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Will I get sick if I swim?

Suitability for recreation grades for selected marine and fresh water bathing sites in the Wellington region

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Executive summary

Recreational water quality monitoring is currently undertaken at 23 freshwater and 76 marine sites across the Wellington region. This report presents suitability for recreation grades (SFRGs) for these sites, based on an assessment of microbiological risk and actual indicator bacteria counts determined from routine summer recreational water quality monitoring undertaken over the period 1 November 2001 to 31 March 2006 inclusive. The determination of SFRGs is made following protocol outlined in the Ministry for the Environment/Ministry of Health (MfE/MoH 2003) Microbiological Water Quality Guidelines for Marine and Fresh Water Recreational Areas.

A SFRG describes the general condition of the water at a site at any given time (during the summer bathing season) and helps determine whether on-going monitoring is required, and provides the basis for advising people whether or not the water at a site is suitable for recreational use from a public health perspective. The risk of becoming sick from contact with the water at a site increases as the grading shifts from "very good" to "very poor".

Only 17% of the 23 freshwater sites received a SFRG of "very good" or "good". The majority of the sites (74%) received a grade of "poor" or "very poor", reflecting "moderate" to "high" risks of microbiological contamination at these sites due to the likely influence of either agricultural run-off or urban stormwater. In most cases, the SFRGs improve with the removal of *E. coli* results coinciding with significant rain events. This suggests that for the majority of sites, the SFRGs better reflect the condition of water during wet weather than dry weather when contact recreation would be greatest. The key exceptions are the Hutt River at Silverstream, the Ruamahanga River at Double Bridges and Riversdale Lagoon. These sites have regularly exceeded the alert and action level of the recreational water quality guidelines in the absence of any significant rainfall prior to sampling. Some other factor(s) influence water quality at these sites, such as stock access upstream, wildlife and/or poor water quality in tributary streams.

Of the 76 marine sites, four have a SFRG of "very good". The majority (87%) of sites have a SFRG of "good" or "fair", reflecting "low" to "moderate" risks of microbiological contamination due to the direct or indirect (i.e., via tributary streams) influence of urban stormwater, agricultural run-off or, in a few instances, waterfowl. Just six sites received a grade of "poor", a result of a "moderate" risk of microbiological contamination combined with a history of elevated indicator bacteria counts. No site received a grade of "very poor."

Overall, there is a relatively high correlation between rainfall events and elevated indicator bacteria counts at marine sites, particularly in the Wairarapa. However, on an individual site basis many sites often exceeded the alert and action level of the recreational water quality guidelines in the absence of any significant rainfall prior to sampling. These sites include Paraparaumu Beach (especially Ngapotiki Street) on the Kapiti Coast, Plimmerton Beach, Pauatahanui Inlet (Browns Bay) and Titahi Bay (Bay Drive) in Porirua City, Petone Beach (Sydney Street) in Hutt City, and Oriental Bay (Wishing Well) and Owhiro Bay in Wellington City. At most of these sites, elevated enterococci counts are attributed to poor water quality in tributary streams. Sediment re-suspension as a result of high wave energies and/or strong winds may also influence

water quality at many sites, including the Kapiti Coast beaches, Petone Beach, Oriental Bay, Mahanga Bay and some bathing areas on the south coast of Wellington City.

The relatively high correlation between the occurrence of heavy rainfall and elevated bacteria counts at the majority of monitoring sites in both fresh and marine waters across the region supports advice from the Greater Wellington Regional Council and the Ministry of Health to avoid swimming and other contact recreation activities during, and for up to two days after, heavy rain. Urban stormwater (including sewer overflows during very heavy rainfall) and diffuse-source agricultural runoff into rivers and streams are considered to be the major contributors to faecal contamination of recreational waters in the Wellington region.

Recommendations

1. Continue to monitor recreational water quality at freshwater and marine bathing sites in accordance with the MfE/MoH (2003) recreational water quality guidelines.

2. Cease routine weekly monitoring in the Otaki River at the Pots and the Waiohine River Gorge, and use monthly microbiological water quality results obtained from these sites under the Rivers State of the Environment Monitoring Programme to assess recreational water quality.

3. Remove Riversdale Lagoon from the list of freshwater bathing sites and erect permanent signage at the lagoon mouth advising against swimming.

4. Consider reducing the frequency of summer monitoring at Camp Bay, Breaker Bay, Princess Bay and Riversdale South.

5. Review microbiological risk assessments for freshwater and marine bathing sites on a three to five yearly basis, or sooner if new information comes to light indicating a likely change in risk.

6. Review and update MAC values and SFRGs annually upon the conclusion of each summer bathing season.

7. Continue annual reporting of recreational water quality monitoring results, and include SFRGs in all future reports.

Contents

1. Introduction

1.1 Background

Regional and territorial authorities monitor recreational water quality to identify risks to public health from disease-causing organisms and advise the public of these risks. People can then make informed decisions about where, when, and how they use rivers and the marine environment for recreation.

The Greater Wellington Regional Council has monitored water quality at selected recreational sites in both fresh and marine waters across the Wellington region for over 10 years. From the start of the 2000/2001 summer, monitoring has been a joint effort involving the Greater Wellington Regional Council and its constituent local councils, in particular the Kapiti Coast District Council, Porirua City Council, Hutt City Council, and Wellington City Council. Regional Public Health and Wairarapa Public Health are consulted on occasions when the results of the monitoring indicate a serious health risk might exist.

The Greater Wellington Regional Council produces annual *On the Beaches* reports summarising the results of recreational water quality monitoring conducted during the summer bathing season. *Will I get Sick if I Swim?* focuses on the water quality monitoring results from the last five summer bathing seasons, together with the major microbiological risks present at bathing sites in the region, to determine the suitability of selected freshwater and marine sites for contact recreation.

1.2 Legislative framework and responsibilities

The Resource Management Act 1991 (RMA) and the Health Act 1956 (HA) are the two principal Acts that address water quality aspects of recreational water use. Responsibility for overseeing these Acts is shared between regional councils (RMA), territorial authorities (RMA and HA), and district health boards (HA). Neither Act specifies which agency has primary responsibility for recreational water quality monitoring, although the Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas (Ministry of Health (MoH), Ministry for the Environment (MfE), 2003) attempt to outline the various responsibilities.

In the Wellington region, the Greater Wellington Regional Council has taken responsibility as the lead agency for coordinating and reporting on the results of recreational water quality monitoring. The territorial authorities collect the majority of the water samples, and are responsible for erecting signs when results indicate a bathing site should be closed and undertaking sanitary surveys when required. Regional Public Health and Wairarapa Public Health have responsibility for informing the public when an exceedance of the guidelines occurs although during the summer bathing season, weekly water test results are collated by the Greater Wellington Regional Council and displayed at www.gw.govt.nz/on-the-beaches.

1.2.1 Resource Management Act and Regional Plans

Part IV of the RMA sets out the functions, powers and duties of regional councils under the RMA. Included in the functions of regional councils are the control of the use of land for the purpose of maintaining and enhancing the quality of fresh and coastal waters, and the control of the discharges of contaminants to water (s30(1)). Regional councils also have a duty to monitor and report on the state of the environment to ensure they are effectively carrying out their functions under the RMA (s35(1) and (2)).

The Greater Wellington Regional Council has set out its responsibilities with respect to fresh and coastal water quality in three documents; the Regional Policy Statement (1995), the Regional Freshwater Plan (1999), and the Regional Coastal Plan (2000). The relevant objectives and policies in each of these documents are outlined below.

The Regional Policy Statement (RPS)

- Freshwater (Chapter 5) -
  - Objective 2: the quality of fresh water meets the range of uses and values for which it is required, safeguards its life supporting capacity, and has the potential to meet the reasonably foreseeable needs of future generations.
  - Objective 3: Freshwater resources of significance or of high value for cultural, spiritual, scenic, ecosystem, natural, recreational, or other amenity reasons are protected or enhanced.
- Coastal water (Chapter 7) -
  - Objective 3: Coastal water quality is of a high standard.

The RPS also outlines a range of policies to address fresh and coastal water quality; Policies 4 to 9 in Chapter 5 (freshwater), and Policy 7 in Chapter 7 (coastal water). More specific guidance is provided in the Regional Freshwater Plan and the Regional Coastal Plan.

The Regional Freshwater Plan

- Policy 5.2.4: To manage water quality for contact recreation purposes in selected stretches of the following water bodies (Figure 1.1):
  - The Otaki River
  - The Waikanae River
  - The Hutt River
  - The Pakuratahi River
  - The Akatarawa River
  - The Waingawa River
  - The Waiohine River
  - The Ruamahanga River

The Regional Coastal Plan

- Policy 10.2.2: To manage water quality in selected areas for contact recreation purposes – these areas include Otaki Beach, Te Horo Beach, Waikanae Beach, Paraparaumu Beach, Raumati Beach, Paekakariki

Beach, Plimmerton Beach, Porirua Harbour, Titahi Bay, Wellington Harbour, Lake Onoke, Castlepoint Beach and Riversdale Beach.

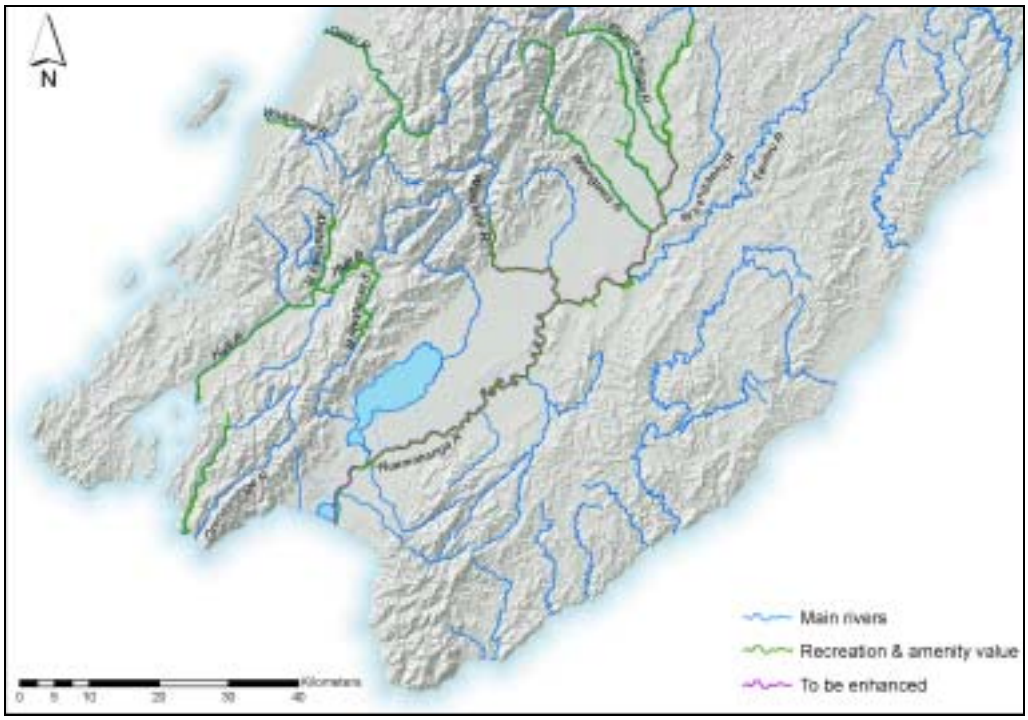

Figure 1.1: River reaches specified in the Regional Freshwater Plan as needing to be managed or enhanced for recreational water quality purposes.

1.3 Monitoring and reporting objectives

The aims of Greater Wellington Regional Council's recreational water quality monitoring programme are to:

1. Determine the suitability of selected sites in fresh and marine waters for contact recreation;
2. Determine the suitability of marine water in designated areas for the gathering of shellfish for human consumption;
3. Assist in safeguarding public health and the environment;
4. Provide a mechanism to determine the effectiveness of regional plans;
5. Provide information to assist in the determination of spatial and temporal changes in the environment (State of the Environment (SoE) monitoring); and
6. Provide information to assist in targeted investigations where remedial action or mitigation of poor water quality is desired.

The primary aim of this report is to use protocol set out by MfE/MoH (2003) to assess the suitability of the existing 23 freshwater and 76 marine sites in the Wellington region for contact recreation. In particular, the following questions are addressed:

- What is the level of compliance with recreational water quality guidelines at these sites?
- What are the key microbiological risk factors present at these sites?

The reporting period is limited to the five summer bathing seasons within the period 1 November 2001 to 31 March 2006 inclusive.

1.4 Outline of report

This report comprises five sections. Section 1 provides an overview of the legislative and policy framework for recreational water quality monitoring in the Wellington region, and outlines the monitoring and reporting objectives. Section 2 provides a brief synopsis of the microbiological water quality indicators and guidelines for recreational waters, and the process undertaken to determine the suitability of fresh and marine water sites for contact recreation. Microbiological water quality results for fresh waters and marine waters across the region are then summarised separately in Sections 3 and 4 respectively, together with the key microbiological risks present at each site, and the subsequent suitability for recreation grade. The influence of rainfall on the suitability of sites for recreation, particularly freshwater sites, is also examined in some detail. Overall conclusions and recommendations are presented in Section 5.

2. Microbiological water quality indicators and guidelines

2.1 Background

Water contaminated by human or animal excreta may contain a diverse range of pathogenic (disease-causing) micro-organisms such as bacteria, viruses, and protozoa (e.g., salmonella, campylobacter, cryptosporidium, giardia, etc). These organisms may pose a health hazard when the water is used for recreational activities such as swimming. The most common illness from swimming in contaminated water is gastroenteritis, but recent evidence shows that respiratory illness and skin infections are also quite common. In most cases, the ill-health effects from exposure to contaminated water are minor and short-lived, although the potential for more serious diseases such as Hepatitis A, Giardiasis, Cryptosporidiosis, Campylobacteriosis, and Salmonellosis can not be discounted.

In 2003 the Ministry for the Environment (MfE) and the Ministry of Health (MoH) finalised microbiological water quality guidelines for recreational waters which are based on an assessment of the risk from exposure to contaminated water. These guidelines use bacteriological indicators associated with the gut of warm blooded animals to assess the risk of faecal contamination and therefore the potential presence of harmful pathogens[1]. The indicators used are:

- Freshwater (including estuarine waters): *Escherichia coli (E. coli)*
- Marine waters: Enterococci
- Recreational shellfish-gathering waters: Faecal coliforms

Compliance with the MfE/MoH (2003[2]) microbiological water quality guidelines (from this point on referred to as *the recreational water quality guidelines*) should ensure that people using water for contact recreation are not exposed to significant health risks. The guideline values are outlined Sections 3 (fresh waters) and 4 (marine waters) of this report. In essence, the guidelines are "trigger" values to help water managers determine when management intervention is required. The "trigger" values underpin a three-tier management framework analogous to traffic lights (Table 2.1).

Table 2.1: Three-tier management framework for recreational waters advocated by MfE/MoH (2003).

Mode	Management Response
Green/Surveillance	Routine monitoring
Amber/Alert	Increased monitoring, investigation of source and risk assessment
Red/Action	Closure, public warnings, increased monitoring and investigation of source

[1] Indicator bacteria are monitored because individual pathogenic organisms are often present in very low numbers, can be hard to detect, and the analytical tests are expensive.

[2] The guidelines were published in June 2002 and updated in June 2003.

2.2 Beach grading

In recent years there has been a move away from the sole use of quantitative "guideline" values of bacteriological indicators to assess the risk of faecal contamination and therefore the potential presence of pathogens. Instead, the MFE/MoH (2003) guidelines advocate a risk-based approach to managing recreational waters. This involves combining a qualitative assessment of the susceptibility of a recreational site to faecal contamination, and direct measurements of appropriate bacteriological indicators at the site to generate a "Suitability for Recreation Grade" (SFRG) for the site (Figure 2.1).

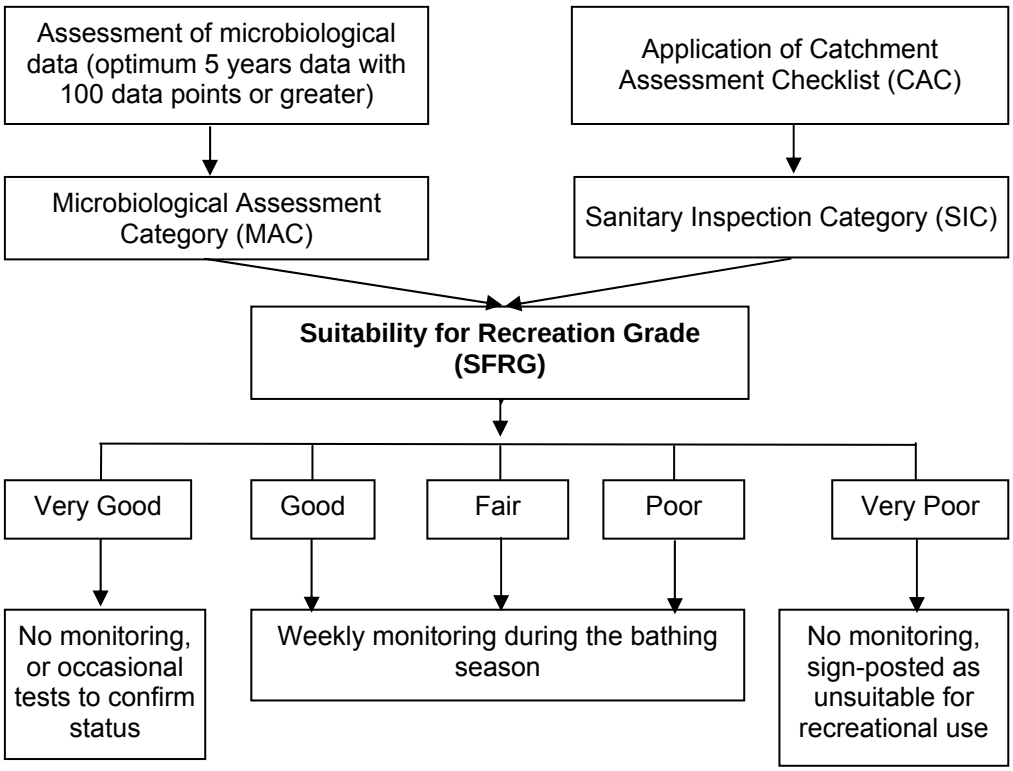

Figure 2.1: Overview of the bathing site grading process and surveillance requirements.
(Source: after MfE/MoH (2003), p. C3)

The SFRG describes the general condition of the water at a site at any given time, based on both microbiological risk and indicator bacteria counts. This grade helps determine whether on-going monitoring is required, and provides the basis for advising people whether or not the water at a site is suitable for recreational use from a public health perspective. The risk of becoming sick from contact with the water at a site increases as the grading shifts from "very good" to "very poor". Conditions affecting water quality will vary the most for the middle range of grades ("good", "fair", and "poor"). For example, the water at "good" sites will usually comply with the guidelines, but events such as high rainfall can increase the risk of microbiological contamination (e.g., via run-off from low-intensity land). Consequently, weekly water quality monitoring at these middle-range sites is recommended during the bathing season (Table 2.2).

Table 2.2: Description of Suitability for Recreation Grades.

SFRG	Definition	Recommendation
Very Good	There may be some indirect run-off from low intensity agricultural/ urban/rural/bush catchments, but there are likely to be no significant sources of faecal contamination.	Considered satisfactory for swimming at all times, and therefore may not require monitoring on a regular basis.
Good	On occasions (such as after high rainfall) there may be an increased risk of contamination from run-off. Such sites receive run-off from one or more of the following sources which may contain animal or human faecal material: • River discharges impacted by tertiary treated wastewater, combined sewer overflows, sewer overflows, intensive agricultural/rural catchments, significant feral/bird/animal populations. • River discharges impacted by; run-off from low-intensity agricultural/urban/rural catchment. • Direct discharges from stormwater not contaminated by sewage, boat moorings or marinas. • Direct discharges from low-intensity agriculture.	Satisfactory for swimming most of the time. Exceptions may include following rainfall. Such beaches are monitored regularly throughout the summer season and warning signs will be erected if water quality deteriorates.
Fair	Events such as high rainfall increase the risk of contamination levels from run-off. Such sites receive run-off from one or more of the following sources which may contain animal or human faecal material: • River discharges impacted by tertiary treated wastewater, combined sewer overflows, sewer overflows, intensive agricultural/rural catchments, significant feral bird/animal populations. • River discharges impacted by; run-off from low-intensity agricultural/urban/rural catchment. • Direct discharges from stormwater not contaminated by sewage, boat moorings or marinas. • Direct discharges from low-intensity agriculture.	Generally satisfactory for swimming, though there may be potential sources of faecal material. Caution should be taken during periods of high rainfall, and swimming should be avoided if water is discoloured. Sites are monitored weekly throughout the summer season and warning signs erected if water quality deteriorates.
Poor	These sites receive run-off from one or more of the following sources which may contain animal or human faecal material: • Tertiary treated wastewater. • Urban stormwater, intensive agriculture, unrestricted stock access, dense bird populations. • Low-intensity agriculture, marinas or boat moorings, urban stormwater not contaminated by sewage. • River discharges containing untreated/primary/secondary treated wastewater or on-site waste treatment systems. • River discharges impacted by tertiary treated wastewater, combined sewer overflows, intensive agricultural/rural catchments, feral bird/animal populations.	Generally not okay for swimming, as indicated by historical water quality results. Swimming should be avoided, particularly by the very young, the very old and those with compromised immunity. Permanent warning signs may be erected at these sites, although councils may monitor these sites weekly and post temporary warnings.
Very Poor	These sites receive run-off from one or more of the following sources which may contain animal or human faecal material: • Untreated/primary/secondary treated wastewater. • On-site waste treatment systems. • Tertiary treated wastewater. • Urban stormwater, intensive agriculture, unrestricted stock access, dense bird populations. • River discharges containing untreated/primary/secondary treated wastewater or on-site waste treatment systems.	Avoid swimming, as there are direct discharges of faecal material. Permanent signage will be erected at the beach stating that swimming is not recommended.

Source: adapted from pp. H20-21, MfE/MoH (2003)

The two components providing a SFRG for the water at an individual site are:

- the Sanitary Inspection Category (SIC), which is a measure of the susceptibility of the water body to faecal contamination based on a Catchment Assessment Checklist (CAC); and
- the Microbiological Assessment Category (MAC), which is a measure of the actual water quality over time based on bacteriological test results.

2.2.1 Sanitary Inspection Category (SIC)

The SIC allows the principal source of faecal contamination (e.g., sewage overflows, stormwater discharges, agricultural runoff, wildlife, etc.) to be identified and assigns a category (value) according to risk. This value is "very high", "high", "moderate", "low", or "very low", and is found for a specific water body by use of a SIC flow chart. The information for using the flow chart comes from a Catchment Assessment Checklist (CAC). The CAC includes a summary of key catchment characteristics such as land use and land cover, water uses (e.g., marina, boat ramp), the prevailing wind direction and total annual rainfall, together with an assessment of microbiological hazards that may affect water quality in the recreational area. The list of hazards to consider for freshwater and marine areas are summarised in Table 2.3, together with the SIC value associated with each hazard. The SIC value assigned to the *primary* microbiological hazard influencing water quality at a site is used in the determination of the SFRG for that site.

The Greater Wellington Regional Council completed CACs for the majority of the 76 marine recreational water quality monitoring sites in 2002, along with preliminary CACs for the 23 freshwater monitoring sites. The microbiological hazard component of the CACs are revisited and updated in this report. Information for the assessment was drawn from a range of sources including site inspections, aerial photographs, sewerage/stormwater reticulation maps, resource consent information, pollution incident records, Regional Public Health, Wairarapa Public Health, and environmental health officers and engineers at selected territorial authorities.

2.2.2 Microbiological Assessment Category (MAC)

The MAC is determined from the 95th percentile value in an existing or collected set of microbiological water quality data. The MfE/MoH (2003) state that ideally there should be 100 data points or greater, collected over the previous five years, although it is feasible to consider grading with a minimum of 20 data points collected over one full bathing season. The grading is considered interim until five years of data have been collected. Five years of data are available for the majority of the sites monitored in the Wellington region.

Table 2.3: Microbiological hazards and associated SIC grades for marine and fresh waters.

	Microbiological Hazards – Fresh Waters	SIC†
	Is water quality affected by:	
1	Direct discharge of sewage or animal wastes	Very High
2	Stormwater with potential sewage contamination	High
3	Urban stormwater protected from sewage ingress	Moderate
4	Private sewage disposal systems discharge (septic tanks)	Very High
5	Communal sewage disposal with primary or secondary treatment	Very High
6	Communal sewage disposal with tertiary treatment	High
7	Intensive agricultural land use and potential for direct run-off	High
8	Focal points of drainage from low intensity land use	Moderate
9	Unrestricted stock access to waterways	High
10	Dense birdlife near the area	High
11	Water craft mooring or use of area	Moderate
12	Faecal contamination from feral animals (e.g., forest or bush run-off)	Low
13	Stream/drain/wetland discharging into/upstream of site	(refer to 14-20)
	If rivers/streams/drains are present, are these affected by:	
14	Discharges of human or animal effluent	High
15	Urban stormwater with potential sewage contamination	Moderate
16	Urban stormwater protected from sewage ingress*	Moderate**
17	Communal sewage disposal with tertiary treatment	Moderate
18	Intensive agricultural land use and potential for direct run-off	Moderate
19	Focal points of drainage from low intensity land use	Low
20	Faecal contamination from feral animals (e.g., forest or bush run-off)	Very Low
	Other influences to consider: Does rainfall trigger contamination? Does microbiological water quality exceed guidelines? Have illnesses been notified from this area?	
	Microbiological Hazards – Marine Waters	SIC
	Is the beach water quality affected by:	
1	Direct discharge of sewage or animal wastes	Very High
2	Urban stormwater with potential sewage contamination	High
3	Urban stormwater protected from sewage ingress	Moderate
4	Private sewage disposal systems discharge (septic tanks)	Very High
5	Communal sewage disposal with primary or secondary treatment	Very High
6	Communal sewage disposal with tertiary treatment	High
7	Intensive agricultural land use and potential for direct run-off	High
8	Dense birdlife near the beach	Moderate
9	Water craft mooring or use of area	High
10	Focal points of drainage from low intensity land use*	Low**
11	River/stream/drain discharging near the beach	(refer to 12-17)
	If rivers/streams/drains are present, are these affected by:	
12	Discharges of human or animal effluent	High
13	Urban stormwater with potential sewage contamination	Moderate
14	Urban stormwater protected from sewage ingress*	Moderate**
15	Intensive agricultural land use and potential for direct run-off	Moderate
16	Faecal contamination from feral animals (e.g., forest or bush run-off)	Very Low
17	Focal points of drainage from low intensity land use	Low
	Other influences to consider: Does water quality change with currents, tide or wind? Does rainfall trigger contamination? Does microbiological water quality exceed guidelines? Have illnesses been notified from this area?	

† Only applies if hazard identified as being the primary factor influencing water quality at the site

* Represents an additional hazard considered by Greater Wellington Regional Council

** Estimated SIC value

2.2.3 Cautionary notes

- The MfE/MoH (2003) recreational water quality guidelines do not cover toxic algal blooms, which in certain places and under certain conditions, may pose a significant risk to contact recreation. Such blooms have occurred in recreational waters in the Wellington region in the past. For example, Milne and Wyatt (2006) reported on the presence of benthic cyanobacteria blooms in several Wellington rivers over the 2005/2006 summer.
- A lot of illness associated with contact with potentially contaminated waters will not come to medical attention, so the true burden of illness is likely to be significantly underestimated (Bokkerink[3], pers. comm., 2006).

[3] Stephen Bokkerink, RPH Environmental Health Protection Officer

3. Suitability for recreation – fresh waters

3.1 Introduction

Recreational water quality is currently monitored at 23 freshwater sites across the Wellington region. These sites were selected on the basis of their use by the public for contact recreation; in particular, swimming, canoeing, and rafting. Four of the sites are located in the Kapiti Coast District, six in the Hutt Valley and 13 in the Wairarapa. The locations of the monitoring sites are shown in Figure 3.1. A full site list can be found in Appendix 1.

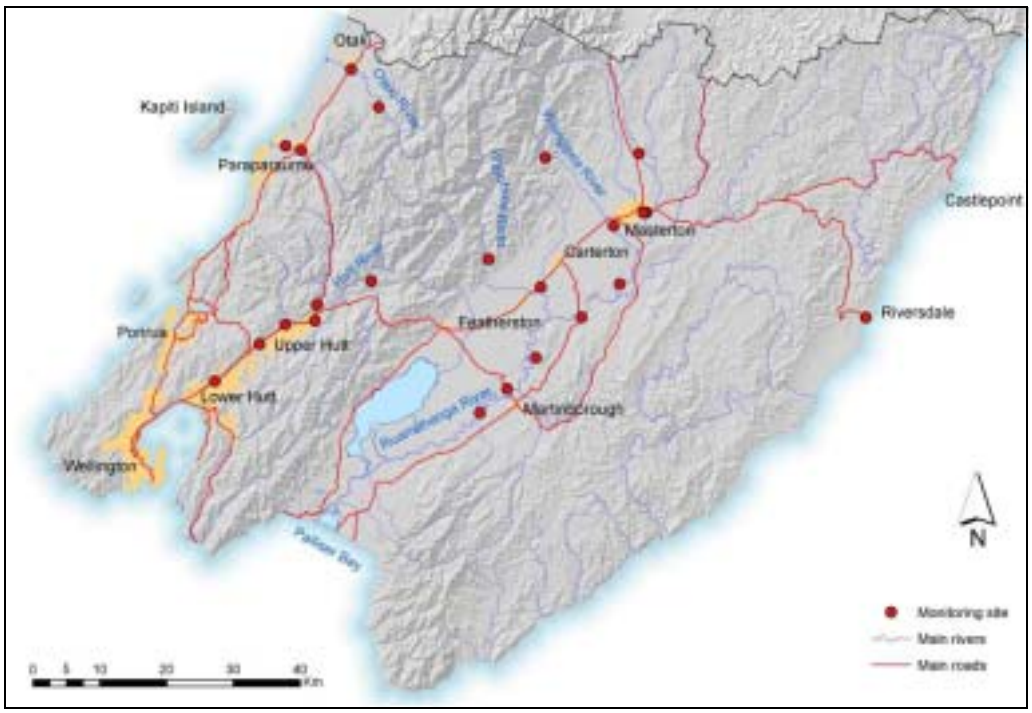

Figure 3.1: Freshwater recreational water quality monitoring sites in the Wellington region.

