

RECREATIONAL BATHING WATER QUALITY IN NORTHLAND

SUMMER 2008-09



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EXECUTIVE SUMMARY

- During the summer of 2008-09, 19 freshwater and 43 coastal swimming sites were monitored through the Recreational Bathing Water Quality Programme. Water samples were collected from each site once a week, starting on the 28 November 2008 and finishing on the 12 February 2009, with additional sampling undertaken at selected sites for two weeks over the Easter period.
- Pollution indicator bacteria (*E. coli* in freshwater and Enterococci in coastal water) counts were carried out on each sample and the results compared to the Ministry for the Environment (MfE) and Ministry of Health's **Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas**.
- Each site was given a weekly grading based on these results, indicating the sites suitability for recreational bathing – green for 'safe', amber for 'caution' or red for 'unsafe'. These gradings, along with the bacterial counts, were displayed on the Northland Regional Council (NRC) website – www.nrc.govt.nz/swimming - at the end of each week.
- Results were also forwarded to the District Councils and District Health Board at the end of each week. It is the responsibility of the relevant District Council to action any amber (alert to a problem) or red (action necessary) results, either by undertaking further investigative sampling or by erecting public warning signs.
- During the 2008-09 sampling season, two freshwater sites complied with the relevant guidelines on all sampling occasions. In addition, 22 coastal sites complied with the relevant guidelines on all sampling occasions.
- Of the freshwater sites sampled, five had a compliance rate of less than 75%. These sites included Otamure Bay stream, middle Langs Beach stream, Otua stream, Kerikeri at Stone Store and Coopers Beach stream. Only two coastal sites, Ngunguru at toilets and Tinopai below creek, had a compliance rate of less than 75%.
- Samples taken from other sites in the programme complied with the guidelines on most sampling occasions however some results were elevated above the recommended guidelines, particularly after heavy rainfall.
- Interim 'suitability for recreation grades', based on the MfE guidelines, have been produced for sites in the programme that have sufficient data. Although these gradings can indicate the suitability of a site for recreational bathing purposes, the calculation used tends to produce a conservative estimate and can overstate the health risks at some sites.
- During 2008-09, further investigations were undertaken at two problem sites in order to isolate the source of contamination. At Coopers Beach stream the results proved inconclusive and further investigations will be undertaken at this site during 2009-10. Investigative work at the Ngunguru toilet site traced the source of contamination back to a long-drop sited too close to a contributing stream.
- Fifteen sites were also graded for their suitability for recreational shellfish gathering. Only one site, Oakura, complied with the microbiological water quality guidelines during the summer months.

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1 INTRODUCTION

The Recreational Bathing Water Quality Programme is a joint project, administered by the Northland Regional Council (NRC), in partnership with the Northland District Health Board (DHB), and the Far North District Council (FNDC), Whangarei District Council (WDC) and Kaipara District Council (KDC). The aim of the programme is to provide information on water quality at popular freshwater and coastal swimming sites in Northland, to allow the public to make an informed decision about where is safe to swim.

In Northland, bathing sites, particularly freshwater sites or those with a freshwater influence (such as harbours and estuaries), are not always safe for recreational use. Water can sometimes be contaminated with human or animal effluent, which contains large numbers of illness causing organisms. These organisms, called pathogens, can include “bugs” such as giardia (*Giardia lamblia*) and campylobacter (*Campylobacter jejuni*).

The most common sources of pathogenic contamination are human sewage (from sewage spills or leaking septic tanks), storm water and rural run-off (Jarman, 2002a). In Northland, stock access to waterways and waterfowl are also a contributing factor. Contamination from human sewage is perhaps the easiest to identify and ‘fix’. However, the effects of storm water and rural run-off are not as easy to identify and mitigate. No matter what the source, the potential for causing illness is the same (Jarman, 2002a).

The objective of the programme is to facilitate ‘safer’ swimming in Northland, by identifying problem sites and informing the public of the implications of recreational contact with contaminated water. Once problem sites have been identified, the Regional and District Councils can also work together to identify the source of contamination and work towards improving water quality at these sites.



Photo: Matapouri beach, Tutukaka coast

2 HEALTH RISKS

Swimming in contaminated water can lead to skin, eye and ear infections; gastrointestinal and respiratory illnesses (Jarman, 2002a). Most pathogens are ingested when contaminated water is swallowed, but inhalation of contaminated water has also been identified as a route of infection (MfE 2002). Pathogens may also enter the body through the mucus membranes in the nose and mouth and through open wounds on the body.

Pathogenic organisms associated with contaminated water can cause significant ill health. Campylobacteriosis, for example, can cause fever, severe abdominal pain, nausea and diarrhoea, with symptoms lasting up to ten days (Jarman, 2002b). Depending on the type of disease and the severity of the infection, hospitalisation may be required.

2.1 Acceptable risks

The amount of pathogens a person needs to ingest before becoming sick varies from many thousands to a single pathogen, and depends on a number of factors. When you consider how small bacteria and viruses are, and how big water bodies can be (including the sea), it makes it impossible to ever guarantee that any water is safe to swim in. This uncertainty is the reason that health authorities recommend you boil any untreated freshwater before consuming it.

Instead, when determining how safe a body of water is for recreation, it is better to consider things in terms of *maximum acceptable risk*. If only one person in a million became ill after swimming at a site, it is unlikely to be of concern. On the other hand, if every swimmer got sick, the risks become unacceptable. The maximum acceptable risk falls somewhere between the two; some people may get sick from contact with the water but not so many as to become a strain on health resources, or pose a significant risk to human life.

For freshwater recreation in New Zealand, the Ministry for the Environment (MfE) and the Ministry of Health (MoH) has set the maximum acceptable risk at 8 in every 1000 users falling ill as a result of contact with contaminated water (MfE, 2002; MfE 2003). For marine waters, the maximum acceptable risk is 19 in every 1000 users. These figures are based on both international and New Zealand studies.

2.2 When to avoid contact recreation

In order to minimise the risk when using our coastal and fresh water sites for contact recreation, a number of simple rules should be followed:

CLARITY

Stagnant and/or murky water contains more pathogens than crystal clear and/or flowing water. Research has shown that there is a link between suspended solids in water (which reduce water clarity) and agricultural run-off (which can contain high levels of pathogens). **A good way to reduce your risk is to only swim¹ in water in which you can see your feet when you are standing knee deep.**

¹ The term 'swimming', when used in this report, refers to all contact recreational uses of a water body, for example, diving, water skiing and swimming.

DISCOLOURATION, FOAMS AND ODOUR

Water can be unsafe for swimming if it has an unpleasant or unusual smell, if it is discoloured or if there is foam or a slick on the water's surface. Even if the water is relatively clear, foams, discolouration and/or odour are often a sign of contamination. **Do not swim in water where there is evidence of contamination.**

RAINFALL

Rainfall has a big impact on water quality in Northland, particularly in fresh water bodies. When it rains, some rainfall runs off the land, carrying contaminants from farmland and urban areas, including animal dung, fertiliser and chemicals. This run-off enters rivers, streams and lakes and eventually, the sea.

In areas of limited mixing, such as lakes or slow-flowing rivers, this can result in elevated levels of contaminants for several days after heavy rainfall. Areas that have greater mixing, for example, open coastal sites where the tide flushes contaminants out to sea, are less susceptible to the effects of rainfall runoff.

In Northland, it is recommended to wait for 48 hours after heavy rainfall before swimming in freshwater or semi-enclosed (harbours and estuaries) coastal sites.



Photo: Wataua stream above Whangarei Falls. Low water clarity after heavy rainfall

3 RECREATIONAL CONTACT GUIDELINES

The Ministry for the Environment (MfE) and Ministry of Health (MoH) released national *Microbiological Water Quality Guidelines* in June 2003. Where practicable, the Recreational Bathing Water Quality Programme has incorporated recommendations presented in these guidelines, and results from the programme can therefore be assessed against the national criteria. This section provides an outline and discussion of the key aspects of the guidelines, which are available online at:

www.mfe.govt.nz/publications/water/microbiological-quality-jun03/

Sites in the programme are graded throughout the sampling season, based on single weekly samples. At the end of the season, sites are also given a 'Suitability for Recreation Grade' (SFRG), which gives an indication of how safe the site is overall for contact recreation.

