## 8.5 CONTACT RECREATION WATER QUALITY ANNUAL REPORT: 2012/2013 SEASON

**Information Only - No Decision Required**

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| **Report To:** | Environment and Planning Committee |
| **Meeting Date:** | 4 July 2013 |
| **Report Author:** | Trevor James, Resource Scientist |
| **Report Number:** | REP13-07-05 |
| **File Reference:** | W416 |

### 1 Summary

1.1 Monitoring of swimming holes and coastal beaches has been undertaken by this Council since the mid 1990s in accordance with national guidelines and responsibilities under s35 of the Resource Management Act. Councils around New Zealand report these data and recreation site grades annually to Ministry for the Environment.

1.2 Nine sites (five coastal and four freshwater) were sampled weekly and twice-weekly in January, over the 2012-13 summer bathing season. In addition to the six core sites sampled every year, the following sites were sampled: Buller River at Riverview Campground, Kaiteriteri Inlet at Bridge (on outgoing tide) and Tukurua Stream at Camp Playground. Targeted flood event sampling was carried out at selected sites in the Buller catchment (5 sites) and Motueka River plume (6 sites).

1.3 There were a total of 23 exceedences of national guidelines (11 “Alert” and 12 “Alarm”) recorded at eight of the sites. Out of a total of 189 samples taken, this equates to approximately 12% of samples exceeding guidelines, about half of these being above alarm levels. All but six of the 23 exceedences (~3%) were associated with rainfall events. Average compliance rates of 97% is in line with the average over the last 10 years. With the exception of samples from the Tukurua site, all the results from follow-up samples taken two days after the exceedence were back down to the typical low levels (usually at or near the lower level of detection). The site with the most exceedences (8) was Tukurua Stream. The concentrations of faecal indicator bacteria at this site were well within guidelines at the beginning of the season which resulted in the warning sign being removed. However, such concentrations appeared to progressively increase and warning signs went back up on February 7. The only other site where warnings were issued was Pohara Beach for a one off significant breach (approximately four times guidelines). The only site with full compliance was Rabbit Island.

1.4 Sampling rivers during or immediately after rainfall events in the Buller catchment revealed that water quality was very poor across all sites sampled, but toward the lower end of the range of catchments with significant areas of intensive farming. Like most of our region faecal indicator bacteria concentrations returned to within guidelines after one-two days. While water quality in rivers in flood will always be of higher risk for contact recreation, it is considered that Council has an obligation to try to reduce the peak load and reduce the time taken for water quality to improve i.e. to return to guidelines after the peak faecal indicator bacteria concentration. Flood-flow monitoring is also important if we are to model contaminant loads for obligations under the national policy statement for freshwater.

1.5 In the Motueka River plume sampling was undertaken to provide data to use in predictive modelling of faecal indicator bacteria concentrations at Kaiteriteri and nearby beaches. Five rainfall events were captured over the period from January to May. Preliminary data exploration shows that even small floods (about 90 $m^3$/sec) in the Motueka River and coastal

streams can cause non-compliance with guidelines at Kaiteriteri Beach and Stephens Bay for about 8-36 hours. Data from another five or more floods will be required to have potential to successfully predict compliance with contact recreation guidelines at these very popular beaches.

1.6 Ponding of freshwater within the main recreation areas at Rabbit Island re-occurred after heavy rainfall events on 17 January and 21-22 April. Three of the six samples taken from the ponded water on Rabbit Island were above alarm levels but returned to within guidelines within a week (during which time the reserve was closed). The origin of the faecal indicator bacteria was confirmed as human, and not from birds or dogs.

1.7 Weekly sampling of toxic algae (cyanobacteria) coverage of the river bed was undertaken in the Waimea River for most of the season and at least once at over 60 sites around the district. This coverage was above national guidelines in the Waimea River and lower Wai-iti River from late November 2012, to mid April, apart from about four-five weeks total after flood events (e.g. January 3 and 15). The only other river that breached guidelines was the lower Sherry River. Three dog deaths were reported to Council, all from the Waimea and lower Wai-iti. Only a low risk (below interim guidelines) to dogs and people was apparent in other rivers. The toxins produced by the cyanobacteria are some of the most toxic in the natural world. However, in New Zealand there have been very few health affects in humans, most likely because people do not consume water directly from the river. There is reasonable risk for toddlers due to their habit of consuming materials as a way to explore their environment.

1.8 Nutrient profiling showed that the Waimea/lower Wai-iti and Sherry Rivers had slightly-elevated nitrogen concentrations and very low dissolved reactive phosphorus concentrations. This combination is unusual for rivers in the district. This cyanobacteria is thought to proliferate in these conditions due to gaining a competitive edge against other algae which require greater phosphorus concentrations. The worst-affected rivers in the country have a similar profile.

## 2 Draft Resolution

**That the Environment and Planning Committee receives the Contact Recreation Water Quality Annual Report: 2012/2013 Season REP13-07-05.**

## 3 Purpose of the Report

3.1 To present information from the regular Contact Recreation Water Quality Monitoring Programme over the past season, toxic algae issues and any other related investigations or issues.

## 4. Introduction

4.1 This report outlines:

- results of bathing water quality monitoring at Tasman's most popular contract recreation sites over the 2012/2013 summer
- results of flood-flow sampling in the Buller catchment
- data collection to support predictive modelling of faecal indicator bacteria concentrations at Kaiteriteri and nearby beaches
- results of sampling ponded water at Rabbit Island main beach reserve after rain events
- monitoring of toxic algae coverage in the region

### Programmed Sampling for Faecal Indicator Bacteria at Contact Recreation Sites

4.1.1 Contact recreation in natural waters can be a health risk if the concentration of disease-causing organisms is high. Such recreation commonly involves full immersion of a person's head and includes swimming, water skiing and whitewater kayaking. Monitoring of waters used for contact recreation in Tasman District has been ongoing since the mid-1990s. During that time 17 of the sampling sites in the programme have been sampled consistently, with three of those sites being sampled every year since 2000. Other sites have been surveyed for short periods and then discontinued because of consistently good water quality and lower risk from discharges of faecal matter. To ensure we get some water quality information at additional lesser-used sites or sites with lower risk of faecal pollution, additional short-term investigations have been carried out. Where it is found that there are on-going issues, such as Tukurua, those sites may then be brought into the programme until such time as the issue is resolved.

4.1.2 Nine sites (five coastal and four freshwater) were sampled over the 2012-13 summer bathing season. In addition to the six core sites sampled every year, the following sites were sampled: Buller River at Riverview Campground, Kaiteriteri Inlet at Bridge (on outgoing tide) and Tukurua Stream at Camp Playground. It was timely that the Buller River at Riverview Campground site was sampled because:

1. Very few samples have been collected at this site over the years.

2. The site gets moderate use during the summer and there is a growing community of interest and concern about water quality in this catchment.

The Buller site was sampled by a contractor for cost and efficiency reasons. It has been many years since this site was sampled. The swimming hole gets a lot of use, particularly by beginner kayakers who spend a reasonable amount of time fully immersed in the water. Also sampled this season was the water flowing out of the Kaiteriteri Inlet because there is a greater risk of this water being contaminated with faecal matter from a variety of sources, particularly from sewage and dogs or birds. It is understood that all dwellings are connected to the sewer, however it is worth checking the estuary water quality given the urbanised catchment and the high use of the outflow channel in case sewer pipe breakages or crossed connections between sewer and storm water exist and have not been identified.

4.1.3 Sampling continued at the Tukurua site to confirm that the remedial actions undertaken by two septic-tank owners have had a lasting improvement in faecal indicator bacteria concentrations.