3.1.1 Monitoring protocol

Sites are sampled weekly during the summer bathing season (1 November to 31 March inclusive). On each occasion a single water sample is collected 0.2 metres below the surface in 0.5 metres water depth and analysed for *Escherichia coli (E. coli)* indicator bacteria using a membrane filtration method. This analytical method provides a result in 24 hours, therefore enabling prompt re-sampling in the event that a result exceeds recommended guideline values.

Measurements of water temperature and turbidity, and visual estimates of periphyton (algae) cover, are also made at each freshwater site. Excessive amounts of periphyton, in particular filamentous algae, can reduce the amenity value of waterways by decreasing their aesthetic appearance, reducing visibility, and being a physical nuisance to swimmers. Some species of blue-green algae (cyanobacteria) are also capable of producing cytotoxins that can adversely affect humans and animals.

An estimate of the daily rainfall in the catchment adjoining each site over the bathing season is made by obtaining records from Greater Wellington Regional Council's nearest rain gauge (refer Appendix 1). Rainfall can have a significant impact on water quality, as a result of runoff from rural or urban land and re-suspension of river sediments.

3.1.2 Guidelines

As outlined in Section 2.1, the MfE/MoH (2003) recreational water quality guidelines use bacteriological "trigger" values to help water managers determine when management intervention is required. The "trigger" values for freshwater recreational sites underpin a three-tier management framework analogous to traffic lights (Table 3.1).

Table 3.1: MfE/MoH (2003) surveillance, alert and action levels for fresh waters.

Mode	Guideline (***E. coli*** count in colony-forming units (cfu) per 100 mL)	Management Response
Green/Surveillance	Single sample ≤ 260	Routine monitoring
Amber/Alert	Single sample > 260 and ≤ 550	Increased monitoring, investigation of source and risk assessment
Red/Action	Single sample > 550	Closure, public warnings, increased monitoring and investigation of source

When water quality falls in the "surveillance mode", this indicates that the risk of illness from bathing is acceptable (8/1,000 risk). If water quality falls into the "alert" category, this indicates an increased risk of illness from bathing, but still within an acceptable range. However, if water quality enters the "action" category, then the water poses an unacceptable health risk from bathing (MfE/MoH 2003). At this point, warning signs are erected at the bathing site, and the public is informed that it is unsafe to swim at that site.

Annapolis protocol/beach grading

The process for grading the suitability of sites for contact recreation purposes was outlined in Section 2. The suitability for recreation grades (SFRGs) for fresh waters are shown in Table 3.2. Refer to Table 2.2, Section 2.2, for more information on SFRGs.

Table 3.2: MfE/MoH (2003) Suitability for Recreation Grades for fresh waters.

Susceptibility to faecal influence		Microbiological Assessment Category (MAC)[1]			
		A ≤130 *E. coli*/100mL	B 131-260 *E. coli*/100mL	C 261-550 *E. coli*/100mL	D >550 *E. coli*/100mL
Sanitary Inspection Category (SIC)	Very Low	Very Good	Very Good	Follow Up[3]	Follow Up[3]
	Low	Very Good	Good	Fair	Follow Up[3]
	Moderate	Follow Up[2]	Good	Fair	Poor
	High	Follow Up[2]	Follow Up[2]	Poor	Very Poor
	Very High	Follow Up[2]	Follow Up[2]	Follow Up[2]	Very Poor

1 95th percentile value calculated using the Hazen percentile method from five years of data obtained from routine weekly monitoring during the bathing season

2 Indicates unexpected results requiring investigation (reassess SIC and MAC)

3 Implies non-sewage sources of indicators requiring verification

3.1.3 Data analysis, limitations and reporting

All sampling and evaluation of results has been undertaken in accordance with the MfE/MoH (2003) microbiological water quality guidelines for freshwater recreational areas. Derivation of the MAC grades is limited to the results of routine weekly samples[4] collected over the official summer bathing season.

During data processing, any *E. coli* counts reported as less than or greater than detection limits were replaced by values one half of the detection limit or the detection limit respectively (i.e., counts of <1 cfu/100 mL and >400 cfu/100 mL were treated as 0.5 cfu/100 mL and 400 cfu/100 mL respectively).

Cautionary note

The number of exceedances of recreational water quality guidelines reported differs from those previously reported by Greater Wellington Regional Council and other authorities. There are two primary reasons for this:

- Water quality results reported prior to the 2003/2004 summer will have been assessed against either the MfE/MoH (1999) or the MfE/MoH(2002) *interim* microbiological water quality guidelines for freshwater recreational areas. The guidelines used in this report were only finalised in June 2003 and differ from the interim guidelines.
- A comprehensive quality assurance audit undertaken in early 2006 on recreational water quality data stored in Greater Wellington Regional Council's water quality database resulted in some corrections to data collected during the reporting period.

[4] This means that results arising from any subsequent follow-up sampling were excluded from the data-set.

3.2 Kapiti

Over the last five years, four freshwater sites have been monitored on the Kapiti Coast, two on the Otaki River and two on the Waikanae River (Figure 3.2).

Figure 3.2: Freshwater recreational water quality monitoring sites on the Kapiti Coast.

3.2.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Overall, the Otaki River at The Pots recorded the highest level of compliance with the recreational water quality guidelines over the five year period (Figure 3.3). The Waikanae River at State Highway 1 recorded the lowest level of compliance, exceeding the alert and action level guidelines on 8.4% and 6.5% of sampling occasions respectively.

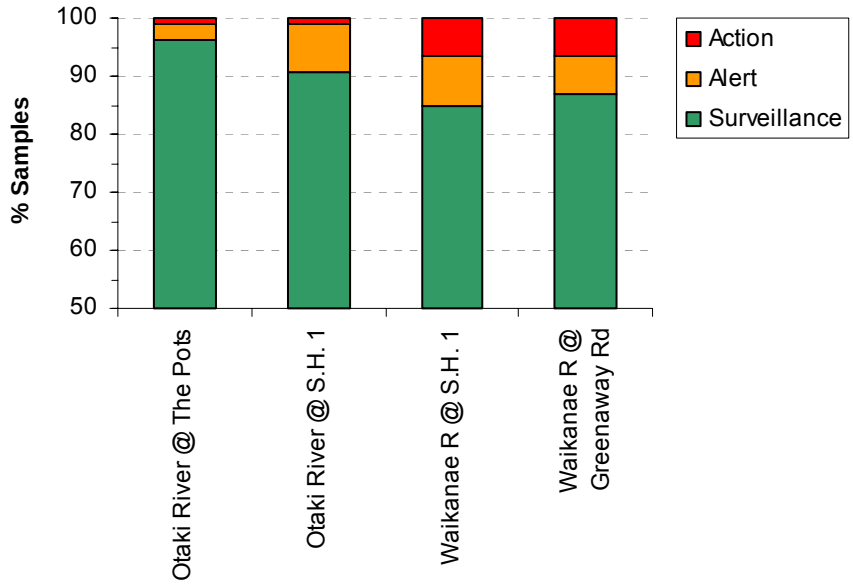

Figure 3.3: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

3.2.2 Microbiological risk factors

The Otaki River at the Pots is considered to be at low risk of microbiological contamination, reflecting the high percentage of unmodified native bush cover present in the upstream catchment (Figure 3.4). The remaining three sites have a moderate risk of contamination, as a result of drainage from low intensity rural land. Refer to Appendix 3 for a complete assessment of the risk factors present at each site.

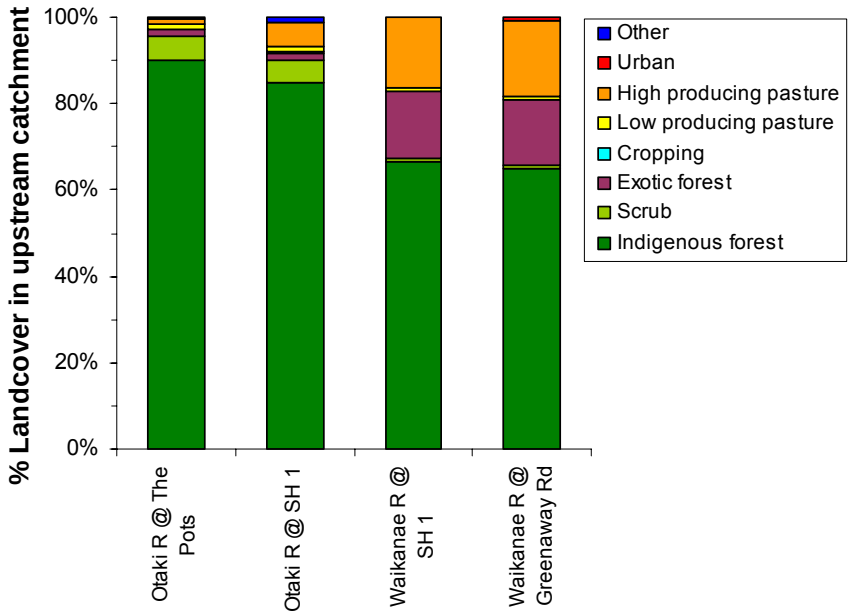

Figure 3.4: Predominant land cover types in the catchment area upstream of the freshwater bathing sites on the Kapiti Coast.

3.2.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 3.3. Lower SFRGs for the two Waikanae River sites reflect both higher microbiological contamination risks due to low intensity agriculture in the upstream catchment area, urban drainage (Greenaway Road) and poorer MAC values.

Table 3.3: MAC values, SIC values and SFRGs for freshwater bathing sites in the Kapiti Coast District.

Site	n	No. action events	95th %ile (*E. coli*/100 ml)	Key Microbiological Risks	SIC	MAC	SFRG
OTAKI RIVER							
The Pots	107	1	196	Contamination from feral animals	Low	B	Good
State Highway 1	107	1	340	Focal points of drainage	Moderate	C	Fair
WAIKANAE RIVER							
State Highway 1	107	7	789	Focal points of drainage	Moderate	D	Poor
Greenaway Rd	107	7	810	Focal points of drainage – rural and urban land	Moderate	D	Poor

Influence of rainfall

Analysis of rainfall records indicates that water quality at both Waikanae River sites is heavily influenced by rainfall events. For example, three of the seven action level events recorded at these sites to date occurred during the exceptionally wet month of February 2004 (Figure 3.5). To a lesser degree, the Otaki River at State Highway 1, is also affected by heavy rainfall.

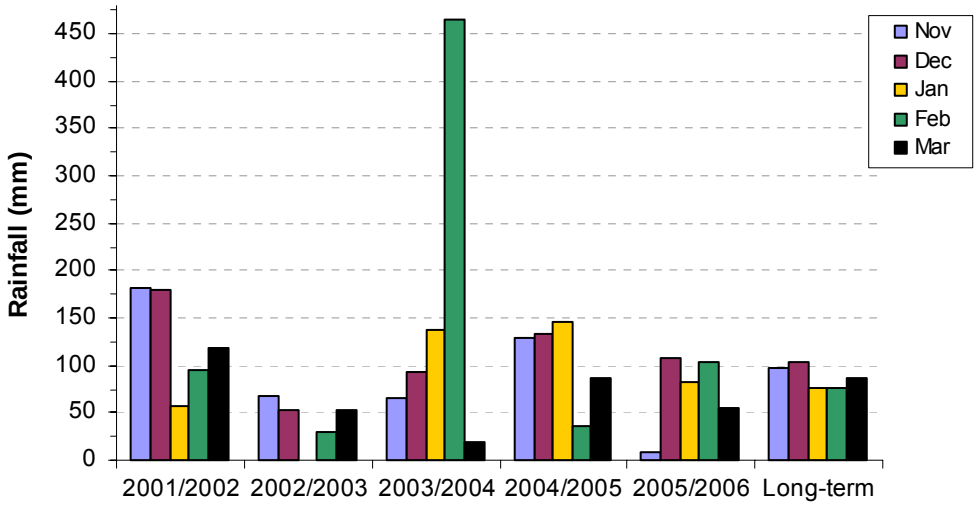

Figure 3.5: Monthly rainfall recorded at the Waikanae Water Treatment Plant over the 2001-2006 summer months, together with the long-term average monthly rainfall (1995 to 2005).

Of the seven level action results recorded at each Waikanae River site over the last five summers, six coincided with more than 10 mm of rainfall (and four with more than 40 mm of rainfall) in the 24 hours prior to day of sampling (Figure 3.6a). A review of rainfall recorded in the catchment over the 2001-2006 summer sampling periods shows that more than 10 mm of rain in 24 hours could be expected on just 10 % of all 24 hour periods, with more than 40 mm of rain expected on less than 2 % of these occasions (Figure 3.6b). Therefore the heavy rain events that result in action level events do not occur very often.

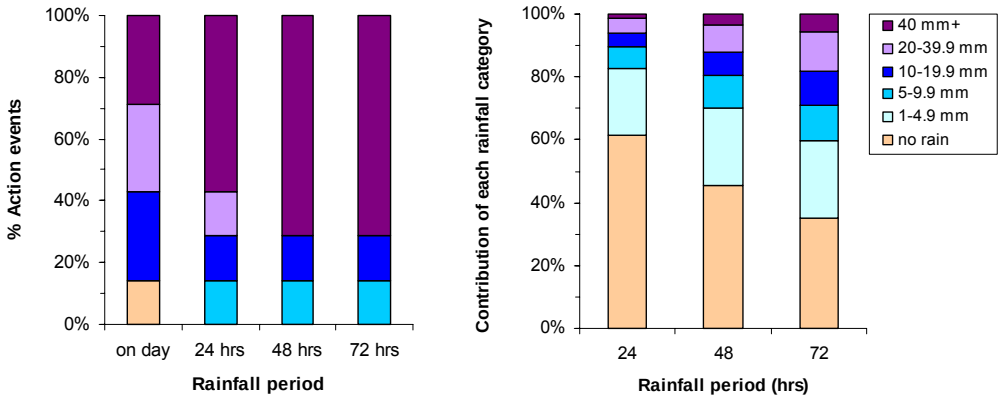

Figure 3.6: (a), left – rainfall on the day and in the hours prior to action level results (7) recorded during routine weekly sampling in the Waikanae River at Greenaway Road over the 2001-2006 summer bathing months; (b), right – frequency of rainfall events of varying amounts recorded at the Waikanae Water Treatment Plant over the 2001-2006 summer months.

If action level *E. coli* results that coincided with 10 mm or more of rainfall in the 24 hours preceding sampling were removed from the five-year data set, the MAC values for both Waikanae River sites would improve significantly from a "D' to a "C". The resulting SFRGs would improve to a grade of "fair" for both sites (Table 3.4).

Table 3.4: MAC values and SFRGs for freshwater bathing sites in the Kapiti Coast District with the removal of action and alert ***E. coli*** results that coincided with rainfall of 10 mm or more or in the 24 hours prior to sampling.

Site	No. of events		All routine samples			Without action level results			Without action & alert level results		
	Action	Alert	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG
OTAKI RIVER											
The Pots	1	3	107	196 (B)	Good	107	196 (B)	Good	104	135 (B)	Good
State Highway 1	1	9	107	340 (C)	Fair	106	296 (C)	Fair	99	201 (B)	Good
WAIKANAE RIVER											
State Highway 1	7	9	107	789 (D)	Poor	100	308 (C)	Fair	93	234 (B)	Good
Greenaway Rd	7	7	107	810 (D)	Poor	99	294 (C)	Fair	95	219 (B)	Good

The Otaki River at State Highway 1 breached the action guideline just once over the five summer bathing seasons, but exceeded the alert level on nine occasions. The Waikanae River sites also exceeded the alert level on a number of occasions. Across the four Kapiti freshwater bathing sites, 21 of the 28 alert level results coincided with at least 10 mm of rain in the 24 hour period prior to sampling. If these alert level results were also removed from the data set, all four sites would have an SFRG of "good" (Table 3.4). Therefore, it is considered that the SFRGs better reflect the condition of the bathing sites during wet weather than dry weather when recreational activity would be greatest.

3.3 Hutt

Currently recreational water quality is monitored at five sites on the Hutt River and at one site on the Pakuratahi River (Figure 3.7).

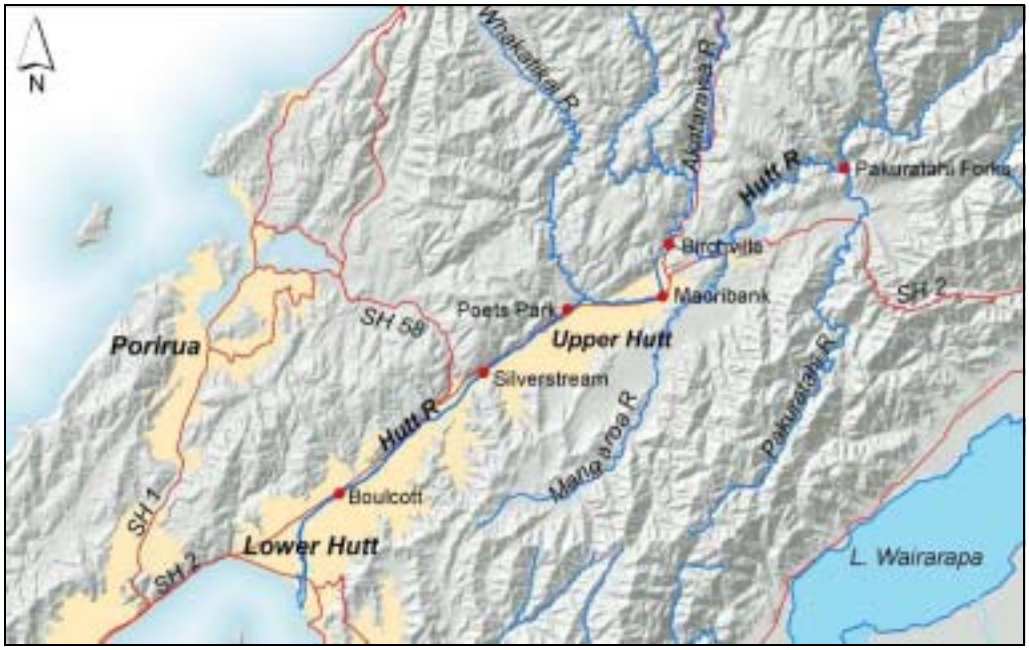

Figure 3.7: Recreational water quality monitoring sites in the Hutt River catchment.

3.3.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Of the six monitoring sites in the Hutt River catchment, the Hutt River at Poets Park recorded the highest level of compliance with the recreational water quality guidelines, with just 5.6 % of routine weekly samples exceeding the action level (Figure 3.8). In contrast, the Hutt River at Silverstream recorded the lowest level of compliance, exceeding the action level on 14 % of sampling occasions. Six of the 15 action level events recorded at this site occurred over the 2005-2006 bathing season.

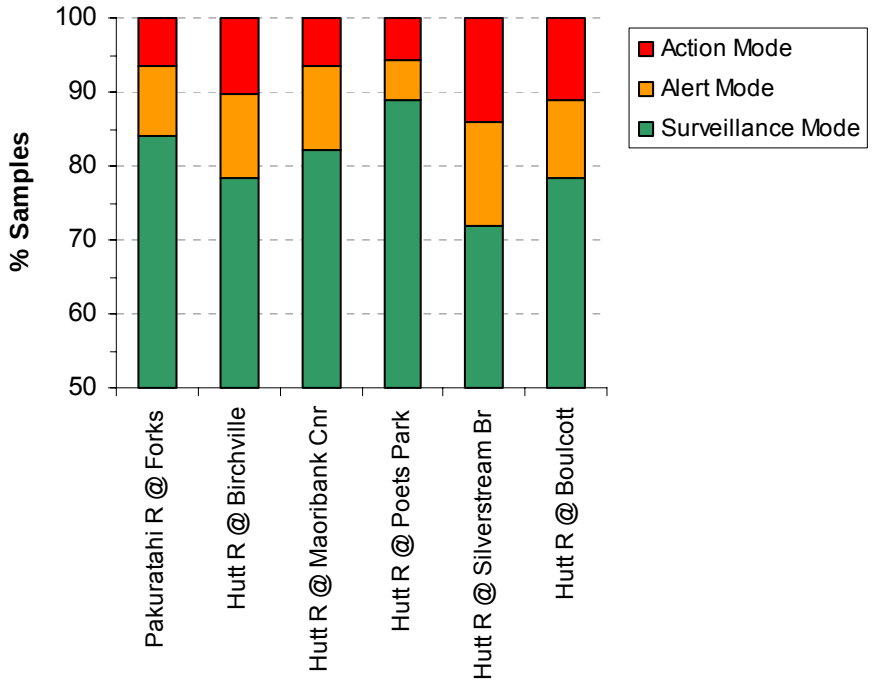

Figure 3.8: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

3.3.2 Microbiological risk factors

All six sites are considered to have a moderate risk of microbiological contamination, reflecting either agricultural influences (the Pakuratahi River and the Hutt River at Birchville), or urban stormwater discharges in the upstream catchment (Figure 3.9). At Birchville, water quality is likely to be strongly influenced by water quality in the Akatarawa River which discharges immediately upstream of the monitoring site. The Mangaroa River is also likely to have some influence. Although it enters the Hutt River over 2.5 km upstream of Birchville, the Mangaroa River contributes a significant portion of the flow to the Hutt River (on average 24% at Te Marua, reducing to 14% at Birchville[5]) and has the poorest water quality of the major Hutt River tributaries (Milne and Perrie 2005). Agricultural activities are the major contributor to poor water quality. Refer to Appendix 3 for a complete assessment of the risk factors present at each site.

[5] Laura Watts, GWRC hydrologist, pers. comm., 2006

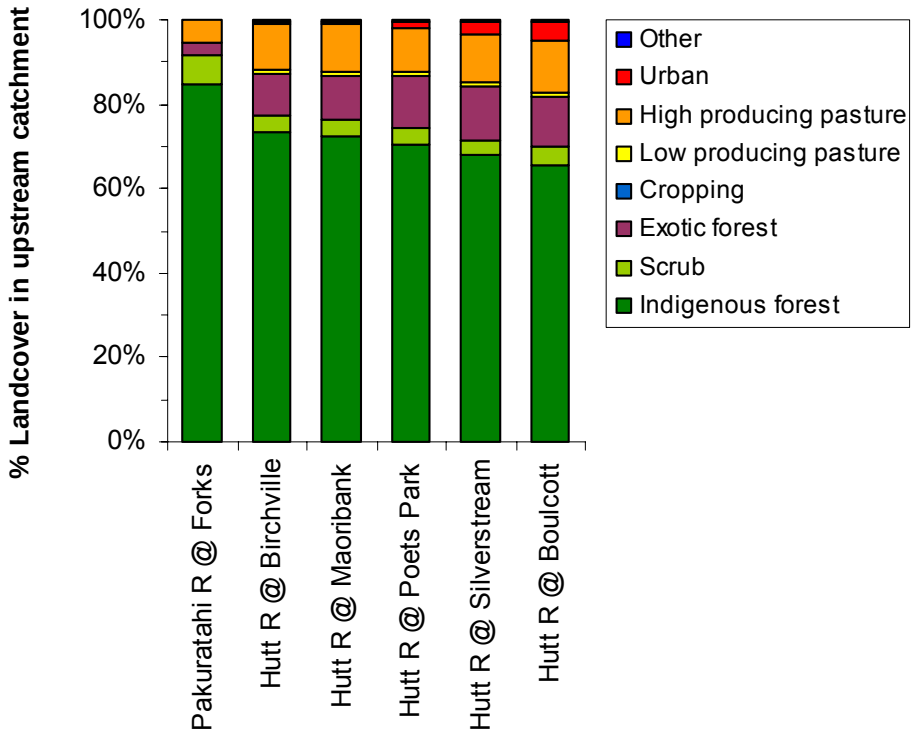

Figure 3.9: Predominant land cover types in the catchment area upstream of the Hutt River bathing monitoring sites.

3.3.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 3.5. Despite higher 95th percentile *E. coli* counts for Birchville, Silverstream and Boulcott, all six bathing sites have a MAC value of "D" and a SFRG of "poor". The poor MAC values reflect the number and magnitude of action level events recorded at many sites over the last five summers.

Table 3.5: MAC values, SIC values and SFRGs for freshwater bathing sites in the Hutt River catchment.

Site	*n*	No. action events	95th %ile (***E. coli***/100 ml)	Key Microbiological Risks	SIC	MAC	SFRG
PAKURATAHI RIVER							
The Forks	107	7	645	Focal points of agricultural/rural drainage	Moderate	D	Poor
HUTT RIVER							
Birchville	107	11	1,215	Tributaries (Akatarawa R & Mangaroa R) with agricultural influence	Moderate	D	Poor
Maoribank Cnr	107	7	724	Urban stormwater	Moderate	D	Poor
Poets Park	107	6	666	Urban stormwater	Moderate	D	Poor
Silverstream Br.	107	15	1,120	Urban stormwater and Mawaihakona Stream influenced by waterfowl & urban runoff	Moderate	D	Poor
Boulcott	107	12	1,415	Urban stormwater	Moderate	D	Poor

Influence of rainfall

Water quality at all six sites in the Hutt River catchment is affected by rainfall events. For example, on nine sampling occasions over the 2001-2006 summer bathing seasons, all six sites exceeded either the alert or action guideline, and eight of these occasions coincided with more than 10 mm of rainfall in the 24 hour period prior to sampling.

Three of the six sites are heavily influenced by rainfall; the Pakuratahi River at Forks, and the Hutt River at both Maoribank and Poets Park. Six of the seven action level results recorded at the Pakuratahi River over the last five summers coincided with 10 mm or more rainfall in the 24 hour period prior to sampling (Figure 3.10a). The effect of rainfall may be cumulative; on nearly 60% of sampling occasions where action level events were recorded, at least 40 mm of rain had fallen in the preceding 72 hour period. A review of rainfall recorded in the catchment over the 2001-2006 summer sampling periods indicates that more than 10 mm of rainfall in 24 hours could be expected in 18 % of all 24 hour periods, with more than 40 mm of rainfall in a 72 hour period expected on just over 13 % of all three day periods (Figure 3.10b).

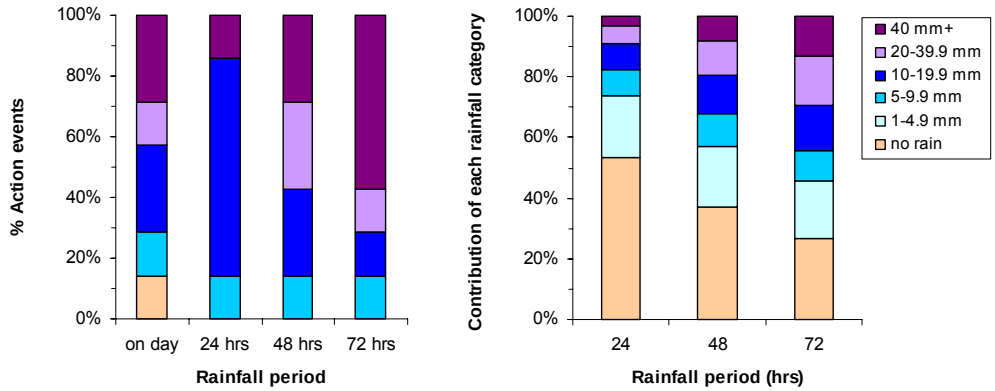

Figure 3.10: (a), left – rainfall on the day and in the hours prior to action level results recorded during routine weekly sampling in the Pakuratahi River at Forks over the 2001-2006 summer bathing months (Maoribank Corner and Poets Park exhibit a similar pattern); (b), right – frequency of rainfall events of varying amounts recorded at Kaitoke Headworks over the 2001-2006 summer months.

The Hutt River sites at Boulcott, Birchville and to a greater extent, Silverstream (five out of 15 action events and nine out of 15 alert events), also exceeded the recreational water quality guidelines on a few occasions when there was little or no rainfall in the 24 hour period prior to sampling (Figure 3.11). However, on some of these occasions, 15 mm or more rainfall was recorded on the day of sampling[6] and the river was observed to be turbid and discoloured or carrying debris, or more than 40 mm of rain had fallen in the 72 hour period prior to sampling.

[6] The day is said to begin at 9 am and sampling is typically conducted 3-4 hours after that time.

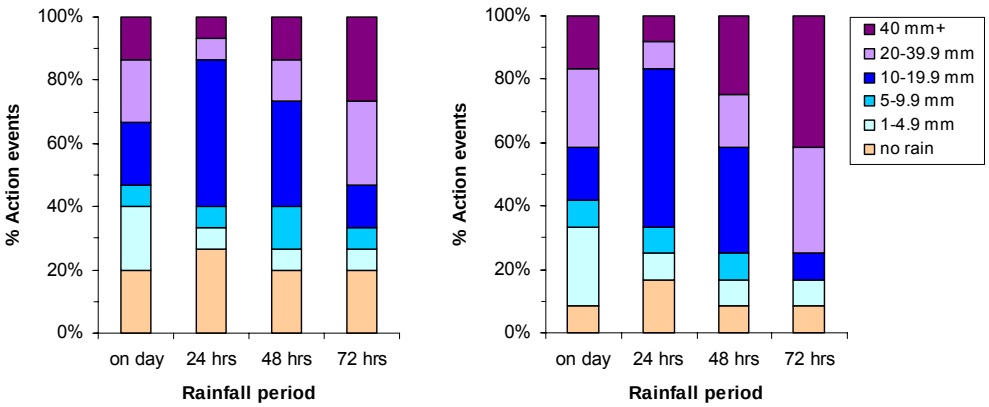

Figure 3.11: Rainfall on the day and in the hours prior to action level results recorded during routine weekly sampling in the Hutt River at Silverstream (left) and Boulcott over the 2001-2006 summer bathing period.

