Tasman District Council Short Report

Sherry River Water Quality Investigation 2007-08

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Part 1: Disease-Causing Organisms

Objectives:

Tasman District Council undertook sampling of eight selected small creeks in the catchment, at the same time as the four core monitoring sites, with the aim of identifying hotspots of faecal contamination. The ultimate goal for the Sherry River is to better target farm management response to improve water quality in the stream so it meets bathing water quality guidelines.

Methods:

Sampling of these small creek sites occurred on six occasions with the exception of the following sites: Greenhills Creek (potential water quality issues at this site were brought to Tasman District Council's attention later in the programme), Harford Creek (only flowed on the three occasions when it was monitored), Orchard Creek at Wangapeka Road (a snap-shot reference for the lower Orchard Creek site) and Wadsworth Creek (flow at this site was very low (<1litre/sec) and therefore unlikely to contribute a high loading to the waterway). Samples were collected during stable flows (waited at least 2 days after rainfall of more than 20mm) using standard protocols (Tasman District Council Surface Water Quality Monitoring Programme Manual, Version 4, 2007). Flow gaugings were carried out at most sites but there were some gaps in the flow data. To calculate loadings some estimations of flow were made for these gaps.

Results and Discussion:

Figure 1 shows the location of sites monitored and summary data. The green boxes show data for the core water quality monitoring sites (up to 46 data points per site) and the other boxes show data for sites that have only been monitored starting this summer. The data highlighted in red (three sites) show concentrations of *E.coli* over stock drinking water guidelines (1000 faecal coliforms/100ml; the bottom line in any catchment in NZ). See Table 1 for *E.coli* loadings data compared to the Sherry River at Blue Rock site. Average of *E.coli* loadings almost 30% was of accounted for

Of all the small streams investigated **Biggs Creek** had the poorest water quality with four of six samples with *E.coli* concentrations over 3000 *E.coli*/100ml. Median *E.coli* concentrations were 21 times the median guideline for bathing (ANZECC 2000 150 *E.coli*/100ml). This creek contributed an average *E.coli* loading to the Sherry River at Blue Rock of about 8% (range from 1.7 to 20%) which is considerable for a creek this size. In addition to high *E.coli* concentrations, **Biggs Creek** recorded high levels of fine sediment in the stream and very poor ecological health as a result.

Loadings in **Granity Creek** were also high; about 4-8% compared to the loading of Blue Rock site.

Absolute concentrations of *E.coli* in **Orchard Creek** were around half that of Biggs Creek but loadings were similar both on average and range (average 7.5% and range from 1.5 to 20%). Samples taken upstream of the Wangapeka Road show that the faecal contamination is coming from farmland further upstream in the catchment.

While **Harford Creek** contributes a about 1-2% of the loading of the Blue Rock site when it is flowing, the lack of flow for about half the year means it is unlikely to significantly effect water quality for the purposes of bathing which usually takes place when river flows have reduced and cleared after a rainfall event.

Water quality in **Bavin Creek** seems to have improved considerably over the monitoring period. Loading averaged 1.7% of the Blue Rock site and ranged from 0.14 to 3.8% if you disregard the first sampling round. On the first sampling event there was a cover of filamentous green algae of over 50% and the highest *E.coli* concentration of any site in the programme. This could be due to mob-stocking in an unfenced portion of the waterway upstream and to a lesser extent the recent disturbance of soil associated with removal of cottonwood trees and subsequent cropping.

Comparing the Sherry River sites downstream, there is usually a big increase in loading between Cave Creek and Granity Creek and Matariki and Blue Rock. Between 10% and 50% of the loading of *E.coli* to the **Sherry River** is coming in between **Cave Creek and Granity Creek** compared to the 0.8-6.5% of loading coming from **upstream of Cave Creek**. Potential sources for this are not obvious. Biggs and Orchard Creeks are likely to be the main sources for the increase in *E.coli* downstream of Matariki. It is important to note that these comparisons with Blue Rock do not consider faecal bacteria die-off between the sites.