3.1 Single sample guidelines

The MfE guidelines set a recommended course of action for the treatment of data collected during the survey season. Under the current guidelines, each sample falls into one of three categories depending on levels of bacteria present. For freshwater sites, these are: Acceptable (green), Alert (yellow), or Action (red), as shown in Table 1. For coastal sites, these are: Surveillance (green), Alert (amber), or Action (red), as shown in Table 2.

Results are sent to the District Councils and District Health Board at the end of each sampling week. Any 'alert' or 'action' results are notified to the relevant District Council within 24 hours, so that they can instigate further investigative sampling or erect warning signs. All results are also advertised on the NRC website – www.nrc.govt.nz/swimming - at the end of each week.

<i>E. coli</i> count	Category	Suggested response
Sample < 260 per 100 mL	Acceptable	<ul style="list-style-type: none">No response necessary – Continue weekly sampling
260 < Sample < 550 per 100 mL	Alert	<ul style="list-style-type: none">Increase sampling to dailyUndertake sanitary survey to isolate source of faecal contamination
Sample > 550 per 100 mL	Action	<ul style="list-style-type: none">Increase sampling to dailyUndertake sanitary surveyErect warning signsInform public through the media that a public health risk exists

Table 1: Single sample guidelines for freshwater sites (MfE 2003)

Enterococci count	Category	Suggested response
Sample < 140 per 100 mL	Surveillance	<ul style="list-style-type: none"> No response necessary – Continue weekly sampling
140 < Sample < 280 per 100 mL	Alert	<ul style="list-style-type: none"> Increase sampling to daily Undertake sanitary survey to isolate source of faecal contamination
Sample > 280 per 100 mL	Action	<ul style="list-style-type: none"> Increase sampling to daily Undertake sanitary survey Erect warning signs Inform public through the media that a public health risk exists

Table 2: Single sample guidelines for coastal sites (MfE 2003)

3.2 The Microbiological Assessment Category (MAC)

The **Microbiological Assessment Category (MAC)** is established by looking at existing microbiological data collected for a site. Ideally, each site analysed should have 100 samples or greater collected over the previous five years. These results are added together and the 95th percentile of the dataset calculated (95% of the samples fall below this number).

The MfE guidelines group the possible range of microbiological results for both coastal and freshwater sites into four categories, ranging from A to D as presented in Tables 3 and 4 below. Sites are allocated a category according to their 95th percentile.

A	Sample 95 th percentile ≤ 130 <i>Escherichia coli</i> per 100 mL
B	Sample 95 th percentile 131-260 <i>Escherichia coli</i> per 100 mL
C	Sample 95 th percentile 261-550 <i>Escherichia coli</i> per 100 mL
D	Sample 95 th percentile > 550 <i>Escherichia coli</i> per 100 mL

Table 3: Microbiological Assessment Category (MAC) definitions for freshwater

A	Sample 95 th percentile ≤ 40 enterococci coli per 100 mL
B	Sample 95 th percentile 41-200 enterococci coli per 100 mL
C	Sample 95 th percentile 201-500 enterococci coli per 100 mL
D	Sample 95 th percentile > 500 enterococci coli per 100 mL

Table 4: Microbiological Assessment Category (MAC) definitions for marine

3.3 The Sanitary Inspection Category (SIC)

The **Sanitary Inspection Category (SIC)** identifies the principal potential source of microbiological contamination for a site, for example, an adjacent sewage treatment plant, and assigns a category for the site according to risk from this source.

In order to determine the SIC for a site, the potential and probable suppliers of faecal bacteria are listed and the most prominent source of contamination is chosen. The MfE guidelines have grouped the most commonly occurring sources of contamination into five categories, as shown in Table 5 below. Once the major source of faecal contamination for a water body has been identified, a SIC can be assigned.

Sanitary Inspection Category	Examples Of Source
Very Low	No significant source; indirect run-off from native bush or forest.
Low	Indirect run-off from horticulture or low-intensity agriculture/urban/rural catchment; direct run-off from forests.
Moderate	Urban stormwater not contaminated by sewage; receives tertiary treated discharge or sewage overflows; agricultural or rural catchment; significant feral bird/animal population.
High	Tertiary treated wastewater discharged to beach or adjacent area; urban stormwater; marinas or moorings; direct run-off from intensive agriculture or unrestricted access of stock to waterways, significant bird populations.
Very High	Direct discharge of untreated sewage or on-site waste treatment systems (including leaking septic tanks).

Table 5: Sanitary Inspection Category (SIC) Definitions (MfE 2003)

3.4 The Suitability for Recreation Grade (SFRG)

The **Suitability for Recreation Grade (SFRG)** is determined by combining the MAC and SIC of a recreational bathing site. There are five grades, ranging from very good to very poor. Table 6 below shows how the MAC and SIC scores combine. An explanation of the various grades follows.

Suitability for Recreation Grade		Microbiological Assessment Category (MAC)			
		A	B	C	D
Sanitary Inspection Category (SIC)	Very low	Very good	Very good	Follow up [†]	Follow up [†]
	Low	Very good	Good	Fair	Follow up [†]
	Moderate	Follow up [†]	Good [†]	Fair	Poor
	High	Follow up [†]	Follow up [†]	Poor	Very poor
	Very high	Follow up [†]	Follow up	Follow up	Very poor

Table 6: Suitability for Recreation Grade Guidelines (MfE 2003)

Note: If there is insufficient data to calculate the MAC (100 samples over 5 years), then the grade given should be considered an interim grade only.

[†] Implies non-sewage source of faecal contamination, and this needs to be verified.

[†] Unexpected results, which require further investigation (either SIC or MAC needs to be reassessed).

Although the SFRG can give an indication of a site's suitability for swimming, it can be unduly restrictive and does not take into account the effects of weather and rainfall on water quality. Northland has a semi-tropical climate and unpredictable rainfall patterns, including frequent high intensity rainfall events. Coupled with Northland's steep topography, these rainfall events can wash significant amounts of contaminants off the land.

As the MAC assessment is based on the Hazen 95th percentile, it typically only takes one elevated *E. coli* result caused by a single rainfall event to give a 95th percentile above 550 *E. coli* per 100 mL and therefore a MAC assessment of 'D'. This automatically means the site can only be given an SFRG of 'poor' or 'very poor', which may not be representative of actual results.

SFRG = VERY GOOD

Without any significant sources of faecal contamination, a site with a "Very Good" SFRG may be considered suitable for contact recreation at all times. A site with a "Very Good" SFRG may not require regular sampling in the future.

SFRG = Good

While water quality is generally good at a "Good" site, potential sources of faecal contamination, such as indirect agricultural run-off or non-sewage stormwater, can make the site unsuitable for contact recreation during and after periods of significant rainfall. Regular monitoring of such sites is necessary as there is a possibility that the water quality could deteriorate with future development of the upstream catchment.

SFRG = FAIR

At sites with a "Fair" grade, water is usually suitable for contact recreation but sources of contamination, such as direct discharges from low-intensity agriculture and stormwater drains or indirect discharges from intensive agriculture, may mean that these sites are unsuitable for swimming during or immediately after heavy rainfall. MfE recommends that such sites should be monitored weekly during popular times of the year (for example, summer school holidays).

SFRG = POOR

The water at sites with a "Poor" grade tends to breach alert guidelines on a regular basis. Direct discharges from intensive agriculture or tertiary treated sewage, or indirect discharges from leaking septic tanks and other untreated wastes, mean that these sites are generally unsuitable for swimming. Because of the nature of contamination, this grading stands even during dry periods and territorial authorities may choose to erect permanent warning signs, especially if weekly sampling is discontinued at such sites.

SFRG = VERY POOR

Sites that receive a grade of "Very Poor" should not be used for recreational activities. Direct discharges of faecal material from sources such as leaking septic tanks or untreated wastewater mean that local authorities should erect permanent warning signs at such sites, advising that the water is categorically unsuitable for use.

4 METHODOLOGY

4.1 Sampling Technique

Sampling is undertaken once a week, at selected freshwater and coastal sites, throughout the summer months. In 2008-09, sampling ran from 28 November 2008 to the 12 February 2009, with additional samples taken from selected sites (Whangarei Heads, Ruakaka, Onerahi and Ngunguru) during the Easter holidays. Sampling is undertaken regardless of weather conditions but weather at the time of sampling is noted and water temperature is also recorded.

