Kauaka Stream Monitoring June 2014

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Contents

Executive Summary

This report summarises the results of the first survey of the Kauaka stream within the area planted by Joe Fleet and known as Joes block.

The results show the Kauaka to have moderate clarity values, macro invertebrate communities indicative of high water quality and stable temperatures.

1. Introduction

The Kauaka stream forms part of the catchment that contributes to the Puaenga Stream and then to Lake Rotorua. With the decline in water Quality the Kauaka stream along with other major tributaries flowing into Lake Rotorua were retired and planted in the 1980s. The majority of these retirement strips were planted and then left and with no ongoing maintenance most reverted to scrub and blackberry. With an increase in public awareness, individuals and in some cases community groups came together to look after sections of water ways throughout the Rotorua catchment.

Joe Fleet took an early interest in the Kauaka stream 19 years ago and has slowly been restoring a section of the stream next to state highway five south of Rotorua. Joe has a strong desire to know what the long term effects of his restoration work has on the stream and so it has been proposed to monitor the stream initially seasonally and depending on future results adjust the frequency to maintain a robust data set. The initial monitoring will be based on Shmack protcols (Biggs, B. et al 2002) with more intense monitoring in the early stages to assist with any possible trends

The initial monitoring programme will include water clarity, stream habitat and macroinvertebrate communities. The stream habitat work includes stream bed particle size, stream width and stream temperatures. The macroinverebrate communities will be sampled seasonally for the first year and then the frequency will be reviewed.

This report summarises the results of the first survey carried out in June 2014.

2. Methods

The survey site is situated approximately halfway through the area of the Kauaka stream known as Joes block (See Figure one for sampling location) and hopefully is representative of the whole stream. The habitat and invertebrate sampling was carried out over a 50 metre stretch of stream and the flow and temperature measurement carried out approximately 80 meters upstream. Future flow measurements will be carried out closer to the sampling site.

Habitat Survey

2.2.1 Black disc clarity

Black disc clarity was carried out with a 60 mm black disc and under water viewer.

2.2.2 Particle size of streambed sediments

Particle size of the streambed sediments was measured (Wolman 1954) across 10 cross sections spaced regularly through the reach. The substrate sizes used were boulder (>256mm), large cobble (129-256 mm), small cobble (65-128mm), large gravel (16-64mm), small gravel (2-15mm), sand (1-2mm), silt-mud (<1mm), woody debris.

2.2.3 Stream temperatures

Stream temperatures have been continuously monitored since the 6th March 2008 using onset temperature loggers with a resolution of +/- 0.1°C and a recording interval of 15 minutes. Spot checks are made at each download to check the accuracy of the loggers.

2.2.4 Dissolved oxygen

Dissolved oxygen was measured with a Hach HO40d meter.

2.2.5 Stream widths and depth

Stream widths were measured at the 2nd, 4th, 6th, 8th and 10th section and 3 depth measurements across 3 sections were taken to get average depth.

2.2.6 pH and conductivity

ph and conductivity were measured on-site with Merck Nevtralit 5-10 pH sticks and with an Evtech instruments TDScan conductivity meter.

2.2.7 Discharge

Discharge was measured with a pigmy current meter and calibrated rod with a minimum of 20 verticals.

2.2.8 Periphyton

Periphyton was accessed using the D1 Stream-bed life: level 1 form for periphyton (New Zealand Stream Health Monitoring and Assessment Kit v2) was filled in at each of the 10 sections as a comparison with the data collected above.

2.3 Benthic macroinvertebrate community composition and density

Benthic macroinvertebrates were sampled in run habitats with a surber sampler ($0.04m^2$, 250µ metre mesh). Five replicate samples were collected and preserved in 70% isoproponal and processed off site. Macroinvertebrates were separated from the sample debris and identified to thetaxonomical level in table one of Stark (1993). This taxonomic level is suitable for calculation of the Macroinvertebrate Community Index (MCI).

After the macroinvertebrate samples were processed, we then calculated taxon richness (number of species present), number of individuals. % of EPT and MCI. Taxon richness provides a measure of change in overall invertebrate biodiversity. The invertebrate groups mayflies (Ephemerotera), stoneflies (Plecoptera) and caddisflies (Tricoptera) (collectively referred to as EPT) are generally considered sensitive to high temperature, sedimentation and nutrient enrichment, and the number of EPT Taxa and their percent abundance provide a measure of the biodiversity and relative abundance of sensitive species. The Macroinvertebrate Community index (MCI) (Stark, 1985) is based on the presence or absence of certain types of invertebrates on the stream bed which differ in their ability to tolerate changes in stream health.

In addition the D1 Stream-bed life: level 1 form for invertebrates (New Zealand Stream Health Monitoring and Assessment Kit v2) was filled in at each of the 10 sections as a comparison with the data collected above.