In addition to rainfall, tributary streams are likely to impact on water quality at some of the Hutt River sites; the Akatarawa River enters the Hutt River at Birchville and the Mawaihakona Stream enters the river approximately 600 metres upstream of Silverstream. The Mawaihakona Stream may have high bacteria counts as it runs through a pond-like setting in Heretaunga Park where it attracts large numbers of waterfowl (Figure 3.12).

Figure 3.12: Mawaihakona Stream at Heretaunga Park.

If action level results that coincided with 10 mm or more of rainfall in the 24 hours preceding sampling were removed from the five-year data set, the 95th percentile *E. coli* counts would be significantly lower for all six bathing sites in Hutt River catchment, with an improvement in the MAC values at four sites. The resulting SFRGs for these sites would also improve to a grade of "fair" but remain "poor" for the other two sites; Silverstream and Boulcott (Table 3.6).

Table 3.6: MAC values and SFRGs for freshwater bathing sites in the Hutt River catchment with the removal of action and alert ***E. coli*** results that coincided with rainfall of 10 mm or more or in the 24 hours prior to sampling.

Site	No. of events		All routine samples			Without action level results			Without action & alert level results		
	Action	Alert	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG
PAKURATAHI RIVER											
Forks	7	10	107	645 (D)	Poor	101	358 (C)	Fair	98	316 (C)	Fair
HUTT RIVER											
Birchville	11	12	107	1,215 (D)	Poor	100	495 (C)	Fair	96	497 (C)	Fair
Maoribank Cnr	7	12	107	724 (D)	Poor	101	363 (C)	Fair	97	313 (C)	Fair
Poets Park	6	6	107	666 (D)	Poor	101	280 (C)	Fair	99	260 (B)	Good
Silverstream Br	15	15	107	1,120 (D)	Poor	98	600 (D)	Poor	97	600 (D)	Poor
Boulcott	12	11	107	1,415 (D)	Poor	99	513 (D)	Poor	97	519 (D)	Poor

Of the 66 alert level results recorded across the six Hutt River catchment monitoring sites over the previous five bathing seasons, half coincided with more than 5 mm of rainfall in the 24 hour period prior to sampling, and a quarter coincided with more than 10 mm of rainfall. However, removing the alert level results that followed 10 mm or more of rainfall from the MAC data set only improves the MAC value at one site, Poets Park (from "C" to "B"), resulting in a SFRG of "good" (Table 3.6).

Overall, with the possible exception of Silverstream, it is considered that the SFRGs presented in Table 3.5 better reflect the condition of the bathing sites during wet weather than dry weather when recreational activity would be greatest.

3.4 Wairarapa

Recreational water quality is monitored at 13 locations on five rivers in the Wairarapa (Figure 3.13):

- Ruamahanga River (seven sites);
- Waingawa River (two sites);
- Waiohine River (two sites);
- Waipoua River (one site); and
- the mouth of the Motuwaireka River (Riversdale Lagoon).

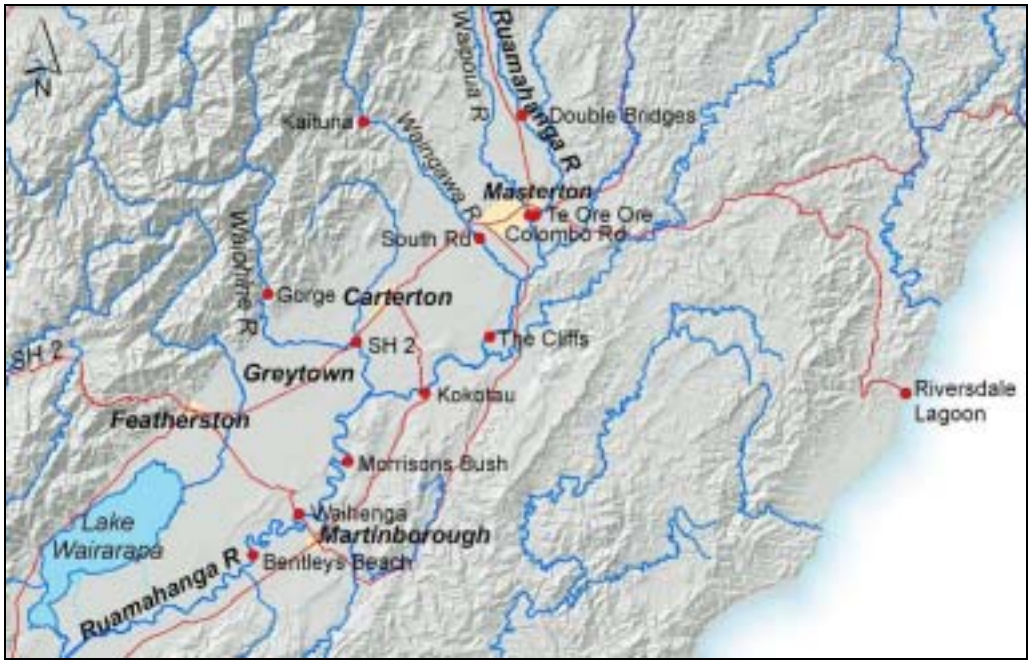

Figure 3.13: Recreational water quality monitoring sites in the Wairarapa.

3.4.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Three sites have not been monitored for the full five year period; the Waipoua River at Colombo Road and the Ruamahanga River at Bentleys Beach were only added to the recreational water quality monitoring programme in November 2002 and Riversdale Lagoon was not monitored over the 2002/2003 summer.

The sites on the Waiohine and Waingawa rivers recorded the highest level of compliance with the recreational water quality guidelines over the five year period, with the Waiohine River at Gorge the only one of the 23 freshwater sites in the Greater Wellington Regional Council's Recreational Water Quality Monitoring Programme not to exceed the action level on any occasion (Figure 3.14). Sites on the Waipoua and Ruamahanga rivers exceeded the action guideline on approximately 10 % of sampling occasions. Riversdale Lagoon recorded the lowest level of compliance, exceeding the surveillance level guideline on more than 41% of sampling occasions, and the action guideline on more than 21 % of sampling occasions. More than half of the action level results exceeded the action guideline (550 *E. coli*/100 mL) by an order of magnitude. Many elevated results recorded at other sites were also an order of magnitude above the action guideline (Figure 3.15). .

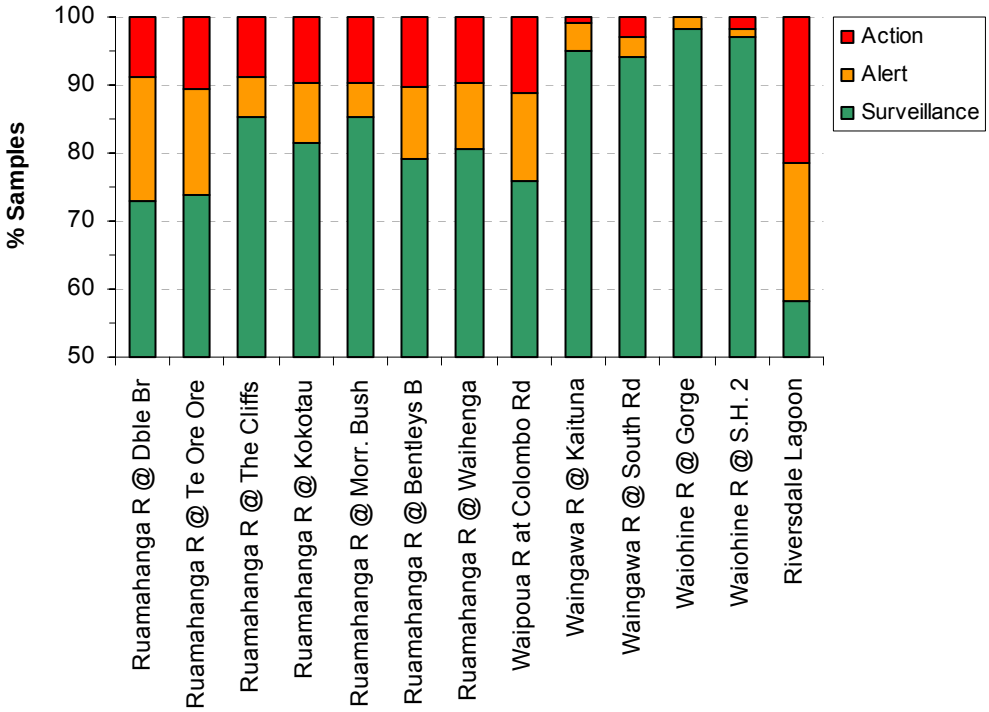

Figure 3.14: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

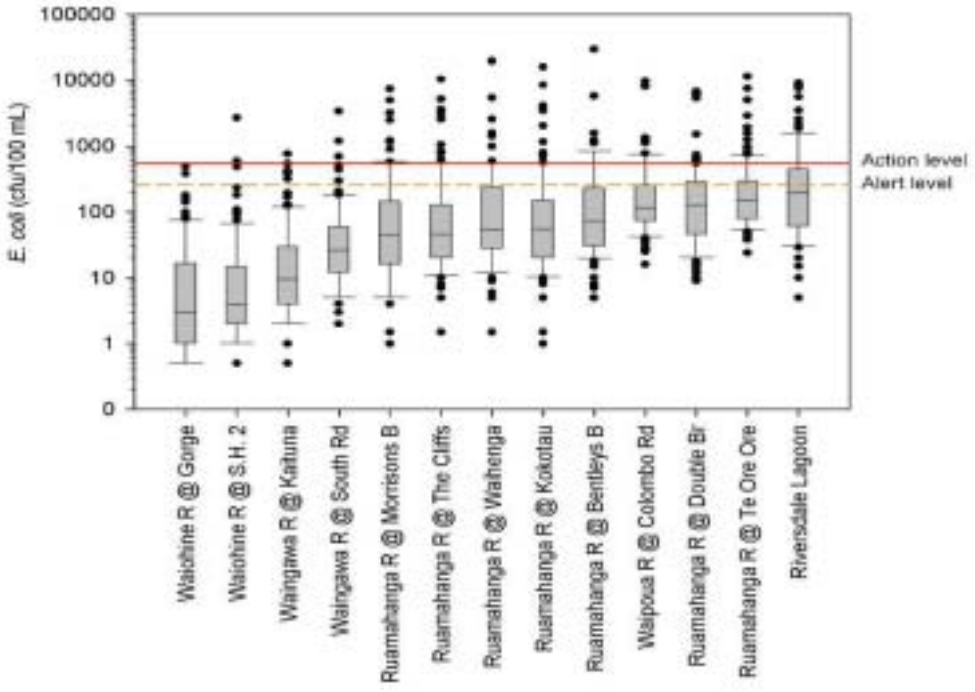

Figure 3.15: Comparison of the median and range of ***E. coli*** counts recorded at each of the 13 freshwater monitoring sites in the Wairarapa over the 2001-2006 summer seasons – ranked from lowest to highest median value. Note the log-scale on the y-axis.

(Note: the horizontal black line across each box represents the median value, the bottom and top edges of the box represent the 25th and 75th percentile values respectively, and the "whiskers" extending below and above the box represent the 5th and 95th percentile vales respectively).

3.4.2 Microbiological risk factors

The majority of the 13 sites, including six of the seven Ruamahanga River sites, are considered to have a high risk of microbiological contamination, reflecting the large amount of agricultural land use in the upstream catchment (Figure 3.16). The Ruamahanga River also receives treated municipal wastewater (sewage) from Rathkeale College and the townships of Masterton, Carterton, Greytown and Martinborough either directly or indirectly via tributary rivers or streams (see Milne 2005). However, the discharges do not occur in close proximity to any of the monitoring sites.

The Waipoua River at Colombo Road carries a high risk of microbiological contamination due to both agricultural activity in the upstream catchment and its urban location; stormwater is discharged to the river immediately upstream of the bathing site and sewer overflows have been recorded in the past (Yeats[7], pers. comm., 2006). Riversdale Lagoon also has a high risk of microbiological contamination (Figure 3.17). The lagoon drains an agricultural catchment and has a history of poor water quality. Agricultural practices (e.g., stock access, drainage) are the likely reason for this, along with birdlife and possible seepage of septic tank and landfill leachate (Stansfield 2000).

Sites on the Waingawa and Waiohine rivers have a lower risk of microbiological contamination. In the largely forested headwaters at Kaituna and the Waiohine River Gorge, faecal contamination from feral animals would be the only potential source of contamination. The risk of microbiological contamination is moderate further downstream at South Road and State Highway 2, with run-off from low intensity agricultural/rural land likely to be the primary source of contamination.

[7] Stephen Yeats, GWRC Senior Resource Advisor

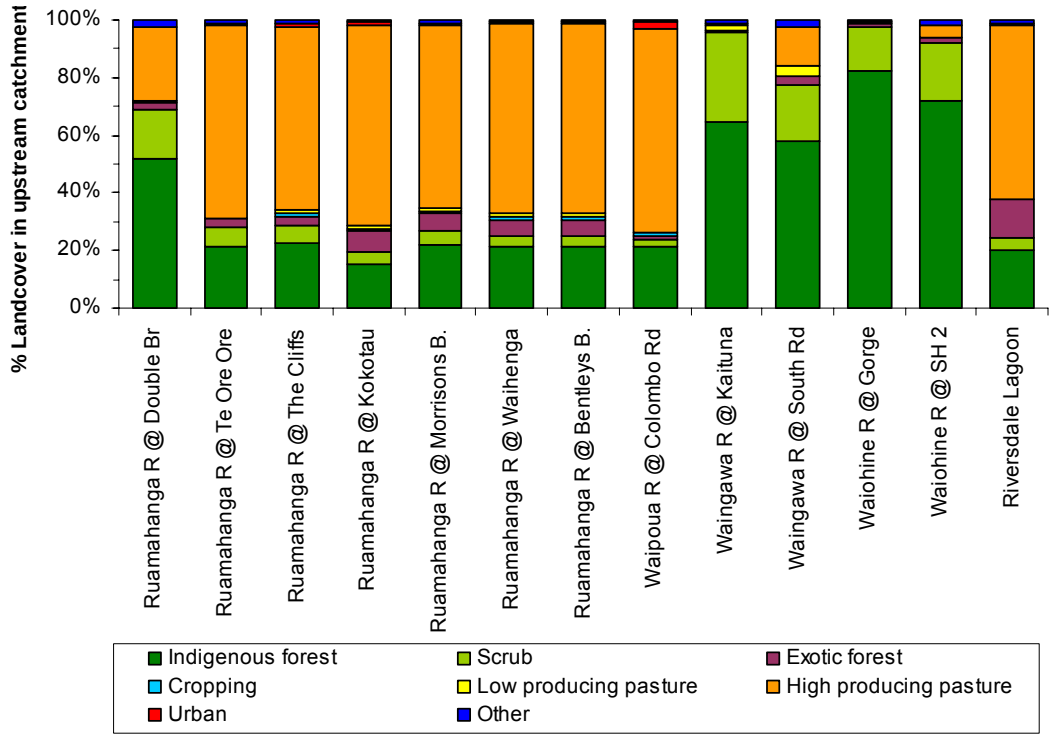

Figure 3.16: Predominant land cover types in the catchment area upstream of each of the 13 freshwater bathing sites in the Wairarapa.

Figure 3.17: Riversdale Lagoon at Riversdale.

3.4.3 Suitability for recreation

The SFRGs for each monitoring site, based on the combined MAC and SIC values, are summarised in Table 3.7. The Ruamahanga River site at Double Bridges has a SFRG of "poor" due to the strong influence of a "D" MAC value. The other Ruamahanga River sites, as well as the Waipoua River and

Riversdale Lagoon sites, also have "D" MAC values; these combine with "high" SIC values to produce SFRGs of "very poor". The poor MAC values reflect the number and magnitude of action level events recorded at many sites over the last five summers. Better MAC and SIC values for the Waingawa River and Waiohine River sites result in higher SFRGs, with a grade of "very good" awarded for the Waiohine River at Gorge.

Table 3.7: MAC values, SIC values and SFRGs for freshwater bathing sites in the Wairarapa.

Site	*n*	No. action events	95th %ile (*E. coli*/100 ml)	Key Microbiological Risks	SIC	MAC	SFRG
RUAMAHANGA RIVER							
Double Bridges	103	9	681	Intensive agriculture in immediate catchment	Moderate /High	D	Poor
Te Ore Ore	103	11	1,700	Intensive agriculture in immediate catchment, Henley Lake supporting large numbers of waterfowl	High	D	V. Poor
The Cliffs	103	9	1,589	Intensive agriculture in immediate catchment	High	D	V. Poor
Kokotau	103	10	2,533	Intensive agriculture in immediate catchment	High	D	V. Poor
Morrisons Bush	103	10	1,209	Intensive agriculture in immediate catchment	High	D	V. Poor
Waihenga	103	10	1,571	Intensive agriculture in immediate catchment	High	D	V. Poor
Bentleys Beach	77	8	1,233	Intensive agriculture in immediate catchment	High	D	V. Poor*
WAIPOUA RIVER							
Colombo Road	83	11	1,244	Intensive agriculture, urban stormwater	High	D	V. Poor*
WAINGAWA RIVER							
Kaituna	103	1	238	Contamination from feral animals	Low	B	Good
South Road	103	3	349	Drainage/run-off from low-intensity agricultural/rural land	Moderate	C	Fair
WAIOHINE RIVER							
Gorge	103	0	114	Contamination from feral animals	Low	A	V. Good
State Highway 2	103	2	134	Drainage/run-off from low-intensity agricultural/rural land	Moderate	B	Good
MOTUWAIREKA RIVER							
Riversdale Lagoon	84	18	4,144	Intensive agriculture, stock access, waterfowl, possible septic tank seepage	V. High	D	V. Poor*

* Interim SFRG only (based on four years of data)

Influence of rainfall

Water quality at the majority of the 13 freshwater bathing sites in the Wairarapa is affected by rainfall events. The influence of rainfall is greatest at

sites draining predominantly pastoral catchments. For example, 70-80% of the action level *E. coli* results recorded at the Ruamahanga River sites of Te Ore Ore, The Cliffs and Kokotau coincided with rainfall of 10 mm or more in the 24 hours prior to sampling, and at least 20 mm in the 48 hours prior to sampling (Figure 3.18). The lower Ruamahanga River sites of Morrisons Bush, Waihenga and Bentleys Beach exhibited a similar, but slightly delayed rainfall effect. This is probably due to the use of rainfall records from the Mount Bruce rainfall station in north Wairarapa, closer to upper Ruamahanga River monitoring sites. At the lower sites, 80-90% of the action level results coincided with rainfall of 10 mm or more in the 48 hours prior to sampling, with 70-90% of the elevated results coinciding with at least 20 mm in the 72 hour prior to sampling (Figure 3.18).

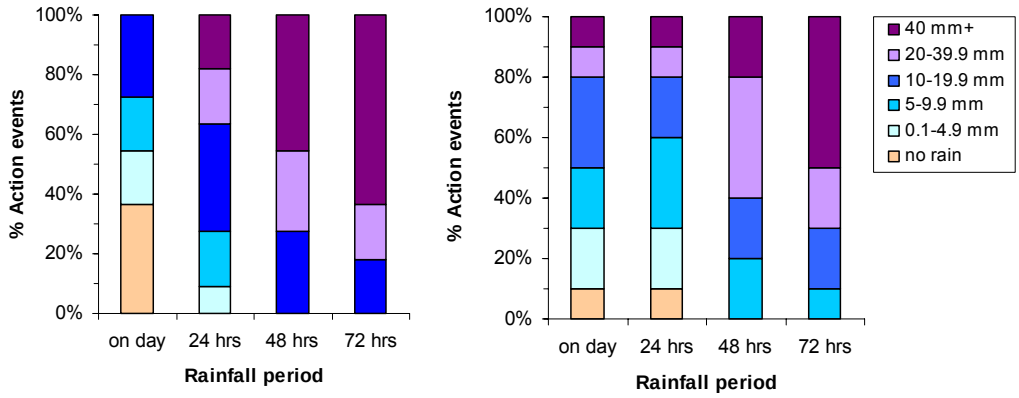

Figure 3.18: Rainfall on the day and in the hours prior to action level results recorded during routine weekly sampling in the Ruamahanga River at Te Ore Ore (left) and Waihenga over the 2001-2006 summer bathing months.

Water quality at Double Bridges, the uppermost monitoring site on the Ruamahanga River, does not appear to be as strongly influenced by rainfall events. Of the nine action level *E. coli* counts recorded at this site, four coincided with little or no rainfall in the 24 hours prior to sampling (Figure 3.19). In addition, on more than a dozen occasions, breaches of the alert level guideline at this site did not coincide with breaches at any other Ruamahanga River site. Elevated *E. coli* counts at Riversdale Lagoon are also poorly correlated with rainfall. Eighteen action level results were recorded in the lagoon over the last five years, with only 30% coinciding with more than 5 mm of rainfall in the 24 hours prior to sampling (Figure 3.19). The correlation improves to just over 55% if rainfall in the 72 hour period prior to sampling is considered. This suggests that other factors, notably stock access upstream, wildlife and septic tank seepage, may account for some of the elevated *E. coli* counts in "fine" weather.

The reason for the poor correlation between action level *E. coli* results and rainfall at Double Bridges is not clear. Elevated faecal bacteria counts at this site have previously been attributed to poor water quality in a small tributary upstream; a targeted water quality investigation undertaken in April 1998 found evidence of a potential bird roosting site in the lower reaches of this tributary (Stansfield 1999). However the actual influence of the tributary on water quality downstream is unclear given it is located approximately 10 km upstream (drains the southern portion of Mount Bruce and a pastoral farming

area west of Mauriceville), and the faecal coliform counts recorded during the investigation did not significantly increase counts downstream of the confluence with the Ruamahanga River (Stansfield 1999).

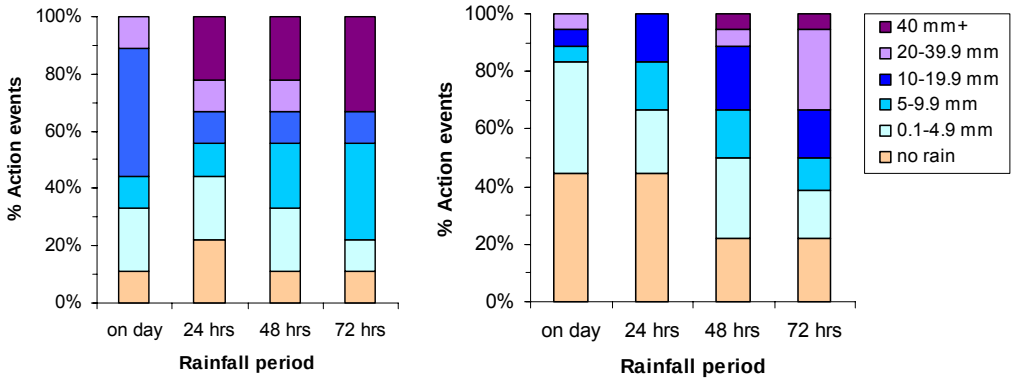

Figure 3.19: Rainfall on the day and in the hours prior to action level results recorded during routine weekly sampling in the Ruamahanga River at Double Bridges (left) and at Riversdale Lagoon over the 2001-2006 summer bathing months.

Action level *E. coli* results recorded in the Waipoua River at Colombo Road all correlate with heavy rain events (Figure 3.20), as do action level results recorded at sites on the lower Waiohine and Waingawa rivers. The latter sites have only exceeded the action level on a few occasions, always following heavy rainfall, and usually in conjunction with at least 10 other Wairarapa freshwater sites.

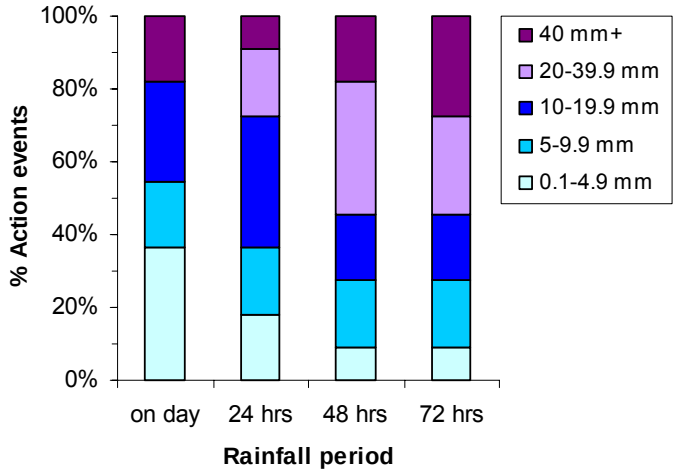

Figure 3.20: Rainfall on the day and in the hours prior to action level results recorded during routine weekly sampling in the Waipoua River at Colombo Road over the 2001-2006 summer bathing months.

Removal of action level results that coincided with at least 10 mm of rainfall in the 24 hours prior to sampling would improve the MAC values, and therefore the SFRGs, for most of the Wairarapa freshwater bathing sites (Table 3.8). For example, the MAC value for the Ruamahanga River sites at Te Ore Ore, The Cliffs, Kokotau and Morrisons Bush would all improve from a "D" to a "C", resulting in an improvement in the SFRG for these sites from "very poor" to "poor". MAC values for the Waingawa River at South Road and the Waiohine

River at State Highway 2 would also improve, with the latter site improving to a SFRG of "very good". Such a grade is at odds with the "moderate" SIC grade for this site but demonstrates the influence rainfall has on microbiological water quality.

Table 3.8: MAC values and SFRGs for freshwater bathing sites in the Wairarapa with the removal of action and alert ***E. coli*** results that coincided with rainfall of 10 mm or more or in the 24 hours prior to sampling.

Site	No. of events		All routine samples			Without action level results			Without action & alert level results		
	Action	Alert	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG
RUAMAHANGA RIVER											
Double Bridges	9	19	103	681 (D)	Poor	99	588 (D)	Poor	94	606 (D)	Poor
Te Ore Ore	11	16	103	1,700	V. Poor	95	458 (C)	Poor	93	459 (C)	Poor
The Cliffs	9	6	103	1,589 (D)	V. Poor	96	385 (C)	Poor	92	259 (B)	Follow Up
Kokotau	10	9	103	2,533 (D)	V. Poor	96	497 (C)	Poor	93	470 (C)	Poor
Morrisons Bush	10	5	103	1,209 (D)	V. Poor	97	488 (C)	Poor	93	332 (C)	Poor
Waihenga	10	10	103	1,571 (D)	V. Poor	99	591 (D)	V. Poor	94	596 (D)	V. Poor
Bentleys Beach	8	8	77	1,233 (D)	V. Poor	73	566 (D)	V. Poor	71	568 (D)	V. Poor
WAIPOUA RIVER											
Colombo Rd	11	9	83	1,244 (D)	V. Poor	76	584 (D)	V. Poor	74	594 (D)	V. Poor
WAINGAWA RIVER											
Kaituna	1	4	103	238 (B)	Good	102	180 (B)	Good	99	119 (A)	V. Good
South Road	3	3	103	349 (C)	Fair	100	187 (B)	Good	97	156 (B)	Good
WAIOHINE RIVER											
Gorge	0	2	103	114 (A)	V. Good	103	114 (A)	V. Good	102	92 (A)	V. Good
State Highway 2	2	1	103	134 (B)	Good	101	94 (A)	Follow Up	101	94 (A)	Follow Up
MOTUWAIREKA RIVER											
Riversdale Lagoon	18	17	84	4,144 (D)	V. Poor	81	2,318 (D)	V. Poor	80	2,340	V. Poor

Table 3.8 demonstrates that the MAC values and SFRGs for some sites would further improve if rain-related alert level results were also removed from the data set used to calculate the MAC values[8]. For example, the SFRGs for the

[8] In most cases there is no change, with the 95th percentile values actually going up at some sites, which reflects the removal of rain-related *E. coli* counts that are lower than the other alert level *E. coli* counts recorded during little or no rainfall.

Ruamahanga River at The Cliffs and the Waingawa River at Kaituna would improve to "good" and "very good" respectively.

Removal of rain-related action (and alert) level *E. coli* results has little influence on the MAC values or SFRGs for the Ruamahanga River at Double Bridges and Riversdale Lagoon – even if the rainfall period is extended to 72 hours prior to sampling (Table 3.9). This reflects the poor correlation between elevated *E. coli* counts and rainfall at these sites.

Overall, with the exception of the Ruamahanga at Double Bridges and Riversdale Lagoon, it is considered that the SFRGs presented in Table 3.7 better reflect the condition of the bathing sites during wet weather than dry weather.

Table 3.9: MAC values and SFRGs for freshwater bathing sites in the Wairarapa with the removal of action ***E. coli*** results that coincided with rainfall of 10 mm or more or in the 72 hours prior to sampling.

Site	All routine samples			Without action level results		
	n	95th %ile (MAC)	SFRG	n	95th %ile (MAC)	SFRG
RUAMAHANGA RIVER						
Double Bridges	103	681 (D)	Poor	99	635 (D)	Poor
Te Ore Ore	103	1,700 (D)	V. Poor	92	420 (C)	Poor
The Cliffs	103	1,589 (D)	V. Poor	94	354 (C)	Poor
Kokotau	103	2,533 (D)	V. Poor	94	416 (C)	Poor
Morrisons Bush	103	1,209 (D)	V. Poor	94	335 (C)	Poor
Waihenga	103	1,571 (D)	V. Poor	94	426 (C)	Poor
Bentleys Beach	103	1,233 (D)	V. Poor	70	500 (C)	Poor
WAIPOUA RIVER						
Colombo Rd	83	1,244 (D)	V. Poor	76	537 (C)	Poor
WAINGAWA RIVER						
Kaituna	103	238 (B)	Good	102	180 (B)	Good
South Road	103	349 (C)	Fair	101	198 (B)	Good
WAIOHINE RIVER						
Gorge	103	114 (A)	V. Good	103	114 (A)	V. Good
State Highway 2	103	134 (B)	Good	101	94 (A)	Follow Up
MOTUWAIREKA RIVER						
Riversdale Lagoon	84	4,144 (D)	V. Poor	75	1,205 (D)	V. Poor

3.5 Synthesis

Of the 23 freshwater bathing sites in the Wellington region, all but one – the Waiohine River at Gorge – exceeded the action level of the recreational water quality guidelines on at least one routine summer sampling occasion over 2001-2006 (Figure 3.21). Nine sites exceeded the action level on 10 or more occasions over this period, often by an order of magnitude (Figure 3.22). Spatial and temporal trends are evident, with sites in some areas exceeding guidelines on more occasions in one year than sites in other regions (Table 3.10). For example, in 2005/2006, none of the four sites in the Kapiti Coast District exceeded the action level guideline but five of the six Hutt River catchment sites did exceed the guideline, with one site exceeding the guideline on six occasions.