4.1.4 Methods used for sampling are described in the following documents:

- *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas, Ministry for the Environment and Ministry of Health, June 2003. ISBN: 0-478-24091-0*
- *Contact Recreation Water Quality Monitoring Programme for the Tasman District. Last updated May 2013. Prepared by Trevor James and reviewed by Rob Smith.*

4.1.5 Results of the sampling were posted on the Council website (see http://www.tasman.govt.nz/environment/water/swimming-water-quality/ ). The aim is to post results within three days of each sampling event, but technical problems prevented this for the first half of the season. Also available on this website is information about the sampling sites (including maps and photographs) and background to the monitoring programme.

### 4.2 Water Quality for Contact Recreation in the Buller Catchment During Flood Flows

4.2.1 From Spring 2012 to April 2013 sampling of six sites in the Buller Catchment was conducted with the following aims:

- Determine the disease risk for contact recreation (mainly whitewater kayaking) during high flows. Of particular interest is the magnitude of the peak faecal indicator bacteria concentrations as the risk of disease increases with higher peak faecal indicator bacteria concentrations.
- Determine the recovery time (i.e. the time for water quality to return to within guidelines)

4.2.2 While quarterly sampling for faecal indicator bacteria has been undertaken by Council at base flows at five sites in the Buller catchment since 2000, as well as monthly all-flow sampling at Buller at Longford since 2002, there have not been any flood-flow targeted sampling.

### 4.3 Predictive Modelling of Faecal Indicator Bacteria Concentrations along the Kaiteriteri Coast

4.3.1 Last year's annual contact recreation water quality report recommended further flood-targeted sampling in the Motueka/Riwaka River plume and affected beaches in order to develop a model that could successfully predict faecal indicator bacteria at the beaches. This will add value to a big investment sampling faecal indicator bacteria in the Motueka River as part of the ICM programme. Thirteen samples were taken this season over five flood events (see Figure 1).

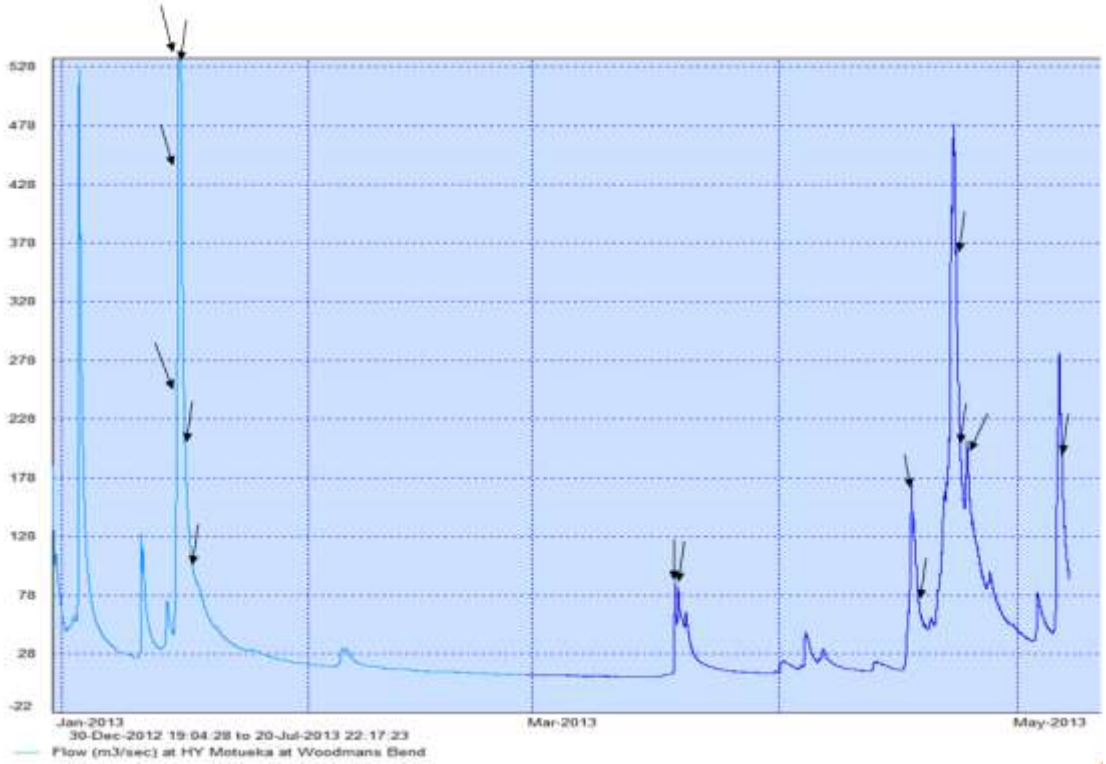


Figure 1: Flow record for Motueka River at Woodmans Bend from Jan-May 2013. Arrows indicate when samples were taken.

### 4.4 Water Quality in Ponded water on Rabbit Island Main Beach Reserve

4.4.1 The Parks and Reserves Department requested that samples from ponded water at Rabbit Island main beach reserve be taken to assess the risk to users of the picnic areas. Microbial Source Tracking was also carried out to try to determine the source of the contamination.

### 4.5 Toxic Algae (cyanobacteria)

4.5.1 Toxic algae (cyanobacteria) in rivers was first implicated in dog deaths in Southland in 2000 and subsequently the issue has manifested in most other regions in New Zealand. The cyanobacteria, *Phormidium*, is the main cause, is native and is found in many of our pristine rivers such as the upper Wangapeka. While dog deaths associated with the consumption of cyanobacteria in rivers have become increasingly common around New Zealand, it is not known if *Phormidium* coverage in rivers is increasing in New Zealand.

4.5.2 Conditions for growth: *Phormidium* proliferates particularly in stable flow periods (about three weeks after a flood with flushing flows) during October-April (other times it is thought to be light limited). In addition, it appears to have a competitive advantage over other algae when soluble phosphorus concentrations are very low and soluble nitrogen concentrations are slightly elevated. It also appears to fare better than other algae growth after slight-moderate deposition of fine sediment on the stream bed.

4.5.3 Methods used for sampling cyanobacteria are described in the following document: *New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters: Interim Guidelines. 2009. Prepared for Ministry for the Environment and Ministry of Health by SA Wood, DP Hamilton, WJ Paul, KA Safi and WM Williamson.*

4.5.4 Sampling collection: Council has been consistently collecting data on *Phormidium* coverage in rivers on a quarterly basis at about 60 sites as part of the River Water Quality Monitoring

Programme since 2010 (prior to that it was just noted if it was an issue). However, this is not sufficient for two reasons:

1. Sampling frequency is not enough to detect whether there is, or is not an issue at a site, and
2. The sites in this programme are not necessarily near areas popular for contact recreation.

So in December 2012 staff began sampling weekly for cyanobacteria at Lee at Reserve and Waimea at 1km upstream SH60. Motueka at Whakarewa St was sampled during stable flow periods when *Phormidium* is known proliferate until it became apparent that coverage there was well below guidelines during the highest risk periods. Casual observations during the highest risk period were undertaken by kayak on the Buller, Matakitaki at mid Motueka Rivers.

4.5.5 In addition, sampling at seven sites for *Phormidium* coverage, dissolved inorganic nitrogen, dissolved reactive phosphorus, dissolved oxygen, pH, conductivity, and temperature was undertaken along a longitudinal transect down the Wairoa and Waimea Rivers on 5 March 2013.

## 5 Results and Discussion

### 5.1 Programmed Sampling For Faecal Indicator Bacteria at Contact Recreation Sites

5.1.1 There were a total of 23 exceedences of national guidelines (11 “Alert” and 12 “Alarm”) recorded at eight of the sites (out of a total of 189 samples taken, see Figure 2a and 2b). This equates to approximately 12% of samples exceeding guidelines, about half of these being above alarm levels. Only six of the 23 exceedences (approximately 3% of all samples) were not associated with rainfall events, three of these being at Tukurua. Average compliance rates with guidelines of 97% is also the average over the last 10 years.