Figure one: Sampling site location within the Kauaka Stream.

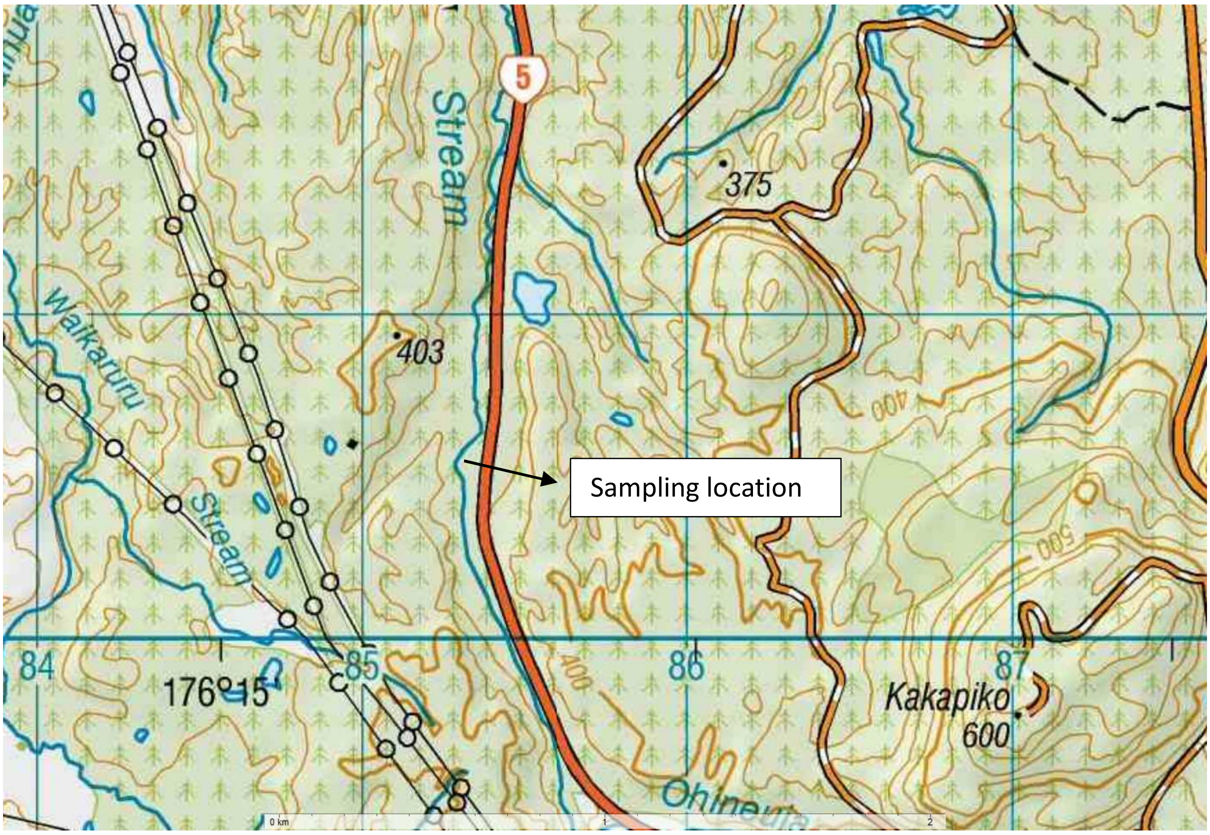


Photo one: Looking downstream from top of sampling reach.

Photo two: Looking upstream from bottom of sampling reach.

3.0 Results and Discussion

3.1.1 Black disc clarity

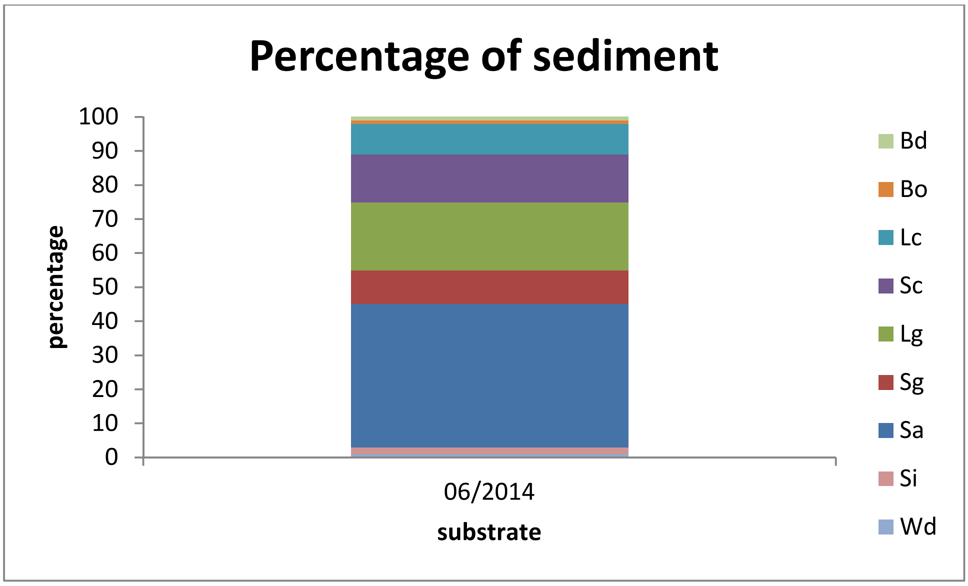
The water clarity measured on the 15th June was 1.38 metres. Future measurements if higher will indicate an improvement in water quality and a lower value a possible decline. Results should be viewed long term as localised events can have an effect on short term clarity ie high rainfall so trends are best viewed over many years of data collection.