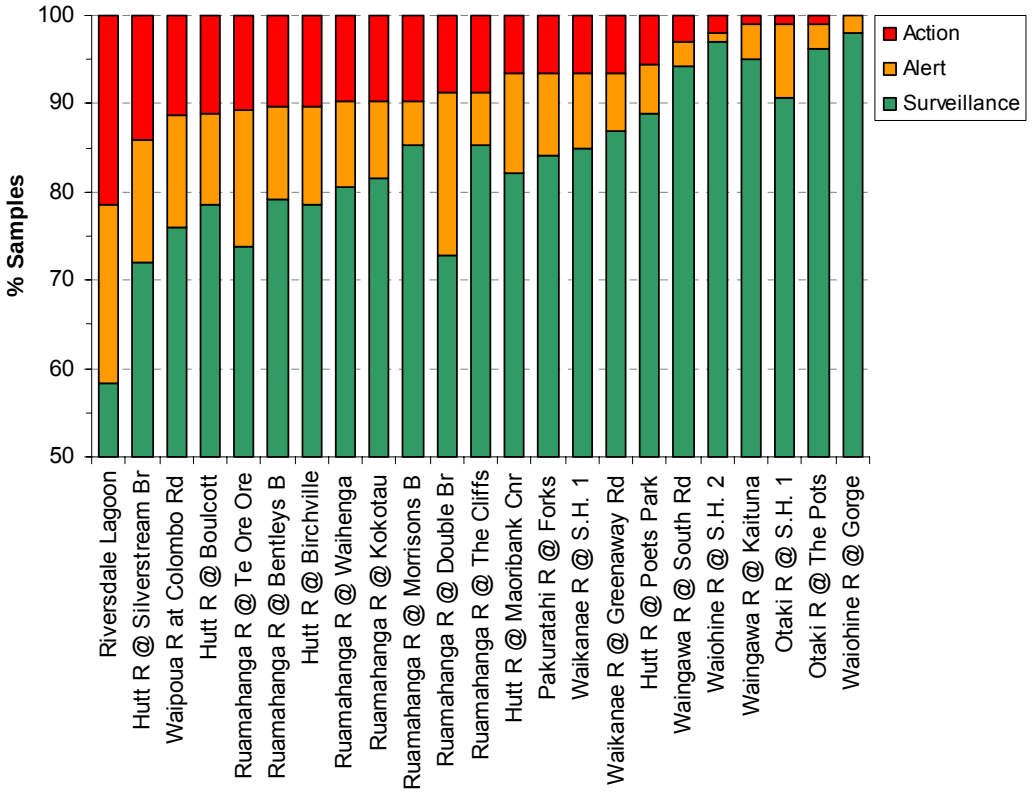

Figure 3.21: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons. Sites are ranked from lowest to highest, based on the percentage of results above the action guideline.

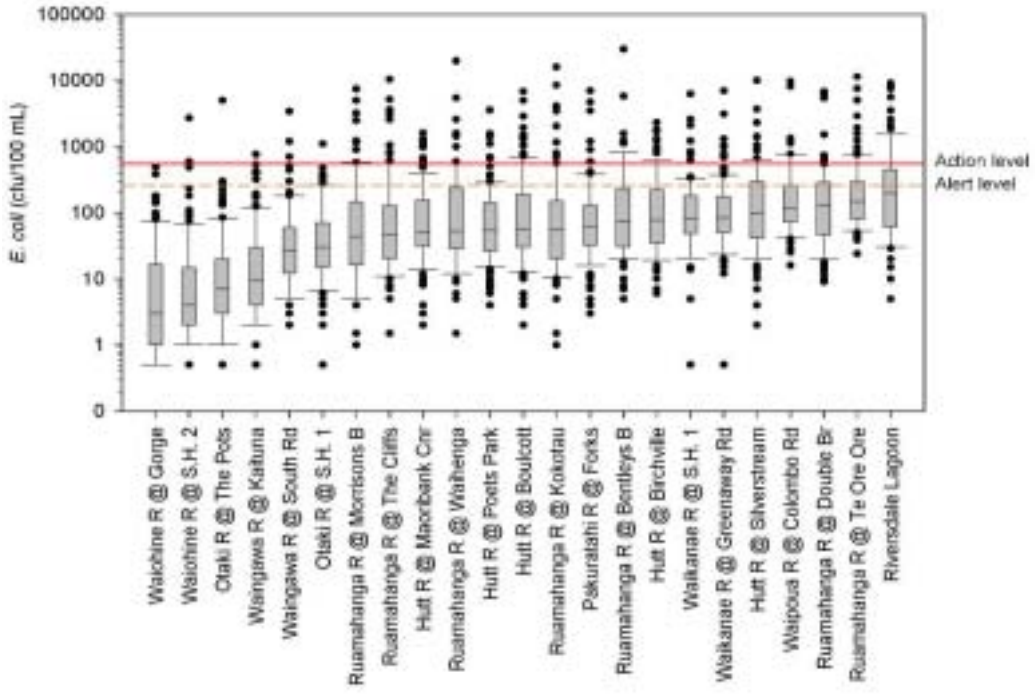

Figure 3.22: Comparison of the median and range of ***E. coli*** counts recorded at each of the 23 freshwater recreational water quality monitoring sites over the 2001-2006 summer seasons – ranked from lowest to highest median value. Note the log-scale on the y-axis.

(Note: the horizontal black line across each box represents the median value, the bottom and top edges of the box represent the 25th and 75th percentile values respectively, and the "whiskers" extending below and above the box represent the 5th and 95th percentile vales respectively).

Table 3.10: Comparison of compliance with the action level of the MfE/MoH (2003) recreational water quality guidelines between sites over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons.

Summer	Exceedances of Action Level	No. of Sites in each Exceedance Category			Total No. of Sites	% of Sites
		Kapiti (4 sites)	Hutt (6 sites)	Wairarapa (13 sites*)		
2001/2002	0	2	0	4	6	28.6
	1	0	1	1	2	9.5
	2	2	2	0	4	19.0
	3	0	2	1	3	14.3
	4	0	1	2	3	14.3
	5	0	0	3	3	14.3
	6	0	0	0	0	0.0
	7	0	0	0	0	0.0
2002/2003	0	1	0	9	10	45.5
	1	3	5	3	11	50.0
	2	0	1	0	1	4.5
	3	0	0	0	0	0.0
	4	0	0	0	0	0.0
	5	0	0	0	0	0.0
	6	0	0	0	0	0.0
	7	0	0	0	0	0.0
2003/2004	0	2	0	1	3	13.0
	1	0	0	1	1	4.3
	2	0	3	5	8	34.8
	3	2	3	3	8	34.8
	4	0	0	2	2	8.7
	5	0	0	0	0	0.0
	6	0	0	0	0	0.0
	7	0	0	1	1	4.3
2004/2005	0	1	0	5	6	26.1
	1	3	4	5	12	52.2
	2	0	2	0	2	8.7
	3	0	0	3	3	13.0
	4	0	0	0	0	0.0
	5	0	0	0	0	0.0
	6	0	0	0	0	0.0
	7	0	0	0	0	0.0
2005/2006	0	4	1	4	9	39.1
	1	0	2	0	2	8.7
	2	0	1	7	8	34.8
	3	0	1	1	2	8.7
	4	0	0	0	0	0.0
	5	0	0	0	0	0.0
	6	0	1	1	2	8.7
	7	0	0	0	0	0.0

* Only 11 sites in 2001/2002 and 12 sites in 2002/2003

Overall, there is a strong correlation between rainfall events and action level *E. coli* results. For example, fewer sites exceeded the action level in 2002/2003 (54.5%) than in 2003/2004 (87.0%) which correlates with, on average drier and wetter summers respectively (Figure 3.23). However, analysis of *E. coli* results on an individual site basis indicates that several sites regularly exceeded the alert and action level guidelines in the absence of any significant rainfall prior to sampling. These include the Hutt River at Silverstream, the Ruamahanga River at Double Bridges and Riversdale Lagoon. At these sites, some other factor(s) influence microbiological water quality, such as stock access upstream, wildlife and/or poor water quality in tributary streams.

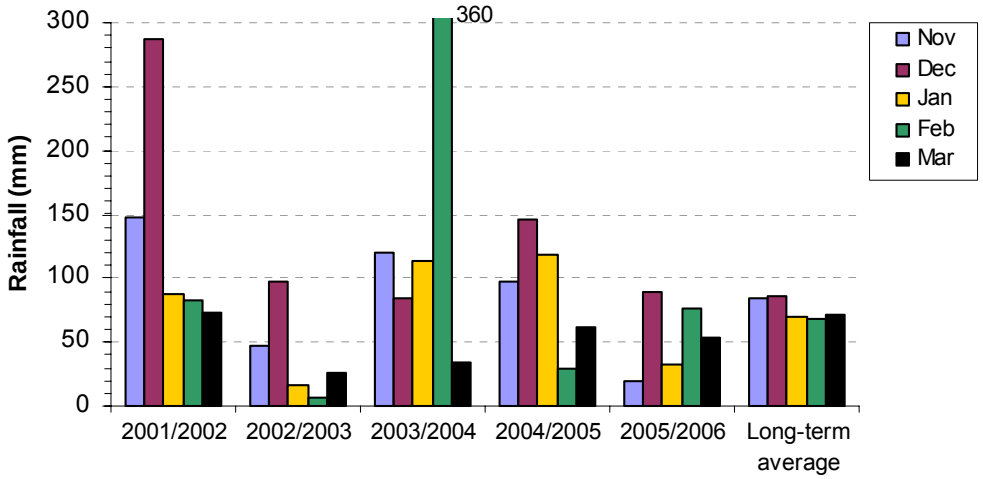

Figure 3.23: Monthly rainfall recorded at the Otaki Depot, Kapiti Coast, over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer months, together with the long-term average monthly rainfall (1951 to 2005).

The amount of rainfall required to trigger an action level result appears to differ across the region; more often than not, the Kapiti sites only exceeded the action guideline following at least 40 mm of rainfall in the 24-48 hours prior to sampling. In contrast, most sites in the Hutt River and Ruamahanga River catchments exceeded the action level if 10 mm of rain had fallen in the 24 hours prior to sampling, with many of the alert level results in the Hutt River catchment coinciding with as little as 5 mm rainfall.

Overall, the high correlation between rainfall events and high bacteria counts supports advice from the Greater Wellington Regional Council and the Ministry of Health to avoid swimming and other contact recreation activities during and for up to several days after heavy rainfall. Urban stormwater (including sewer overflows) and agricultural runoff following rainfall are the major contributors to faecal contamination in rivers and streams in the region.

3.5.1 Suitability for recreation

The SFRGs for each site are determined by combining the MAC value for the 2001-2006 summers with the SIC value based on an assessment of microbiological risks present at each site. The grades are therefore only indicative of the condition of the water at a site during the *summer bathing*

season. The SFRGs for the 23 freshwater monitoring sites (Figure 3.24) are as follows:

- One site has a SFRG of "very good"
- Three sites have a SFRG of "good"
- Two sites have a SFRG of "fair"
- Nine sites have a SFRG of "poor"
- Five sites have a SFRG of "very poor" and three sites have an *interim* SFRG of "very poor"

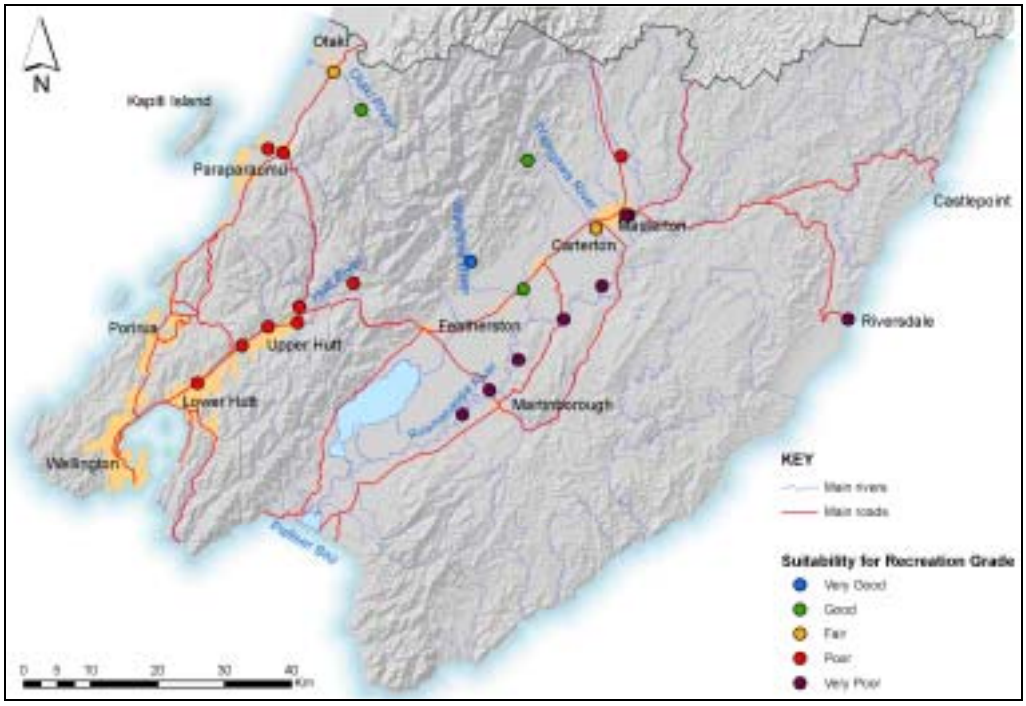

Figure 3.24: Suitability for recreation grades for the 23 freshwater monitoring sites in the Wellington region, based on microbiological risk and MAC values determined from ***E. coli*** counts measured at weekly intervals over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons.

The majority (74%) of the sites have a "poor" or "very poor" SFRG, reflecting "moderate" to "high" risks of microbiological contamination at these sites due to the likely influence of either agricultural run-off or urban stormwater. Agricultural run-off, together with stock access to waterways, can have a major impact on microbiological water quality and all 17 sites graded "poor" or "very poor" had at least 10% of the upstream catchment area in high producing pasture, with most sites in the Wairarapa draining catchments with greater than 50% pasture cover. In contrast, water quality is significantly higher and the risk of microbiological contamination significantly lower, at those sites draining catchments with predominantly (>90%) forest and scrub cover. These include the Otaki River at the Pots, the Waiohine River at Gorge, and the Waingawa River at Kaituna.

If action and alert level *E. coli* results that coincided with more than 10 mm of rainfall in the 24 hours prior to sampling are removed from the data-set used to calculate the MAC value, then the SFRGs for most sites would improve:

- Three sites would have a SFRG of "very good"
- Six sites would have a SFRG of "good", including all four sites in the Kapiti Coast District.
- Four sites would have a SFRG of "fair"
- Six sites would have a SFRG of "poor"
- One site would have a SFRG of "very poor" and three sites would have an *interim* SFRG of "very poor"

According to the MfE/MoH (2003) guidelines, the SFRG describes the general condition of the water at a site at *any given time*, taking into account both microbiological risk and actual microbiological counts measured over time. However, the improvement in SFRGs for most sites with the removal of *E. coli* counts coinciding with significant rain events confirms that the SFRGs generated using all routine summer data better reflect the condition of the bathing sites during wet weather than dry weather when recreational activity is greatest. Exceptions to this include the Hutt River at Silverstream, the Ruamahanga River at Double Bridges and Riversdale Lagoon.

The MfE/MoH (2003) guidelines do set out protocol for "modifying" beach grades, where there are known and predictable periods of high risk, such as following heavy rain. Essentially this means removing rainfall related data. However, this has a 'sanitising' effect on the data and before an SFRG can be modified, local and regional authorities must be able to demonstrate that management interventions have been effective at deterring bathing during, and for several days following, rainfall. While the Greater Wellington Regional Council regularly advises against swimming after heavy rain events, it is unlikely that these warnings are always observed.

3.5.2 Future monitoring requirements

According to MfE/MoH (2003) protocol, sites with a SFRG of "good", "fair" or "poor" should be monitored on a regular weekly basis during the summer bathing season, but routine monitoring is not required at sites graded "very good" or "very poor" (refer Table 2.2, Section 2.2). On this basis, monitoring would cease at 11 of the 23 freshwater sites. However, given that the SFRGs for most "very poor" sites largely reflect bathing conditions during wet weather, it is not considered appropriate to cease monitoring and/or recommend that territorial authorities erect permanent warning signage at these sites. One obvious exception is Riversdale Lagoon. Although the SFRG for Riversdale Lagoon is only based on four years of data (i.e., an interim grade), this site clearly exceeds the recreational water quality guidelines on a regular basis and is not suitable for bathing. Therefore it is recommended that Riversdale Lagoon is removed from the list of freshwater bathing sites. However, ongoing monitoring of microbiological water quality should continue as the lagoon drains to Riversdale Beach, one of the most popular bathing beaches in the Wairarapa.

Regular monitoring of recreational water quality should cease in the Otaki River at the Pots and the Waiohine River at Gorge. Both sites have a very low risk of microbiological contamination and regular monitoring is not justified

given the very high level of compliance with the recreational water quality guidelines over the last five summers. Moreover, microbiological water quality is already monitored at both sites on a monthly basis as part of the Rivers State of the Environment (RSoE) Programme. Therefore, the *E. coli* results obtained from the RSoE Programme over the months of November to March inclusive should be used to monitor compliance with recreational water quality guidelines.

RSoE summer monitoring results from the Akatarawa River upstream of the Hutt River confluence should also be used to assess recreational water quality in the lower reaches of this river. The Regional Freshwater Plan specifies the lower reaches are to be managed for contact recreation purposes (refer Section 1.2.1) but recreational water quality monitoring has not been conducted on the Akatarawa River to date.

4. Suitability for recreation – marine waters

4.1 Introduction

Recreational water quality is currently monitored at 76 marine sites across the Wellington region. These sites were selected on the basis of their use by the public for contact recreation; in particular, swimming, surfing, and boating. Twenty of the sites are located in the Kapiti Coast District, 14 in Porirua City, 15 in Hutt City, 22 in Wellington City, and five in the Wairarapa. The locations of the monitoring sites are shown in Figure 4.1. A full site list can be found in Appendix 1.

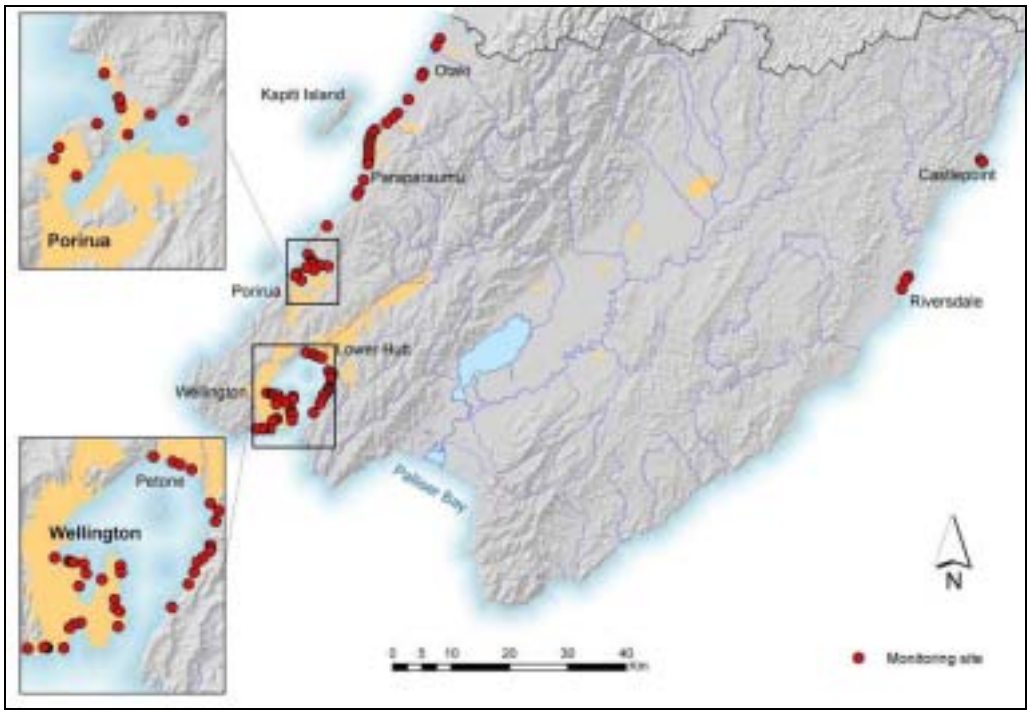

Figure 4.1: Marine recreational water quality monitoring sites in the Wellington region.

4.1.1 Monitoring protocol

Sites are sampled weekly during the summer bathing season (1 November to 31 March inclusive) and at least monthly during the remainder of the year. On each sampling occasion a single water sample is collected 0.2 metres below the surface in 0.5 metres water depth and analysed for enterococci indicator bacteria using a membrane filtration method. This analytical method provides a result in 24 hours, therefore enabling prompt re-sampling in the event that a result exceeds recommended guideline values.

Observations of weather and the state of the tide, and visual estimates of seaweed cover, are also made at each site to assist with the interpretation of the monitoring results. For example:

- Rainfall may increase enterococci counts by flushing accumulated debris from urban and agricultural areas into coastal waters.

- Wind direction can influence the movement of currents along the coastline and can therefore affect water quality at a particular site.
- In some cases, an increase in enterococci counts may be due to the presence of seaweed. Under warm conditions when seaweed is excessively photosynthesising or decaying, enterococci may feed off the decayed seaweed or increased carbonaceous material produced by the seaweed during photosynthesis.

An estimate of the daily rainfall in the catchment adjoining each site over the bathing season is made by obtaining records from Greater Wellington Regional Council's nearest rain gauge (refer Appendix 1).

4.1.2 Guidelines

As outlined in Section 2.1, the MfE/MoH (2003) recreational water quality guidelines use bacteriological "trigger" values to help water managers determine when management intervention is required. The "trigger" values underpin a three-tier management framework analogous to traffic lights (Table 4.1).

Table 4.1: MfE/MoH (2003) surveillance, alert and action levels for marine waters.

Mode	Guideline (Enterococci count in colony-forming units (cfu) per 100 mL)	Management Response
Green/Surveillance	Single sample ≤ 140	Routine monitoring
Amber/Alert	Single sample > 140	Increased monitoring, investigation of source and risk assessment
Red/Action	Two consecutive samples within 24 hours > 280	Closure, public warnings, increased monitoring and investigation of source

When water quality falls in the "surveillance mode", this indicates that the risk of illness from bathing is acceptable (19/1000 risk). If water quality falls into the "alert" category, this indicates an increased risk of illness from bathing, but still within an acceptable range. However, if the water quality enters the "action" category, then the water poses an unacceptable health risk from bathing. At this point, warning signs are erected at the bathing site, and the public is informed that it is unsafe to swim at that site.

Annapolis protocol/beach grading

The process for grading the suitability of sites for contact recreation purposes was outlined in Section 2. The suitability for recreation grades for marine waters are shown in Table 4.2. Refer to Table 2.2, Section 2.2, for more information on SFRGs.

Table 4.2: MfE/MoH (2003) Suitability for Recreation Grades (SFRG) for marine waters.

Susceptibility to faecal influence		Microbiological Assessment Category (MAC)[1]			
		A ≤40 Enterococci/100mL	B 41-200 enterococci/100mL	C 201-500 enterococci/100mL	D >500 enterococci/100mL
Sanitary Inspection Category (SIC)	Very Low	Very Good	Very Good	Follow Up[3]	Follow Up[3]
	Low	Very Good	Good	Fair	Follow Up[3]
	Moderate	Follow Up[2]	Good	Fair	Poor
	High	Follow Up[2]	Follow Up[2]	Poor	Very Poor
	Very High	Follow Up[2]	Follow Up[2]	Follow Up[2]	Very Poor

1 95th percentile value calculated using the Hazen percentile method from five years of data obtained from routine weekly monitoring during the bathing season

2 Indicates unexpected results requiring investigation (reassess SIC and MAC). If after reassessment the SFRG is still "follow-up", assign a conservative grade

3 Implies non-sewage sources of indicators requiring verification. If after verification the SFRG is still "follow-up", assign a conservative grade

4.1.3 Data analysis, limitations and reporting

All sampling and evaluation of results has been undertaken in accordance with the MfE/MoH (2003) microbiological water quality guidelines for marine recreation areas. However, it is not possible to accurately specify the number of true exceedances of the red/action mode of the guidelines. The guidelines specify that a bathing site only enters the action mode when *two consecutive samples* exceed 280 enterococci/100 mL but historically in Wellington, as has occurred in some other regions, a second sample was not always collected, particularly when the first exceedance coincided with a heavy rainfall event. Therefore to ensure that recreational water quality at all 76 sites is assessed on an equal basis, the approach taken in this report was to treat any single result greater than 280 enterococci/100 mL obtained from routine weekly monitoring as an exceedance of the red/action mode of the guidelines.

In this report, assessment of compliance with the recreational water quality guidelines, including derivation of the MAC grades, is limited to the results of routine weekly samples[9] collected over the official summer bathing season (1 November to 31 March inclusive). This is the approach recommended in the MfE/MoH (2003) guidelines, although it is acknowledged that a degree of recreational activity occurs year round at many sites.

During data processing, any enterococci counts reported as less than or greater than detection limits were replaced by values one half of the detection limit or the detection limit respectively (i.e., counts of <1 cfu/100 mL and >400 cfu/100 mL were treated as 0.5 cfu/100 mL and 400 cfu/100 mL respectively).

[9] This means that results arising from a second consecutive sample taken to confirm an action level event, and any subsequent follow-up samples, were excluded from the data-set.

Cautionary note

The number of exceedances of recreational water quality guidelines reported differs from those previously reported by the Greater Wellington Regional Council and other authorities. There are two primary reasons for this:

- Water quality results reported prior to the 2003/2004 summer will have been assessed against either the MfE/MoH (1999) or the MfE/MoH(2002) *interim* microbiological water quality guidelines for recreational areas. The guidelines used in this report were only finalised in June 2003 and differ from the interim guidelines.
- A comprehensive quality assurance audit undertaken in early 2006 on recreational water quality data stored in Greater Wellington Regional Council's water quality database resulted in some corrections to data collected during the period 1 November 2001 to 31 March 2006 inclusive, in particular, data collected over the 2004/2005 summer.

4.2 Kapiti

Recreational water quality monitoring has been conducted at 20 marine sites on the Kapiti Coast over the last five years. These sites stretch from Otaki Beach in the north to Paekakariki Beach in the south (Figure 4.2).

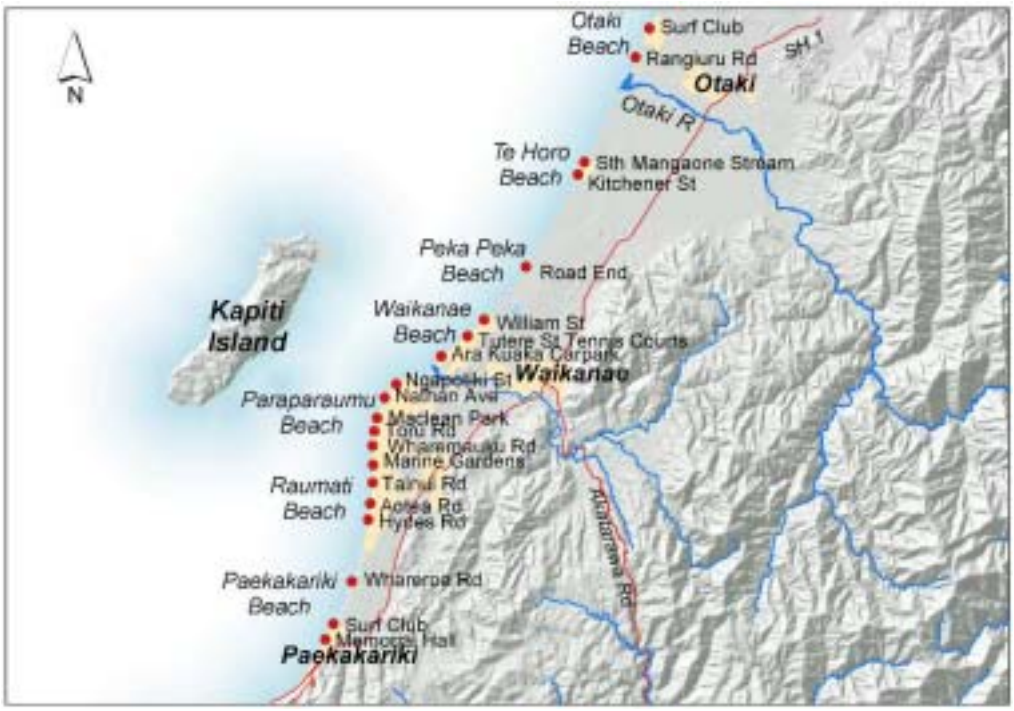

Figure 4.2: Marine recreational water quality monitoring sites on the Kapiti Coast.

4.2.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Paekakariki Beach recorded the highest level of compliance with the guidelines over the five year period (Figure 4.3). The Surf Club was the only site out of

the 76 marine sites in Greater Wellington Regional Councils' Recreational Water Quality Monitoring Programme not to exceed the action or alert guidelines on any occasion. The other two Paekakariki Beach sites (Memorial Hall and Whareroa Rd), together with Peka Peka Beach, also showed a high level of compliance; these sites each exceeded the action guideline just once. In contrast, Te Horo Beach (south of Mangaone Stream) exceeded the action level guideline on nine (8.6%) sampling occasions.