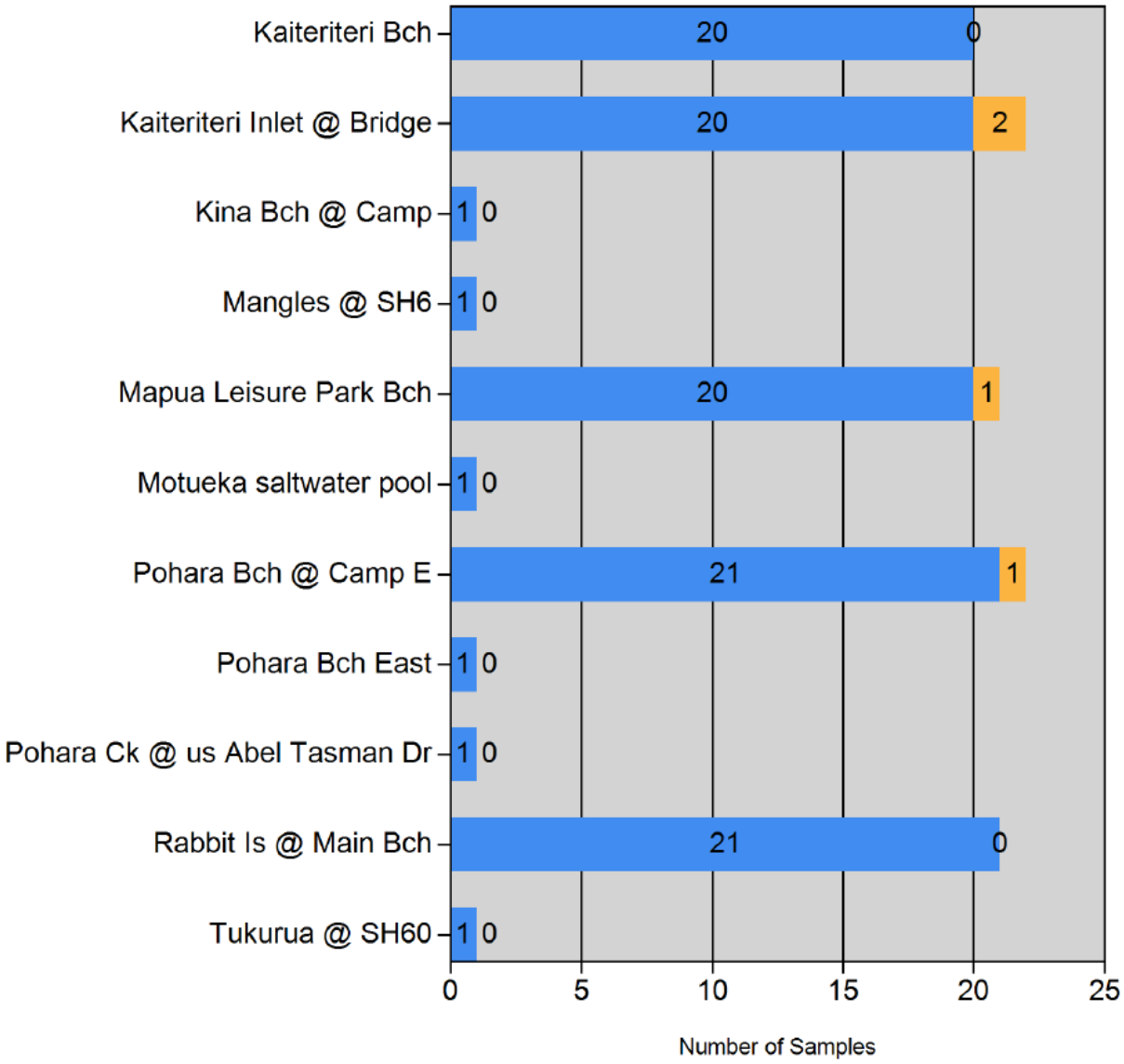


**Figure 2a: Number of samples exceeding national guidelines for contact recreation water quality at marine beaches for the 2012-2013 season.** Orange shows results over alarm levels (>280 *Enterococci*/100ml). Note: This is different to Figure 2b where red indicates alarm levels. The one exceedence for Kaiteriteri Bch is missed out in this graph. There were no results in the alert level category (140-280 *Enterococci*/100ml).

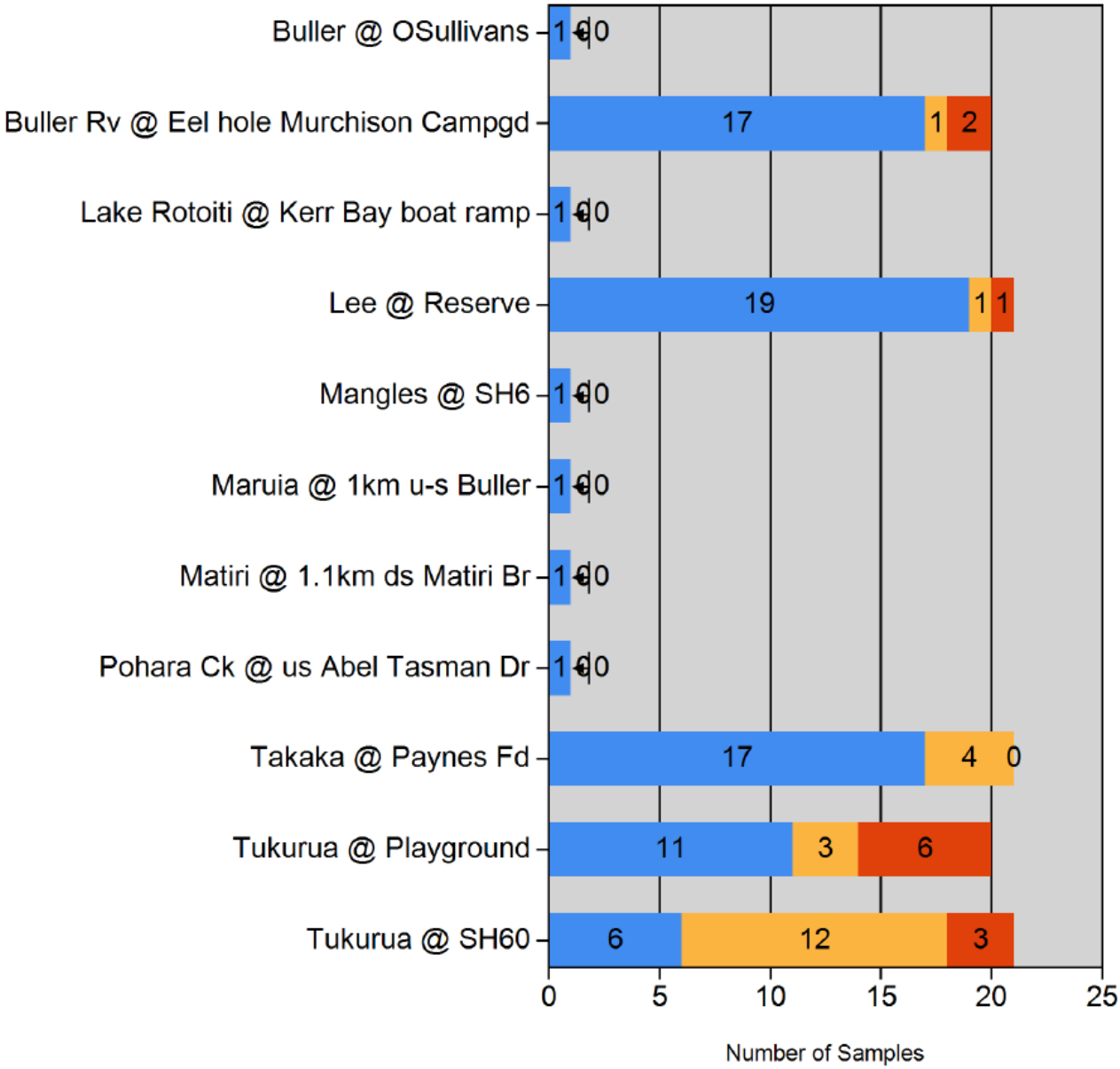


**Figure 2b: Number of samples exceeding national guidelines for contact recreation water quality at freshwater swimming holes for the 2012-2013 season.** **Red** shows results over alarm levels (>550 *E. coli*/100ml) and orange shows results over alert levels (260 *E. coli*/100ml). Note: Tukurua River at SH60 is not a swimming site and is included as a reference for the Tukurua @ Playground.