Over the 2007-08 summer the most upstream site on the Sherry (**Sherry River upstream of Cave Creek**) recorded its highest ever *E.coli* result. While it is difficult to know for sure without walking the whole length of the creek and tributaries, the most likely cause is a dead animal, or animals, in the creek or offal from gutted animals which is known to be dumped in or near the stream in this area. Supporting this argument is the fact that we have only ever had two results over 500 *E.coli*/100ml for the whole dataset for this site. Please note the very low median[1] value.

Summary and Recommendations

The results of this investigation provide some obvious priorities for water quality improvements. The big focus areas for reduction in run-off of disease-causing organisms should be in the areas between Cave Creek and Granity Creek as well as Orchard and Biggs Creeks. This information should be used in combination with the findings from the farm environmental planning process to try to achieve improvements in water quality. Education may be an appropriate way to target hunters, suggesting they gut their animals well away from streams. Articles in hunting magazines and even the Council's Newsline may be a good start.

[1] Median is the middle number in the dataset and is used preferentially over averages, such as means, in datasets with wide variation (as is typical for water quality data).

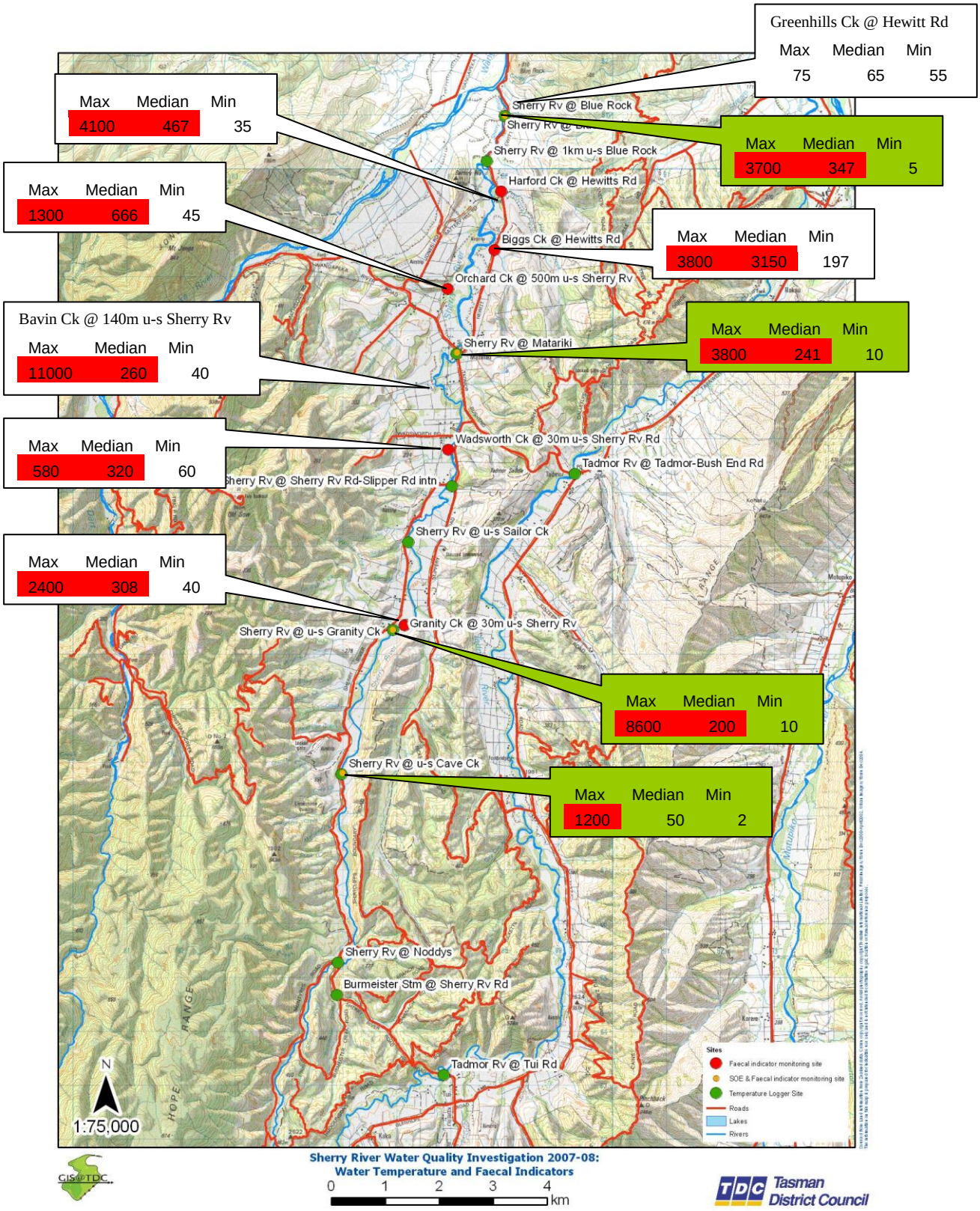


Figure 1: *E.coli* data at sites sampled in the 2007-08 water quality investigation (cfu/100 ml). Data boxes marked in green are the core water quality monitoring sites in the catchment. Data highlighted in red is over the guideline value for stock drinking.

Table 1: *E.coli* Loadings for Sites in this investigation

Proportion of the Bacterial Loading at Blue Rock

	15/01/2008	29/01/2008	7/04/2008	22/08/2008	29/10/2008	Median proportion
Greenhills Ck @ Hewitt Rd	-	-	-	0.28	0.15	0.22
Biggs Ck @ Hewitts Rd	6.79	3.52	1.70	3.50	20.40	3.52
Harford Ck @ Hewitts Rd	-	-	-	1.36	3.18	2.27
Orchard Ck @ 500m u-s Sherry Rv	3.23	19.80	2.32	5.27	1.49	3.23
Orchard Ck @ Wangapeka Rv Rd	1.76	-	-	7.40	16.80	7.41
Sherry Rv @ Matariki	49.46	365.08	80.36	50.13	81.60	80.36
Bavin Ck @ 140m u-s Sherry Rv	29.46	3.81	0.14	1.17	1.68	1.68
Granity Ck @ 30m u-s Sherry Rv	2.49	6.30	0.79	4.03	8.04	4.03
Sherry Rv @ u-s Granity Ck	0.00	51.51	15.71	25.06	41.40	25.06
Sherry Rv @ u-s Cave	71.43	6.55	1.66	16.05	0.85	6.55
Total excluding main stem sites						28.68