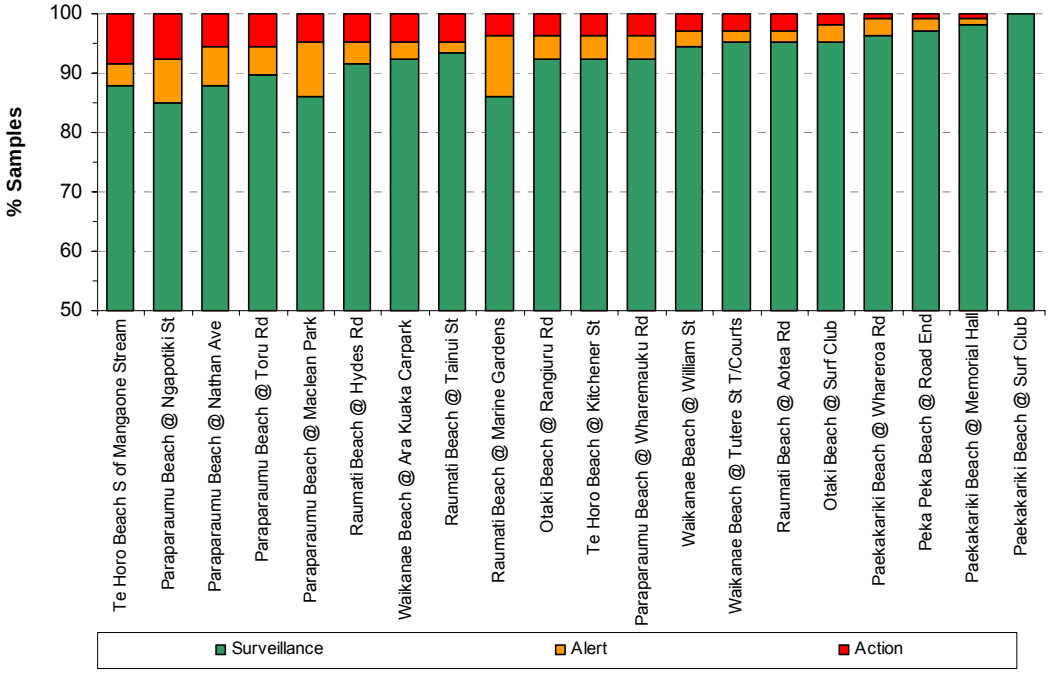

Figure 4.3: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

4.2.2 Microbiological risk factors

Over half of the bathing sites carry a moderate risk of microbiological contamination due to being located in close proximity to stormwater outfalls or confluences with rivers or streams that receive agricultural run-off or urban stormwater, or support significant numbers of waterfowl (Figure 4.4). Sites along Otaki Beach, Peka Peka Beach and Paekakariki Beach are more remote and, although probably influenced by local rivers or streams at times, are considered to have a lower risk of microbiological contamination, mostly from run-off from low intensity land use. Refer to Appendix 3 for a complete assessment of the risk factors present at each site and their influence on water quality.

Figure 4.4: Tikotu Stream drains to Paraparaumu Beach (left) and stormwater outfalls discharge to Waikanae Beach behind the Tutere Street tennis courts.

4.2.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 4.3. Nine of the 20 sites with a "B" MAC value received a grade of "good", including all sites along Otaki Beach, Peka Peka Beach, and Paekakariki Beach. Two of the three Waikanae Beach monitoring sites also have a SFRG of "good" as does Raumati Beach at Aotea Road. The remaining 11 sites, including all five sites along Paraparaumu Beach, have a SFRG of "fair", reflecting "moderate" SIC values and a "C" MAC value.

Table 4.3: MAC values, SIC values and SFRGs for marine bathing sites on the Kapiti Coast.

Site	n	No. action events	95th %ile (Ent./100 mL)	Key Microbiological Risks	SIC	MAC	SFRG
OTAKI BEACH							
Surf Club	107	2	110	Focal points of drainage, via Otaki River/Waitohu Stream	Low	B	Good
Rangiuru Road	107	4	187		Low	B	Good
TE HORO BEACH							
Sth of Mangaone Stream	107	9	408	Mangaone Stream draining agricultural land	Moderate	C	Fair
Kitchener Street	107	4	252		Moderate	C	Fair
PEKA PEKA BEACH							
Road End	107	1	102	Focal points of drainage	Low	B	Good
WAIKANAE BEACH							
William Street	107	3	167	Ngarara Stream draining agricultural land & urban stormwater	Moderate	B	Good
Tutere Street	107	3	135		Moderate	B	Good
Ara Kuaka Carpark	107	5	236	Waikanae River Estuary draining urban/rural land & supporting large numbers of waterfowl	Moderate	C	Fair
PARAPARAUMU BEACH							
Ngapotiki Street	107	8	340	Waikanae River Estuary	Moderate	C	Fair
Nathan Avenue	107	6	343	Waikanae River Estuary, urban stormwater		C	Fair
Maclean Park	107	5	248	Tikotu Stream carrying urban stormwater	Moderate	C	Fair
Toru Road	107	6	333		Moderate	C	Fair
Wharemauku Rd	107	4	238		Moderate	C	Fair
RAUMATI BEACH							
Tainui Street	107	5	259	Urban stormwater	Moderate	C	Fair
Marine Gardens	107	4	238	Wharemauku Stream & urban stormwater	Moderate	C	Fair
Aotea Road	107	3	138		Low/ Moderate	B	Good
Hydes Road	107	5	246	Urban stormwater	Moderate	C	Fair
PAEKAKARIKI BEACH							
Whareroa Road	107	1	113	Whareroa Stream/focal points of drainage	Low	B	Good
Surf Club	107	0	67	Wainui Stream/focal points of drainage	Low	B	Good
Memorial Hall	107	1	68		Low	B	Good

Influence of rainfall

Four of the 20 monitoring sites exceeded the action guideline level on more than five occasions over the last five years, including Te Horo Beach (south of Mangaone Stream) and three sites along Paraparaumu Beach (Table 4.3). Of the nine action level events recorded at Te Horo Beach, all but one coincided with significant (>10 mm) rainfall in the 72 hours prior to sampling (Figure 4.5). These events probably result from high flows in the Mangaone Stream which discharges to the coast approximately 80 m north of the monitoring site. If these eight action results are removed from the data set used to calculate the MAC value, the MAC value would improve from "C" to "B"[10], resulting in a SFRG of "good".

[10] The 95th percentile result used to determine the MAC value would decrease from 408 to 143 enterocci/100 mL (n=99).

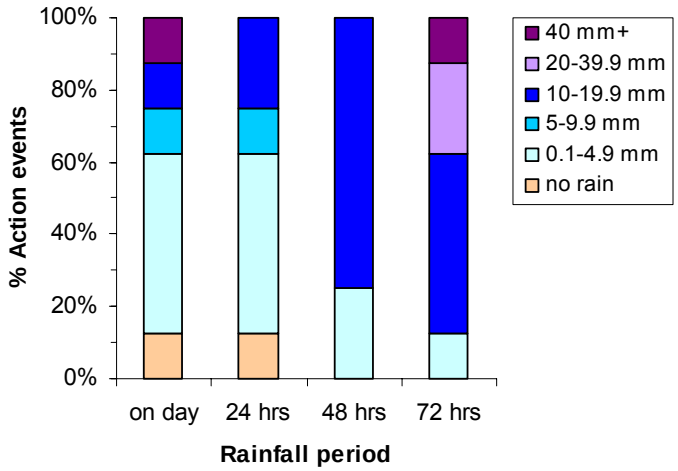

Figure 4.5: Rainfall on the day and in the hours prior to action level events (nine) recorded during routine weekly sampling at Te Horo Beach south of Mangaone Stream over the 2001-2006 summer bathing period.

Of the 20 action level events recorded across the three Paraparaumu Beach sites, only 11 (55%) coincided with rainfall in the 24 hours prior to sampling, and just six (30%) coincided with 10 mm or more of rainfall in the 72 hour period prior to sampling. Action level events at the Ngapotiki Street site showed the poorest correlation with rainfall; just one of a total of eight action events coincided with more than 10 mm of rainfall (Figure 4.6). The correlation was similar at Nathan Street but better at Toru Road, where half of the six action events coincided with more than 10 mm of rainfall (Figure 4.6).

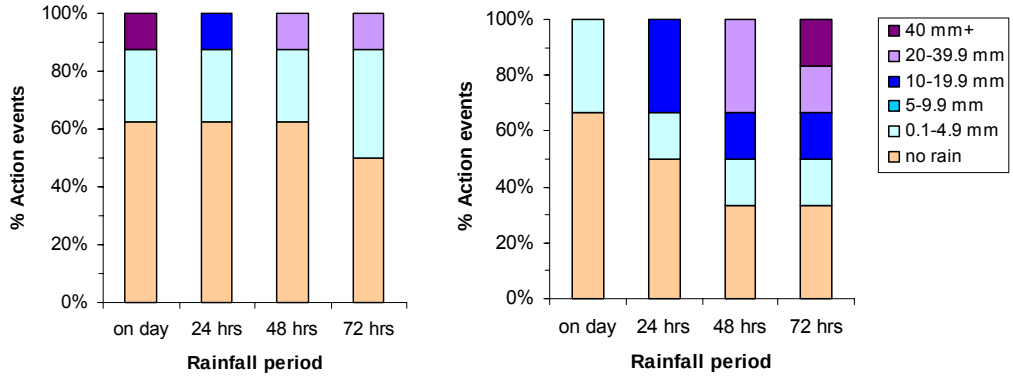

Figure 4.6: Rainfall on the day and in the hours prior to action level events recorded during routine weekly sampling along Paraparaumu Beach at Ngapotiki Street (left) and Toru Road over the 2001-2006 summer bathing period.

The poor correlation between elevated enterococci counts at Paraparaumu Beach and rainfall events suggests that water quality at this beach is more strongly influenced water quality in the rivers and streams discharging to the coast. For example, the Waikanae River discharges to the coast approximately 900 m north of the Ngapotiki site. Microbiological water quality in the lower estuarine reaches is affected by a combination of factors including large populations of waterfowl, agricultural activity, the Mazengarb Drain and urban stormwater. Given the size of the Waikanae River, and the net direction of

water movement on the Kapiti Coast typically being southwards[11], then it is highly likely that the river influences water quality along the northern part of Paraparaumu Beach, particularly during strong northerly winds which, together with multiple sandbars and lagoons, keep the river outflow inshore (Robertson[12], pers. comm., 2006). Further south, Tikotu Stream is likely to influence water quality in the vicinity of Maclean Park and Toru Road, although at times the Waikanae River may also influence water quality at these sites.

High wave energies are also a feature at many Kapiti beaches, resulting in sediment re-suspension that may be a factor in some high bacterial counts in "fine" weather. In addition, bacterial counts at beaches towards the northern end of the Kapiti Coast appear to be influenced by floods in the major rivers to the north of the Wellington region (e.g., Manawatu River, Rangitikei River).

4.3 Porirua

Recreational water quality monitoring has been conducted at 14 marine sites in Porirua City over the last five years (Figure 4.7). An additional site – Porirua Harbour at Te Hiko Street – was monitored over 2001/2002 but was dropped after twelve of the 22 samples collected exceeded the action level of the recreational water quality guidelines (Milne 2005).

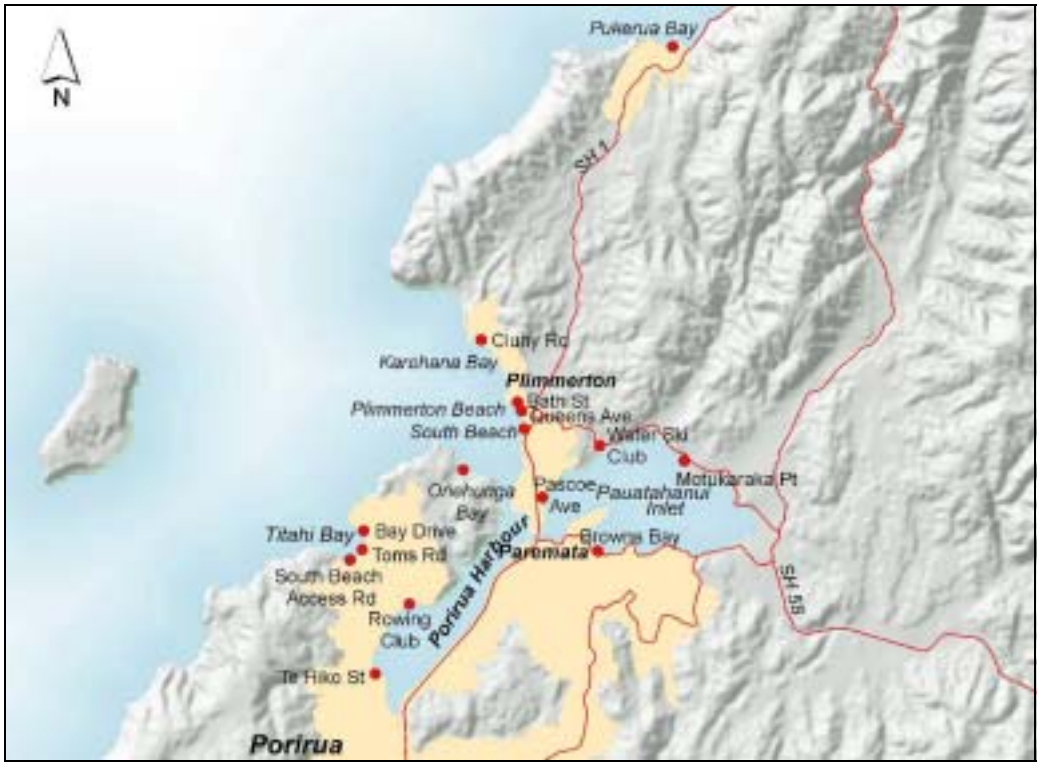

Figure 4.7: Marine recreational water quality monitoring sites in Porirua City.

[11] On the Kapiti and Porirua coast the net direction of water movement is usually southwards, the result of the (oceanic) D'Urville Current entering Cook Strait from the west, the predominant westerly winds, and refraction of the south-westerly swell around the top of the South Island so that wave approach to the beach is usually from the north-west (Gary Stephenson, Coastal Marine Ecology Consultants, pers. comm. 2005).

[12] Anne Robertson, KCDC Laboratory Manager.

4.3.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Overall, Pukerua Bay recorded the highest level of compliance with the recreational water quality guidelines over the five year period (Figure 4.8). This site exceeded the action level guideline on two occasions and the alert guideline on one occasion. Titahi Bay at Bay Drive, the Pauatahanui Inlet at Browns Bay and South Beach at Plimmerton recorded the lowest level of compliance, exceeding the action level guideline on more than 10% of sampling occasions. At many sites, a number of exceedances were one or two orders of magnitude above the recreational water quality guidelines. No site exceeded the action or alert guideline levels over the 2005/2006 summer (Milne and Wyatt 2006).

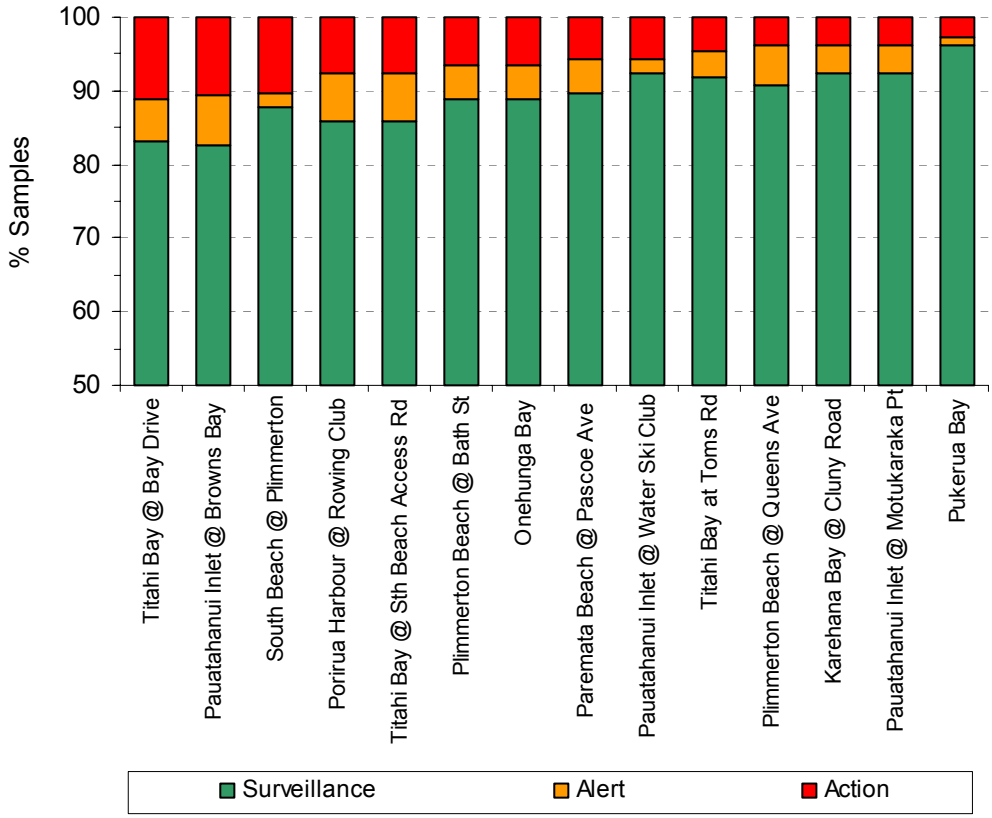

Figure 4.8: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

4.3.2 Microbiological risk factors

The majority of bathing sites carry a moderate risk of microbiological contamination due to being located in close proximity to confluences with streams or drains that receive either agricultural run-off or urban stormwater (Figure 4.9). Pukerua Bay is more remote and is considered to have a lower risk of microbiological contamination, despite the presence of a stream nearby. Refer to Appendix 3 for a complete assessment of the risk factors present at each site.

Figure 4.9: Browns Stream (left) flows into the Pauatahanui Inlet at Browns Bay and Taupo Stream discharges to Plimmerton Beach.

4.3.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 4.4. Although 13 of the 14 sites had a "moderate" SIC value, variation in the MAC values ("B" to "D"), results in SFRGs of "good" (three sites), "fair" (five sites) and "poor" (six sites). The SFRG for the Pauatahanui Inlet at Browns Bay is an interim grade; this site has only been monitored for four years to date.

Table 4.4: MAC values, SIC values and SFRGs for marine bathing sites in Porirua City.

Site	n	No. action events	95th %ile (Ent./100 mL)	Key Microbiological Risks	SIC	MAC	SFRG
PUKERUA BAY							
Pukerua Bay	106	3	113	Focal points of drainage	Low	B	Good
KAREHANA BAY							
Cluny Rd	107	4	188	Drain carrying urban stormwater	Moderate	B	Good
PLIMMERTON BEACH							
Bath Street	107	7	502	Taupo Stream draining swampland & populated by waterfowl, urban stormwater	Moderate	D	Poor
Queens Avenue	107	4	204			C	Fair
South Beach	107	11	811			D	Poor
PAREMATA BEACH							
Pascoe Ave	107	6	490	Drain carrying urban stormwater	Moderate	C	Fair
PAUTAHANUI INLET							
Water Ski Club	107	6	344	Streams draining agricultural land	Moderate	C	Fair
Motukaraka Pt	107	4	191	Streams draining agricultural land	Moderate	B	Good
Browns Bay	107	9	632	Browns Stream carrying urban stormwater	Moderate	D*	Poor
PORIRUA HARBOUR (ONEPOTO ARM)							
Rowing Club	107	8	918	Stream carrying urban stormwater	Moderate	D	Poor
TITAHI BAY							
Bay Drive	107	12	962	Stream/drain carrying urban stormwater	Moderate	D	Poor
Toms Road	107	4	309		Moderate	C	Fair
S/Beach Access Rd	107	8	361		Moderate	C	Fair
ONEHUNGA BAY							
Onehunga Bay	107	7	563	Stream draining rural land (Whitireia Park)	Moderate	D	Poor

* Interim SFRG only (based on four years of data)

Influence of rainfall

Nine of the 14 monitoring sites exceeded the action guideline level on more than five occasions over the last five years. Of the 74 action level events recorded across these nine sites, 57 (77%) coincided with some rainfall in the 24 hours prior to sampling, and 49 (66%) coincided with rainfall of 10 mm or more in the 72 hour period prior to sampling.

Analysis of rainfall records for the individual sites that have exceeded the action level guideline on more than five occasions suggests that the influence of rainfall in contributing to elevated results may be more important at some sites than others. For example, of the nine action events recorded in the Pauatahanui Inlet at Browns Bay, just three coincided with more than 10 mm of rain in the 72 hours prior to sampling (Figure 4.10). In contrast, action level events recorded across the inlet at the Water Ski Club showed a greater correlation with rainfall (five out of six), with four events coinciding with more than 20 mm of rainfall in the 72 hours prior to sampling (Figure 4.10). Some of the elevated enterococci counts recorded at Browns Bay in the absence of significant rainfall may be attributed to the influence of Browns Stream (Figure 4.9); this stream flows into the Pauatahanui Inlet immediately west of the monitoring site and has a history of poor water quality (refer Appendix 3).

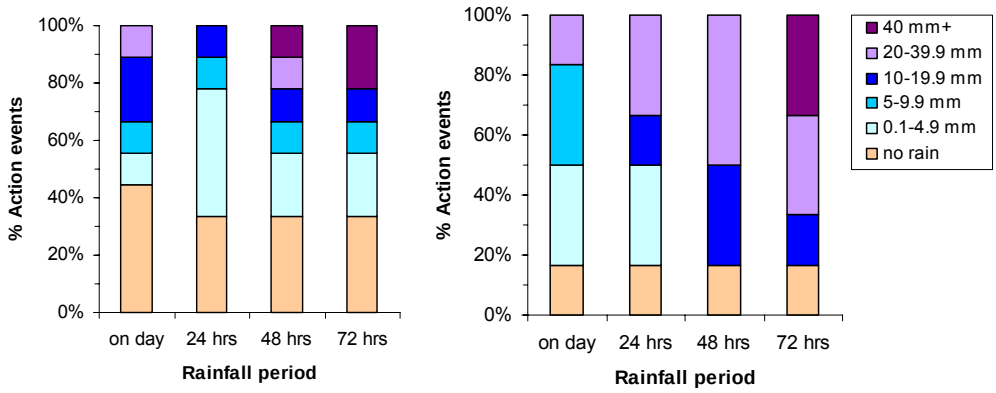

Figure 4.10: Rainfall on the day and in the hours prior to action level events recorded during routine weekly sampling in the Pauatahanui Inlet at Browns Bay (left) and the Water Ski Club over the 2001-2006 summer bathing period.

Although action level events recorded at Plimmerton Beach at Bath Street and South Beach at Plimmerton show a better correlation with rainfall events than those recorded at Browns Bay, several events did not coincide with any rainfall in the 72 hours prior to sampling (Figure 4.11). It is likely that Taupo Stream influences water quality at these sites at times. Taupo Stream discharges to the beach 100 metres north of South Beach and has a history of high bacteria counts, resulting largely from waterfowl in Taupo Swamp and urban stormwater in the lower reaches.

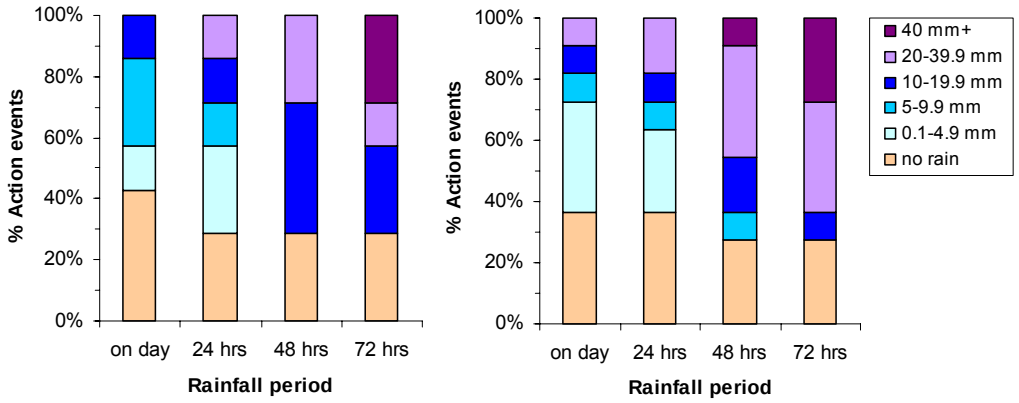

Figure 4.11: Rainfall on the day and in the hours prior to action level events recorded during routine weekly sampling at Plimmerton Beach at Bath Street (left) and South Beach over the 2001-2006 summer bathing period.

Action level events recorded at Paremata Beach (Pascoe Avenue), the Porirua Harbour at the Rowing Club, Titahi Bay at South Beach Access Road and Onehunga Bay all show a reasonably strong correlation with rainfall. For example, of the seven action events recorded at Onehunga Bay, six coincided with more than 10 mm of rainfall in the 72 hours prior to sampling, with five recorded following more than 20 mm of rainfall (Fig 4.12).

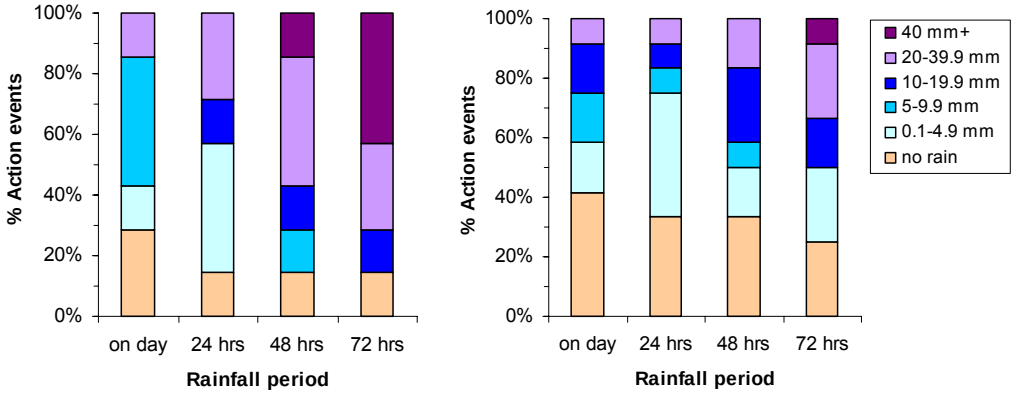

Figure 4.12: Rainfall on the day and in the hours prior to action level events recorded during routine weekly sampling at Onehunga Bay (left) and Titahi Bay at Bay Drive over the 2001-2006 summer bathing period.

Titahi Bay at Bay Drive recorded the highest number of action level events of the 76 marine recreational water quality monitoring sites (12). Analysis of rainfall records for this site indicates that nine of the 12 events coincided with less than 5 mm of rainfall in the 24 hours prior to sampling (Fig. 4.12). If the 72 hour period prior to sampling is considered, only six events followed more than 10 mm of rain. This suggests that water quality at this site is often influenced by a factor(s) other than rainfall. A small stream/drain does discharge onto the beach at the monitoring site although the influence of this on water quality is unclear as is the movement of water within the bay. Streams/drains also discharge onto the beach at the other two monitoring sites (Toms Road and South Beach Access Road) and a grab sample from the outlet of the stream at South Beach Access Road in May 2006 revealed a high bacteria count (12,000 faecal coliforms per 100 mL). There are also a large number of boatsheds located to the north (and south) end of Titahi Bay and

concern has been expressed that some of these may contain washing or other facilities that are not reticulated (Fleming[13], pers. comm., 2006). This requires further investigation.

Removal of the six action events that coincided with more than 10 mm of rainfall only improves the MAC value from a "D" to a "C" (resulting in a SFRG of "fair") and confirms that other factors contribute to elevated enterococci counts at Bay Drive.

4.4 Hutt

Recreational water quality monitoring has been conducted at 15 marine sites in Hutt City over the last five years (Figure 4.13).

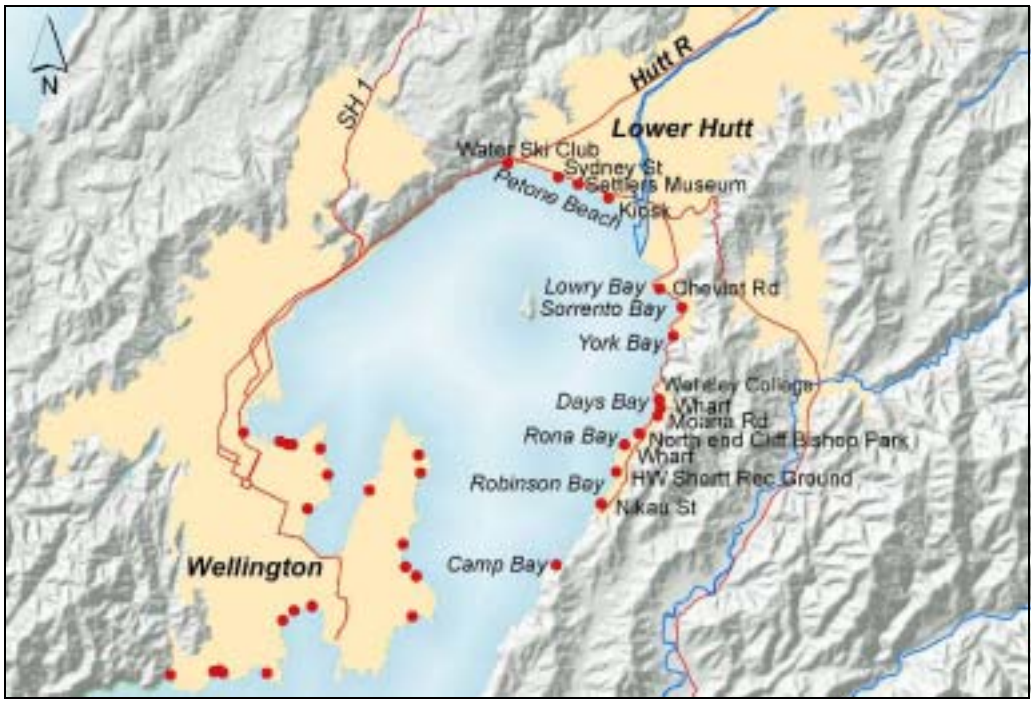

Figure 4.13: Marine recreational water quality monitoring sites in Hutt City.

