | 20 | | | 30 | 25 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Filaments long (>2cm) | Green (% cover) | | 5 | | | | 5 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Submerged bryophytes | NA | | | | | | 0 | | |
| Iron Bacteria growths | NA | | | | | | 0 | | |

| Macrophy | te recording | sheet | | | | | | | | |
|----------------------|-----------------|---------------|----------------------------------|-----------------|---------------|---------------|---------------|------------|-------------------|-----------------|
| Stream: Piak | onui Stream d/s | | Located number: Sa | | | Sample Number | r: Piako S | Site 5 | Date: 14/2/1 | 2 |
| | | | Vegetation cover (% wetted area) | | | | | | - | |
| Transact Wetted Char | | Channel width | | | Sub | merged plants | | | | Emergent plants |
| Transect | width (m) | (m) | Total | | Sur | ace-reaching | Bel | ow surface | | |
| | | | cover | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species |
| 1 | 4.5 | 4.8 | 0 | | | | | | | |
| 2 | 3.7 | 4.0 | 0 | | | | | | | |
| 3 | 2.7 | 3.0 | 0 | | | | | | | |
| 4 | 3.2 | 3.5 | 5 | 5 | | | 5 | Ed | | |
| 5 | 3.6 | 3.8 | 1 | | | | | | 1 | Ph |

| Periphyton Assessm | nent | | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|---------------|----|----|----|------|--|--|--|
| Stream: Mangapapa Strea | am | Date: 15/2/12 | | | | | | | | |
| Sample Number: Piako Si | te 6 | Located number: | | | | | | | | |
| Thickness category | Colour category | Е | Mean cover | | | | | | | |
| Thin (<0.5mm) Mat/Film | NA | 10 | | | | | 10 | | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | | |
| | Light brown (% cover) | | 15 | 15 | 15 | 15 | 15 | | | |
| | Black/dark brown (% cover) | | | | | | 0 | | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | 2 | | | 2 | | | |
| | Black/dark brown (% cover) | | | | | | 0 | | | |
| Filaments short (<2cm) | Green (% cover) | | | | | 5 | 5 | | | |
| | Brown/Reddish (% cover) | | 20 | 10 | 30 | | 20 | | | |
| Filaments long (>2cm) | Green (% cover) | 2 | 2 | 30 | 3 | | 9.25 | | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | | |
| Submerged bryophytes | NA | | | | 2 | | 2 | | | |
| Iron Bacteria growths | NA | | | | | | 0 | | | |

| Macrophy | te recording | | | | | | | | | |
|----------------------|---------------|---------------|----------------------------------|-----------------|---------------|---------------|---------------|------------|-------------------|-----------------|
| Stream: Man | gapapa Stream | | Located number: Sample Numb | | | | : Piako S | Site 6 | Date: 15/2/1 | 2 |
| | | | Vegetation cover (% wetted area) | | | | | | | |
| Wetted Channel widtl | | Channel width | | | Sub | merged plants | | | | Emergent plants |
| Transect | width (m) | (m) | Total cover | | Sur | ace-reaching | Bel | ow surface | | |
| | | | | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species |
| 1 | 3.2 | 3.8 | 0 | | | | | | | |
| 2 | 3.6 | 3.8 | 0 | | | | | | | |
| 3 | 4.1 | 4.2 | 0 | | | | | | | |
| 4 | 5.3 | 5.5 | 0 | | | | | | | |
| 5 | 4.0 | 5.0 | 0 | | | | | | | |

| Periphyton Assessm | nent | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|---------------|---|---|----|-----|--|--|
| Stream: Waitoa River | | Date: 15/2/12 | | | | | | | |
| Sample Number: Piako Si | te 7 | Located number: | | | | | | | |
| Thickness category | Colour category | Е | Mean cover | | | | | | |
| Thin (<0.5mm) Mat/Film | NA | | | | | | 0 | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | |
| | Light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Filaments long (>2cm) | Green (% cover) | 5 | 7 | 5 | 2 | 10 | 5.8 | | |
| | Brown/Reddish (% cover) | | | 5 | 5 | | 5 | | |
| Submerged bryophytes | NA | | | | | | 0 | | |
| Iron Bacteria growths | NA | | | | | | 0 | | |