In 2008-09, NRC staff collected 12 samples from each site in the programme during the summer months. Each sample was collected following the methods in the '*Microbiological Water Quality Guidelines for Freshwater and Marine Recreational Bathing Areas*' (MfE, 2002). Samples are taken from the shore at about 0.5m depth.



Photo: NRC staff undertaking water quality sampling

4.2 Sample Analysis

It is an expensive and difficult procedure to identify and count pathogens in water. Instead NRC uses indicator bacteria to grade water quality at each site, as recommended in the MfE guidelines. For freshwater sites, the indicator bacteria *Escherichia coli* (*E. coli*) is counted. This bacterium indicates faecal pollution and scientific studies have shown that where *E. coli* is present, we can safely assume there are pathogens in the water (MfE, 2002).

For coastal waters, both enterococci and faecal coliforms are counted. The New Zealand Marine Bathing Study showed that enterococci are the indicator most closely correlated with health effects in New Zealand marine waters. Faecal coliforms are not as closely related to human health effects however they are useful in environmental circumstances, such as brackish or estuarine environments, where levels of enterococci may be misleading (for example, naturally occurring enterococci are known to reproduce successfully in organic matter contained within mangrove forests).

All samples are analysed in the NRC laboratory using the procedures in the '*Standard Methods for the Examination of Water and Wastewater*' (APHA, 1998).

5 SAMPLING SITES

Due to the large number of coastal and freshwater swimming sites in Northland, it is not practical or economically viable to monitor every one. NRC, along with key stakeholders, reviews sites to be monitored at the start of each bathing season and chooses sites based on popularity, and/or because of a specific request from the public or if there is a suspected human health risk associated with microbiological contamination.

In the 2008-09 sampling season, a total of 19 freshwater sites and 43 coastal sites were monitored through the programme, as shown in Table 7 (below). Sites highlighted in orange were added for the 2008-09 season, either to increase coverage in these areas (Opua and Victoria River) or because of suspected water quality issues (Kaneke stream).

Freshwater Site	Location	Site number	District
Otamure Bay Stream	Otamure Bay, Whananaki	108859	Whangarei
Lake Waro	Hikurangi	107272	
Waitaua Stream	Whangarei Falls	105972	
Raumanga Stream	Raumanga reserve	103246	
Kaikou River	Pipiwai	108919	
Langs Beach Stream	Middle of Langs Beach	104539	
Victoria River	At DOC Reserve	104908	Far North
Waipapa River	Puketi Forest	103248	
Waipapa River	Waipapa Landing	105706	
Kerikeri River	Stone Store	101530	
Waitangi River	Lily Pond Reserve	104830	
Tirohanga Stream	Tirohanga Road	102252	
Kapiro Stream	Purerua Road bridge	102838	
Waipoua River	DOC camping site	108613	
Mangakahia River	Twin Bridges	105973	
Kaneke Stream	Coopers Beach	101870	
Otaua Stream	Kaikohe	108510	
Kaihu River	Motor camp	102221	
Omamari Beach Stream	Omamari Beach	102305	
Coastal Site	Location	Site number	District
McLeod Bay	By toilet	101254	Whangarei
Taurikura	By toilets	101262	
Urquharts Bay	Before rock wall	108311	
Pataua South	Footbridge	102217	
Pataua South	East end of beach	104986	
Onerahi	Foreshore	101600	
Whananaki	Footbridge	103147	
Whananaki	East end of bay	106938	
Oakura	North end of beach	101345	
Ohawini Bay	From beach	105388	
Teal Bay	From beach	101331	
Langs beach	Mid way along beach	108318	
Langs beach	North end of beach	108317	
Waipu Cove	From beach	108316	
Ruakaka	Near surf club	108315	
Ruakaka	By motor camp	108314	
Ngunguru	Motor camp	100073	
Ngunguru	By Norfolk Pine	100076	
Ngunguru	By toilet	108320	
Church Bay	From beach	105448	
Kowharewa Bay	From beach	106444	

Coastal Site	Location	Site number	District
Pacific Bay	From beach	108313	
Matapouri	First bridge	100711	
Matapouri	Second bridge	100712	
Opuia	Foreshore	101418	Far North
Paihia	Te Haumi	101195	
Paihia	Beside toilets	101194	
Paihia	Waitangi bridge	101183	
Kerikeri	Skudders beach	100974	
Coopers Beach	Foreshore	101066	
Cable Bay	Beach	105780	
Taipa	Beach	105777	
Rawene	Boat ramp	100236	
Opononi	Beach	106011	
Omapere	Beside jetty	102317	
Pahi	Broken rocky groyne	102579	
Pahi	North west of jetty	102198	
Tinopai	Below shops	102310	Kaipara
Tinopai	Below creek	101232	
Whakapirau	Beach	106100	
Mangawhai	At macrocarpa tree	101830	
Mangawhai	Above motor camp	100709	
Mangawhai	Opposite Norfolk pine	101832	

Table 7: Sites monitored in 2008-09

5.1 Sites Removed

Both freshwater and coastal sites in the programme were reviewed before the start of the 2008-09 sampling season. As a result of the review, eight freshwater sites and 15 coastal sites were removed from the monitoring programme (see Table 8 below). Sites removed had consistently good water quality, and an SFRG of Very Good (do not require further sampling in the future) or consistently very poor water quality, and an SFRG of Very Poor (permanent warning signs erected at these sites). If multiple sites were identified in close proximity to each other, some of these sites were also removed (these are identified in red in the table below).

Coastal Sites Removed	Site number	District	Grade
Oakura below shop	101346	Whangarei	Good
Pataua North	105992	Whangarei	Very good
Matapouri beach	101107	Whangarei	Very good
Ngunguru cable marker	100061	Whangarei	Fair
Bay of Islands English bay	100802	Far North	Very good
Bay of Islands Okiato point	105712	Far North	Good
Kawakawa Fuller's jetty	100581	Far North	Good
Kawakawa first pile	100643	Far North	Good
Kerikeri Windsor landing	105707	Far North	Very good
Dove's Bay	101537	Far North	Good
Paihia below junction	101186	Far North	Poor
Russell mid-south	105711	Far North	Very good
Russell mid-north	105710	Far North	Very good
Mataurahi Bay	102636	Far North	Very good
Opito Bay	101538	Far North	Very good
Freshwater Sites Removed	Site number	District	Grade
Ocean Beach stream	102077	Whangarei	Very poor

Freshwater Sites Removed	Site number	District	Grade
Langs Beach stream (southern end by toilets)	100686	Whangarei	Very poor
Wairoa stream (Ahipara)	105053	Far North	Very poor
Otiria stream	105376	Far North	Very poor
Lake Ngatu launch site	100401	Far North	Good
Lake Ngatu south	100402	Far North	Very good
Lake Taharoa pump house	105434	Kaipara	Very good
Lake Taharoa promenade point	100447	Kaipara	Very good

Table 8: Sites removed from the programme prior to the 2008-09 sampling season

5.2 Permanent Monitoring Sites

For the purposes of monitoring NRC's performance, performance targets are laid out in the Long Term Council Community Plan (LTCCP) 2009-2019. For the Recreational Bathing Water Quality Programme the performance target is:

Annual Median % compliance of 20 representative bathing sites complies with Ministry of the Environment guidelines.

The baseline for this target is the average % compliance for these sites in 2007-08, which was 95%.

Due to the large number of sites monitored through the programme, and as some sites may be removed or added each year (which would effect overall % compliance if all sites were used) 20 sites have been randomly selected from the programme to be monitored every year to measure performance. These sites are listed in Table 9 below.