4.4.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Overall, Days Bay at Moana Road and Petone Beach at the Settlers Museum recorded the highest level of compliance with the recreational water quality guidelines (Figure 4.14). Neither of these sites exceeded the action level guideline on any occasion, although both sites exceeded the alert guideline on four or more occasions. Petone Beach at Sydney Street recorded the lowest level of compliance, exceeding the action level guideline on seven (6.5%) sampling occasions.

[13] Tracey Fleming, PCC Senior Environmental Health Officer

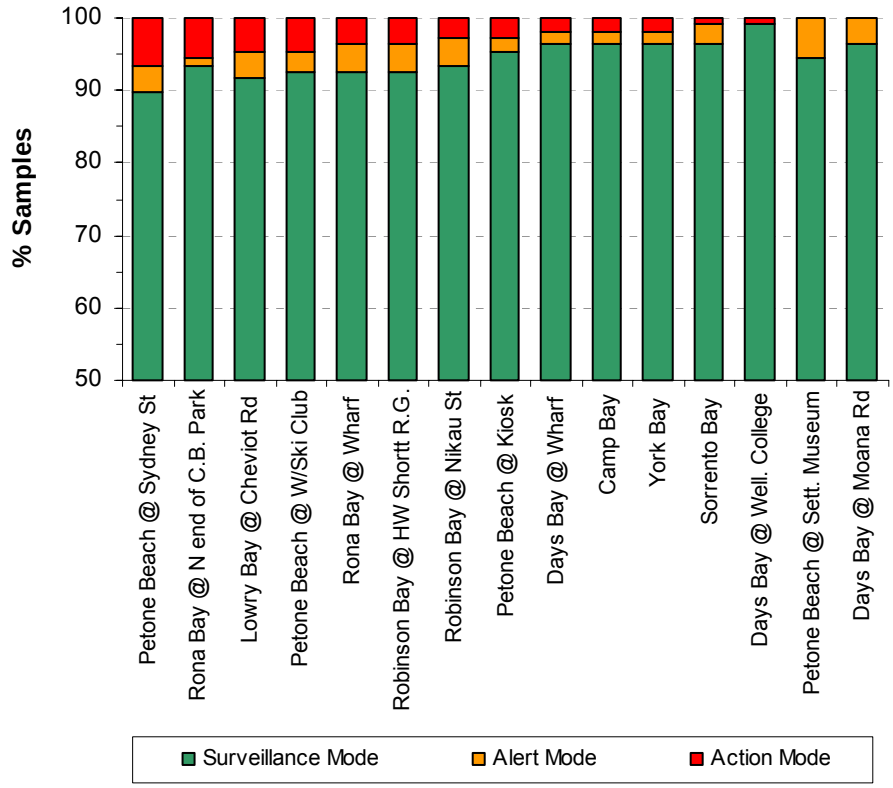

Figure 4.14: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer bathing seasons.

4.4.2 Microbiological risk factors

All four Petone Beach bathing sites have a moderate risk of microbiological contamination, reflecting their close proximity to multiple stormwater outfalls draining the heavily urbanised areas of Lower Hutt and Petone (Figure 4.15). In contrast to Petone Beach sites, the majority of the bathing sites around the eastern bays, from Sorrento Bay to Camp Bay inclusive, are considered to have a low risk of microbiological contamination. Most of these sites receive some drainage from low intensity urban areas, but this runoff is unlikely to carry the same degree of microbiological contamination as the urban stormwater draining Lower Hutt and Petone.

Figure 4.15: Stormwater outfalls at Petone Beach (left) and Rona Bay at the northern end of Cliff Bishop Park.

Some sites are also likely to be influenced by the Hutt River and smaller streams draining to the coast. This is discussed further in Section 4.4.3. Refer to Appendix 3 for a complete assessment of the risk factors present at each site.

4.4.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 4.5. The majority of the sites have a SFRG of "good" or "fair", with poorer MAC values being largely responsible for sites classified as "fair". Camp Bay is graded "very good", reflecting the absence of any major inputs of microbiological contaminants at this site.

Table 4.5: MAC values, SIC values and SFRGs for marine bathing sites in Hutt City.

Site	n	No. action events	95th %ile (Ent./100 mL)	Key Microbiological Risks	SIC	MAC	SFRG
PETONE BEACH							
Water Ski Club	107	5	283	Urban stormwater	Moderate	C	Fair
Sydney Street	107	7	375	Urban stormwater	Moderate	C	Fair
Settlers Museum	107	0	158	Urban stormwater	Moderate	B	Good
Kiosk	107	3	124	Urban stormwater	Moderate	B	Good
SORRENTO BAY							
Sorrento Bay	107	1	102	Focal points of drainage	Low	B	Good
LOWRY BAY							
Cheviot Rd	107	5	283	Focal points of drainage	Low	C	Fair
YORK BAY							
York Bay	107	2	89	Focal points of drainage	Low	B	Good
DAYS BAY							
Wellesley College	107	1	85	Focal points of drainage	Low	B	Good
Wharf	107	2	140	Stream/focal points of drainage	Low	B	Good
Moana Road	107	0	122	Focal points of drainage	Low	B	Good
RONA BAY							
Cliff Bishop Park	107	6	342	Stream/drain – focal points of drainage, incl. urban stormwater	Low/ Moderate	C	Fair
Wharf	107	4	215	Stream/drain – focal points of drainage, incl. urban stormwater	Low/ Moderate	C	Fair
ROBINSON BAY							
HW Shortt Rec Ground	107	4	235	Focal points of drainage	Low	C	Fair
Nikau St	107	3	172	Focal points of drainage	Low	B	Good
CAMP BAY							
Camp Bay	107	2	122	None identified	Very Low	B	V.Good

Influence of rainfall

Milne (2005) reported that the correlation between the number of action level events and rainfall is poor for many marine bathing sites in Hutt City. The 2003/2004 summer highlights this well. For example, despite February 2004 being exceptionally wet (Figure 4.16), only six of the 20 action level events

recorded over the 2003/2004 summer occurred during this month. In contrast, seven of the events occurred over the months of November and December when rainfall was well below the long-term average.

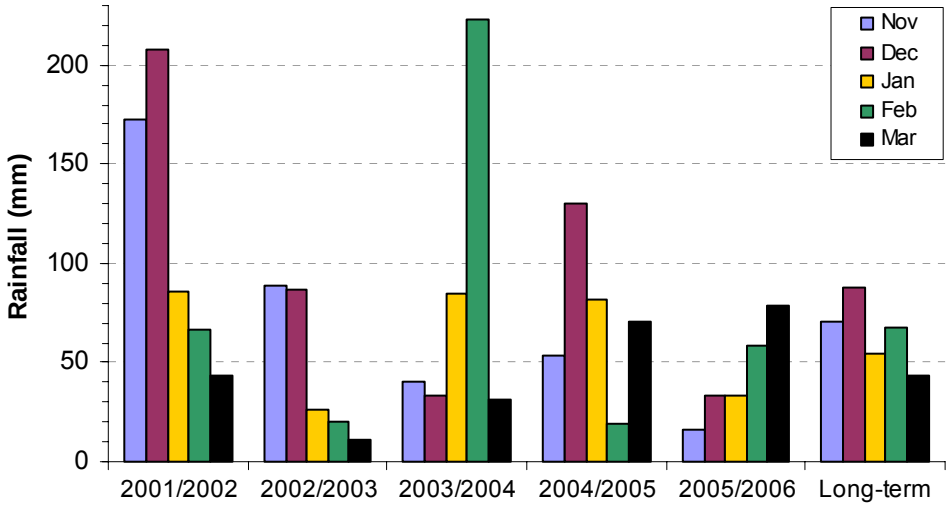

Figure 4.16: Monthly rainfall recorded at the Shandon Rainfall Station over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer months, together with the long-term average monthly rainfall (2000 to 2006).

Only two of the 15 marine bathing sites in Hutt City have exceeded the action level on more than five occasions over the last five summers; Petone Beach at Sydney Street and Rona Bay at Cliff Bishop Park (Table 4.5). Analysis of rainfall records for these two sites suggests that the influence of rainfall in contributing to elevated results may be more important at Rona Bay than Petone Beach. For example, of the seven action events recorded at Sydney Street, only three coincided with rainfall in the 24 hours prior to sampling, and the amount of rainfall on each of these occasions was less than 5 mm (Figure 4.17). In contrast, action level events recorded at Cliff Bishop Park showed a greater correlation with rainfall (five out of six), with three events coinciding with more than 10 mm of rainfall in the 72 hours prior to sampling (Figure 4.17).

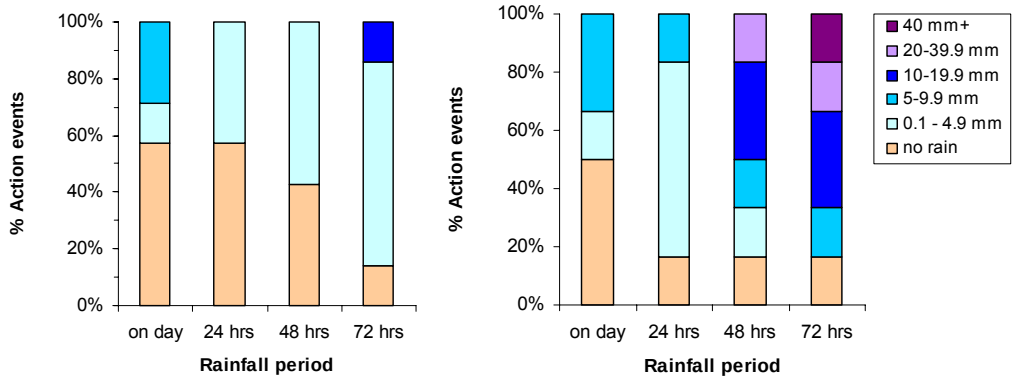

Figure 4.17: Rainfall recorded on the day and the hours prior to action level events recorded during routine weekly sampling at Petone Beach (Sydney Street) (left) and Rona Bay (Cliff Bishop Park) over the 2001-2006 summer bathing period.

The reasons why a number of elevated enterococci results coincide with little or no rainfall are unclear. There does not appear to be any consistent pattern with respect to seaweed cover, tides or wind direction. At some sites, local streams or drains may be affecting coastal water quality at times. For example, water quality at Petone Beach can be influenced by the Hutt River, particularly when a high tide and strong southerly wind coincide. It is also likely that elevated enterococci counts occur with sediment re-suspension as a result of high wave energies at some locations.

4.5 Wellington City

Recreational water quality monitoring has been conducted at 22 marine sites in Wellington City over the last five years (Figure 4.18). There was one change in monitoring sites during this period; the Old Bait Shed at Island Bay was dropped after the 2004/2005 summer in favour of a site adjacent to Derwent Street, to the west of the Reef Street Recreation Ground. Monitoring at the Derwent Street site commenced in January 2005.

Figure 4.18: Marine recreational water quality monitoring sites in Wellington City.

4.5.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Scorching Bay and Lyall Bay at Onepu Road were the only two sites not to exceed the action level of the recreational water quality guidelines over the five year period (Figure 4.19). In contrast, Oriental Bay at the Wishing Well and the Band Rotunda exceeded the action level guidelines on seven (6.9%) and five (5.0%) sampling occasions respectively.

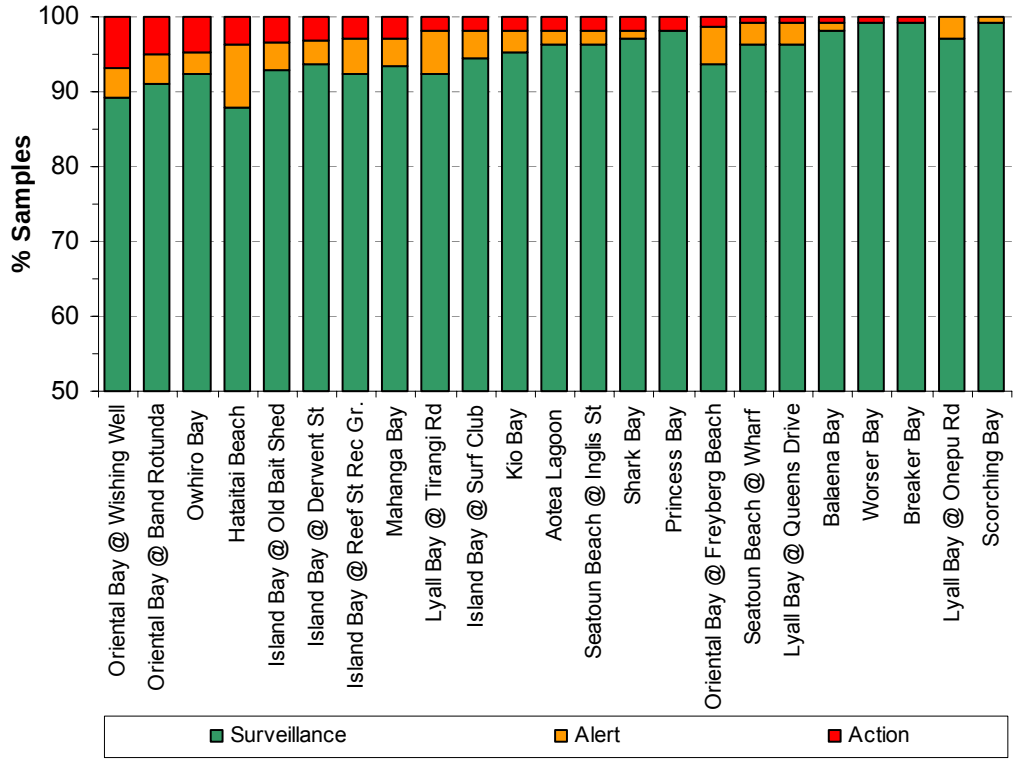

Figure 4.19: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the last five summer bathing seasons (November 2001 to 31 March 2006 inclusive).

4.5.2 Microbiological risk factors

Sites at Aotea Lagoon, Oriental Bay, Seatoun Beach, Lyall Bay and Island Bay all have a moderate risk of microbiological contamination, reflecting their close proximity to urban stormwater outfalls (Figure 4.20). Hataitai Beach and Owhiro Bay also have a moderate risk of contamination. Faecal contamination from ducks and urban runoff pose the major risks at Hataitai Beach, although decaying leaf litter from nearby pohutukawa trees may also play a role (Wood[14], pers. comm., 2006). Owhiro Stream, an urban stream draining a mix of residential and industrial land use, discharges to Owhiro Bay and has a long history of elevated faecal bacteria counts (Figure 4.21).

Sites at Balaena Bay, Kio Bay, Shark Bay, Mahanga Bay, Scorching Bay, Worser Bay, Breaker Bay and Princess Bay are considered to have a low risk of microbiological contamination. Most of these sites receive some drainage from low intensity urban areas, but this runoff is unlikely to carry the same degree of microbiological contamination as the large urban stormwater outfalls that drain to the inner Wellington Harbour and areas such as Lyall Bay and Island Bay. Refer to Appendix 3 for a complete assessment of the risk factors present at each site and their likely influence on water quality.

[14] Nicci Wood, Investigations Engineer, Capacity (Wellington Water Management Ltd).

Figure 4.20: Stormwater outfall at Tirangi Road, Lyall Bay.

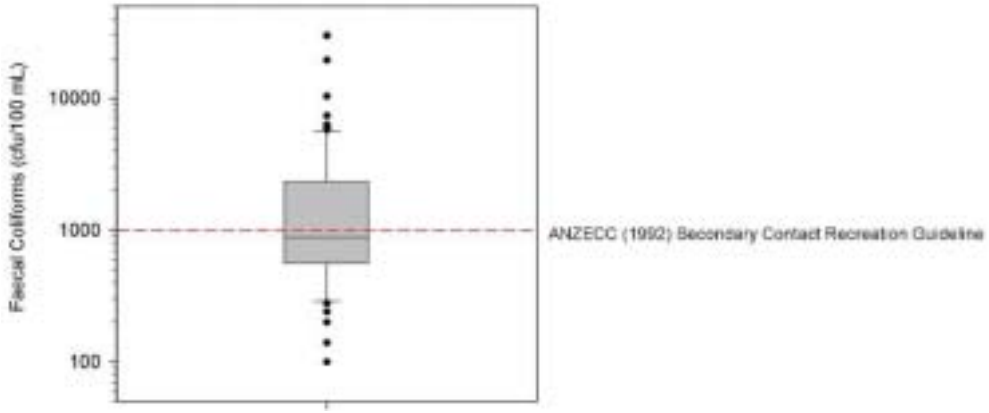

Figure 4.21: Box-plot summarising faecal coliforms counts recorded near the mouth of the Owhiro Stream, based on routine monthly monitoring over August 1997-August 2003 inclusive as part of the Rivers State of the Environment Monitoring Programme. Note the log-scale and break on the y-axis.

(Note: the horizontal black line across the box represents the median value, the bottom and top edges of the box represent the 25th and 75th percentile values respectively, and the "whiskers" extending below and above the box represent the 5th and 95th percentile vales respectively).

4.5.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 4.6. Most sites have a SFRG of "good", resulting from "B" MAC values and low-moderate SIC values. Despite exceeding the action level on two occasions over the last five years, Princess Bay has a SFRG of "very good", as the 95th percentile enterococci value (37 cfu/100 mL) just falls within the "A" MAC value requirements. Breaker Bay also has a SFRG of "very good". Oriental Bay (Wishing Well and Band Rotunda), Hataitai Beach

and Owhiro Bay all have an SFRG of "fair" reflecting poorer MAC values for these sites.

Table 4.6: MAC, SIC and SFRGs for marine bathing sites in Wellington City.

Site	n	No. action events	95th %ile (Ent./100 mL)	Key Microbiological Risks	SIC	MAC	SFRG
AOTEA LAGOON							
Aotea Lagoon	107	2	115	Urban stormwater	Moderate	B	Good
ORIENTAL BAY							
Freyberg Beach	81	1	169	Urban stormwater	Moderate	B	Good*
Wishing Well	101	7	413	Urban stormwater	Moderate	C	Fair
Band Rotunda	100	5	285	Urban stormwater	Moderate	C	Fair
BALAENA BAY							
Balaena Bay	107	1	42	Focal points of drainage	Low	B	Good
KIO BAY							
Kio Bay	107	2	126	Focal points of drainage	Low	B	Good
HATAITAI BEACH							
Hataitai Beach	107	4	232	Waterfowl, urban stormwater	Moderate	C	Fair
SHARK BAY							
Shark Bay	107	2	68	Focal points of drainage	Low	B	Good
MAHANGA BAY							
Mahanga Bay	107	3	191	Focal points of drainage	Low	B	Good
SCORCHING BAY							
Scorching Bay	107	0	58	Focal points of drainage	Low	B	Good
WORSER BAY							
Worser Bay	107	1	46	Focal points of drainage	Low	B	Good
SEATOUN BEACH							
Wharf	107	1	110	Focal points of drainage, incl. urban stormwater	Low/ Moderate	B	Good
Inglis Street	107	2	95	Focal points of drainage, incl. urban stormwater	Low/ Moderate	B	Good
BREAKER BAY							
Breaker Bay	107	1	80	None identified	V. Low	B	V. Good
LYALL BAY							
Tirangi Road	107	2	182	Urban stormwater	Moderate	B	Good
Onepu Road	107	0	85	Urban stormwater	Moderate	B	Good
Queens Avenue	107	1	78	Urban stormwater	Moderate	B	Good
PRINCESS BAY							
Princess Bay	107	2	37	Focal points of drainage	Low	A	V. Good
ISLAND BAY							
Old Bait Shed	85	3	188	Focal points of drainage, incl. urban stormwater nearby	Low/ Moderate	B	Good*
Surf Club	107	2	153	Urban stormwater	Moderate	B	Good
Reef Street Rec G.	107	3	172	Urban stormwater	Moderate	B	Good
Derwent Street	32	1	165	Urban stormwater	Moderate	B	Good*
OWHIRO BAY							
Owhiro Bay	107	5	232	Owhiro Stream carrying urban stormwater	Moderate	C	Fair

* Interim SFRG only (insufficient data)

The SFRGs apply to the summer bathing season only and several sites, notably Island Bay and Owhiro Bay, have recorded a greater number of elevated enterococci counts during the winter months (Milne 2005). In the case of the sites at Island Bay, if the winter results from the last five years were included in the determination of the MAC values, then the interim SFRGs would be downgraded from "good" to "fair" as the 95th percentile enterococci counts for the full reporting period would result in "C" MAC values[15].

Influence of rainfall

The influence of rainfall on water quality at individual sites is difficult to ascertain as the majority of sites (19 of 23) exceeded the action guideline level on three or less occasions. Oriental Bay at the Wishing Well was the only site to exceed the action guideline on more than five occasions. Analysis of the rainfall records for this site indicates that just three of the seven action events coincided with rainfall in the 24 hours prior to sampling (Figure 4.22). Although this number increases to five when the 72 hour period prior to sampling is considered, only three of these events coincided with significant (>10 mm) rainfall.

It is unclear why some elevated results at Oriental Bay coincide with little or no rainfall. It is possible, as may also be the case at Mahanga Bay (Wood, pers. comm., 2006), that elevated enterococci counts occur with sediment re-suspension as a result of high wave energies during strong northerlies. Similarly, water quality at beaches on Wellington City's south coast is influenced by a combination of sediment re-suspension, debris and other material pushed up onto the beaches at times of high tide and strong southerly winds. This may explain why Island Bay at the Old Bait Shed and Owhiro Bay have also exceeded the action level guideline on a number of occasions that coincided with little or no rainfall (Milne 2005).

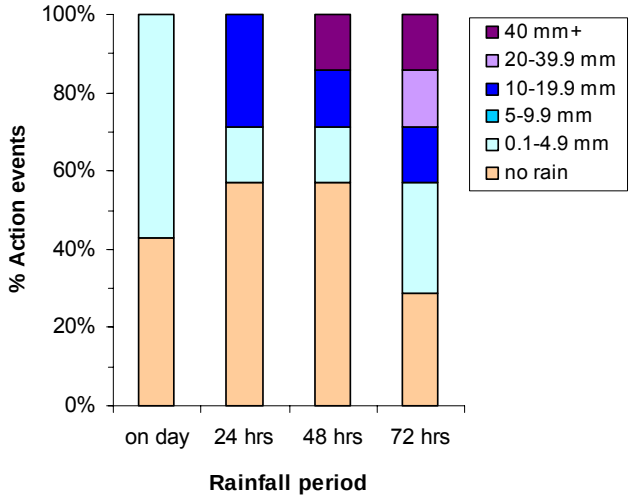

Figure 4.22: Rainfall recorded on the day and the hours prior to action level events recorded during routine weekly sampling at Oriental Bay (Wishing Well) over the 2001-2006 summer bathing period.

[15] For example, the 95th percentile values for the Island Bay Surf Club and Reef Street Recreation Ground would increase from 166 to 252 and from 172 to 360 enterococci/100 mL respectively (n=166).

4.6 Wairarapa

Marine recreational water quality monitoring is conducted at two sandy beaches in the Wairarapa; Riversdale and Castlepoint. Five sites have been monitored along these two beaches over the last five years (Figure 4.23).

Figure 4.23: Marine recreational water quality monitoring sites in the Wairarapa.

4.6.1 Microbiological water quality results

Appendix 2 summarises compliance with the recreational water quality guidelines for each monitoring site over each of the last five summers. Riversdale Beach South did not exceed the action level of the recreational water quality guidelines on any sampling occasion over this period (Figure 4.24). In contrast, Riversdale Beach at the mouth of the Motuwaireka (Riversdale) Lagoon exceeded the action level guideline on four sampling occasions.

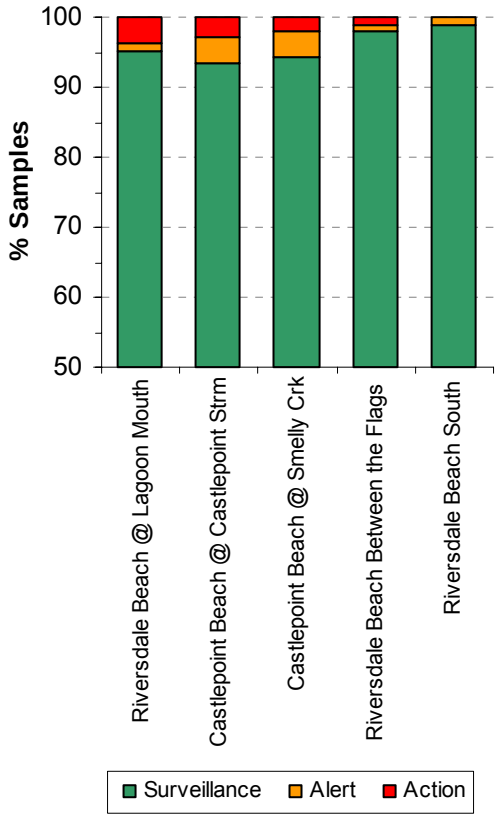

Figure 4.24: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the last five summer bathing seasons (November 2001 to 31 March 2006 inclusive).

4.6.2 Microbiological risk factors

The Castlepoint Beach sites have a moderate risk of microbiological contamination, as they are located adjacent to the outflows from Castlepoint Stream (Figure 4.25) and Smelly Creek. Both of these streams drain predominantly agricultural catchments, with the former also receiving treated wastewater from the Castlepoint township during the winter months.

Figure 4.25: Castlepoint Stream and Castlepoint Beach.

Riversdale Beach adjacent to the mouth of the Motuwaireka Lagoon also has a moderate risk of microbiological contamination. Water quality in the lagoon is affected by agricultural activity in the upstream catchment, particularly following periods of high rainfall, and also by possible septic tank seepage and leachate from a decommissioned landfill entering a tributary of the Motuwaireka Stream (Stansfield 2000). The lagoon also often supports a significant number of waterfowl.

Sites further south on Riversdale Beach at the Surf Club (Between the Flags) and at Riversdale South are considered to have a low and very low risk of microbiological contamination respectively. These sites receive some drainage from the adjacent Riversdale community, but this runoff is unlikely to carry a high degree of microbiological contamination. Refer to Appendix 3 for a complete assessment of the risk factors present at each site.

4.6.3 Suitability for recreation

The SFRGs for each site, based on the combined MAC and SIC values, are summarised in Table 4.7. Three sites have a SFRG of "good", resulting from "B" MAC values and low-moderate SIC values. Castlepoint Beach at Castlepoint Stream has a SFRG of "fair" due to a poorer MAC value. The absence of any major microbiological risks to water quality at Riversdale South results in a SGRG of "very good" for this site.

Table 4.7: MAC, SIC and SFRGs for marine bathing sites in the Wairarapa.

Site	n	No. action events	95th %ile (Ent./100 mL)	Key Microbiological Risks	SIC	MAC	SFRG
CASTLEPOINT BEACH							
Castlepoint Stream	104	3	233	Castlepoint Stream draining an agricultural catchment	Moderate	C	Fair
Smelly Creek	103	2	163	Smelly Creek draining an agricultural catchment	Moderate	B	Good
RIVERSDALE BEACH							
Lagoon Mouth	105	4	134	Riversdale Lagoon draining an agricultural catchment & populated by wildfowl	Moderate	B	Good
Between the Flags	105	1	90	Focal points of drainage	Low	B	Good
Riversdale South	104	0	42	None identified	Very Low	B	V.Good

Influence of rainfall

All but one action level events recorded at the five Wairarapa marine sites during the 2001-2006 summer bathing period have coincided with rainfall prior to sampling. Often this rainfall has been heavy. For example, two of the four action level events recorded at Riversdale Beach adjacent to the mouth of the Motuwaireka Lagoon coincided with more than 75 mm of rainfall in the 72 hour period prior to sampling (Figure 4.26).

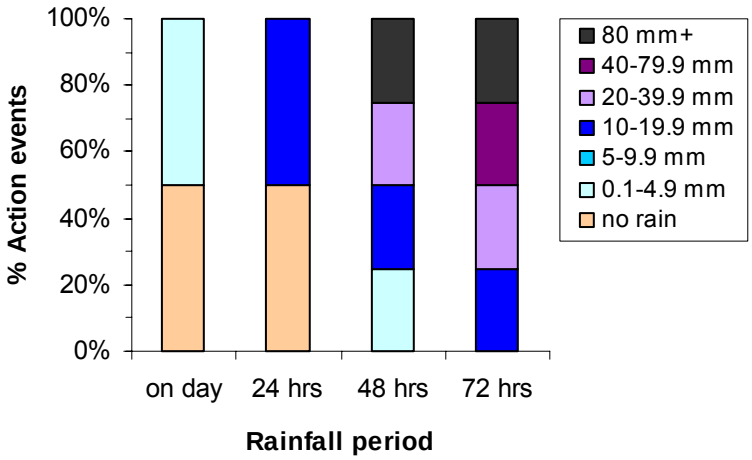

Figure 4.26: Rainfall recorded on the day and the hours prior to action level events (four) recorded during routine weekly sampling at Riversdale Beach (Lagoon Mouth) over the 2001-2006 summer bathing period.

4.7 Synthesis

Seventy of the 76 marine bathing sites in the Wellington region exceeded the action level of the recreational water quality guidelines on at least one routine summer sampling occasion over 2001-2006 (Figure 4.27). Twenty three sites exceeded the action level on at least five occasions over this period, with two sites exceeding this level on more than 10 occasions. Spatial and temporal trends are evident, with sites in some areas exceeding guidelines on more occasions in one year than sites in other regions (Table 4.8). For example, in 2001/2002, just four of the 20 sites on the Kapiti Coast District exceeded the action level guideline (each on one occasion), while all 14 sites in Porirua City exceeded the guideline, with one site exceeding the guideline on five occasions.