Water clarity values below 1.2 metres are considered to be of low clarity, values between 1.2 and 4.0 metres are considered to be moderate and those above 4.0 metres are high (Davies – Colley and Close, 1990). The initial value of 1.38 metres gives the Kauaka Stream a moderate water clarity value.

3.1.2 Stream bed sediment

The initial survey shows that nearly half of the available stream bed is unsuitable for invertebrates. Nearly 44% of the substrate consists of sand and mud. (figure two)

Figure two: Stream particle size in the Kauaka stream June 2014.



3.1.3 Stream temperatures

Temperature is one of the primary factors affecting growth, metabolism and survivorship of stream invertebrates. Temperatures above 19ºC begin to affect Plecoptera (stoneflies) and above 21ºC begin to limit the distribution of Ephemeroptera (mayflies) (Quinn et al., 1994).

New Zealand fish appear to thrive in a wide range of temperatures. (Richardson et al.,1994). Upper lethal temperatures ranged between 28.3ºC and 39.7ºC. Preferred temperatures ranged between 16.1ºC and 26.9ºC.

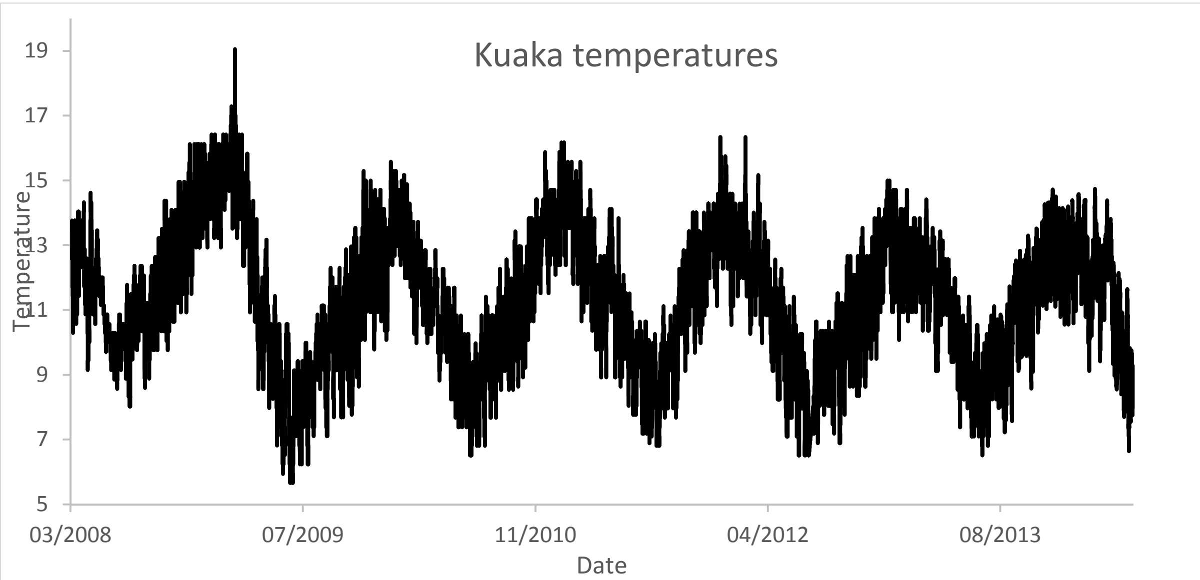
Stream temperatures in the Kauaka stream have been recorded since the 6th March 2008. The maximum temperature measured is 19.1ºC and the minimum is 5.7ºC. Temperatures within the Kauaka stream are in the range that will not affect key invertebrate or fish groups.

Table one summarises the annual maximum and minimum temperatures recorded. Figure three shows a plot of the temperature since 2008. The spot measurement taken on the 15th June was 8.0^{o}C.