Site Name	Site Number	% compliance in 2007-08
Opononi	106011	100
Taipa	105777	92
Paihia – Waitangi bridge	101183	92
Pahi – rocky groyne	102579	100
Tinopai – below shops	102310	100
Taurikura	101262	92
Matapouri – second bridge	100712	85
Church Bay	105448	100
Pacific Bay	108313	100
Pataua South – east of beach	104986	92
Onerahi – play ground	101600	100
Ruakaka – by motor camp	108314	100
Lang's beach – mid beach	108318	100
Teal Bay	101331	92
Waipu Cove	108316	100
Kerikeri – Stone Store	101530	77
Waipoua River	108613	85
Waipapa River – Puketi	103248	92
Lake Waro – Hikurangi	107272	100
Raumanga Stream	103246	54

Table 9: Permanent monitoring sites

6 RESULTS & INTERPRETATION

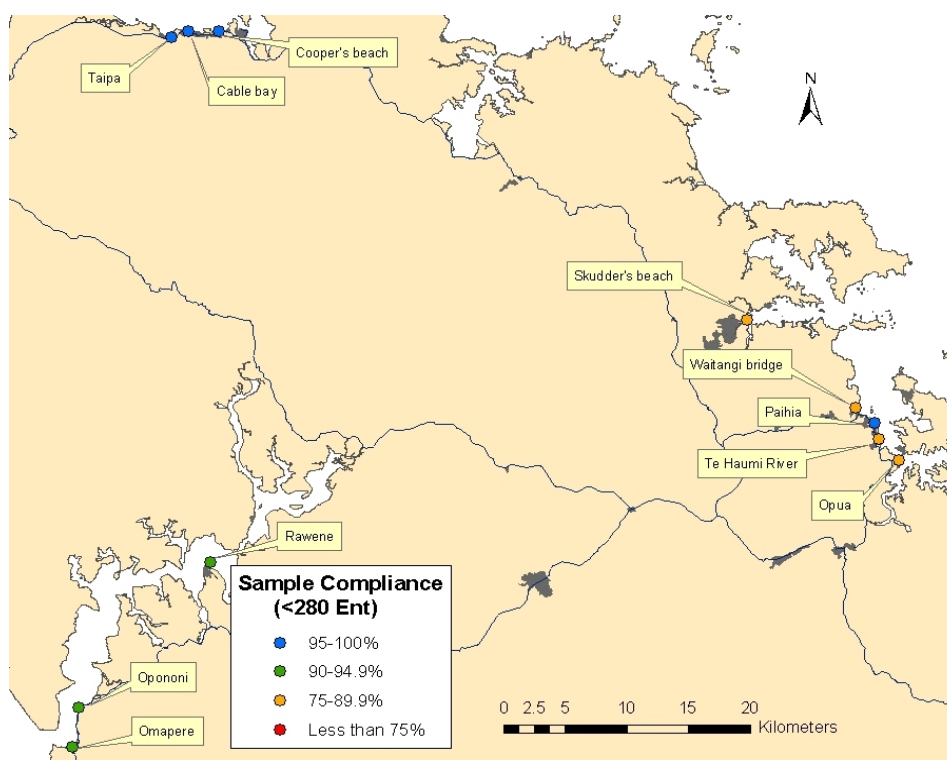
The results for each site sampled in 2008-09 can be viewed in Appendix 1. The maps below summarise the % compliance of samples from each site for the 2008-09 season, along with the interim SFRG, which has been recalculated for each site from 2007-08, using this years data.

Compliance rates can be compared to the MfE guidelines whereby if greater than 95% of samples are compliant, a site can be classified as 'good' or 'very good' for swimming; if 90-95% of samples are compliant a site can be classified as 'fair'; if 75-95% of samples are compliant, a site can be classified as 'poor' and if less than 75% of samples are compliant, a site can be classified as 'very poor'.

6.1 Coastal Sites

FAR NORTH

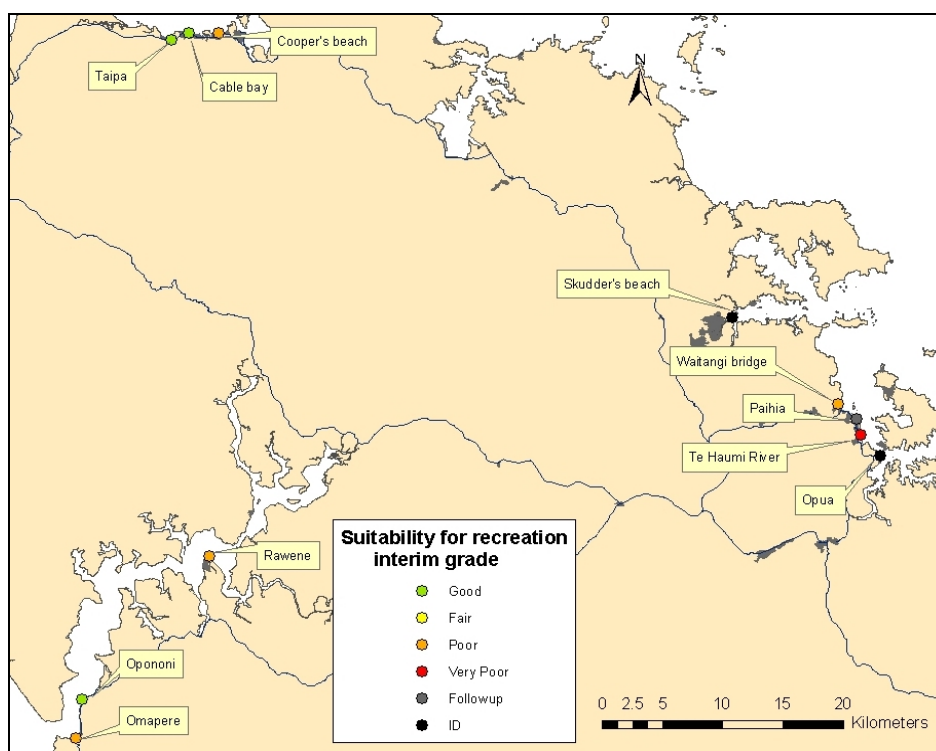
The map below summarises the compliance rates for samples taken from each site in the Far North during the 2008-09 summer season.



As can be seen, sites around the Hokianga harbour and Taipa had a high compliance rate and most sites were 'very good' or 'good' for swimming during 2008-09. However, sites around the Bay of Islands (BOI) had a lower compliance rate. The only site to be graded as 'very good' in this area during 2008-09 was Paihia. Remaining sites had a compliance rate between 75 – 90% and were therefore graded as 'poor' for swimming.

The site with the lowest compliance rate in this area during 2008-09 was the Te Haumi River site, which is highly influenced by rainfall and freshwater input. Other sites in the BOI are also affected by freshwater input and samples collected after heavy or prolonged rainfall were those that contained the highest levels of bacteria.

The map below shows the interim SFRG grades for sites in the Far North, incorporating data from the 2008-09 sampling season. As can be seen, these results do not necessarily correlate with compliance rates for the season and some sites that are generally good for swimming have an SFRG of 'poor'. For a discussion of the drawbacks of using the SFRG, please see [Section 3.4 – Suitability for Recreation Grade](#), above.