Overall, there is a strong correlation between rainfall events and action level enterococci results. For example, fewer sites exceeded the action level in 2002/2003 (23.7%) than in 2003/2004 (69.8%) which correlates with, on average, drier and wetter summers respectively. However, analysis of enterococci results on an individual site basis indicates that many sites often exceeded the alert and action level guidelines in the absence of any significant rainfall prior to sampling. These include Paraparaumu Beach (especially Ngapotiki Street) on the Kapiti Coast, Plimmerton Beach, Pauatahanui Inlet (Browns Bay) and Titahi Bay (Bay Drive) in Porirua City, Petone Beach (Sydney Street) in Hutt City, and Oriental Bay and Owhiro Bay in Wellington City. At most of these sites, the elevated enterococci counts are attributed to poor water quality in tributary rivers or streams. Sediment re-suspension as a result of high wave energies and/or strong winds may also influence water quality at many sites, including the Kapiti Coast beaches, Petone Beach, Oriental Bay, Mahanga Bay and some bathing areas on the south coast of Wellington City.

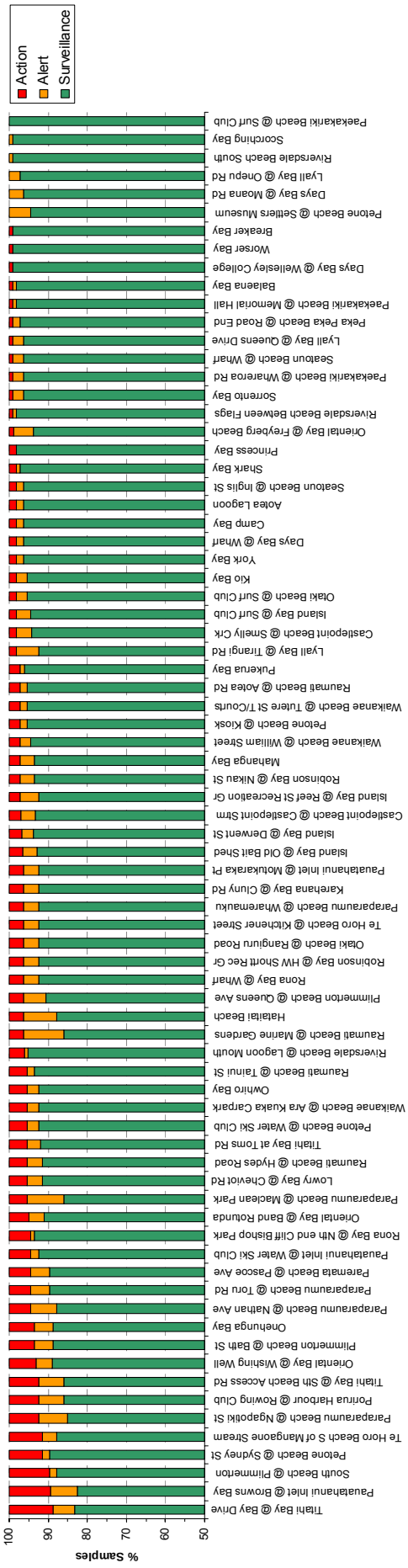

Figure 4.27: Summary of compliance with the surveillance, alert and action modes of the MfE/MoH (2003) recreational water quality guidelines, expressed as a percentage of the total number of routine sampling events undertaken over the 2001-2006 summer seasons. Sites are ranked from lowest to highest, based on the percentage of results above the action guideline.

Table 4.8: Comparison of compliance with the action level of the MfE/MoH (2003) recreational water quality guidelines between sites over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons.

Summer	Exceedances of Action Level	No. of Sites in each Exceedance Category					Total No. of Sites	% of Sites
		Kapiti (20 sites)	Porirua (14 sites*)	Hutt (15 sites)	Wellington (23 sites**)	Wairarapa (5 sites)		
2001/2002	0	16	0	10	14	4	44	59.5
	1	4	1	5	7	0	17	23.0
	2	0	5	0	1	1	7	9.5
	3	0	4	0	0	0	4	5.4
	4	0	1	0	0	0	1	1.4
	5	0	1	0	0	0	1	1.4
	6	0	0	0	0	0	0	0.0
	7	0	0	0	0	0	0	0.0
2002/2003	0	19	6	7	21	5	58	76.3
	1	1	5	6	1	0	13	17.1
	2	0	1	2	0	0	3	3.9
	3	0	2	0	0	0	2	2.6
	4	0	0	0	0	0	0	0.0
	5	0	0	0	0	0	0	0.0
	6	0	0	0	0	0	0	0.0
	7	0	0	0	0	0	0	0.0
2003/2004	0	4	0	6	11	2	23	30.2
	1	9	2	5	8	3	27	35.5
	2	6	2	0	2	0	10	13.2
	3	1	9	3	0	0	13	17.1
	4	0	0	0	1	0	1	1.3
	5	0	0	1	0	0	1	1.3
	6	0	1	0	0	0	1	1.3
	7	0	0	0	0	0	0	0.0
2004/2005	0	5	7	13	9	2	36	46.8
	1	11	5	2	9	3	30	39.0
	2	4	2	0	4	0	10	13.0
	3	0	0	0	1	0	1	1.3
	4	0	0	0	0	0	0	0.0
	5	0	0	0	0	0	0	0.0
	6	0	0	0	0	0	0	0.0
	7	0	0	0	0	0	0	0.0
2005/2006	0	6	14	7	17	3	47	61.8
	1	5	0	7	5	2	19	25.0
	2	5	0	1	0	0	6	7.9
	3	2	0	0	0	0	2	2.6
	4	1	0	0	0	0	1	1.3
	5	1	0	0	0	0	1	1.3
	6	0	0	0	0	0	0	0.0
	7	0	0	0	0	0	0	0.0

* Only 12 sites in 2001/2002

** Only 22 sites in all years except 2004/2005

Overall, the high correlation between rainfall events and high bacteria counts supports advice from the Greater Wellington Regional Council and the Ministry of Health to avoid swimming and other contact recreation activities during and for up to several days after heavy rainfall. Urban stormwater (including sewer overflows during very heavy rainfall) and diffuse-source

agricultural runoff into rivers and streams are considered to be the major contributors to faecal contamination of marine bathing waters in the Wellington region.

4.7.1 Suitability for recreation

The SFRGs for each site are determined by combining the MAC value for the 2001-2006 summers with the SIC value based on an assessment of microbiological risks present at each site. The grades are therefore only indicative of the condition of the water at a site during the *summer bathing season*. Some sites (e.g., Island Bay in Wellington City) have exceeded guidelines more regularly during the winter months and would have a lower SFRG if winter water quality data was included in the determination of the MAC value.

The distribution of SFRGs across the 76 marine monitoring sites are illustrated in Figure 4.28 and summarised by area in Table 4.9[16]. Of the 76 sites:

- Four sites have a SFRG of "very good"
- Thirty seven sites have a SFRG of "good" and two sites have an *interim* SFRG of "good"
- Twenty seven sites have a SFRG of "fair"
- Six sites have a SFRG of "poor" and one site has an *interim* SFRG of "poor"
- No site has a SFRG of "very poor"

Table 4.9: Distribution of SFRGs across the Wellington region.

SFRG	Kapiti (20 sites)	Porirua (14 sites)	Hutt (15 sites)	Wellington (2 sites)	Wairarapa (5 sites)	Total
Very Good	0	0	1	2	1	4
Good	9	3	8	16	3	39
Fair	11	5	6	4	1	27
Poor	0	6	0	0	0	6
Very Poor	0	0	0	0	0	0

The majority (86.8%) of the sites have a "good" or "fair" grade, reflecting "low" to "moderate" risks of microbiological contamination due to the direct or indirect (i.e., via tributary streams) influence of either urban stormwater or agricultural run-off. The six sites with a SFRG of "poor" all carry a moderate risk of microbiological contamination attributed to the influence of tributary streams and have "D" MAC values. In contrast, the risk of microbiological contamination at the four sites with a SFRG of "very good" is very low, reflected in a high level of compliance (96-99%) with the surveillance level of the recreational water quality guidelines.

[16] The SFRG for Island Bay at Old Bait Shed is not included here as this site is no longer monitored.

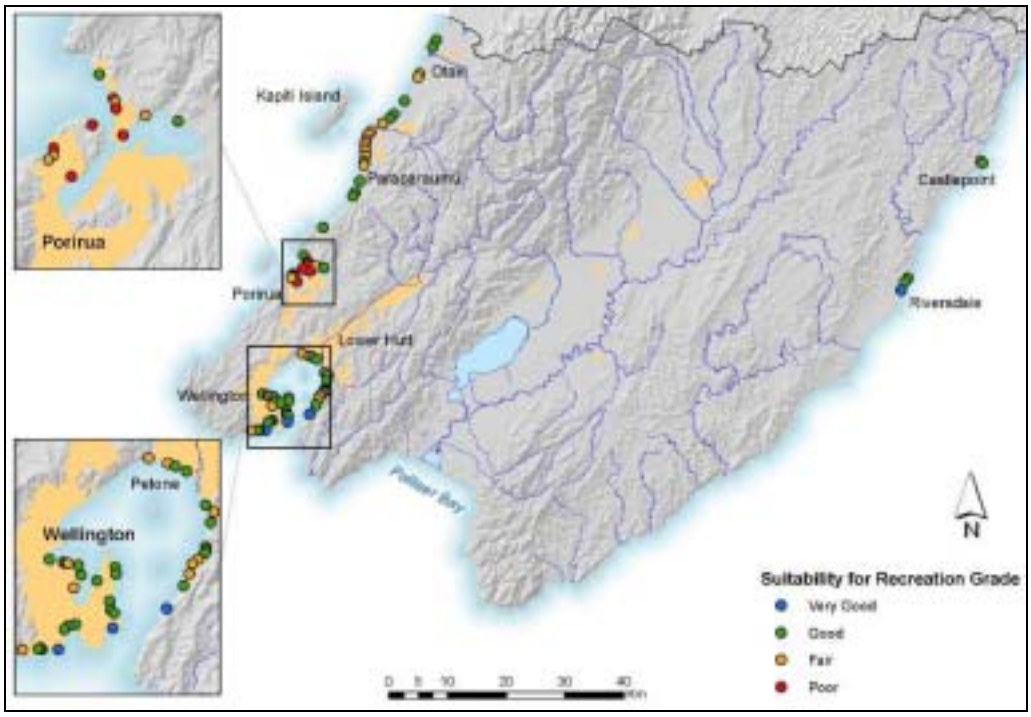

Figure 4.28: Suitability for recreation grades for the 76 marine monitoring sites in the Wellington region, based on microbiological risk and MAC values determined from enterococci counts measured at weekly intervals over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons.

As the SFRG takes into account both microbiological risk and the 95th percentile enterococci count determined from weekly monitoring over the preceding five summers, the sites with the lowest or highest number of alert and action level exceedances do not necessarily correlate with SFRGs of "very good" and "very poor". For example, although it was the only site that did not exceed the alert or the action guideline levels over the last five summers, Paekakariki Beach at the Surf Club recorded a 95th percentile of 114 cfu/100 mL, resulting in a "B" MAC value. In contrast, Princess Bay has an "A" MAC value (95th percentile = 40 cfu/100 mL), despite exceeding the action level guideline on two occasions. Overall, the microbiological water quality results show quite marked variability even within the same MAC class. For example, four sites that did not exceed the action level on any occasion during the 2001-2006 summer periods, have the same MAC grade as sites such as Otaki Beach at Rangiuru Road, Karehana Bay and Pauatahanui Inlet at Motukaraka Point which have significantly higher 95th percentile values and exceeded the action level on four occasions each (Figure 4.29).

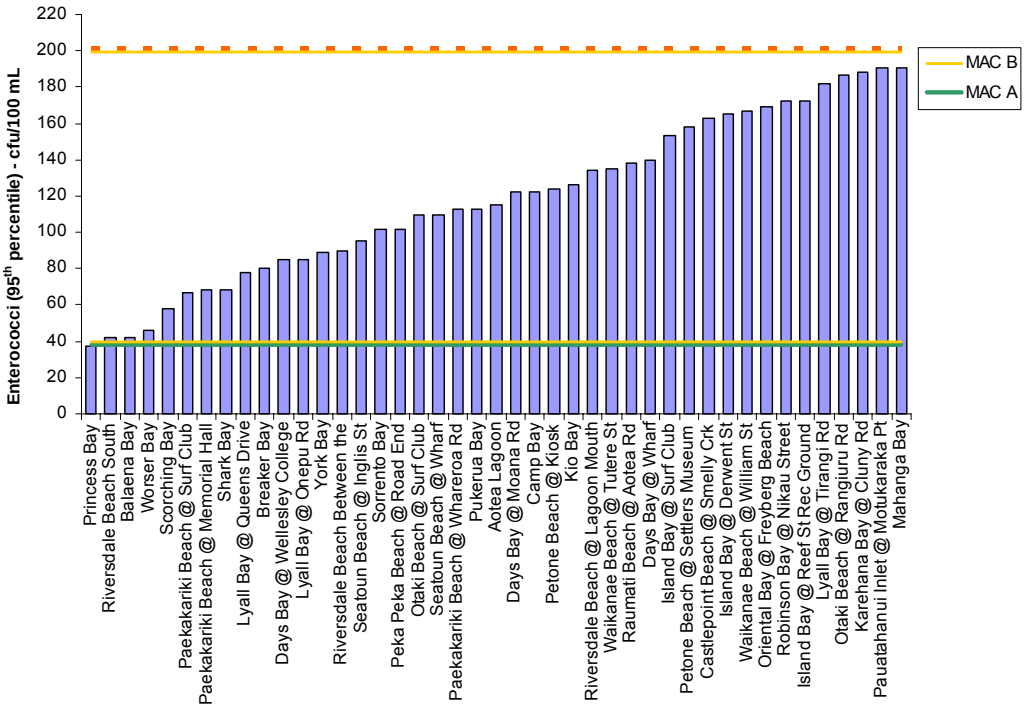

Figure 4.29: Marine sites with a MAC grade of "A" or "B", ranked from lowest to highest based on 95th percentile enterococci values determined from routine weekly monitoring over the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons.

4.7.2 Future monitoring requirements

According to MfE/MoH (2003) protocol, sites with a SFRG of "good", "fair" or "poor" should be monitored on a regular weekly basis during the summer bathing season, but routine monitoring is not required at sites graded "very good" or "very poor" (refer Table 2.2, Section 2.2). On this basis, monitoring could cease at four sites; Princess Bay, Breaker Bay, Camp Bay and Riversdale Beach South. However, the MfE/MoH (2003) protocol does not provide any guidance for how the SFRGs are reassessed if routine monitoring ceases at a bathing site. Given this, and the popularity of some of these sites it is not recommended that monitoring ceases, but consideration should be given to reducing the frequency of monitoring to fortnightly or monthly.

5. Conclusions and recommendations

Of the 23 freshwater sites:

- Compliance with the MfE/MoH (2003) recreational quality guidelines was highest at sites located within relatively unmodified bush catchments, notably the Waiohine River Gorge, the Waingawa River at Kaituna and the Otaki River at The Pots. Compliance was significantly lower at sites draining agricultural catchments, with many indicator bacteria counts one or two orders of magnitude above the action guideline of 550 *E. coli*/100 mL.

- There was a very high correlation between rainfall events and elevated indicator bacteria counts at most sites, although several sites regularly exceeded the alert and action level guidelines in the absence of any significant rainfall prior to sampling. These sites are the Hutt River at Silverstream, the Ruamahanga River at Double Bridges and Riversdale Lagoon. Some other factor(s) influence water quality at these sites, such as stock access upstream, wildlife and/or poor water quality in tributary streams.

- The amount of rainfall required to trigger an action level result appears to differ across the region; more often than not, the Kapiti sites only exceeded the action guideline following at least 40 mm of rainfall in the 24-48 hours prior to sampling. In contrast, most sites in the Hutt River and Ruamahanga River catchments exceeded the action level if 10 mm of rain had fallen in the 24 hours prior to sampling, with many of the alert level results in the Hutt River catchment coinciding with as little as 5 mm of rainfall.

- Using protocol outlined by the MfE/MoH (2003), only 17% of sites received a SFRG of "very good" or "good". The majority of the sites (74%) received a grade of "poor" or "very poor", reflecting "moderate" to "high" risks of microbiological contamination at these sites due to the likely influence of either agricultural run-off or urban stormwater. In most cases, the SFRGs improve with the removal of *E. coli* results coinciding with significant rain events. This suggests that for the majority of sites, the SFRGs better reflect the condition of water during wet weather than dry weather when contact recreation would be greatest.

Of the 76 marine sites:

- Compliance with the MfE/MoH (2003) recreational quality guidelines was generally highest at sites located away from urban stormwater outfalls and stream mouths. These include Paekakariki Beach (Surf Club) on the Kapiti Coast, Days Bay (Moana Road) in Hutt City, Scorching Bay in Wellington City, and Riversdale Beach South in the Wairarapa.

- Overall, there is a relatively high correlation between rainfall events and elevated indicator bacteria counts, particularly in the Wairarapa. However, on an individual site basis many sites often exceeded the alert and action level guidelines in the absence of any significant rainfall prior to sampling. These sites include Paraparaumu Beach (especially Ngapotiki Street) on the Kapiti Coast, Plimmerton Beach, Pauatahanui Inlet (Browns Bay) and Titahi Bay (Bay Drive) in Porirua City, Petone Beach (Sydney Street) in Hutt City, and Oriental Bay (Wishing Well) and Owhiro Bay in Wellington City. At most of these sites, elevated enterococci counts are attributed to poor water quality in tributary streams. Sediment re-suspension as a result of high wave energies and/or strong winds may also influence water quality at many sites, including the Kapiti Coast beaches, Petone Beach and some bathing areas on the south coast of Wellington City.

- Using protocol outlined by the MfE/MoH (2003), four sites have a SFRG of "very good". The majority (87%) of sites have a SFRG of "good" or "fair", reflecting "low" to "moderate" risks of microbiological contamination due to the direct or indirect (i.e., via tributary streams) influence of urban stormwater, agricultural run-off or, in a few instances, waterfowl. Just six sites received a grade of "poor", a result of a "moderate" risk of microbiological contamination combined with poor MAC values. No site received a grade of "very poor."

- The SFRGs are only indicative of the condition of the water at a site during the *summer bathing season* – microbiological results indicate that some sites (e.g., Island Bay Wellington City), would have a lower SFRG if the MAC value was determined using both summer and winter monitoring results.

The relatively high correlation between the occurrence of heavy rainfall and elevated bacteria counts at the majority of monitoring sites in both fresh and marine waters across the region supports advice from the Greater Wellington Regional Council and the Ministry of Health to avoid swimming and other contact recreation activities during, and for up to two days after, heavy rain. Urban stormwater (including sewer overflows during very heavy rainfall) and diffuse-source agricultural runoff into rivers and streams are considered to be the major contributors to faecal contamination of recreational waters in the Wellington region.

5.1 Recommendations

1. Continue to monitor recreational water quality at freshwater and marine bathing sites in accordance with the MfE/MoH (2003) recreational water quality guidelines.

2. Cease routine weekly monitoring in the Otaki River at the Pots and the Waiohine River Gorge, and use monthly microbiological water quality results obtained from these sites under the Rivers State of the Environment Monitoring Programme to assess recreational water quality.

3. Remove Riversdale Lagoon from the list of freshwater bathing sites and erect permanent signage at the lagoon mouth advising against swimming.

4. Consider reducing the frequency of summer monitoring at Camp Bay, Breaker Bay, Princess Bay and Riversdale South.

5. Review microbiological risk assessments for freshwater and marine bathing sites on a three to five yearly basis, or sooner if new information comes to light indicating a likely change in risk.

6. Review and update MAC values and SFRGs annually upon the conclusion of each summer bathing season.

7. Continue annual reporting of recreational water quality monitoring results, and include SFRGs in all future reports.

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[17] Published June 2002, updated June 2003.

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Appendix 1: List of Monitoring Sites

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Hutt	Petone Beach @ Water Ski Club	2665765	5996304	Marine
Hutt	Petone Beach @ Sydney Street	2667067	5995961	Marine
Hutt	Petone Beach @ Settlers Museum	2667577	5995770	Marine
Hutt	Petone Beach @ Kiosk	2668348	5995425	Marine
Hutt	Sorrento Bay	2669654	5993098	Marine*
Hutt	Lowry Bay @ Cheviot Road	2670228	5992605	Marine
Hutt	York Bay	2669999	5991874	Marine
Hutt	Days Bay @ Wellesley College	2669639	5990243	Marine
Hutt	Days Bay @ Wharf	2669677	5990027	Marine
Hutt	Days Bay @ Moana Road	2669605	5989834	Marine
Hutt	Rona Bay @ N end of Cliff Bishop Park	2669132	5989367	Marine
Hutt	Rona Bay @ Wharf	2668753	5989084	Marine
Hutt	Robinson Bay @ HW Shortt Rec Ground	2668542	5988387	Marine
Hutt	Robinson Bay @ Nikau Street	2668154	5987569	Marine
Hutt	Camp Bay	2667013	5986001	Marine
Hutt	Hutt River @ Silverstream Bridge	2677619	6004887	Freshwater
Hutt	Hutt River @ Boulcott	2670941	5999283	Freshwater
Kapiti	Otaki Beach @ Surf Club	2688639	6050044	Marine*
Kapiti	Otaki Beach @ Rangiuru Road	2688028	6048783	Marine
Kapiti	Te Horo Beach S of Mangaone Stream	2685797	6044192	Marine
Kapiti	Te Horo Beach @ Kitchener Street	2685513	6043648	Marine
Kapiti	Peka Peka Beach @ Road End	2683233	6039620	Marine*
Kapiti	Waikanae Beach @ William Street	2681406	6037299	Marine
Kapiti	Waikanae Beach @ Tutere St Tennis Courts	2680673	6036577	Marine
Kapiti	Waikanae Beach @ Ara Kuaka Carpark	2679532	6035693	Marine
Kapiti	Paraparaumu Beach @ Ngapotiki Street	2677561	6034477	Marine
Kapiti	Paraparaumu Beach @ Nathan Avenue	2677051	6033889	Marine
Kapiti	Paraparaumu Beach @ Maclean Park	2676712	6032982	Marine
Kapiti	Paraparaumu Beach @ Toru Road	2676595	6032430	Marine
Kapiti	Paraparaumu Beach @ Wharemauku Road	2676521	6031785	Marine
Kapiti	Raumati Beach @ Tainui Street	2676549	6030944	Marine
Kapiti	Raumati Beach @ Marine Gardens	2676535	6030156	Marine
Kapiti	Raumati Beach @ Aotea Road	2676433	6029244	Marine
Kapiti	Raumati Beach @ Hydes Road	2676337	6028550	Marine*
Kapiti	Paekakariki Beach @ Whareroa Road	2675617	6025843	Marine
Kapiti	Paekakariki Beach @ Surf Club	2674810	6023988	Marine
Kapiti	Paekakariki Beach @ Memorial Hall	2674452	6023305	Marine
Kapiti	Otaki River @ The Pots	2695461	6040455	Freshwater
Kapiti	Otaki River @ State Highway 1	2691326	6046120	Freshwater
Kapiti	Waikanae River @ State Highway 1	2683770	6034011	Freshwater
Kapiti	Waikanae River @ Greenaway Road	2681549	6034626	Freshwater
Porirua	Pukerua Bay	2669309	6017968	Marine
Porirua	Karehana Bay @ Cluny Road	2666113	6013074	Marine
Porirua	Plimmerton Beach @ Bath Street	2666726	6012030	Marine
Porirua	Plimmerton Beach @ Queens Avenue	2666790	6011888	Marine
Porirua	South Beach @ Plimmerton	2666830	6011588	Marine
Porirua	Pauatahanui Inlet @ Water Ski Club	2668094	6011307	Marine
Porirua	Pauatahanui Inlet @ Motukaraka Point	2669506	6011052	Marine
Porirua	Pauatahanui Inlet @ Browns Bay	2668059	6009547	Marine
Porirua	Paremata Beach @ Pascoe Avenue	2667137	6010447	Marine

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Porirua	Porirua Harbour @ Rowing Club	2664911	6008661	Marine*
Porirua	Titahi Bay @ Bay Drive	2664152	6009883	Marine
Porirua	Titahi Bay at Toms Road	2664130	6009571	Marine
Porirua	Titahi Bay @ South Beach Access Road	2663926	6009396	Marine
Porirua	Onehunga Bay	2665816	6010895	Marine
Upper Hutt	Pakuratahi River @ Forks	2694308	6014337	Freshwater
Upper Hutt	Hutt River @ Birchville	2686216	6010807	Freshwater
Upper Hutt	Hutt River @ Maoribank Corner	2685902	6008412	Freshwater
Upper Hutt	Hutt River @ Poets Park	2681482	6007807	Freshwater
Wairarapa	Ruamahanga River @ Double Bridges	2734363	6033494	Freshwater
Wairarapa	Ruamahanga River @ Te Ore Ore	2735543	6024638	Freshwater
Wairarapa	Waipoua River at Colombo Road	2735010	6024610	Freshwater
Wairarapa	Waingawa River @ Kaituna	2720341	6032867	Freshwater
Wairarapa	Waingawa River @ South Road	2730565	6022599	Freshwater
Wairarapa	Ruamahanga River @ The Cliffs	2731492	6013902	Freshwater
Wairarapa	Ruamahanga River @ Kokotau	2725774	6008913	Freshwater
Wairarapa	Waiohine River @ Gauge	2711871	6017655	Freshwater
Wairarapa	Waiohine River @ State Highway 2	2719683	6013431	Freshwater
Wairarapa	Ruamahanga River @ Morrisons Bush	2718938	6002829	Freshwater
Wairarapa	Ruamahanga River @ Waihenga	2714631	5998182	Freshwater
Wairarapa	Ruamahanga River @ Bentleys Beach	2710556	5994533	Freshwater
Wairarapa	Riversdale Lagoon	2768314	6008860	Freshwater
Wairarapa	Castlepoint Beach @ Castlepoint Stream	2781366	6029287	Marine
Wairarapa	Castlepoint Beach @ Smelly Creek	2781670	6028931	Marine
Wairarapa	Riversdale Beach @ Lagoon Mouth	2768974	6009275	Marine
Wairarapa	Riversdale Beach Between the Flags	2768445	6008680	Marine
Wairarapa	Riversdale Beach South	2767844	6007246	Marine
Wellington	Aotea Lagoon	2659007	5989395	Marine
Wellington	Oriental Bay @ Freyberg Beach	2659942	5989176	Marine
Wellington	Oriental Bay @ Wishing Well	2660140	5989098	Marine
Wellington	Oriental Bay @ Band Rotunda	2660265	5989087	Marine
Wellington	Balaena Bay	2660980	5988979	Marine
Wellington	Kio Bay	2661163	5988311	Marine
Wellington	Hataitai Beach	2660654	5987442	Marine
Wellington	Shark Bay	2662233	5987909	Marine*
Wellington	Mahanga Bay	2663490	5988828	Marine*
Wellington	Scorching Bay	2663539	5988360	Marine
Wellington	Worser Bay	2663097	5986535	Marine
Wellington	Seatoun Beach @ Wharf	2663152	5985946	Marine
Wellington	Seatoun Beach @ Inglis Street	2663428	5985706	Marine
Wellington	Breaker Bay	2663335	5984682	Marine
Wellington	Lyall Bay @ Tirangi Road	2660770	5984942	Marine
Wellington	Lyall Bay @ Onepu Road	2660309	5984828	Marine
Wellington	Lyall Bay @ Queens Drive	2660013	5984580	Marine
Wellington	Princess Bay	2659609	5983216	Marine
Wellington	Island Bay @ Old Bait Shed	2658484	5983228	Marine
Wellington	Island Bay @ Surf Club	2658400	5983302	Marine
Wellington	Island Bay @ Reef St Recreation Ground	2658252	5983254	Marine
Wellington	Owhiro Bay	2657145	5983174	Marine

* Water quality is also monitored for recreational shellfish gathering purposes

Rainfall Recording Stations

Freshwater Recreational Sites

- Kapiti Coast District - Taungata Peak (Otaki River) and Waikanae Water Treatment Plant (Waikanae River)
- Hutt – Kaitoke Headworks (Pakuratahi River) and Te Marua (Hutt River)
- Wairarapa – Mount Bruce (Ruamahanga River), Kaituna (Waipoua River, Waingawa River), Phelps (Waiohine River) and Castlepoint (Riversdale Lagoon)

Marine Recreational Sites

- Kapiti Coast District – Otaki Depot (Otaki Beach, Te Horo Beach), Waikanae Water Treatment Plant (Peka Peka Beach, Waikanae Beach), Kapiti Aerodrome (Paraparaumu Beach, Raumati Beach, Paekakariki Beach)
- Porirua City – Whenua Tapu
- Hutt City – Shandon
- Wellington City – Wellington Airport
- Wairarapa – Castlepoint

Appendix 2: Water quality results, 2001-2006 summers

Note the compliance statistics reported here differ from those reported previously by Greater Wellington Regional Council, including those reported by Milne (2005). The differences are largely minor, and are a result of a comprehensive quality assurance audit undertaken in early 2006 on recreational water quality data stored in Greater Wellington Regional Council's water quality database. This audit resulted in some corrections to data collected during the period 1 November 2001 to 31 March 2006 inclusive, in particular, data collected over the 2004/2005 summer.