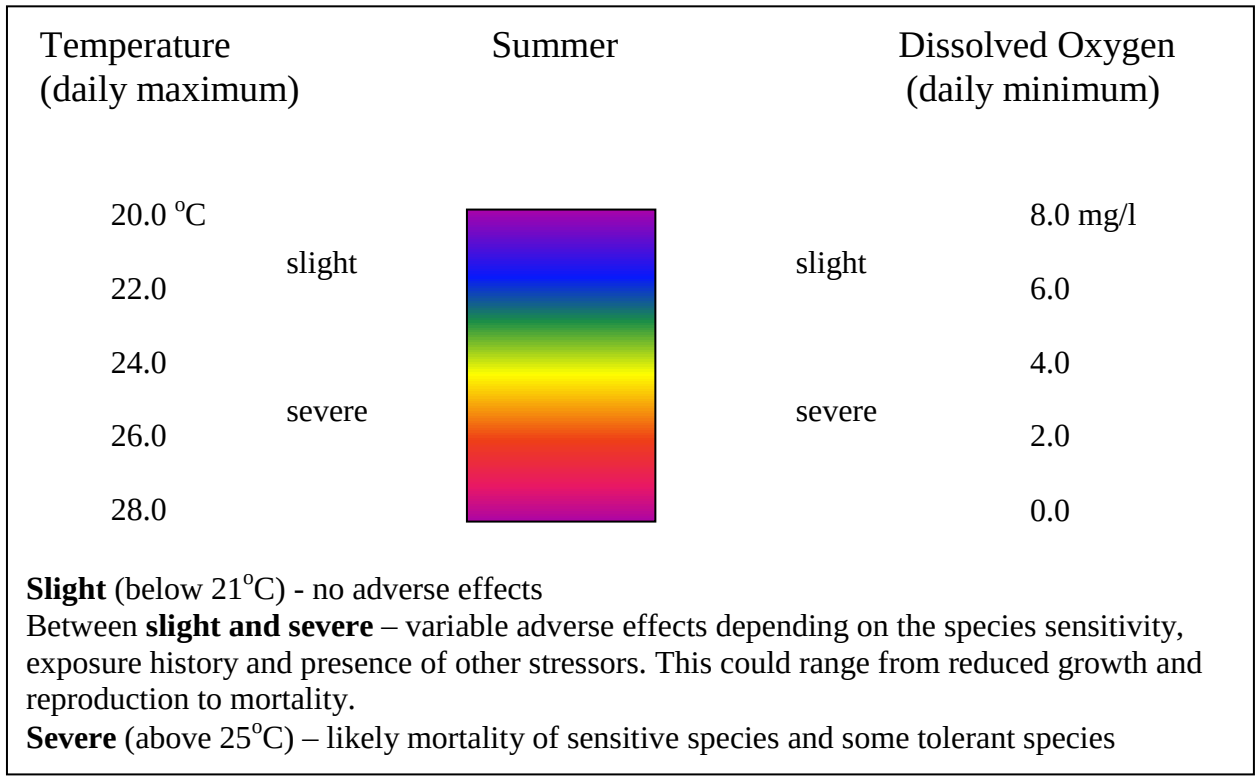
Part 2: Stream Temperature

Objectives:

The aim of this part of the study was to determine if there was a temperature issue on this waterway and the extent to which there was a relationship between riparian shade and stream temperature. The goal is to have the Sherry River main stem water meeting criteria for protecting ecological health.

Background:

When temperatures rise, the capacity of the water to retain dissolved oxygen reduces. The effects of high temperatures and low dissolved oxygen on stream ecology is well established. See Figure 3 for thresholds of daily maxima and daily minima for water temperature and dissolved oxygen (respectively). The water temperature statistic "midpoint of daily max and daily mean" has been found to be the most important temperature determinant for fish survival. National Institute of Water and Atmosphere's research shows water temperatures over 21.5°C cause 50% of the mayflies and stoneflies to die ($LT_{50,}$ Cox & Rutherford, 2000). The main drivers for high water temperatures in streams are: low humidity, high solar radiation and low wind speed.



Slight (below 21°C) - no adverse effects
Between **slight and severe** – variable adverse effects depending on the species sensitivity, exposure history and presence of other stressors. This could range from reduced growth and reproduction to mortality.
Severe (above 25°C) – likely mortality of sensitive species and some tolerant species

Figure 3: The effects of high water temperature and lower dissolved oxygen (taken from published literature).

Methods:

A series of Tidbit and Hobo temperature loggers were installed on the main stem of the Sherry River on 19 December 2007 and retrieved on 6 April, 2008. Calibration was achieved by reference to a dry bulb thermometer prior to deployment. All sites recorded at 30 minute intervals.

Results and Discussion:

Background water temperature in the upper Sherry River catchment is consistently within the criterion for ecological protection. However, downstream of Matariki temperatures were high enough to cause adverse ecological effects for the month of January to early February.

There was a significant increase in temperature between Cave Ck site and Sailor Creek and between the Slippery Road intersection and Matariki. This may be due to the reduced shading in these areas. Willows were removed from these reaches two years prior to this investigation. There was very little change in stream temperature between Sailor Creek and Slippery Road intersection. This is probably because of the shading by willows through this section. The average 0.3 degree temperature increase in stream temperature between the sites 1km upstream of Blue Rock and at Blue Rock site appears small but there is only 1km between the sites. This is surprising given that the waterway is incised and therefore more shaded through this reach. 26.5 degrees was the highest stream temperatures recorded in the river at Blue Rock. Therefore any tree species, that don't cause flooding issues, could help the situation by providing riparian shade. Additionally the insects that rain off these plants can provide a large proportion of the diet to resident fish.

While willows cause adverse effects with respect to flooding, they do have benefits for providing shade.