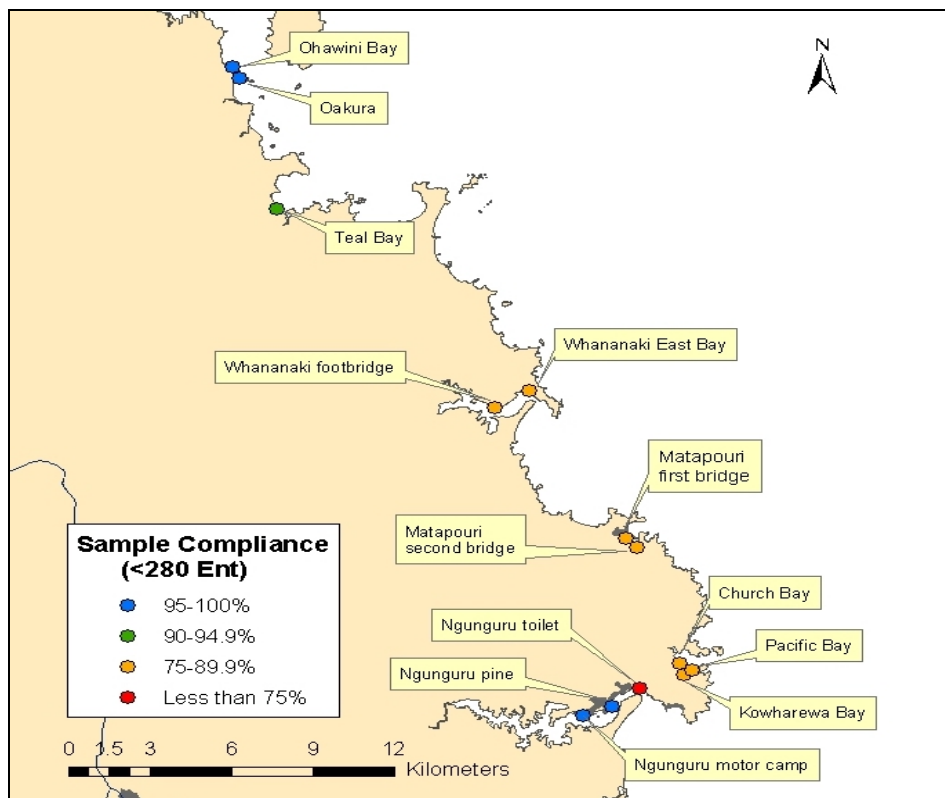


EAST COAST

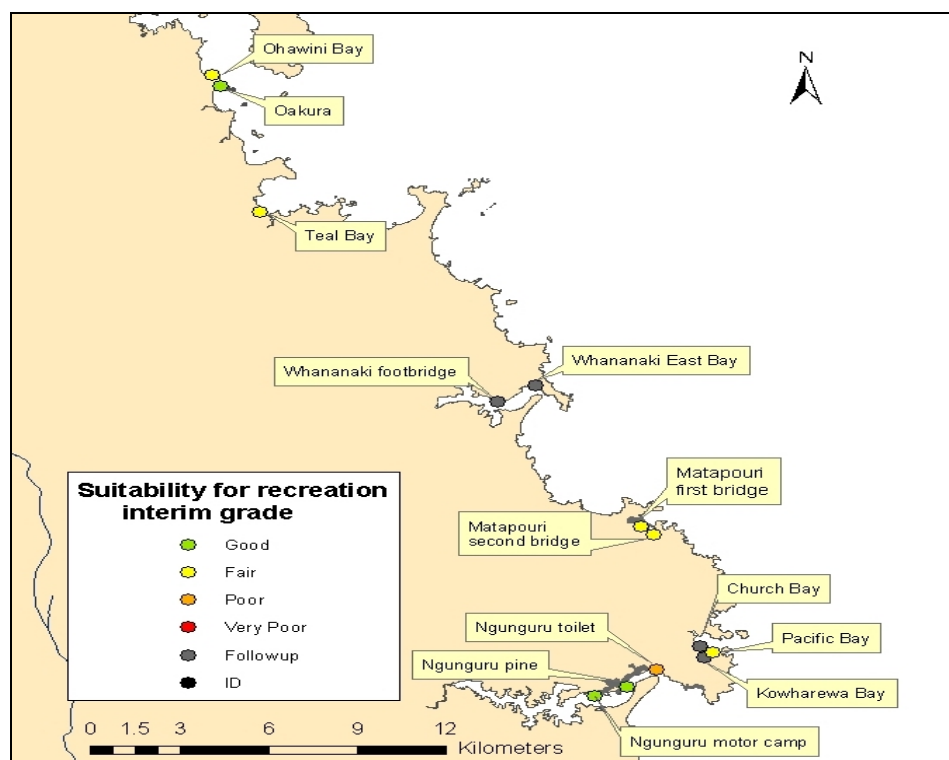
The map below summarises the compliance rates for sites on the east coast during the 2008-09 summer season.

As can be seen, sites located on more open coast, for example, Oakura and Ohawini Bay, had good water quality and high compliance rates during 2008-09 and were classified as 'very good' or 'good' for swimming. Sites in more enclosed coastal waters, for example, Whananaki, had poorer water quality and lower compliance rates and were generally classified as 'poor' for swimming. Again, non-compliant results largely related to rainfall events and could therefore be directly related to rainfall runoff, with sites located in more enclosed coastal waters subject to less flushing and more concentrated freshwater input and therefore higher concentrations of bacteria.

The exception to this was Ngunguru estuary. Water quality in the estuary is generally good and two sites, Ngunguru at motor camp and Ngunguru at Norfolk pine, were 'very good' for swimming during 2008-09. However, the site beside the toilets returned non-compliant results on 50% of sampling occasions. This was particularly noticeable on an outgoing tide and was not rainfall related. This site was subject to further investigation at the end of the sampling season. The results from this investigation are discussed in more detail later in this report (see [Results of Investigative Sampling at Ngunguru](#)).



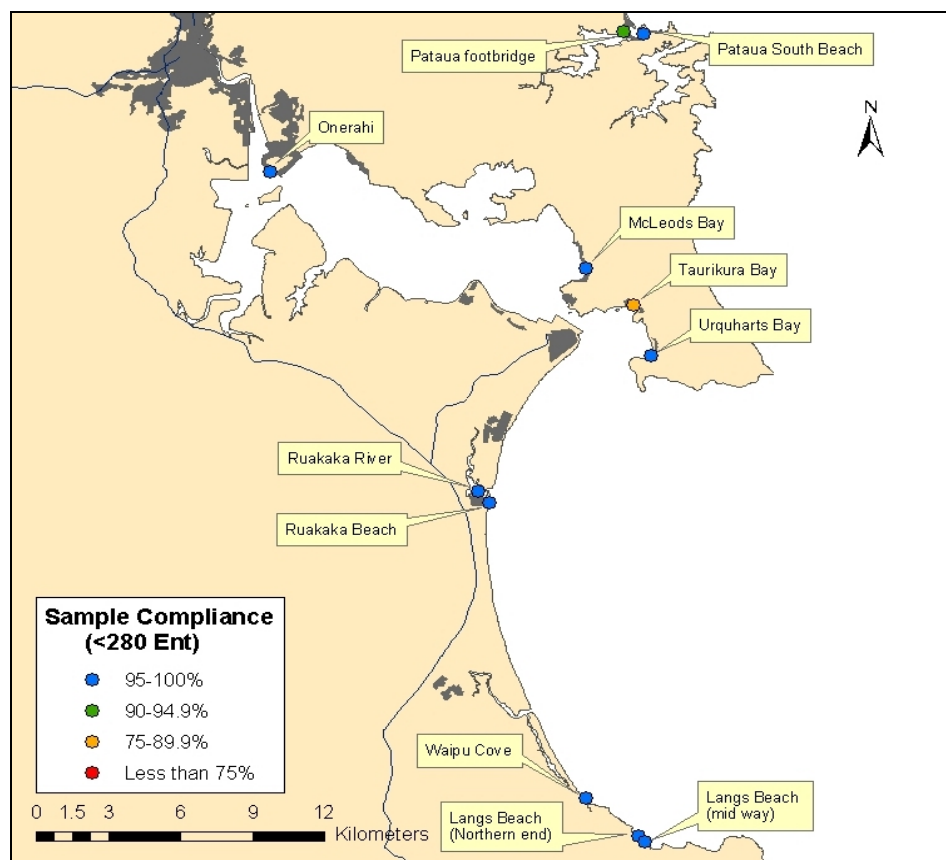
The map below shows the interim SFRG grades for sites along the east coast, incorporating data from the 2008-09 sampling season.



