

Recreational Swimming Water Quality in Northland

Investigation of Problem Sites and On-Going Strategy 2017/18



Putting Northland first



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Strategy 2017/2018

Executive Summary

- A total of 27 sites have been studied as part of a Council initiative to investigate water quality issues at popular swimming sites in the Northland region.
- Investigation work includes collecting samples for microbial source tracking, undertaking sanitary surveys, collecting and analysing water samples from upstream in the catchment and catchment land-use mapping.
- To date, results from microbial source tracking analyses indicate that 24 sites were contaminated by wildfowl, 20 sites were contaminated by ruminant and four sites by dog faecal material. Human faecal contamination has been recorded at Ocean Beach, Pahi, and Raumanga. Weak human markers have also been detected at Ruakaka in 2014/15 and Victoria River during the 2012/13 and 2014/15 summer monitoring periods.
- Waipoua swimming hole will be added to the 2017/18 site investigation programme due to elevated bacteria levels recorded in previous monitoring periods.
- Overall, investigation work will continue at a total of 11 sites where the source(s) of contamination has not been identified, or where additional samples are required to confirm the source(s) of contamination.

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1. Introduction

The Recreational Swimming Water Quality Programme (RSWQP) is a joint project administered by the Northland Regional Council (Council), in partnership with the Northland District Health Board (NDHB), the Far North District Council (FNDC), the Whangarei District Council (WDC) and the Kaipara District Council (KDC). The programme design is derived from the Ministry for the Environment (MfE) and Ministry of Health (MoH) Microbiological Water Quality Guidelines (2003). The aim of the programme is to provide information on microbiological contamination at popular freshwater and coastal swimming sites in Northland, to allow the public to make informed decisions about where to swim.

During this programme, a number of the region's most popular coastal and freshwater swimming sites are sampled once a week throughout the summer months. The samples are analysed for faecal indicator bacteria and the results are distributed to key stakeholders and the general public. Sites are graded each week according to the level of bacteria recorded at each site, i.e. green 'suitable for swimming', orange 'caution' and red 'unsuitable for swimming'.

Water quality testing has identified that at times some of the swimming sites in Northland have been considered unsuitable for swimming. Some sites have had elevated bacteria levels recorded on a number of sampling occasions, and other sites have generally good water quality with occasional elevated bacteria levels. In most cases, the source of bacterial contamination at these sites is not immediately obvious.

Over the previous summers, the Council investigated 27 sites with consistent water quality issues to identify the source(s) of contamination. The results from this work will be used, where possible, to improve water quality at these sites.

In 2017/18 investigations will continue at sites where results have so far been inconclusive. A number of new sites with water quality issues will also be added to the site investigation programme.

2. Site Investigation Update 2017/18

An investigation is triggered once an 'Action' result is recorded at a site listed in the investigation programme. Action results are recorded following the Ministry for the Environment (MfE) and the Ministry of Health (MoH) *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas* released in June 2003. Recreational contact guidelines are based on faecal indicator bacteria levels present in a sample of water. *Enterococci (Ent.)* bacteria are quantified for coastal sites and *Escherichia coli (E. coli)* bacteria for freshwater sites. The MfE/MoH guidelines for swimming suitability are presented in Table 1.

Table 1: Single sample guidelines for freshwater and coastal swimming sites (MfE and MoH 2003)

<i>Freshwater</i>	<i>Coastal</i>	Category	Suggested Response
<i>E.coli</i> ≤ 260/100mL	<i>Ent.</i> ≤ 140/100mL	Surveillance	No response necessary – Continue weekly sampling
260 < <i>E.coli</i> ≤ 540/100mL	140 < <i>Ent.</i> ≤ 280/100mL	Alert	Undertake catchment assessment and sanitary survey to isolate source of faecal contamination
<i>E.coli</i> > 540/100mL	<i>Ent.</i> > 280/100mL	Action	Collect follow-up sample Undertake sanitary survey when applicable Erect warning signs Inform public through the media that a public health risk exists

Ten sites sampled through the RSWQP were identified as having water quality issues, based on historic water quality sampling:

- Hatea at Whangarei Falls
- Kerikeri at Rainbow Falls
- Matapouri at Southern Bridge
- Omapere at Pioneer Walk
- Paihia at Waitangi Bridge
- Raumanga at Raumanga Valley Park
- Rawene
- Ruakaka River Below Motor Camp
- Victoria at DOC Reserve Crossing
- Wellington's Bay

2.1. Investigation Strategy

Investigative work includes taking samples for microbial source tracking, catchment profiling, and undertaking sanitary surveys where microbial source tracking returned a positive human result, or where specific toilets/septic tank systems were suspected to be faulty.