5.1.2 The concentration of faecal indicator bacteria recorded at Pohara Beach on 19 December 2012 was very high (>2000 *Enterococci*/100ml) and not related to a rainfall event so required the erection of warning signs (as prescribed in the response plan agreed with the Public Health Service). Given the result came through on the Friday the follow-up sample was only possible on Monday, 24 December. This result was below detection (<10 *Enterococci*/100ml).

5.1.3 The cause of this Pohara Beach exceedence remains unknown, but a potential source is sewage from boats emptying holding tanks after living aboard for a period at Port Tarakohe. Staff also took the time to visit the Pohara campground owner and another business in-person. Due to the timing of the event being the run-up to the peak of the tourist season, this "other local business" was not happy that there was no further information on the Council website; either the data that is plotted graphically or any explanatory message. We

have now increased the frequency of refreshing our website data that we receive automatically from the lab to twice weekly and timed for when the data should be available after the Tuesday and Thursday sampling. Up until now we have not mirrored the warning signs on the ground with a message on our website but we now intend to. This message needs to be turned on and off at the appropriate times (usually the signs/web message will only last a few days so it is important that the message is turned off as soon as we can). Our environmental information officer who has publishing rights (essential when you get a result on a weekend or public holiday) is now tasked with updating such messages. Since the beginning of 2012 all staff involved in the programme get text messages from the lab as soon as data about an exceedence of the guideline is available.

5.1.4 Exceedences that were unrelated to rainfall were also recorded at the Takaka at Paynes Ford site, Tukurua and Buller at Riverview Campground. Again, no obvious cause was found and, given the short-term nature of the spike, and the lack of further samples in the catchment upstream on the day of the spike, it is not possible to determine the source. Such exceedences are prevalent in intensively-farmed catchments, as we have experienced in the Aorere catchment, it is possible to improve water quality at base flow and to reduce the magnitude of the peaks during smaller rainfall events.

5.1.5 With the exception of samples from the Tukurua site, all the results from follow-up samples taken two-four days after the exceedence were back down to the typical low levels (usually at or near the lower level of detection).

5.1 6 The only site with full compliance even when affected by flooding was Rabbit Island main beach. The site with the most exceedences (8) was Tukurua Stream.

**5.2 Faecal Contamination of Tukurua Stream**.

5.2.1 The concentrations of faecal indicator bacteria at this site were well within guidelines at the beginning of the season which resulted in the warning sign being removed in mid December, 2012. However, such concentrations appeared to progressively increase and warning signs went back up on February 7, 2013 (see Figure 3a).

5.2.2 There was generally little difference between the site at the campground playground (the swimming hole) and upstream at SH60 except for samples taken in February (during dry weather) when there were several spikes, two of which showed the Playground as much higher and one showed SH60 as much higher (see Figure 3b). This irregular pattern makes it hard to narrow down the source without doing a more detailed investigation. However, it is possible that there is an intermittent source upstream of SH60 and when the results show high concentrations at the playground and relatively low at SH60 the plume may have moved past SH60 and cleared at the time the sample was taken. According to the owner/manager of the farm upstream of SH60 there was only open grazing and no break-feeding in the lower paddocks when there was the greatest increase in *E.coli* concentration. It is possible that stock wallowing in a small swampy area of one of the lower paddocks could have caused a concentration of faecal matter that could have entered the stream. This is not unusual on farms in the district but best practice would recommend installing temporary fencing around these swampy areas while they are wet. This also ensures a greater degree of filtering of contaminants in run-off.

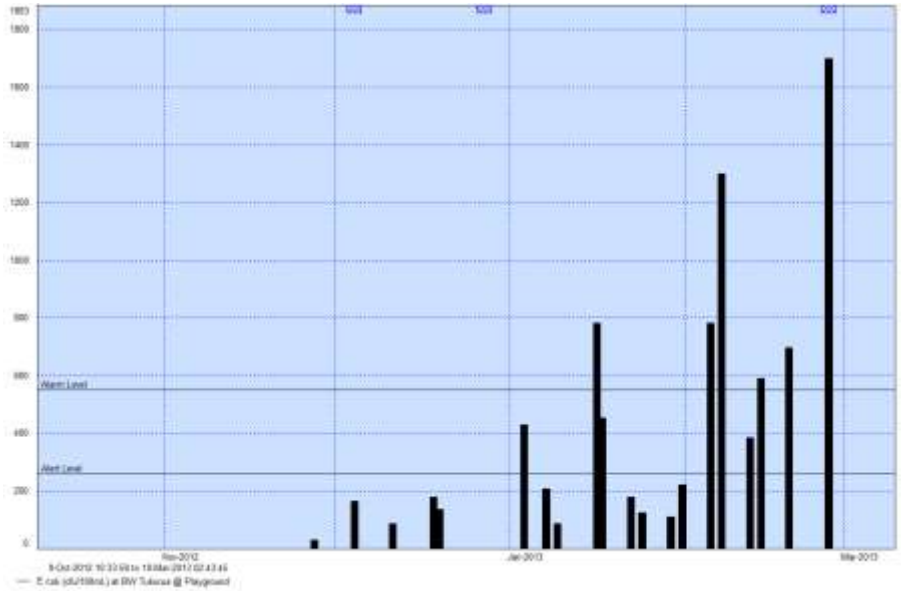

Figure 3a: *E.coli* concentration (cfu/100ml) in Tukurua Stream at Camp Playground showing an apparent increasing trend through the past season.

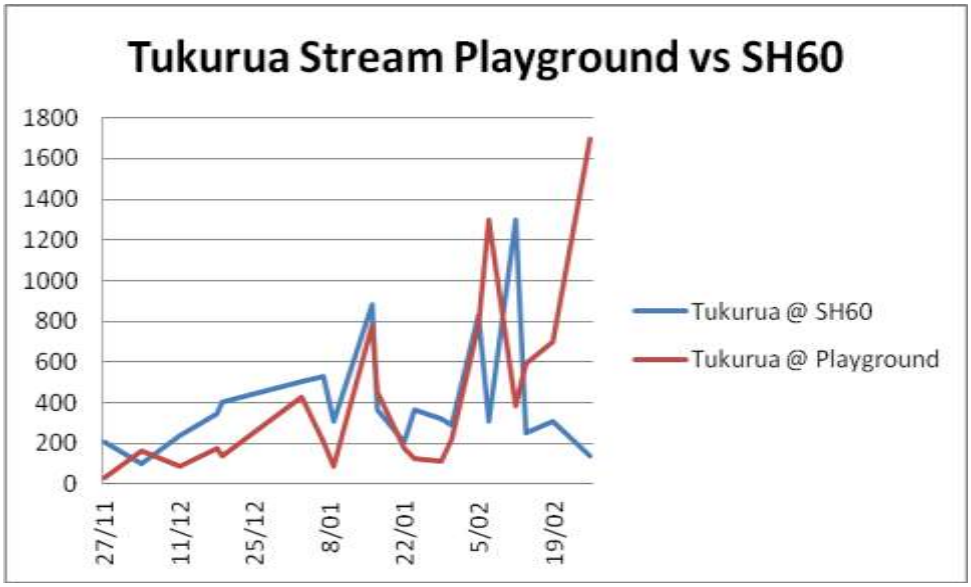


Figure 3b: *E.coli* concentration (cfu/100ml) in Tukurua Stream at two sites: SH60 and camp playground.