| Macrophy | te recording | sheet | | | | | | | | | | | |
|--------------|-----------------|---------------|---|----------------------------------|--------------|---------------|------------|----------------------|---------|--------------|--|--|--|
| Stream: Wait | oa River | | Located number: Sample Number: Piako Site 7 | | | | | Date: 15/2/12 | | | | | |
| | | | | Vegetation cover (% wetted area) | | | | | | | | | |
| | Wetted | Channel width | | | Sub | | | Emergent plants | | | | | |
| Transect | t width (m) (m) | Total | | Sur | ace-reaching | Bel | ow surface | | | | | | |
| | | cover | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species | | | | |
| 1 | 3.3 | 6 | 25 | 5 | | | 5 | Ed | 20 | Ph | | | |
| 2 | 3.2 | 6 | 14 | 9 | | | 9 | Nh 5 Ed 2 Pk 2 | 5 | Ph | | | |
| 3 | 3.2 | 4 | 17 | 15 | | | 15 | Nh 10 Pk 5 | 2 | Ph | | | |
| 4 | 4.3 | 5 | 25 | 15 | | | 15 | Pk 10 Ed 5 | 10 | Ph 5 Ve 5 | | | |
| 5 | 3.8 | 4.5 | 15 | 10 | | | 10 | Pk | 5 | Ph | | | |

| Periphyton Assessm | nent | | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|---------------|---|----|---|-----|--|--|--|
| Stream: Waitoa headwate | rs | Date: 15/2/12 | | | | | | | | |
| Sample Number: Piako Si | te 8 | Located number: | | | | | | | | |
| Thickness category | Colour category | Е | Mean cover | | | | | | | |
| Thin (<0.5mm) Mat/Film | NA | | | | 10 | | 2 | | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | 2 | | | | 5 | 1.4 | | | |
| | Light brown (% cover) | 5 | | | | 5 | 2 | | | |
| | Black/dark brown (% cover) | | | | | | 0 | | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | | |
| | Black/dark brown (% cover) | | | | | | 0 | | | |
| Filaments short (<2cm) | Green (% cover) | | 2 | | | | 0.4 | | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | | |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 | | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | | |
| Submerged bryophytes | NA | | 1 | 1 | | | 0.4 | | | |
| Iron Bacteria growths | NA | | | | | | 0 | | | |

| Macrophyt | e recording | sheet | | | | | | | | | |
|--------------|----------------------|-------|-----------------|-----------------------|---------------|---------------|---------------|-------------|-------------------|-----------------|--|
| Stream: Wait | oa headwaters | | Located number: | | | Sample Number | : Piako S | ite 8 | Date: 16/2/12 | | |
| | | | | | | Vegetation co | ver (% w | etted area) | | | |
| | Wetted Channel width | | | | Sub | merged plants | | | | Emergent plants | |
| Transect | width (m) | (m) | Total | | Sur | face-reaching | Bel | ow surface | | | |
| | | | cover | cover Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species | |
| 1 | 1.9 | 2 | 0 | | | | | | | | |
| 2 | 0.95 | 1 | 0 | | | | | | | | |
| 3 | 1.9 | 2.2 | 0 | | | | | | | | |
| 4 | 1.2 | 1.5 | 5 | | | | | | 5 | An | |
| 5 | 1.1 | 2.0 | 20 | | | | | | 20 | An | |