2.1.1. Microbial Source Tracking

Sites included in the investigation programme which return elevated levels of faecal indicator bacteria undergo microbial source tracking analyses. There are several scientific techniques used to assist in identifying the source of faecal contamination in water. These include faecal sterol ratio (FSR) analysis, fluorescent whitening agents (FWAs) and polymerase chain reaction (PCR) markers.

Faecal Sterols Ratio Analysis

Sterols are neutral lipids that have important biological functions in plants and animals, such as for cell membrane structure, e.g. cholesterol. The sterol profile in faeces depends on the animal's diet, internally produced sterols and the bacteria in the animal's gut. Consequently, analysis of sterol composition of animal faeces can generate distinctive faecal sterol fingerprints. The ratio of different sterols in a water sample can be used to narrow down the potential source(s) of bacterial contamination to either humans, herbivores (animals whose main diet consists of vegetation, including cattle, sheep, deer and goats), and plant decay and/or run-off from vegetation.

Fluorescent Whitening Agents

Fluorescent whitening agents (FWAs) are common constituents of washing powders and only one is used in New Zealand. In most households, effluent from toilets is mixed with grey water from washing machines and therefore FWAs are usually associated with human faecal contamination in both septic tanks and community wastewater systems.

Polymerase chain reaction Markers

Polymerase chain reaction (PCR) markers show the difference between closely related bacteria using DNA sequencing. In some cases, this bacterium is highly host specific, i.e. only associated with the faecal material of one animal or animal group. Therefore the type of animal that the bacteria came from can sometimes be identified.

PCR markers for the following host groups have been developed – human, ducks (wildfowl), ruminants (includes sheep, cattle, deer and goats), possums and pigs – as well as a general indicator for faecal contamination.

2.1.2. Catchment Profiling

Catchment profiling involves mapping catchment land-use around problem sites so that potential sources of contamination can be identified, such as pastoral farming or septic tank soakage fields. Therefore, this is carried out only if the first microbial source tracking result returns a contamination source(s) from ruminant or human.

Once catchment land-use has been mapped for each site, water samples are collected from key locations within each catchment to identify where bacterial levels are at their lowest and highest. This information provides an indication of where contamination is originating from, and in some cases, can point to a specific source of pollution.

2.1.3. Sanitary Surveys

A sanitary survey involves inspecting the septic tank and associated soakage field of each property in order to identify any failing or poorly maintained systems, which could be contributing to the water body contamination. Sanitary surveys will only be completed by the relevant District Council if results indicate the presence of FWAs or human markers.

2.2. Summary of work 2016/17

Table 2 summarises the site investigation work undertaken in 2016/17.

Table 2: Site investigation work undertaken during the 2016/17 season - tick (✓): activity was completed, cross (X): activity was not completed.

Site Name	Weekly Monitoring	Microbial source Analysis (No. of sample)	Catchment Profiling	Sanitary Survey
Hatea at Whangarei Falls	✓	✓(2, ongoing)	<i>In progress</i>	X ^a
Kerikeri at Rainbow Falls	✓	✓(1, ongoing)	n/a	n/a
Matapouri Southern Bridge	✓	✓(0)	Done	X ^a
Omapere at Pioneer Walk Road	✓	✓(0)	X	X
Paihia at Waitangi Bridge	✓	✓(0)	X	X ^a
Raumanga at Raumanga Valley Park	✓	✓(0)	X	X
Rawene	✓	✓(0)	X	X
Ruakaka River Below Motor Camp	✓	✓(0)	X	X
Victoria at DOC Reserve Crossing	✓	✓(3, ongoing)	Done	X
Wellington's Bay	✓	✓(0)	X	X

X^a No human markers identified in samples

n/a: not applicable

3. Updated Site Investigation Strategy 2017/18

The proposed strategy is subject to confirmation following the pre-season stakeholder meeting.

No sites will be removed from the site investigation programme in 2017/18.

3.1. Sites Monitored in 2016/17

Results from the catchment investigations will be summarised at the end of the season and used to explore management options at each site.