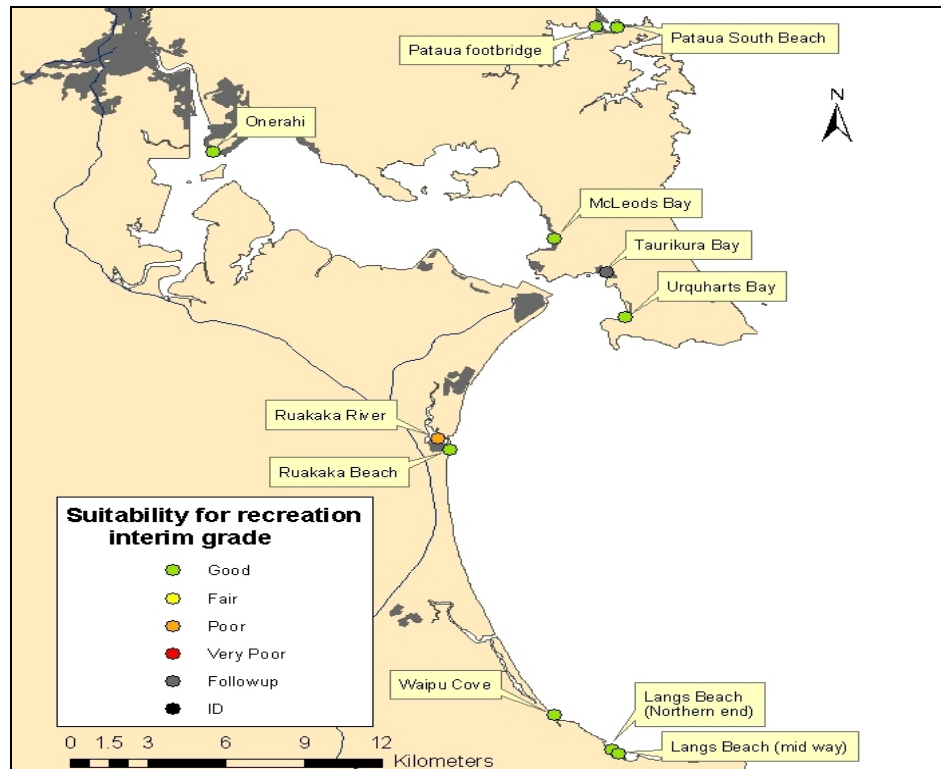
WHANGAREI HEADS AND RUAKAKA

The map below summarises compliance rates for samples taken from sites on the Whangarei Heads and from Ruakaka down to Lang's beach, during the summer of 2008-09. As can be seen, the majority of sites in this area had consistently good water quality and high compliance rates and were therefore graded as 'very good' or 'good' for swimming.

The exception was Taurikura Bay, which returned non-complaint results on three sampling occasions. As no investigation has been undertaken at this site, the source of contamination has not been confirmed however during the summer of 2009, it was reported that a septic tank soakage field had failed in this area, causing pooling of effluent close to the shore. As non-compliant results were recorded on an outgoing tide, this is a likely source of contamination at this site.

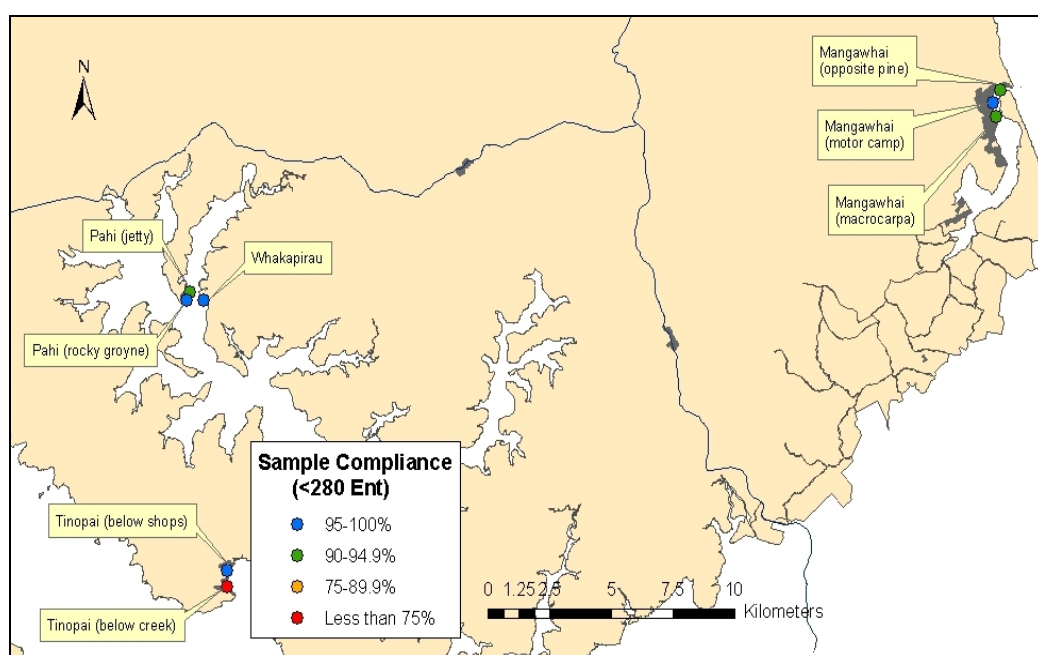


The map below shows the interim SFRG grades for sites in the Whangarei Heads and Ruakaka, incorporating data from the 2008-09 sampling season.

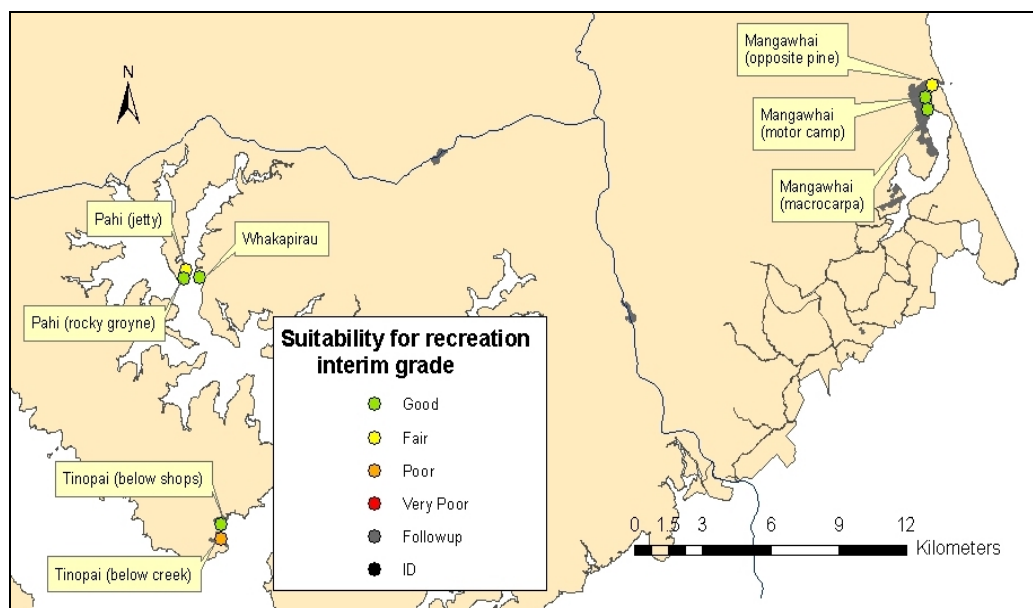


KAIPARA DISTRICT

The map below summarises compliance rates for samples taken from sites in the Kaipara district during the summer 2008-09. As can be seen, the majority of sites had high compliance rates during 2008-09 and were therefore graded as 'very good' or 'good' for swimming. The exception to this was Tinopai (below creek) which returned non-compliant results on 50% of sampling occasions. This site recorded 100% compliance in 2007-08 and this result is therefore of concern as it indicates a recent, persistent, source of contamination. Further investigative sampling will be undertaken at this site during 2009.



The map below shows the interim SFRG grades for sites in the Kaipara District, incorporating data from the 2008-09 sampling season.