5.2.3 Microbial Source Tracking (MST) samples taken on 17 January 2013 from the playground site showed the source as ruminant animal, and not from human or wildfowl origin. Unfortunately the *E.coli* concentration of this sample was only moderate at 453 cfu/100ml. It would have been most desirable to analysed one of the samples with high *E.coli* concentrations. It is possible that the source of *E.coli* at the time of the spike in concentration is different from other sources and only further MST samples will show this (MST samples are not taken regularly due to cost). This suggests a possible ruminant animal source in this section. No stock are held in concentrated areas on the small landholdings to the west of the stream. It was suggested that during January-February stock were held in a concentrated area in the very lowest paddock on the true right of the river.

5.2.4 The results of sampling along a longitudinal transect from the bush edge to the Playground on 1 March, 2013 showed no obvious contaminant source and a very well-managed farm

with full fencing and stock crossings that are very little-used. This part of the farm is not part of the dairy platform and so is not subject to the intensive stocking regime common on dairy farms. *E.coli* was found in trace concentrations at the farm-bush boundary about 1.5km upstream of SH60 and steadily increased to over 200 *E.coli*/100ml at a point 160m upstream of SH60 then almost doubled from there to SH60 (see Figure 4). This pattern is consistent with that found in three other inspections over the previous two bathing seasons.

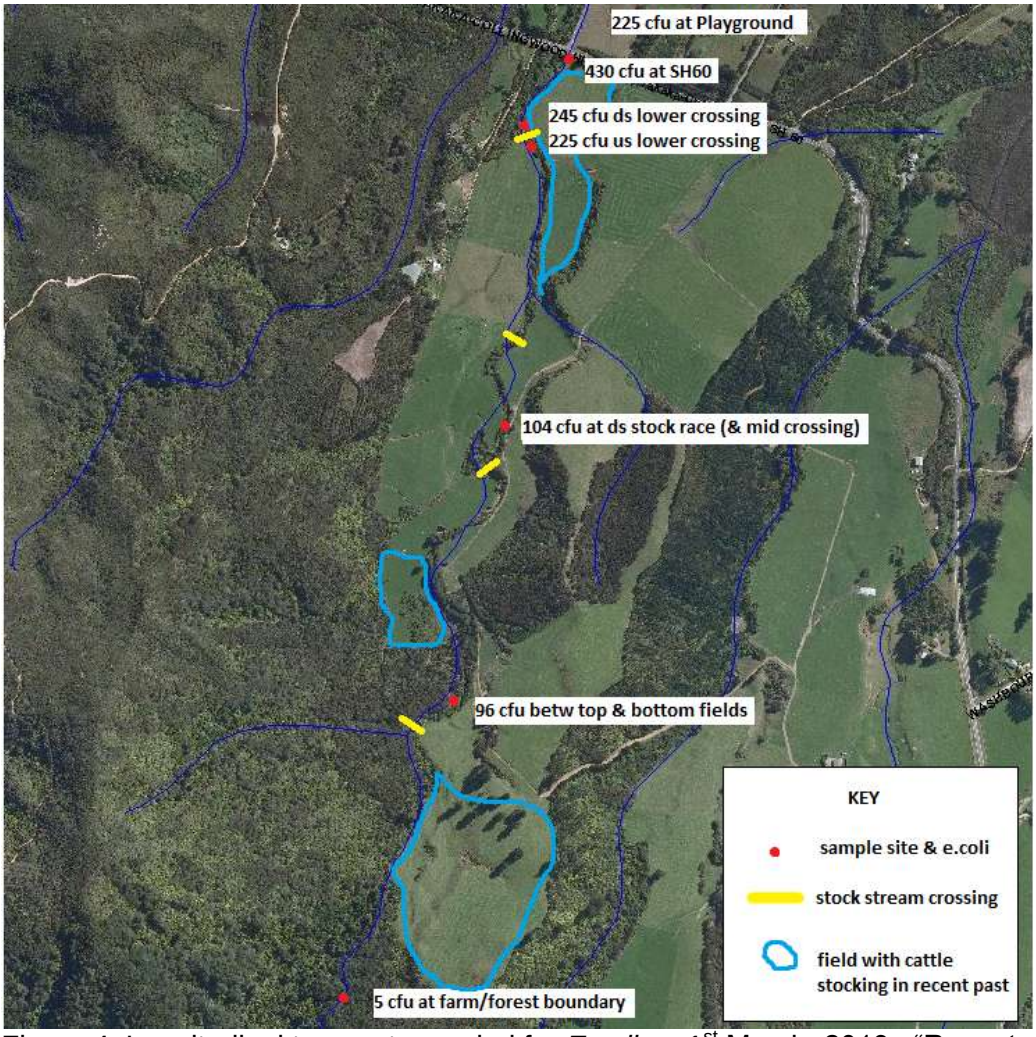


Figure 4: Longitudinal transect sampled for *E.coli* on 1st March, 2013. "Recent past" refers to the last month.

## 5.3 Water Quality for Contact Recreation in the Buller Catchment

5.3.1 During base flows water quality is generally very good for contact recreation in the Buller Catchment (based on sampling at five sites: Mangles at Gorge, Buller at Riverview Campground, Matakitaki at SH6, Buller at O'Sullivans Bridge, Maruia at 1km upstream Buller). Only one of the 20 samples taken weekly at the Riverview Campground site during base flows this season was above guidelines. The other sites are sampled quarterly at base flows and there have been no recorded exceedences of guidelines. In fact, even the highest recorded *E.coli* concentrations are very low in the Matakitaki (50 cfu/100ml) and satisfactory in the Mangles (195 cfu/100ml). Note: the O'Sullivans and Maruia sites have only been sampled since November 2012.

5.3.2 During flood flows the average *E.coli* concentration across all sites, across 40 sample results, was almost 1300 cfu/100ml and the highest result recorded was 4700 cfu/100ml. This average is almost double the average recorded in the Motueka at Woodmans Bend (where about 30 floods were intensively sampled as part of the ICM programme), about half

that recorded in a flood sampled intensively in the Aorere on 29/09/2000, two-three times lower than three floods sampled in the Motupipi and Powell Creek. These comparisons are not precise given the highly variable nature of flooding, both in terms of size of flood, pattern of rainfall over the landscape and antecedent flow conditions. However, it does show that sites in the Buller catchment are not out-of-line with other catchments in Tasman. When considering the high percentage of the Buller catchment in indigenous forest, faecal indicator bacteria concentrations may be expected to be lower.

5.3.3 While the maximum recorded concentrations were well over the alarm level guideline (up to eight times this guideline at the highest) the concentrations were generally back below guidelines within 24 hours.

5.3.4 Flood-flow monitoring is also important if we are to model contaminant loads for obligations under the national policy statement for freshwater.

### 5.4 Predicting Water Quality for Contact Recreation along the Kaiteriteri Coast

5.4.1 What we have learnt from this sampling is:

- Reasonably small flood events (~90 $m^3$/sec; 19 March) in the Motueka River can cause poor water quality at Kaiteriteri and Stephens Bay.

- Antecedent rainfall may be very important as the small flood occurred after a long dry spell which would allow more faecal matter to build up on the land before being washed into waterways. The size of flood in the Motueka River alone did not seem to correlate with the *Enterococci* concentrations at Kaiteriteri and Stephens Bay Beaches. One reasonable flood (480 $m^3$/sec; 21 April) did not lead to an exceedence in samples taken 15 or more hours after the peak flow in the Motueka River. However, it is possible that if we had sampled within six hours prior to the peak flow, we may have got a very short-term exceedence at the beaches (this would have meant sampling floods near and after nightfall). However, this flood followed another flood only four days prior so the waterways may have been “cleaned out” of the in-stream store of faecal indicator bacteria.

- Both the Motueka/Riwaka River plumes and local sources are likely to be implicated in exceedences at the beaches given the high *Enterococci* concentrations in both, very early peaks of *Enterococci* at the beaches and obvious turbid water coming from both. For the flood event on 15/01/2013 the peak *Enterococci* concentrations at Kaiteriteri and Stephens Bay occurred more than six hours before the peak flow and peak *Enterococci* in the Motueka River (see Figure 5). This was at a flow in the Motueka River of below 200 $m^3$/sec.