Hatea at Whangarei Falls

The site at Whangarei Falls was suitable for swimming on all but two sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for 61 'Action' results on 185 sampling occasions within the same time frame. This means the site was considered suitable for swimming 67 percent of the time during the summer season in the last 12 years.

The site was part of the investigation programme in 2007/08, 2009/10, 2010/11, 2015/16 and 2016/17. Microbial source tracking analyses identified contamination caused by ruminant, wildfowl and dogs. More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will continue throughout the summer months as part of the RSWQP.

Kerikeri at Rainbow Falls

The site at Kerikeri at Rainbow Falls was suitable for swimming on all but one sampling occasion during the 2016/17 season. This site has been monitored since 2014/15 and accounted for four 'Action' results on 40 sampling occasions within the same time frame. This means the site was considered suitable for swimming 90 percent of the time during the summer season in the last three years.

The site was part of the investigation programme in 2016/17. Microbial source tracking analyses identified contamination caused by ruminant and possible wildfowl contamination on one sampling occasion. More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will continue throughout the summer months as part of the RSWQP.

Matapouri Southern Bridge

The site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for 14 'Action' results on 184 sampling occasions within the same time frame. This means the site was considered suitable for swimming 92 percent of the time during the summer season in the last 12 years.

The site was part of the investigation programme in 2015/16 and 2016/17. Microbial source tracking analyses identified contamination caused by ruminant and wildfowl. This site is subject to occasionally elevated faecal indicator bacteria levels and will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Omapere at Pioneer Walk Road

The site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for eight 'Action' results on 157 sampling occasions within the same time frame. This means the site was considered suitable for swimming 95 percent of the time during the summer season in the last 12 years.

The site was part of the investigation programme in 2016/17. This site is subject to occasionally elevated faecal indicator bacteria levels and will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Paihia at Waitangi Bridge

The site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for 11 'Action' results on 162 sampling occasions within the same time frame. This means the site was considered suitable for swimming 93 percent of the time during summer season in the last 12 years.

The site was part of the investigation programme in 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17. Microbial source tracking analyses identified contamination caused by ruminant and wildfowl. More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Raumanga at Raumanga Valley Park

The Raumanga Stream site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for 28 'Action' results on 185 sampling occasions within the same time frame. This means the site was considered suitable for swimming 85 percent of the time during the summer season in the last 12 years.

The site was part of the investigation programme in 2007/08, 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17. Microbial source tracking analyses identified contamination caused by ruminant, wildfowl and human. A strong positive human marker was detected due to a sewage spill which occurred the week prior to sampling and caused elevated bacteria levels at the site. The problem was addressed by Whangarei District Council and bacteria levels in the water had returned to 'Surveillance' mode by the following week.

More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Rawene

The site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for nine 'Action' results on 157 sampling occasions within the same time frame. This means the site was considered suitable for swimming 94 percent of the time during the summer season in the last 12 years.

The site was part of the investigation programme in 2016/17. This site is subject to occasionally elevated faecal indicator bacteria levels and will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Ruakaka River below Motor Camp

The Ruakaka River site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2004/05 and accounted for 16 'Action' results on 185 sampling occasions within the same time frame. This means the site was considered suitable for swimming 91 percent of the time during summer season in the last 12 years.

The site was part of the investigation programme in 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17. Microbial source tracking analyses identified contamination caused by ruminant, weak human and wildfowl. More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Victoria at DOC Reserve Crossing

The Victoria River site was suitable for swimming on all but three sampling occasions during the 2016/17 season. This site has been monitored since 2007/08 and accounted for 23 'Action' results on 123 sampling occasions within the same time frame. This means the site was considered suitable for swimming 81 percent of the time during the summer season in the last 10 years.

The site has been part of the investigation programme since 2011/12. Microbial source tracking analyses have identified the source of contamination to be caused by ruminant, wildfowl and plant decay. Weak human markers have also been identified on two occasions during the 2014/15 season. More samples need to be collected to confirm the source(s) of contamination at the site and it will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

Wellington’s Bay

The site was suitable for swimming on all sampling occasions during the 2016/17 season. This site has been monitored since 2009/10 and accounted for seven ‘Action’ results on 125 sampling occasions within the same time frame. This means the site was considered suitable for swimming 94 percent of the time during the summer season in the last eight years.