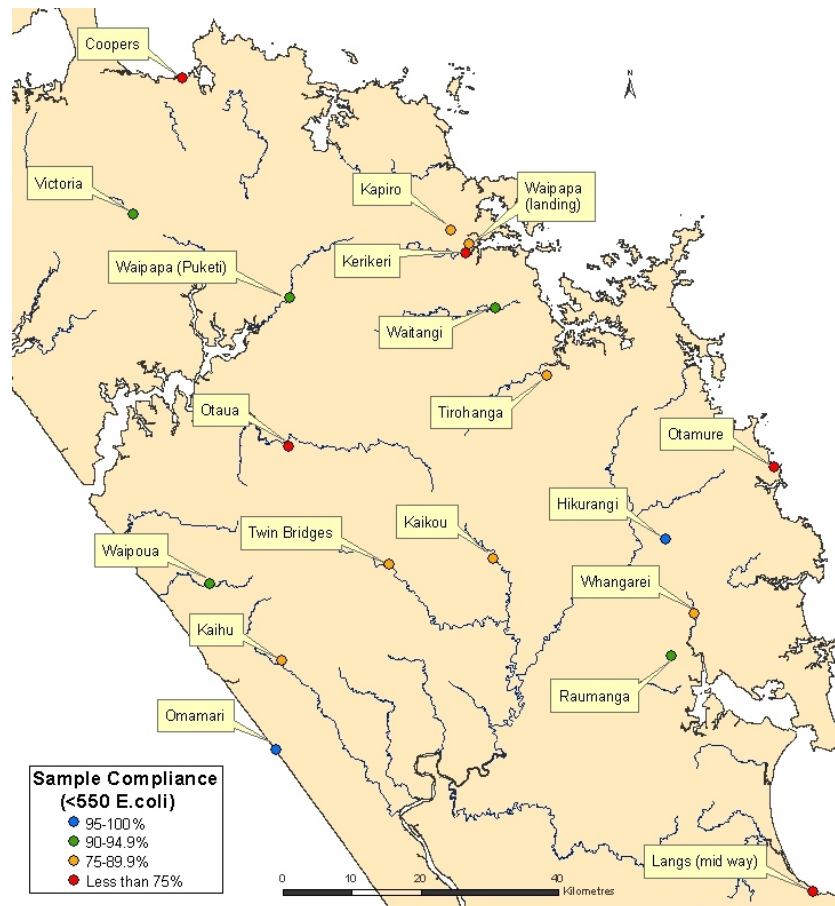
6.2 Freshwater Sites

The map below summarises compliance rates for samples taken from all freshwater sites during 2008-09. As can be seen, freshwater sites in Northland generally had poorer water quality in 2008-09 compared to coastal sites. This is partly due to the fact that freshwater is greatly influenced by rainfall runoff from the land, which can contain high levels of bacteria, and partly due to the fact that any discharge of contaminants into freshwater may take longer to flush through the system.

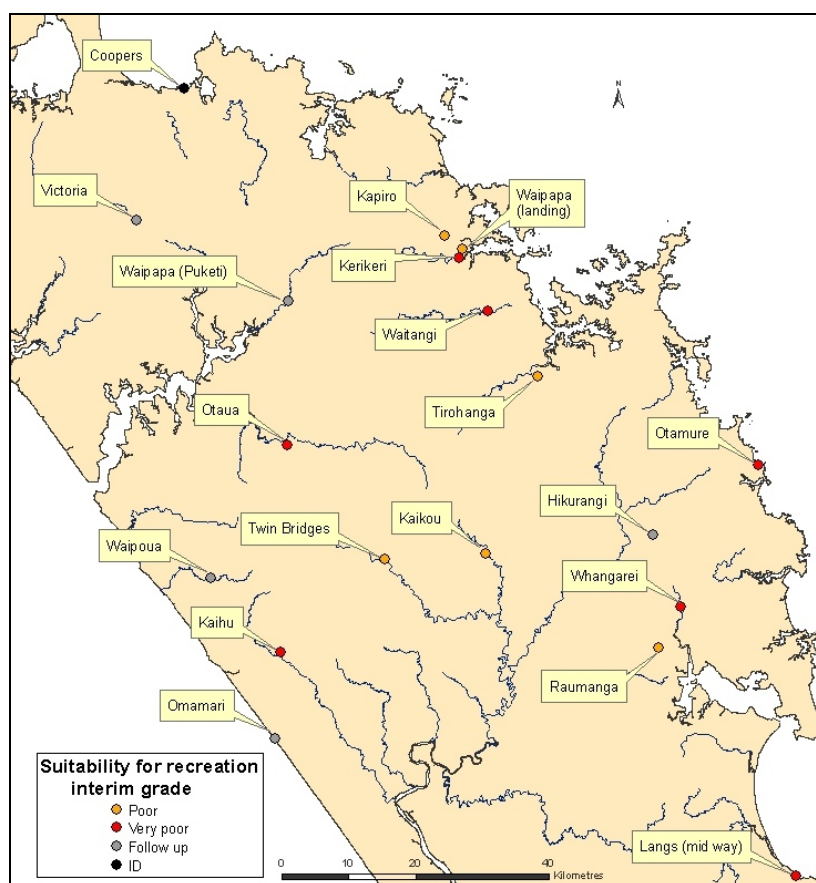
In total, five sites recorded a compliance rate of less than 75% - Otamure Bay Stream, middle Langs Beach stream, Otatau stream, Kerikeri at Stone Store and Cooper's Beach stream. The majority of these sites have a relatively low flow during the summer months and it is easy for contaminants to build up in the water. In particular, it is possible that bacteria may breed in pools of water in streams during periods of low flow and warm weather. More research is needed to explore this theory in Northland.

Faecal source tracking investigations were undertaken for Otamure Bay stream and middle Langs Beach stream in 2007-08. Results from these investigations showed the source of contamination to be herbivores (such as cattle, sheep and horses) and waterfowl (ducks) at both sites. An investigation was undertaken of Cooper's Beach stream (Kanekane stream) in 2008-09. For a discussion of this investigation, please refer to section [7.2 – Results of investigative sampling of the Kanekane Stream](#). No investigation has been undertaken to date on Otatau stream or the Kerikeri river.

Of the remaining sites, two had no incidents of non-compliance, five had only one incidence of non-compliance and seven had two incidents of non-compliance. In most cases, non-compliance was related to rainfall. The results from 2008-09 were better than those recorded in 2007-08, when 10 sites had less than 75% compliance and only one site had 100% compliance. It must be remembered, however, that Northland experienced high rainfall in the summer of 2007-08 and low rainfall in the summer of 2008-09.



The map below shows the interim SFRG grades for all freshwater sites, incorporating data from the 2008-09 sampling season. As can be seen, these grades do not necessarily reflect overall water quality at a site, as one non-incidence of non-compliance in a data set can mean that a site can only be given an SFRG of 'poor' or 'very poor'.



6.3 The National Perspective

In July 2009, MfE released a summary of results for the previous two years for all regions that participate in the recreational bathing water quality programme. Overall, the Northland region had the lowest rate of compliance for freshwater sites, with eight sites having less than 75% compliance. This figure does not tally with results from 2008-09 as it is the median of two years data. Some sites that have been graded as poor, such as Whangarei Falls, Kaikou River and Raumanga Stream, actually had a higher rate of compliance in 2008-09 than in 2007-08.

It is difficult to compare results from Northland to results from other regions that have lower rainfall, or a flatter topography, as they are not as highly influenced by rainfall runoff as Northland. However, there are measures that could be taken to try and improve water quality in the region. Northland is predominantly an agricultural region and investigations have shown a source of contamination at non-compliant sites to be livestock, therefore measures could include fencing waterways in pastoral land to prevent direct stock access and increasing riparian planting to act as a filter to runoff from pastoral land. Other sources of contamination, for example, waterfowl or possums, are more difficult to address.

In addition, it is noted from the report, that some regions sample fewer sites overall (such as Auckland, which only samples four freshwater sites and Waikato, which only samples three freshwater systems). These regions therefore have fewer gradings to publish and less variation in their results.

7 SITE INVESTIGATIONS

In 2008-09, further investigative sampling was undertaken at two sites with consistently high levels of bacteria - Kanekane stream at Coopers Beach and Ngunguru by toilets.

7.1 Identifying the source of contamination

There are several scientific techniques used to assist in identifying the source of bacterial contamination in water. These include faecal sterol analysis, fluorescent whitening agents (FWAs) and polymerase chain reaction (PCR) markers.

FAECAL STEROLS

Sterols are lipids that relate to both plants and animals, for example, 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 the sterol composition of animal faeces can generate distinctive faecal sterol fingerprints. Therefore, 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 ingredients of washing powders and only one is used in New Zealand. In most households, the effluent from toilets is mixed with grey water from washing machines and therefore FWAs are usually linked to human faecal contamination in both septic tanks and community wastewater systems.

PCR 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.

7.2 Results of investigative sampling at Kanekane stream

Kanekane stream at Cooper's beach was re-introduced into the Recreational Bathing Programme in 2008-09, due to concerns over water quality at this popular freshwater swimming site. Results from the 2008-09 season indicated that water quality at this site breached the 'action' (unsafe) threshold on all but one sampling occasion, with some results recording in excess of 16,000 *E. coli* bacteria per 100 mL of water. As results were consistent, rather than rainfall related, it is likely that there is a persistent source of contamination at this site.