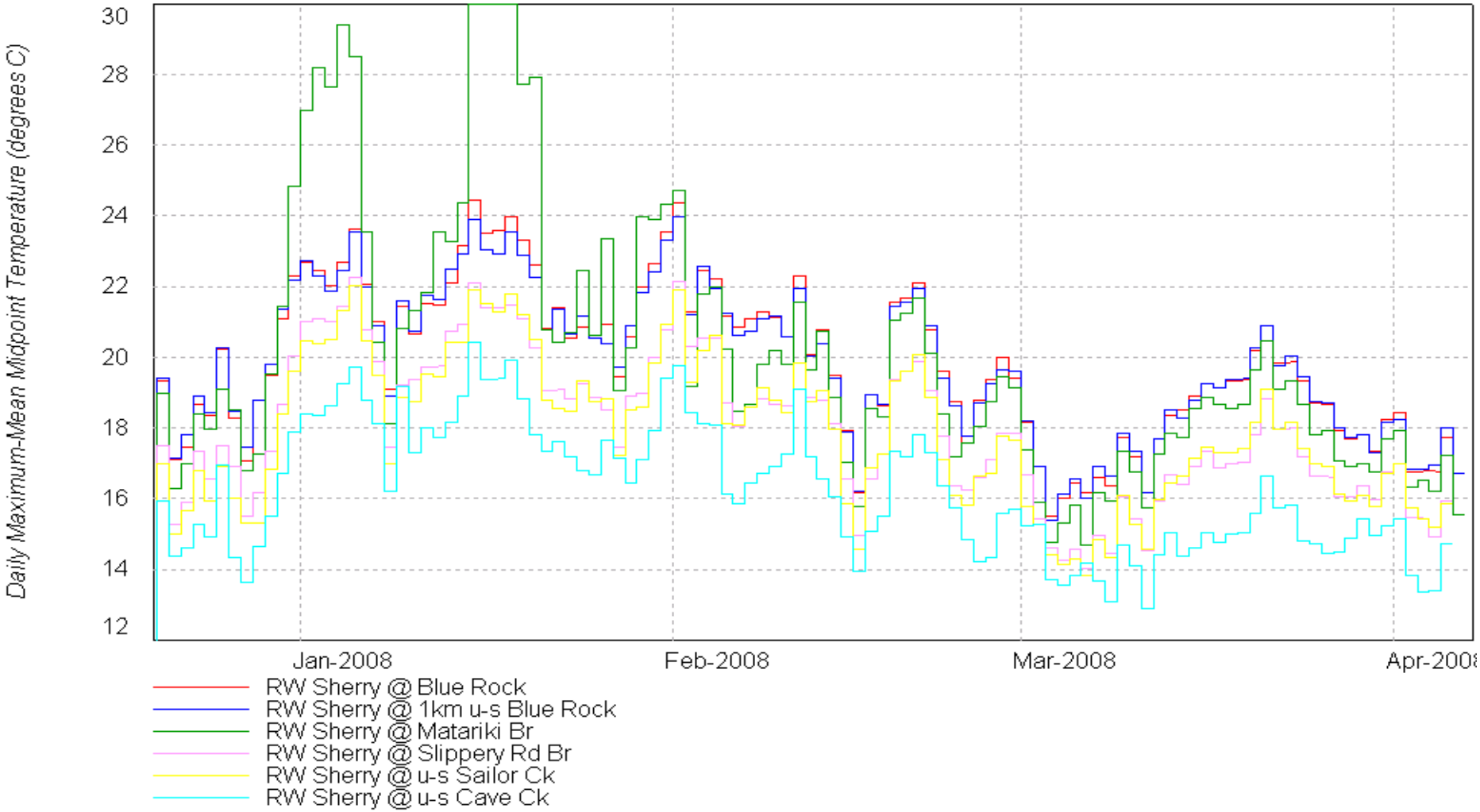


Figure 2: Stream temperature data for sites on the main stem of the Sherry River. Data plotted is the midpoint of the daily maximum and the daily mean. The data for the Matariki Bridge site over the period from the end of 31 December to 5 January and 14-21 January is considered ambient air temperature as the logger was most likely above the surface of the water.