- The time to recover to full compliance with guidelines is short and ranged from 8-36 hours.

5.4.2 While this is useful information, in order to successfully predict faecal indicator bacteria there will need to be thorough and complex analysis of the many variables involved such as tide, wind, solar radiation, turbidity, (from satellite imagery). Before this is done another 15-20 samples are required over 5-10 floods as well as more sampling of local sources of faecal contamination (e.g. Kaiteriteri Inlet). Even with this analysis there is still a chance that predictive power is limited and contaminant transport would have to be “bolted on”. Transport models are costly, both in terms of further data collection from a network of monitoring buoys and analysis time. However, if it was developed at a scale to incorporate the whole top of the South Island in collaboration with parties such as aquaculture, the costs could be significantly reduced.

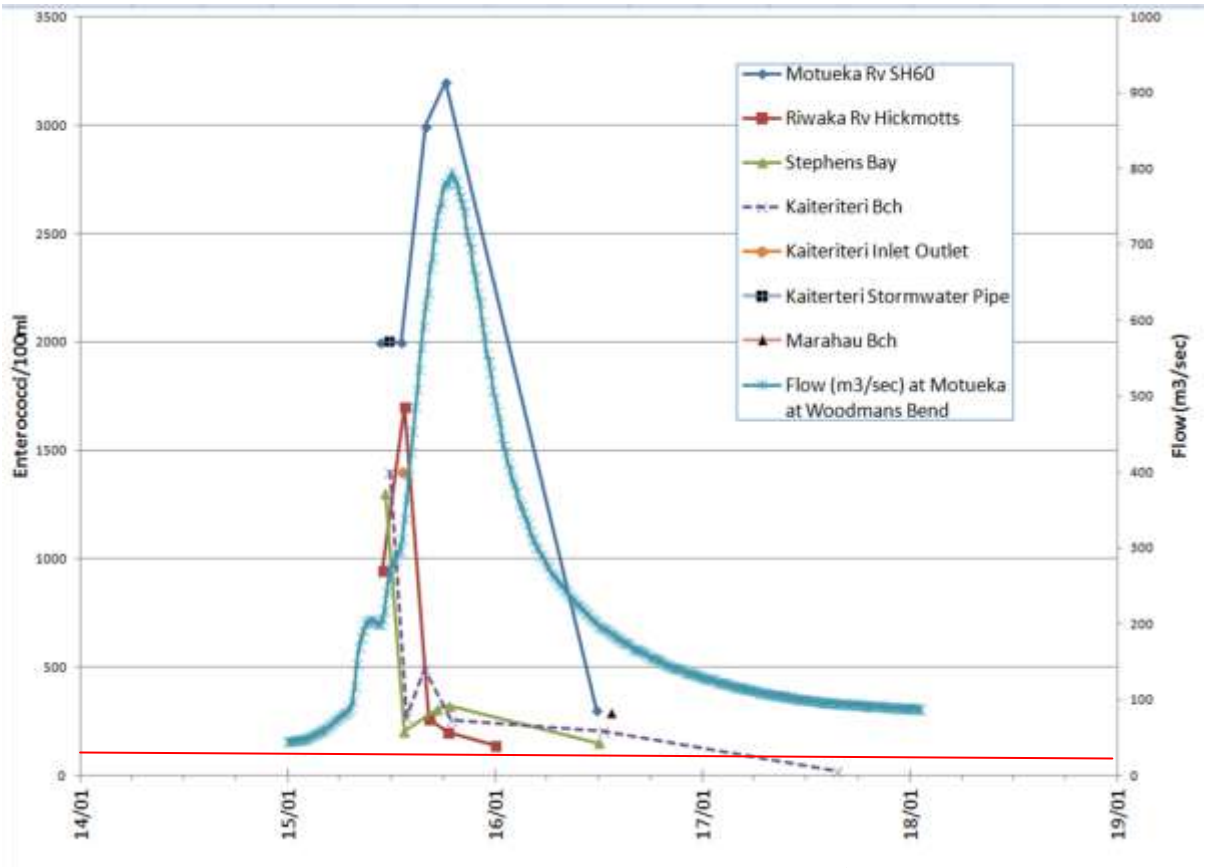


Figure 5: Enterococci concentrations (cfu/100ml) and flow ($m^3$/sec) for the flood event of 15/01/13

## 5.5 Risk to People Using Rabbit Island Main Reserve When Ponding is Present

5.5.1 *E.coli* concentrations in two of the three ponds sampled were double the alarm level guidelines and the other pond was just below alarm level guidelines. This is a significant risk, the concentrations were below guidelines within four days.

5.5.2 As expected the source of faecal indicator bacteria in the ponded water was from human origin in all three ponds sampled. Duck/other wildfowl or dog genetic markers were not found in any of the ponds. These sources were considered unlikely given that very few birds were ever observed using the ponds and dogs are not allowed in the reserve. A faint positive was recorded for gull genetic markers but in only one of the ponds.

5.5.3 To determine whether the source is from the public toilets or from the biosolids discharge would involve monitoring bores being installed over a transect leading from the discharge area would be costly (~$10,000). The option of improving drainage at the reserve (e.g. by flipping or cutting) could well be cheaper. If monitoring was the preferred option the best first step may be to focus on the public toilets in the reserve and hand-drill piezometers around the toilet disposal area to try to determine whether that is the main source. This would cost approximately $5000 including staff time.

## 5.6 Toxic Algae in Rivers

5.6.1 Toxic algae (cyanobacteria) cover in the district was by far the greatest on the Waimea/lower Wai-iti and Sherry Rivers and was not recorded at levels above guidelines anywhere else. The pattern of growth within a reach of river varied depending on the nature of the river. At sites where it was most prolific its coverage was greater in runs than riffles. Riffles are

where the surface of the water is punctured by gravel/cobble/boulders in the river whereas runs have more uniform (less turbulent) flow and deeper water.

**5.6.2 Toxic Algae on the Waimea/Lower Wai-iti River**: The coverage of the cyanobacteria, *Phormidium*, was extensive and above national guideline (20% coverage) in the Waimea River from mid November 2012 to mid March 2013, apart from about six weeks from late December to mid February when it was sloughed off due to flood flows. Maximum coverage reached 80% in mid March. This was towards the end of the long stable flow period of about eight weeks (see Figure 6).

Information was posted within a few days of sampling on the following page: http://www.tasman.govt.nz/environment/water/rivers/river-water-quality/monitoring-toxic-algae/

Three dog deaths, allegedly from consuming algae and water from the river's edge, have been reported to Council, all of which were from the Waimea-lower Wai-iti. One of the dog deaths was on 25 January when coverage of *Phormidium* was below 2.5%. This is probably very unlucky but suggests that there is a risk to dogs at any time. According to the information received, all the dogs that died were puppies. Puppies are well known to consume a lot of "unsavoury" material.

Results of sampling down a longitudinal transect on the Wairoa and Waimea Rivers found a distinct and discrete pattern of proliferation over a 4km section of the lowest 200m of the Wairoa River to about SH60 (Figure 7). A second set of observations of coverage from Bryant Rd to SH60 confirmed this same pattern. Dissolved reactive phosphorus concentrations were eight times less on the Wairoa River at SH6 compared to 3km upstream at Irvines and reduced by a third from SH6 to Bryant Road, after which time they remained consistent at 0.001g/$m^3$. This is about a tenth of typical concentrations in rivers around Tasman District. Apart from a decline from SH6 to Bryant Road, dissolved inorganic nitrogen concentrations increased from <0.011g/$m^3$ to 0.15g/$m^3$ between Irvines and 1.2km upstream SH60. There was no significant change in dissolved oxygen, pH, or temperature down the transect, conductivity decreased from 217µS/cm at Irvines to 194µS/cm at 1km downstream SH60. This could reflect other changes in water chemistry that are currently unknown.