At the end of the sampling season, additional samples were taken for analysis - one from a contributing stream upstream of the sample site, one from upstream of the pumping station, one upstream of the residential area and one from the sample site itself.

A sample was taken from the contributing stream in order to rule this out as a potential source of contamination. A sample was taken upstream of the pumping station in order to identify if bacterial levels were lower upstream rather than downstream (indicating whether or not contamination is coming from the pumping station). A sample was taken on the edge of the residential development, to ascertain if contamination is coming from upstream of the Cooper's beach settlement. A further sample was taken from the original sample site in order to identify if contamination is coming from residential development upstream.

Results showed that water within the contributing stream was within guideline limits and this was therefore ruled out as a possible source of contamination. Results from upstream of the residential area were within the 'action' threshold (813 *E. coli* per 100 mL), indicating that some contamination is coming from upstream of Cooper's beach settlement. Results upstream of the pumping station were lower than both the upstream and downstream sites (563 *E. coli* per 100 mL), indicating some improvement in water quality before the stream passes the pumping station. However, by the time water reaches the sample site at Cooper's beach, bacterial levels were again elevated (842 *E. coli* per 100 mL).

Further samples were taken in March 2009 from the sample site and from upstream of the residential area, for faecal source tracking investigations. However, samples taken at this time were below the 'action' threshold (I.E, bacterial levels had dropped in the stream). It was therefore not possible to undertake FWA or faecal sterol analysis on these samples.

Although the potential sources of contamination have been narrowed down at this site, it is still not clear what the main source/s of contamination is. This site will be re-sampled during the 2009-10 survey season and if levels of bacteria are still elevated above the 'action' threshold, further samples will be taken for analysis in order to try to isolate the source of contamination. It appears likely that this site is affected by both upstream discharges from the catchment, and from discharges within the settlement.

7.3 Results of investigative sampling at Ngunguru

The sites sampled at Ngunguru typically have good water quality and are generally within the 'acceptable' (safe for swimming) threshold. However, during the 2008-09 survey season, levels of bacteria at the Ngunguru toilet site frequently exceeded the 'action' or 'alert' threshold. This was in isolation to the other two sites at Ngunguru, which complied with the recommended guidelines on all sampling occasions.

At the end of the season, additional samples were taken from locations adjacent to the sample site in order to try and isolate the source of contamination. Samples were taken from tributary streams feeding into the estuary adjacent to the site, and both upstream and downstream of the toilet block on an outgoing tide. Results from around the toilet block returned low levels of bacterial contamination on the outgoing tide however results from one tributary returned very high levels of *E. coli* bacteria.

Further investigations of the tributary traced the source of contamination back to a long drop toilet sited close to the stream. Whangarei District Council investigated and closed the toilet and has since emptied effluent out of the pit beneath the toilet, and flushed the site clean.

8 WATER QUALITY FOR RECREATIONAL SHELLFISH GATHERING

In addition to assessing sites for their suitability for contact recreation, results from sites popular for recreational shellfish gathering are analysed against the MfE microbiological guidelines for shellfish gathering. The guidelines are based on those used by the shellfish export sector and are internationally accepted. The guidelines use faecal coliforms as an indicator of the potential presence of pathogens and viruses.

8.1 Guideline Values

There are two guidelines values for assessing water quality for shellfish gathering:

- The median faecal coliform content of samples taken over the entire shellfish gathering season shall not exceed a Most Probable Number (MPN) of 14/100 mL;

And

- Not more than 10% of samples should exceed an MPN of 43/100 mL.

Compliance with these guidelines alone does not guarantee that shellfish grown in these waters will be safe for consumption.

8.2 Results 2008-09

The results for 15 sites from the 2008-09 sampling season are shown in Table 10 below. Results indicate that only one site, Oakura, complied with microbiological water quality guidelines for shellfish gathering for this year. However, samples were only taken for 12 weeks over the summer months, not for the entire shellfish gathering season (which, excluding scallops, is all year in Northland). As such, these results can only be used as an indicator of likely suitability.

Site Name	No. of Samples	% Samples >43/100mL	Median Faecal Coliforms	Pass/Fail
Ngunguru - Norfolk pine	12	17	18	Fail
Whananaki - east end	12	58	51	Fail
Oakura – north end	12	8	8	Pass
McLeod Bay	12	17	6	Fail
Taurikura Bay	12	34	6	Fail
Urquharts Bay	12	17	<2	Fail
Pataua – foot bridge	12	25	14	Fail
Ruakaka – motor camp	12	34	34	Fail
Paihia - Waitangi bridge	12	58	117	Fail
Paihia - Te Haumi River	12	42	21	Fail
Taipa	12	25	2	Fail
Coopers Beach	12	25	28	Fail
Tinopai - below creek	11	91	>600	Fail
Mangawhai – above camp	12	42	29	Fail
Pahi – NW of jetty	12	58	52	Fail

Table 10: Results for recreational shellfish gathering sites 2008-09

9 SUMMARY AND CONCLUSIONS

In summary, the results from 2008-09 indicate that most coastal sites sampled were generally 'safe' for swimming, except after heavy or prolonged rainfall. Two sites, Ngunguru at toilets and Tinopai below creek, had a low compliance rate. The site at Ngunguru has been investigated and the source of contamination has been traced back to a long drop toilet sited close to the creek that feeds into the estuary. The site at Tinopai has yet to be investigated.

Freshwater sites had a lower rate of compliance than coastal sites. Five sites had a low compliance rate (less than 75%) in 2008-09 – Otamure Bay stream, middle Lang's Beach stream, Otaua stream, Kerikeri at Stone Store and Cooper's Beach stream. Three of these sites have been investigated. The source of contamination at both Lang's Beach stream and Otamure Bay stream is likely to be livestock and/or waterfowl; results from Cooper's Beach stream were inconclusive and further work will be done in 2009-10 to try and isolate the source of contamination here.

In general, most freshwater sites sampled during 2008-09 were acceptable for swimming during dry periods, but after heavy and/or prolonged rain, levels of bacteria became elevated to 'alert' or 'action' levels for several days. However, due to a drier than average summer, compliance rates were higher in 2008-09 than the previous year. From a national perspective, Northland's freshwater sites have the lowest rate of compliance in the country but it is difficult to compare region to region due to variations in climate and topography, and because some regions may use a different criteria to select sites for survey, or may simply sample less sites.

The Suitability for Recreation Grade (SFRG) has been calculated for all sites with sufficient data. In a region such as Northland, with its sub-tropical climate and high annual rainfall, the SFRG can sometimes be a misleading way of grading a site as one incidence of non-compliance can lead to a site being graded as 'poor' or 'very poor' for recreational use, even though water quality may generally be good.

The results for 15 sites sampled during 2008-09 for their suitability for recreational shellfish gathering indicated that only one site, Oakura, complied with microbiological water quality guidelines. However, samples were only taken for 12 weeks over the summer months, not for the entire shellfish gathering season (which, excluding scallops, is all year in Northland). As such, these results can only be used as an indicator of likely suitability.

Finally, it must be stressed that results from these sampling programmes only provide an indication of each site's suitability for recreational use. The programme only covers a selection of sites in Northland and there are likely to be many more sites that are 'unsafe' for recreational use in the region. In addition, if a site returns a high compliance rate in summer and is generally safe for swimming, it does not mean that this site may be safe during the winter months when there is heavy and more prolonged periods of rainfall. If in doubt, do not swim.

10 KEY RECOMMENDATIONS

- Continue with the Recreational Bathing Water Quality programme, incorporating additional sites of interest or concern, and publishing the results for public information on the NRC website.
- Improve warning signs at consistently non-compliant (unsafe) sites, in order to improve communication of the problem to potential recreational users.
- Undertake further faecal source tracking investigations at problem sites to isolate the source/s of contamination.
- Develop a strategy to look at catchment characteristics and results for problem sites, in order to identify how best to tackle water quality issues in these areas.
- Work in specific catchments with land owners and the local community to improve water quality and increase awareness of water quality issues and safer swimming.

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