Table one: Summary of minimum and maximum temperatures 06/03/2008 13:30 - 05/06/2014 16:00.

year	minimum	Date and time	Maximum	Date and time
2008	8.0	09/07/2008 5:30	16.1	15/11/2008 15:30
2009	5.7	19/06/2009 7:45	19.1	20/02/2009 16:00
2010	6.5	11/07/2010 9:30	15.9	19/12/2010 17:15
2011	6.8	16/08/2011 8:15	16.3	31/12/2011 13:45
2012	6.5	17/06/2012 5:45	16.3	23/02/2012 15:00
2013	6.5	17/07/2013 5:30	14.7	15/12/2013 13:30
2014	6.6	28/05/2014 8:45	14.7	16/03/2014 18:15

Figure three: Graph of temperatures in the Kauaka stream 2008-2014.



3.1.4 Dissolved Oxygen

Dissolved oxygen is necessary for aquatic life and is a rapid indicator of organic pollution.

High daily readings are usually associated with high levels of periphyton or macrophytes. Low levels are associated with high levels of organic pollution which uses up available O_2 breaking down this material.

The dissolved oxygen measured on the 15th June 2014 was 96.6% (11.0mg/l) which indicates a stream with low impacts.

3.1.5 Stream widths

Streams width (measured as wetted width) averaged 2.8 metres. We are looking at long term trends with width measurements. Stream widths could be expected to increase as the larger trees shade the grasses that currently hold the banks togeather. Slumping will then occur and the stream may get wider and shallower. This transition from narrower to wider may take decades. Streams under canopy are generally wide and shallow while streams in pasture are usually steep and deep (Davis-Colley 1997)

3.1.6 pH and conductivity

The pH measured in the Kauaka stream was 7.0. This is a neutral reading and is good for stream health. A higher reading would indicate enrichment and could be caused by high periphyton or macropyhtes while a lower reading could indicate that the stream exits a swamp or has pollution or discharge upstream.

The conductivity reading was 70µs/cm. This indicates a low concentration of ions so nutrient enrichment is unlikely.

3.1.7 Discharge

The stream was gauged and the discharge was found to be 151 litres/second. It is not known if this represents the base flow but it is assumed this is close to the winter average flow rate. Flow is important as higher flows have a big effect on stream life washing away periphyton, macrophytes and invertebrates.

3.1.8 Periphyton

Periphyton is the slimy stuff seen growing over stones and usually grows on substrate. This slime or periphyton is an important part of the food chain and also provides food to a wide range of invertebrates.

The Periphyton score was obtained using the method outlined in the SHMAK monitoring guide. The periphyton score for the Kauaka was 8.0 which receives a very good rating and indicates a clean stream with steady water flow but with low nutrient concentrations that will support a wide range of invertebrates, such as mayflies, caddisflies and stoneflies.

3.2 Invertebrate sampling

The no of individuals, Taxon richness and % EPT may vary from sampling to sampling due to seasonal variability. Scarsbrook (2002) suggested that “inter-annual variability is probably a result of flow conditions as this is known to be a major factor determining the annual variability of macro invertebrate communities”.

The MCI value of 125 is above the value of 120 which is indicative of pristine water (Stark. 1985). MCI values are higher than the median values recorded for sites from the National River Water Quality Network (Scarsbrook et al, 2000).

The SHMAK value of 6.8 indicates a moderately heathly stream.

Taxon richness (No per 0.2m^2), No of individuals, %EPT, MCI and SHMAK score.

Date	Taxon richness Richness	No of individuals	%EPT	MCI	SHMAK score
15/06/2014	16	313	62.5	125	6.8

A complete list of taxa recorded and densities is given in Appendix one

4.0 Conclusions

The results show the Kauaka stream to have moderate water clarity, macro invertebrate assemblages that show high water quality and stream temperatures that are not excessively high.

5.0 References

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Appendix 1: Benthic invertebrate taxa densities (per0.2m²) in the Kauaka stream June 2014.

	Taxa	
Mecoptera(Dobsonflies)	*Archichauliodes diversus*	3
Ephemeroptera(Mayflies)	*Coloburiscus humeralis*	7
	Deleatidium spp	61
	Mauiulus	9
Plectoptera(Stoneflies)	*Spaniocercoides*	2
	Taraperla	4
Tricoptera(Caddisflies)	*Aoteapsyche*	54
	Confluens	63
	Costachorema	3
	Hydrobiosis spp	2
	Pycnocentrodes	14
Coleoptera (Beetles)	Elmidae	24
Diptera (True flies)	*Aphrophila neozealandica*	39
	Eripterini	2
	Pelecorhynchidae	1
	Tanytarsus sp	25