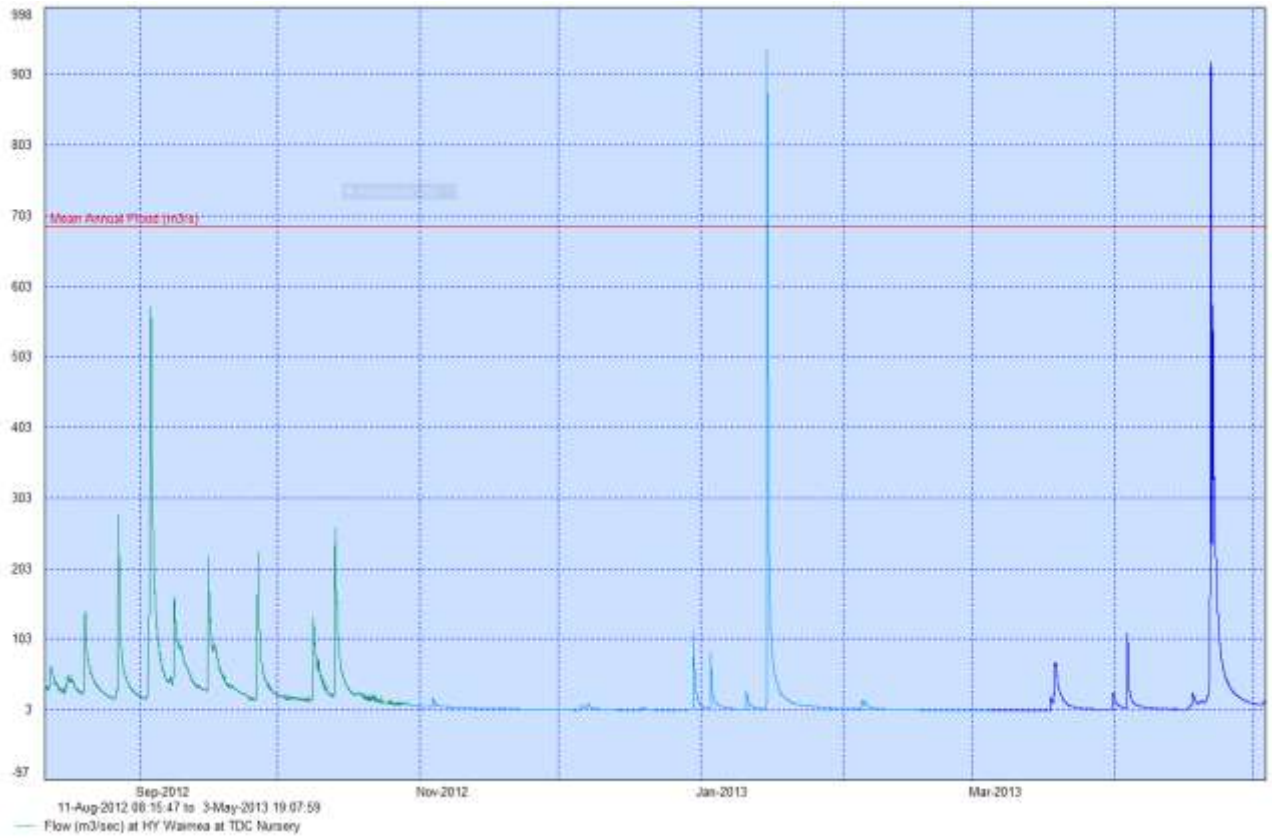


Figure 6: Waimea River flow showing the extended low flow periods after a spring season of frequent floods.

The reason that cyanobacteria coverage was extensive this season is the unusually long periods between bed-moving floods (Figure 6). This could have implications for management flow release from the proposed Lee Dam if longer duration stable-flow periods resulted. However, the flow regime is not the only factor; the sites where *Phormidium* are prolific are also characterised by very low phosphorus concentrations and slightly-elevated nitrogen concentrations.

Whether there has been a real increase over the last decade in *Phormidium* cover in the Lower Wai-iti and Waimea, similar to what has been found in other regions, is not known. However, this summer's bloom could have been influenced by increased periods of stable summer base flows due to steady (non-pulsed) releases from the Kainui Dam. If the water released from the Kainui Dam also had low phosphorus concentration this could have a combined effect.

Further work would be required to determine if this is the case and if there are any options to operate the release differently. If steady flow releases from the Kainui Dam was found to influence *Phormidium* cover, releases from the dam could be pulsed without compromising the aims of the water augmentation programme. While this could work to reduce *Phormidium* growth, the flows will never be sufficient to cause flushing flows enough to cause a significant reaming out of this growth. Regardless the economic and ecological benefits of providing water in the Wai-iti River would seem to far outweigh the health risk to dogs which can be managed by ongoing education.

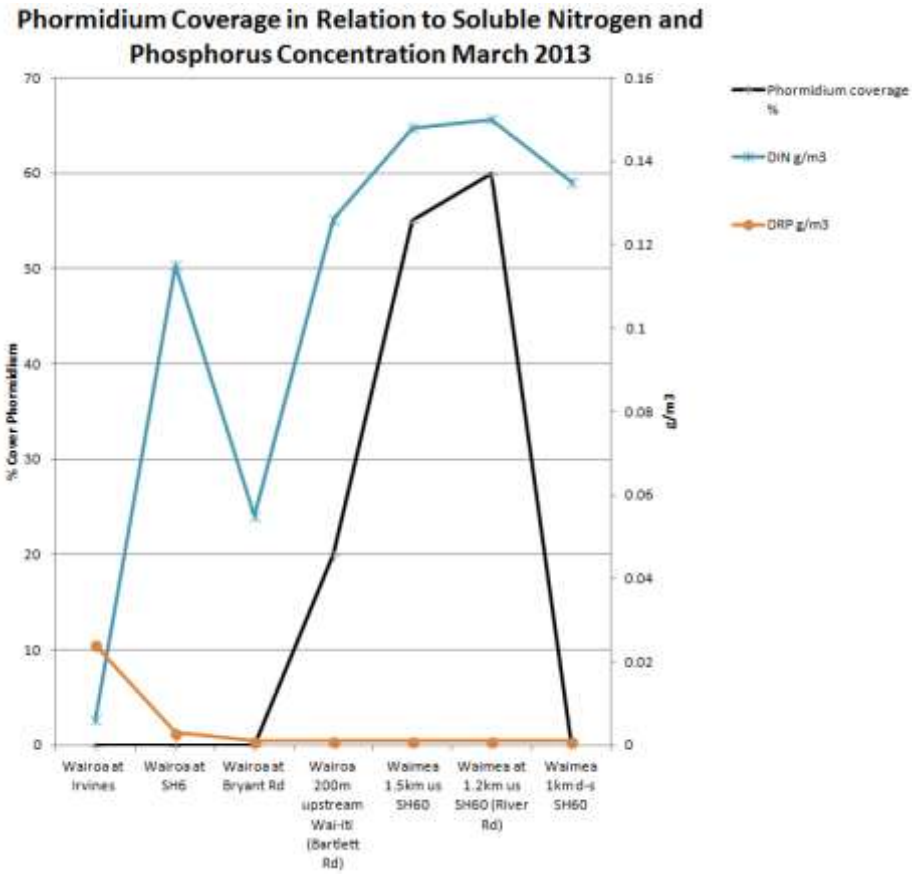


**Figure 7: Phormidium coverage in the Wairoa-Waimea Rivers in relation to soluble nitrogen and phosphorus concentrations on 5 March, 2013.**

### 5.6.3 Toxic Algae Elsewhere in Tasman:

The coverage was up to 80% in runs in mid February in the lower Sherry River and likely to have reached even higher levels by mid March (Table 1). However, all other rivers sampled in the River Water Quality Monitoring Programme in mid February were within guidelines. For the vast majority of sites *Phormidium* was not recorded. On some rivers such as the Aorere, it appeared that *Phormidium* coverage decreased between Devils Boots and the mouth with coverage at Le Comte averaging only 1%, with about 3% in riffles and almost none in runs. Casual observations during the highest risk period on the Buller, Matakitaki at mid Motueka Rivers showed very low coverage (3%).

| Site | % Coverage in riffles | % coverage in runs | Average % coverage |
|---|---|---|---|
| Aorere at Devils Boots | 20% | 5% | 8% |
| Onekaka at Shambala Road | 15% | 5% | 7% |
| Onahau at Onahau Road | 15% | 0% | 6% |
| Takaka at Kotinga | 7% | 0% | 2% |
| Tutaki at Mangles Vallley Road | 10% | 5% | 7% |
| Sherry at Blue Rock | 30% | 80% | 65% |

Table 1: The six sites in the River Water Quality Monitoring Programme with the greatest *Phormidium* coverage in mid February, 2013.