| Periphyton Assessm | nent | | | | | | | | |
|-------------------------------------|-----------------------------|-----------------|--|--|--|---|---------------|--|--|
| Stream: Waihekau Stream | 1 | Date: 16/2/12 | | | | | | | |
| Sample Number: Piako Si | te 9 | Located number: | | | | | | | |
| Thickness category | Colour category A B C | | | | | Е | Mean cover | | |
| Thin (<0.5mm) Mat/Film | NA | | | | | | 0 | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | |
| | Light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Submerged bryophytes | NA | | | | | | 0 | | |
| Iron Bacteria growths | NA | | | | | | 0 | | |

| Macrophyt | e recording | sheet | | | | | | | | |
|--------------|--------------------|-------|---|-----------------|-----------------------------|---------------|---------------|--------------|-------------------|-----------------|
| Stream: Waih | ekau Stream | | Located number: Sample Number: Piako Site 9 | | | | Site 9 | Date: 16/2/1 | 2 | |
| | | | | | 1 | | | | | |
| | Wetted Channel wid | | | | Subr | nerged plants | | | | Emergent plants |
| Transect | width (m) | (m) | Total cover Total sub | | Surface-reaching Below surf | | ow surface | | | |
| | | | | Total submerged | Sub- total | Species | Sub- total | Species | Total emergent | Species |
| 1 | 3.3 | 3.8 | 80 | 80 | | | 80 | Ed | | |
| 2 | 2.9 | 3.5 | 60 | 40 | | | 40 | Ed | 20 | Ph |
| 3 | 3.5 | 3.8 | 70 | 60 | | | 60 | Ed | 10 | Ph |
| 4 | 3.5 | 4.2 | 50 | 25 | | | 25 | Ed | 25 | Ph |
| 5 | 4.0 | 4.5 | 20 | 20 | | | 20 | Ed | | |

| Periphyton Assessment | | | | | | | | | |
|--------------------------------------|-----------------------------|---|-----------------|---|---|---|---------------|--|--|
| Stream: Waitakaruru Stream tributary | | | Date: 16/2/12 | | | | | | |
| Sample Number: Piako Site 10 | | | Located number: | | | | | | |
| Thickness category | Colour category | A | в | с | D | Е | Mean cover | | |
| Thin (<0.5mm) Mat/Film | NA | | | | | | 0 | | |
| Medium mat/film (0.5- 3mm thick) | Green (% cover) | | | | | | 0 | | |
| | Light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Thick (>3mm) mat/film | Green/light brown (% cover) | | | | | | 0 | | |
| | Black/dark brown (% cover) | | | | | | 0 | | |
| Filaments short (<2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Filaments long (>2cm) | Green (% cover) | | | | | | 0 | | |
| | Brown/Reddish (% cover) | | | | | | 0 | | |
| Submerged bryophytes | NA | | | | | | 0 | | |
| Iron Bacteria growths | NA | | | | | | 0 | | |

| Macrophyt | Macrophyte recording sheet | | | | | | | | | | |
|--------------------------------------|----------------------------|----------------------|----------------------------------|------------------|------------------------------|---------|-----------------|---------------|-------------------|---------|--|
| Stream: Waitakaruru Stream tributary | | Located number: | | | Sample Number: Piako Site 10 | | | Date: 16/2/12 | | | |
| Transect | Wetted width (m) | Channel width (m) | Vegetation cover (% wetted area) | | | | | | | | |
| | | | | Submerged plants | | | Emergent plants | | | | |
| | | | Total cover | Total submerged | Surface-reaching | | Below surface | | | | |
| | | | | | Sub- total | Species | Sub- total | Species | Total emergent | Species | |
| 1 | 2.8 | 3.0 | 0 | | | | | | | | |
| 2 | 3.2 | 3.5 | 0 | | | | | | | | |
| 3 | 3.3 | 4.0 | 0 | | | | | | | | |
| 4 | 2.45 | 3.0 | 10 | 10 | | | 10 | Nh | <1 | An | |
| 5 | 2.5 | 2.8 | 0 | | | | | | | | |