The site was part of the investigation programme in 2016/17. This site is subject to occasionally elevated faecal indicator bacteria levels and will remain in the site investigation programme for the 2017/18 season.

Weekly monitoring will also continue throughout the summer months as part of the RSWQP.

3.2. New Sites to be Monitored in 2017/18

Thirteen freshwater sites and 46 coastal sites will be monitored over summer 2017/18 as part of the recreational swimming water quality programme.

Due to elevated bacteria levels last season, the following sites will be added to the investigation programme:

- ✓ Waipoua swimming hole

3.3. Summary of Proposed Work 2017/18

All sites listed in Table 3 will be monitored weekly and samples will be analysed for microbial source tracking if an ‘Action’ result is recorded. Catchment profiling or sanitary surveys may be undertaken depending on the identified source(s) of contamination. If a source of contamination is identified as human, the relevant District Council will undertake a sanitary survey.

Table 3: Site investigation proposed work 2017/18 – IR: If required, Tick (✓): to be completed.

Site Name	Weekly Monitoring	Faecal Source Analysis	Catchment Profiling	Sanitary Survey
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Hatea at Whangarei Falls	✓	✓	IR	IR
Kerikeri at Rainbow Falls	✓	✓	IR	IR
Matapouri Southern Bridge	✓	✓	Done	n/a
Omapere at Pioneer Walk	✓	✓	IR	IR
Paihia at Waitangi Bridge	✓	✓	IR	n/a
Raumanga at Raumanga Valley Park	✓	✓	IR	IR
Rawene	✓	✓	IR	IR
Ruakaka below Motor Camp	✓	✓	IR	IR
Victoria at DOC Reserve Crossing	✓	✓	Done	IR
Waipoua swimming hole	✓	✓	IR	IR
Wellington's Bay	✓	✓	IR	IR

4. Summary and Conclusion

Over the previous summer seasons a total of 27 sites, listed in Table 4 below, were studied as part of a Council initiative to investigate water quality issues at problem sites in the region.

Table 4: Results from microbial source tracking work undertaken from 2007 to 2015. D: Dog, H: Human, R: Ruminant, W: Wildfowl, P: Plant decay. Sources in bold indicate a strong positive markers. Site names in bold are permanent monitoring sites and sites with an asterisk indicate a coastal enclosed site.

Site	2007/08	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Coopers Beach		D/W	R/W/P						
Kaihu River			R/W						
Kapiro Stream			R/W						
Kerikeri at Rainbow Falls								R	R/W
Kerikeri at Stone Store			W	R	R/W				
Kerikeri at Skudders Beach			R/W						
Langs Beach at Toilets	R/W	W	D/R/W						
Langs Beach (Midway)	R/W	W							
Mangawhai Motor Camp*			W	W					
Matapouri Northern Bridge*			R/W		R/W/P	R/W/P	R/W/P		
Matapouri Southern Bridge*			W				R/W/P		
Ngunguru at School			W	W					
Ocean Beach Stream	W		H/R/W						
Omamari Beach Stream			R						
Otamure Bay Stream	R/W	R/W	R						
Pacific Bay Stream		W							
Pahi at Jetty*		H		W	W/P				
Pahia at Te Haumi River					W/P				
Pahia at Waitangi Bridge					R/W	R/W	R		
Raumanga at Park	W				H	R/W/P	R	W	
Ruakaka Motor Camp					R	R	R/W/H		
Tirohanga						R/P	R		
Victoria at DOC Reserve				W	W/P/H	W/P	H	R/W	W
Waipu Cove		W	D/R/W						
Waitangi at Wakelins						R	R		
Hatea at Whangarei Falls	R/W	W	D/R/W					R/W	R/W
Woolley's Bay						W/P			

To date, results from microbial source tracking analyses indicate that contamination by wildfowl occurred at 24 sites – mostly ducks and/or gulls – 20 sites were contaminated by ruminant and four sites by dog faecal material. Contamination by a human source was recorded at Ocean Beach Stream, Pahi Jetty, Raumanga Stream, Ruakaka and Victoria River.

More information is required at some sites to confirm the source of contamination and therefore further samples will be collected in 2017/18. An additional site – Waipoua swimming hole – identified as having elevated bacteria concentrations will be added to the investigation programme for 2017/18.

At the end of the 2017/18 season, results for all remaining sites will be summarised and used to inform the work to be done at each site, whether it be permanent signage, land management or further investigation.



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