Weekly sampling in the Lee River at Reserve generally showed very low coverage of *Phormidium.* While maximum coverage of 12% was recorded on one occasion in a riffle, the average coverage on this occasion over a 100m reach was 3%.

Toxin production: Recent work by Cawthron (Dr. Susie Wood, unpublished) has found that toxin concentrations in the Waimea River were at low concentrations, but all ten samples taken from the lower Motueka River did not produce any toxins (Figure 8). This, together with the low recorded coverage of the river bed in the Motueka River (well below guidelines), suggests that the Motueka River is low risk for dogs and humans. Past sampling has found that only half the samples produced toxins at the Waimea River. Research is under way to find out how and why the cyanobacteria turn on or off their toxin production.

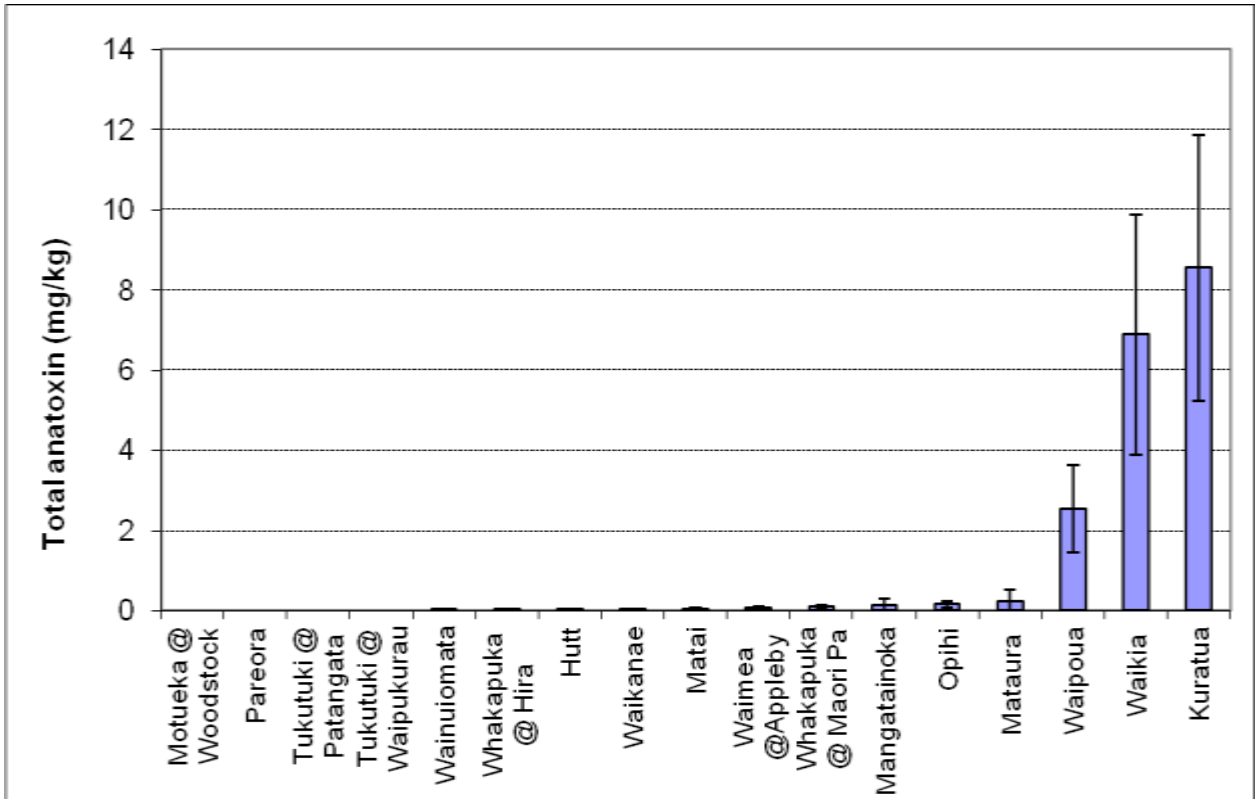


Figure 8: Cyanotoxin (total anatoxin) production for the Waimea and Motueka Rivers compared to other sites around New Zealand.

**5.6.4 Management of Cyanobacteria**.

The following actions were undertaken to manage the issue in the past six months:

- Signage was placed at 10 of the main access points along the Waimea/ Lower Wai-iti River corridor during periods when *Phormidium* coverage was above guidelines. After a flood, signs were left up until such time as the water level receded enough to be able to reassess coverage.

- Newsline article, radio interviews and display in Council foyer.

- Information (including the link to our webpages on the subject) were emailed to all veterinarians in the district.
- Information brochures were produced in May 2013 and offered to all persons registering dogs.

Over the next season an offer will be made speak to dog clubs/groups about the issue. In practical terms, without knowing more about the conditions for proliferation in the Waimea, there is little more than education and warning that can be done to reduce the risk.

If reducing dissolved inorganic nitrogen by 30% (from around 0.15 to 0.10 g/m3) was shown to reduce the coverage of *Phormidium* in this river it may be worth attempting to manage nitrogen leaching or runoff to the river. However, it is not known whether this is practically possible without leading to very restrictive land use practices, given the relatively low concentration in the river that it would have to be managed to. Alternatively, purposefully discharging phosphorus to the river could also reduce *Phormidium* growth. However, this would be very costly and would likely lead to extensive coverage of filamentous green algae which, while not toxic, would be very off-putting for people recreating in the area. There would need to be a lot of research carried out in laboratory conditions and flume trials using a range of nutrient and chemical concentrations before these sorts of trials are undertaken at full scale on a river. This research is likely to occur over the next 5-10 years.

## 6 Conclusion

6.1 Overall compliance with the microbial water quality (contact recreation) guideline at base flows was similar to previous years (97%). Tukurua Stream at Camp Playground was the least compliant and Rabbit Island Main Beach was fully compliant. Rainfall events were attributed to about half of the total non-compliances (~3%). Buller at Riverview Campground was sampled for the first time in many years and recorded very good water quality during base flows.

6.2 Flood-flow sampling in the Buller catchment found concentrations of faecal indicator bacteria in the lower half of the range found to in Tasman District. As is the case in most rivers in the district, all the sites returned to compliance within 24 hours of the non-compliance being recorded.

6.3 The sampling programme is on-track for re-running a predictive model for water quality at beaches in the Kaiteriteri area influenced by the Motueka River plume.

6.4 Ponded water at Rabbit Island main beach reserve was above guidelines for contact recreation and the contamination was of human origin.

6.5 Toxic algae has been found to be an issue in the Waimea/lower Wai-iti and Sherry Rivers and generally at low coverage elsewhere.

## 7 Next Steps / Timeline

7.1 Next summer the programme includes sampling the 16 lower use/lower risk sites that are sampled every second year in addition to the core six sites.

7.2 Further targeted flood-flow samples will be taken from the Motueka River and associated coastal plume from September 2013-April 2014 or until there is enough data to be able to successfully predict water quality at key beaches in the plume.

## 4 Appendices

Nil