(a) Recreational water quality in fresh waters

Analysis of ***E. coli*** counts obtained from routine weekly monitoring during the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons against the MfE/MoH (2003) surveillance, alert and action levels for freshwater recreational waters

(i) Kapiti Coast

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
OTAKI RIVER AT THE POTS								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	20	95.2	1	4.8	0	0.0	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		3		1		107	
OTAKI RIVER AT STATE HIGHWAY 1								
2001-2002	18	85.7	3	14.3	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	18	85.7	3	14.3	0	0.0	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	97		9		1		107	
WAIKANAE RIVER AT STATE HIGHWAY 1								
2001-2002	17	81.0	2	9.5	2	9.5	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	16	76.2	2	9.5	3	14.3	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	19	86.4	3	13.6	0	0.0	22	100
Total	91		9		7		107	
WAIKANAE RIVER AT GREENAWAY ROAD								
2001-2002	17	81.0	2	9.5	2	9.5	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	19	86.4	3	13.6	0	0.0	22	100
Total	93		4		7		107	

(ii) Hutt River catchment

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PAKURATAHI RIVER								
2001-2002	17	81.8	2	9.5	2	9.5	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	19	86.4	1	4.5	2	9.1	22	100
2004-2005	18	81.8	3	13.6	1	4.5	22	100
2005-2006	17	81.0	3	14.3	1	4.8	21	100
Total	90		10		7		107	
HUTT RIVER AT BIRCHVILLE								
2001-2002	14	66.7	4	19.0	3	14.3	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	18	81.8	1	4.5	3	13.6	22	100
2004-2005	15	68.2	5	22.7	2	9.1	22	100
2005-2006	18	85.7	1	4.8	2	9.5	21	100
Total	84		12		11		107	
HUTT RIVER AT MAORIBANK CORNER								
2001-2002	16	76.2	3	14.3	2	9.5	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	17	77.3	2	9.1	3	13.6	22	100
2004-2005	18	81.8	3	13.6	1	4.5	22	100
2005-2006	18	85.7	3	14.3	0	0.0	21	100
Total	88		12		7		107	
HUTT RIVER AT POETS PARK								
2001-2002	18	85.7	2	9.5	1	4.8	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	20	90.9	0	0.0	2	9.1	22	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	17	81.0	3	14.3	1	4.8	21	100
Total	95		6		6		107	
HUTT RIVER AT SILVERSTREAM BRIDGE								
2001-2002	15	71.4	3	14.3	3	14.3	21	100
2002-2003	19	90.5	0	0.0	2	9.5	21	100
2003-2004	15	68.2	4	18.2	3	13.6	22	100
2004-2005	19	86.4	2	9.1	1	4.5	22	100
2005-2006	9	42.9	6	28.6	6	28.6	21	100
Total	77		15		15		107	
HUTT RIVER AT BOULCOTT								
2001-2002	16	76.2	1	4.8	4	19.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	16	72.7	4	18.2	2	9.1	22	100
2004-2005	18	81.8	2	9.1	2	9.1	22	100
2005-2006	14	66.7	4	19.0	3	14.3	21	100
Total	84		11		12		107	

(iii) Wairarapa – Ruamahanga River

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
DOUBLE BRIDGES								
2001-2002	18	90.0	1	4.0	1	5.0	20	100
2002-2003	16	76.2	4	19.0	1	4.8	21	100
2003-2004	15	75.0	3	15.0	2	10.0	20	100
2004-2005	10	47.6	8	38.1	3	14.3	21	100
2005-2006	16	76.2	3	14.3	2	9.5	21	100
Total	75		19		9		103	
TE ORE ORE								
2001-2002	12	60.0	4	19.0	4	20.0	20	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	14	70.0	4	20.0	2	10.0	20	100
2004-2005	17	81.0	1	4.8	3	14.3	21	100
2005-2006	13	61.9	6	14.3	2	9.5	21	100
Total	76		10		11		103	
THE CLIFFS								
2001-2002	14	70.0	3	15.0	3	15.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	16	80.0	1	5.0	3	15.0	20	100
2004-2005	18	85.7	2	9.5	1	4.8	21	100
2005-2006	19	90.5	0	0.0	2	9.5	21	100
Total	88		6		9		103	
KOKOTAU								
2001-2002	13	65.0	2	10.0	5	25.0	20	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	16	80.0	1	5.0	3	15.0	20	100
2004-2005	18	85.7	3	14.3	0	0.0	21	100
2005-2006	17	81.0	2	9.5	2	9.5	21	100
Total	84		9		10		103	
MORRISONS BUSH								
2001-2002	14	70.0	1	5.0	5	25.0	20	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	15	75.0	3	15.0	2	10.0	20	100
2004-2005	20	95.2	0	0.0	1	4.8	21	100
2005-2006	19	90.5	0	0.0	2	9.5	21	100
Total	88		5		10		103	
WAIHENGA								
2001-2002	14	70.0	2	10.0	4	20.0	20	100
2002-2003	18	85.7	2	9.5	1	4.8	21	100
2003-2004	14	70.0	3	15.0	3	15.0	20	100
2004-2005	20	95.2	1	4.8	0	0.0	21	100
2005-2006	17	81.0	2	9.5	2	9.5	21	100
Total	83		10		10		103	
BENTLEYS BEACH								
2001-2002	NS	-	NS	-	NS	-	-	-
2002-2003	13	86.7	2	13.3	0	0.0	15	100
2003-2004	15	75.0	1	5.0	4	20.0	20	100
2004-2005	17	81.0	3	14.3	1	4.8	21	100
2005-2006	16	76.2	2	9.5	3	14.3	21	100
Total	61		8		8		77	

(iii) Wairarapa cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
WAIPOUA RIVER AT COLOMBO ROAD								
2001-2002	NS	-	NS	-	NS	-	-	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	10	50.0	3	15.0	7	35.0	20	100
2004-2005	18	85.7	2	9.5	1	4.8	21	100
2005-2006	16	76.2	3	14.3	2	9.5	21	100
Total	63		9		11		83	
WAINGAWA RIVER AT KAITUNA								
2001-2002	20	100.0	0	0.0	0	0.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	17	85.0	2	10.0	1	5.0	20	100
2004-2005	19	90.5	2	9.5	0	0.0	21	100
2005-2006	21	100.0	0	0.0	0	0.0	21	100
Total	98		4		1		103	
WAINGAWA RIVER AT SOUTH ROAD								
2001-2002	19	95.0	1	5.0	0	0.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	90.0	0	0.0	2	10.0	20	100
2004-2005	19	90.5	1	4.8	1	4.8	21	100
2005-2006	20	95.2	1	4.8	0	0.0	21	100
Total	97		3		3		103	
WAIOHINE RIVER GORGE (AT GAUGE)								
2001-2002	19	95.0	1	5.0	0	0.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	95.0	1	5.0	0	0.0	20	100
2004-2005	21	100.0	0	0.0	0	0.0	21	100
2005-2006	21	100.0	0	0.0	0	0.0	21	100
Total	101		2		0		103	
WAIOHINE RIVER AT STATE HIGHWAY 2								
2001-2002	20	100.0	0	0.0	0	0.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	90.0	0	0.0	2	10.0	20	100
2004-2005	21	100.0	0	0.0	0	0.0	21	100
2005-2006	20	95.2	1	4.8	0	0.0	21	100
Total	100		1		2		103	
RIVERSDALE LAGOON (MOTUWAIREKA LAGOON)								
2001-2002	8	40.0	7	35.0	5	25.0	20	100
2002-2003	NS	-	NS	-	NS	-	-	-
2003-2004	11	55.0	5	25.0	4	20.0	20	100
2004-2005	16	72.7	3	13.6	3	13.6	22	100
2005-2006	14	63.6	2	9.1	6	27.3	22	100
Total	49		17		18		84	

(b) Recreational water quality in marine waters

Analysis of enterococci counts obtained from routine weekly monitoring during the 2001/2002, 2002/2003, 2003/2004, 2004/2005 and 2005/2006 summer bathing seasons against the MfE/MoH (2003) surveillance, alert and action levels for marine recreational waters

(i) Kapiti Coast

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
OTAKI BEACH AT SURF CLUB								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	20	90.9	2	9.1	0	0.0	22	100
Total	102		3		2		107	
OTAKI BEACH AT RANGIURU ROAD								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	1	4.8	1	4.8	21	100
2004-2005	20	90.9	0	0.0	2	9.1	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	99		4		4		107	
TE HORO BEACH SOUTH OF MANGAONE STREAM								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	0	0.0	3	14.3	21	100
2004-2005	18	81.8	2	9.1	2	9.1	22	100
2005-2006	18	81.8	1	4.5	3	13.6	22	100
Total	94		3		9		107	
TE HORO BEACH AT KITCHENER STREET								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	1	4.8	2	9.5	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	99		4		4		107	
PEKA PEKA BEACH								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	104		2		1		107	

(i) Kapiti Coast, cont... - Waikanae Beach

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
WILLIAM STREET								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	2	9.5	1	4.8	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	101		3		3		107	
TUTERE STREET TENNIS COURTS								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	20	90.9	2	9.1	0	0.0	22	100
Total	102		2		3		107	
ARA KUAKA CARPARK								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	1	4.8	2	9.5	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	19	86.4	1	4.5	2	9.1	22	100
Total	99		3		5		107	

(i) Kapiti Coast cont... – Paraparaumu Beach

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
NGAPOTIKI STREET								
2001-2002	18	85.7	2	9.5	1	4.8	21	100
2002-2003	18	85.7	1	4.8	2	9.5	21	100
2003-2004	20	95.2	1	4.8	0	0.0	21	100
2004-2005	19	86.4	3	13.6	0	0.0	22	100
2004-2006	16	72.7	1	4.5	5	22.7	22	100
Total	91		8		8		107	
NATHAN AVENUE								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	19	86.4	2	9.1	1	4.5	22	100
2004-2006	17	77.3	2	9.1	3	13.6	22	100
Total	94		7		6		107	
MACLEAN PARK								
2001-2002	18	85.7	3	14.3	0	0.0	21	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	18	85.7	2	9.5	1	4.8	21	100
2004-2005	19	86.4	1	4.5	2	9.1	22	100
2004-2006	18	81.8	2	9.1	2	9.1	22	100
Total	92		10		5		107	
TORU ROAD								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2004-2006	18	81.8	0	0.0	4	18.2	22	100
Total	96		5		6		107	
WHAREMAUKU ROAD								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2004-2006	19	86.4	1	4.5	2	9.1	22	100
Total	99		4		4		107	

(i) Kapiti Coast cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
RAUMATI BEACH AT TAINUI STREET								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	19	86.4	1	4.5	2	9.1	22	100
Total	100		2		5		107	
RAUMATI BEACH AT MARINE GARDENS								
2001-2002	18	85.7	3	14.3	0	0.0	21	100
2002-2003	18	85.7	3	14.3	0	0.0	21	100
2003-2004	16	76.2	4	19.0	1	4.8	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	19	86.4	1	4.5	2	9.1	22	100
Total	92		11		4		107	
RAUMATI BEACH AT AOTEA STREET								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	102		2		3		107	
RAUMATI BEACH AT HYDES ROAD								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	1	4.8	2	9.5	21	100
2004-2005	20	90.9	0	0.0	2	9.1	22	100
2005-2006	18	81.8	3	13.6	1	4.5	22	100
Total	98		4		5		107	
PAEKAKARIKI BEACH AT WHAREROA ROAD								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	2	9.5	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		3		1		107	
PAEKAKARIKI BEACH AT SURF CLUB								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	107		0		0		107	
PAEKAKARIKI BEACH AT MEMORIAL HALL								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	105		1		1		107	

(ii) Porirua City

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PUKERUA BAY								
2001-2002	18	90.0	1	5.0	1	5.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	102		1		3		106	
KAREHANA BAY								
2001-2002	17	81.0	1	4.8	3	13.6	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	18	85.7	2	9.5	1	4.8	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	99		4		4		107	
PLIMMERTON BEACH AT BATH STREET								
2001-2002	18	85.7	1	4.8	2	9.5	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	16	76.2	2	9.5	3	14.3	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	95		5		7		107	
PLIMMERTON BEACH AT QUEENS AVENUE								
2001-2002	17	81.0	2	9.5	2	9.5	21	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	20	90.9	2	9.1	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	97		6		4		107	
SOUTH BEACH AT PLIMMERTON								
2001-2002	17	81.0	1	4.8	3	14.3	21	100
2002-2003	18	85.7	0	0.0	3	14.3	21	100
2003-2004	18	85.7	0	0.0	3	14.3	21	100
2004-2005	19	86.4	1	4.5	2	9.1	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	94		2		11		107	
PAUATAHANUI INLET AT WATER SKI CLUB								
2001-2002	19	90.5	0	0.0	2	9.5	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	99		2		6		107	
PAUATAHANUI INLET AT MOTUKARAKA POINT								
2001-2002	18	85.7	0	0.0	3	14.3	21	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	19	90.5	1	4.8	1	4.8	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	99		4		4		107	
PAUATAHANUI INLET AT BROWNS BAY								
2001-2002	NS	-	NS	-	NS	-	-	100
2002-2003	17	81.0	1	4.8	3	14.3	21	100
2003-2004	12	57.1	3	14.3	6	28.6	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	71		6		9		86	

(ii) Porirua City cont...

PAREMATA BEACH AT PASCOE AVENUE								
2001-2002	17	81.0	2	9.5	2	9.5	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	16	76.2	2	9.5	3	14.3	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	96		5		6		107	
PORIRUA HARBOUR AT THE ROWING CLUB								
2001-2002	17	81.0	1	4.8	3	14.3	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	17	77.3	4	18.2	1	4.5	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	92		7		8		107	
PORIRUA HARBOUR AT TE HIKO STREET								
2001-2002	9	40.9	1	4.5	12	54.5	22	100
2002-2003	NS	-	NS	-	NS	-	-	-
2003-2004	NS	-	NS	-	NS	-	-	-
2004-2005	NS	-	NS	-	NS	-	-	-
2005-2006	NS	-	NS	-	NS	-	-	-
Total	9		1		12		22	
TITAHI BAY AT BAY DRIVE								
2001-2002	15	71.4	1	4.8	5	23.8	21	100
2002-2003	18	85.7	1	4.8	2	9.5	21	100
2003-2004	15	71.4	3	14.3	3	14.3	21	100
2004-2005	19	86.4	1	4.5	2	9.1	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	89		6		12		107	
TITAHI BAY AT TOMS ROAD								
2001-2002	NS	-	NS	-	NS	-	-	-
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	79		3		4		86	
TITAHI BAY AT SOUTH BEACH ACCESS ROAD								
2001-2002	16	76.2	1	4.8	4	19.0	21	100
2002-2003	17	81.0	3	14.3	1	4.8	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	92		7		8		107	
ONEHUNGA BAY								
2001-2002	16	76.2	3	14.3	2	9.5	21	100
2002-2003	19	90.5	1	4.8	1	4.8	21	100
2003-2004	18	85.7	0	0.0	3	14.3	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	95		5		7		107	

(iii) Hutt City

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PETONE BEACH AT WATER SKI CLUB								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	19	90.5	0	0.0	2	9.5	21	100
2003-2004	19	90.5	1	4.8	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	20	90.9	0	0.0	2	9.1	22	100
Total	99		3		5		107	
PETONE BEACH AT SYDNEY STREET								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	20	95.5	0	0.0	1	4.8	21	100
2003-2004	14	66.7	2	9.5	5	23.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	96		4		7		107	
PETONE BEACH AT SETTLERS MUSEUM								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	2	9.5	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	101		6		0		107	
PETONE BEACH AT KIOSK								
2001-2002	18	85.7	2	9.5	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	21	95.5	0	0.0	1	4.5	22	100
Total	102		2		3		107	
SORRENTO BAY								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		3		1		107	
LOWRY BAY								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	98		4		5		107	
YORK BAY								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	21	95.5	0	0.0	1	4.5	22	100
Total	103		2		2		107	

(iii) Hutt City cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
DAYS BAY AT WELLESLEY COLLEGE								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	106		0		1		107	
DAYS BAY AT WHARF								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	103		1		2		107	
DAYS BAY AT MOANA ROAD								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	103		4		0		107	
RONA BAY AT NORTH END OF CLIFF BISHOP PARK								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	18	85.7	0	0.0	3	14.3	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	100		1		6		107	
RONA BAY AT WHARF								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	18	85.7	1	4.8	2	9.5	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	99		4		4		107	
ROBINSON BAY AT HW SHORTT REC GROUND								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	18	85.7	2	9.5	1	4.8	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	99		4		4		107	
ROBINSON BAY AT NIKAU STREET								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	17	81.0	1	4.8	3	14.3	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	100		4		3		107	
CAMP BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	19	90.5	2	9.5	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		2		2		107	

(iv) Wellington City

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
AOTEA LAGOON								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	2	9.5	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		2		2		107	
ORIENTAL BAY AT FREYBERG BEACH								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	5	100.0	0	0.0	0	0.0	5	100
2003-2004	9	81.8	2	18.2	0	0.0	11	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	76		4		1		81	
ORIENTAL BAY AT WISHING WELL								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	16	100.0	0	0.0	0	0.0	16	100
2003-2004	16	80.0	0	0.0	4	20.0	20	100
2004-2005	19	86.4	1	4.5	2	9.1	22	100
2005-2006	19	86.4	2	9.1	1	4.5	22	100
Total	90		4		7		101	
ORIENTAL BAY AT BAND ROTUNDA								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	14	100.0	0	0.0	0	0.0	14	100
2003-2004	18	85.7	1	4.8	2	9.5	21	100
2004-2005	19	86.4	1	4.5	2	9.1	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	79		3		4		86	
BALAENA BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	105		1		1		107	
KIO BAY								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	2	9.5	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	0	0.0	1	4.5	22	100
Total	102		3		2		107	
HATAITAI BEACH								
2001-2002	18	85.7	2	9.5	1	4.8	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	17	81.0	3	14.3	1	4.8	21	100
2004-2005	18	81.8	2	9.1	2	9.1	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	94		9		4		107	

(iv) Wellington City cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
SHARK BAY								
2001-2002	20	95.2	0	0.0	1	4.8	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	104		1		2		107	
MAHANGA BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	20	95.2	0	0.0	1	4.8	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	18	81.8	3	13.6	1	4.5	22	100
2005-2006	20	90.9	1	4.5	1	4.5	22	100
Total	82		4		3		107	
SCORCHING BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	22	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	106		1		0		107	
WORSER BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	106		0		1		107	
SEATOUN BEACH AT WHARF								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	22	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		3		1		107	
SEATOUN BEACH AT INGLIS STREET								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	103		2		2		107	
BREAKER BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	106		0		1		107	

(iv) Wellington City cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
LYALL BAY AT TIRANGI ROAD								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	18	81.8	4	18.2	0	0.0	22	100
2005-2006	21	95.5	0	0.0	1	4.5	22	100
Total	99		6		2		107	
LYALL BAY AT ONEPU ROAD								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	104		3		0		107	
LYALL BAY AT QUEENS DRIVE								
2001-2002	18	85.7	2	9.5	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	21	100.0	0	0.0	0	0.0	21	100
2004-2005	21	95.5	1	4.5	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	21	100
Total	103		3		1		107	
PRINCESS BAY								
2001-2002	21	100.0	0	0.0	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	0	0.0	2	9.5	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	105		0		2		107	
ISLAND BAY AT OLD BAIT SHED								
2001-2002	17	81.0	2	9.5	2	9.5	21	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	NS	-	NS	-	NS	-	-	-
Total	79		3		3		85	
ISLAND BAY AT SURF CLUB								
2001-2002	19	90.5	2	9.5	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.5	21	100
2004-2005	20	90.9	1	4.5	1	4.5	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	101		4		2		107	
ISLAND BAY AT REEF STREET REC GROUND								
2001-2002	20	95.2	1	4.8	0	0.0	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	95.2	0	0.0	1	4.8	21	100
2004-2005	17	77.3	3	13.6	2	9.1	22	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	99		5		3		107	

(iv) Wellington City cont...

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
ISLAND BAY AT DERWENT STREET								
2001-2002	NS	-	NS	-	NS	-	-	-
2002-2003	NS	-	NS	-	NS	-	-	-
2003-2004	NS	-	NS	-	NS	-	-	-
2004-2005	9	90.0	0	0.0	1	10.0	10	100
2005-2006	21	95.5	1	4.5	0	0.0	22	100
Total	30		1		1		32	
OWHIRO BAY								
2001-2002	19	90.5	1	4.8	1	4.8	21	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	90.5	1	4.8	1	4.8	21	100
2004-2005	18	81.8	1	4.5	3	13.6	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	99		3		5		107	

(v) Wairarapa

Bathing Season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
CASTLEPOINT BEACH AT CASTLEPOINT STREAM								
2001-2002	19	95.0	1	5.0	0	0.0	20	100
2002-2003	19	90.5	2	9.5	0	0.0	21	100
2003-2004	17	89.5	1	5.3	1	5.3	19	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	21	95.5	0	0.0	1	4.5	22	100
Total	97		4		3		104	
CASTLEPOINT BEACH AT SMELLY CREEK								
2001-2002	20	100.0	0	0.0	0	0.0	20	100
2002-2003	18	90.0	2	10.0	0	0.0	20	100
2003-2004	18	94.7	0	0.0	1	5.3	19	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	19	86.4	2	9.1	1	4.5	22	100
Total	97		4		2		103	
RIVERSDALE BEACH AT LAGOON MOUTH								
2001-2002	17	85.0	1	5.0	2	10.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	19	95.0	0	0.0	1	5.0	20	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	100		1		4		105	
RIVERSDALE BEACH BETWEEN THE FLAGS								
2001-2002	19	95.0	1	5.0	0	0.0	20	100
2002-2003	21	100.0	0	0.0	0	0.0	21	100
2003-2004	20	100.0	0	0.0	0	0.0	20	100
2004-2005	21	95.5	0	0.0	1	4.5	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		1		1		105	
RIVERSDALE BEACH SOUTH								
2001-2002	20	100.0	0	0.0	0	0.0	20	100
2002-2003	20	95.2	1	4.8	0	0.0	21	100
2003-2004	19	100.0	0	0.0	0	0.0	19	100
2004-2005	22	100.0	0	0.0	0	0.0	22	100
2005-2006	22	100.0	0	0.0	0	0.0	22	100
Total	103		1		0		104	

Appendix 3: Microbiological risk assessments

Boxes shaded dark grey indicate confirmed selections and boxes shaded light grey indicate probable selections (i.e., some uncertainty exists).

Kapiti freshwater sites (4)

Key (questions 1-20):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 22-24):
Y = yes
N = no
? = not known

To what degree is water quality at the bathing site affected, or likely to be affected by:	Otaki R @ The Pots FCR01			Otaki R @ SH 1 FCR02			Waikanae R @ SH 1 FCR03			Waikanae R @ Greenaway Rd FCR04		
1 Direct discharge of untreated sewage/animal wastes at/upstream of site	0	1	2	0	1	2	0	1	2	0	1	2
2 Stormwater outlets with potential sewage contamination at/upstream of site	0	1	2	0	1	2	0	1	2	0	1	2
3 Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2
4 Discharges from on-site/private sewage systems (e.g., septic tanks)	0	1	2	0	1	2	0	1	2	0	1	2
5 Communal sewage disposal with primary or secondary treatment	0	1	2	0	1	2	0	1	2	0	1	2
6 Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2
7 Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0	1	2	0	1	2	0	1	2	0	1	2
8 Focal points of drainage, as run-off from low-intensity agricultural/urban/rural catchment	0	1	2	0	1	2	0	1	2	0	1	2
9 Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
10 Incidence and density of birdlife	0	1	2	0	1	2	0	1	2	0	1	2
11 Water craft mooring or use	0	1	2	0	1	2	0	1	2	0	1	2
12 Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2	0	1	2
13 Stream, drain or wetland discharging into/upstream of site	0	(1	2)	0	(1	2)	0	(1	2)	0	(1	2)

↓ ↓ ↓ ↓

Continue below if stream/drain/wetland present, otherwise go to question 21

Is the water quality of the stream, drain or wetland affected or likely to be affected by:												
14 Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (e.g., septic tanks)	0	1	2	0	1	2	0	1	2	0	1	2
15 Stormwater outlets with potential sewage contamination/combined stormwater	0	1	2	0	1	2	0	1	2	0	1	2
16 Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2
17 Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2
18 High intensity agriculture/rural activities, density of feral animal/bird populations	0	1	2	0	1	2	0	1	2	0	1	2
19 Focal points of drainage, as run-off from low-intensity agriculture/urban/rural catchment	0	1	2	0	1	2	0	1	2	0	1	2
20 Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2	0	1	2

21 **Of the factors listed 1-12 & 14-20 above, which factor has the primary influence on microbiological water quality of the site?**	12	8	8	8

Other influences:

22 Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
23 Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
24 Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Comments:

1) Significant rainfall (>10 mm in 24 hours) required to trigger action level events in the Waikanae River, more for the Otaki River

Hutt River catchment freshwater sites (6)

Key (questions 1-20):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 22-24):
Y = yes
N = no
? = not known

	To what degree is water quality at the bathing site affected, or likely to be affected by:	Pakuratahi R @ Hutt Forks			Hutt R @ Birchville			Hutt R @ Maoribank Cnr			Hutt R @ Poets Park			Hutt R @ Silverstream			Hutt R @ Boulcott		
		1			2			3			4			5			6		
1	Direct discharge of untreated sewage/animal wastes at/upstream of site	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
2	Stormwater outlets with potential sewage contamination at/upstream of site	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
3	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
4	Discharges from on-site/private sewage systems (e.g., septic tanks)	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
5	Communal sewage disposal with primary or secondary treatment	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
6	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
8	Focal points of drainage, as run-off from low-intensity agricultural/urban/rural catchment	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
9	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
10	Incidence and density of birdlife	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
11	Water craft mooring or use	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
12	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
13	Stream, drain or wetland discharging into/upstream of site	0	(1	2)	0	(1	2)	0	(1	2)	0	(1	2)	0	(1	2)	0	(1	2)

↓ ↓ ↓ ↓ ↓ ↓

Continue below if stream/drain/wetland present, otherwise go to question 21

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:				Akatarawa R at site			Small stream 2 km u/s			Small streams u/s			Mawaihakona S 600 m u/s					
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (e.g., septic tanks)	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
15	Stormwater outlets with potential sewage contamination/combined stormwater	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
16	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
17	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
18	High intensity agriculture/rural activities, density of feral animal/bird populations	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
19	Focal points of drainage, as run-off from low-intensity agriculture/urban/rural catchment	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
20	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2

21 **Of the factors listed 1-12 & 14-20 above, which factor has the primary influence on microbiological water quality of the site?**	8	18	3	3	3/18	3

Other influences:

22	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
23	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
24	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Comments:

1) In most cases, around 5-10 mm of rainfall is required in the 24 hours prior to sampling to cause an exceedance of guideline values.
2) The Hutt River at Silverstream often exceeds guideline values in the absence of any significant rainfall prior to sampling.

Wairarapa freshwater sites (13) - page 1 of 2

Key (questions 1-20):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 22-24):
Y = yes
N = no
? = not known

	To what degree is water quality at the bathing site affected, or likely to be affected by:	Ruamahanga R @ Double Bridges	Ruamahanga R @ Te Ore Ore	Waipoua R @ Colombo Rd	Waingawa R @ Kaituna	Waingawa R @ South Rd	Ruamahanga R @ The Cliffs	Ruamahanga R @ Kokotau	Waiohine R @ Gorge
		R1	R2	R11	R3	R4	R5	R6	R7
1	Direct discharge of untreated sewage/animal wastes at/upstream of site	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination at/upstream of site	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/private sewage systems (e.g., septic tanks)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Focal points of drainage, as run-off from low-intensity agricultural/urban/rural catchment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Unrestricted stock access to waterways	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Incidence and density of birdlife	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
12	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Stream, drain or wetland discharging into/upstream of site	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)

Continue below if stream/drain/wetland present, otherwise go to question 21

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:	Stream 10 km u/s	Henley Lake outflow 75 m u/s					Taueru R 8.5 km u/s	Small stream at site
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (e.g., septic tanks)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Stormwater outlets with potential sewage contamination/combined stormwater	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	High intensity agriculture/rural activities, density of feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
19	Focal points of drainage, as run-off from low-intensity agriculture/urban/rural catchment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
20	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

21	**Of the factors listed 1-12 & 14-20 above, which factor has the primary influence on microbiological water quality of the site?**	7	7	7	12	8	7	7	12

Other influences:

22	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
24	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) The microbiological risk at Double Bridges is probably lower than at the other Ruamahanga River sites due to a significantly lower proportion of pastoral landuse in the upstream catchment
2) Sewer overflows occur rarely, during very heavy rain events, at the Waipoua River site
3) Contamination events in the Waingawa River occur rarely, in extremely wet weather
4) One report of illness from swimming upstream of the Ruamahanga River at the Cliffs in Easter 2005 - incident was unable to be clinically substantiated (Rebecca Fox, Wairarapa Regional Health, pers. comm., 2006)

Wairarapa freshwater sites (13) - page 2 of 2

Key (questions 1-20):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 22-24):
Y = yes
N = no
? = not known

	To what degree is water quality at the bathing site affected, or likely to be affected by:	Waiohine R @ SH 2	Ruamahanga R @ Morrisons Bush	Ruamahanga R @ Waihenga	Ruamahanga R @ Benleys Beach	Riversdale Lagoon
		R8	R9	R10	R12	C4
1	Direct discharge of untreated sewage/animal wastes at/upstream of site	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination at/upstream of site	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/private sewage systems (e.g., septic tanks)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Focal points of drainage, as run-off from low-intensity agricultural/urban/rural catchment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Unrestricted stock access to waterways	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Incidence and density of birdlife	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
12	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Stream, drain or wetland discharging into/upstream of site	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)

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Continue below if stream/drain/wetland present, otherwise go to question 21

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:			Huangarua R 1.8 km u/s		
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (e.g., septic tanks)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Stormwater outlets with potential sewage contamination/combined stormwater	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	High intensity agriculture/rural activities, density of feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
19	Focal points of drainage, as run-off from low-intensity agriculture/urban/rural catchment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
20	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

21	**Of the factors listed 1-12 & 14-20 above, which factor has the primary influence on microbiological water quality of the site?**	8	7	7	7	7

Other influences:

22	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
24	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

Kapiti marine sites (20) - page 1 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

To what degree is the beach water quality affected, or likely to be affected by:

		Otaki Beach @ Surf Club	Otaki Beach @ Rangiuru Road	Te Horo Beach S of Mangaone Stream	Te Horo Beach @ Kitchener Street	Peka Peka Beach @ Road End	Waikanae Beach @ William Street	Waikanae Beach @ Tutere St Tennis Courts	Waikanae Beach @ Ara Kuaka Carpark	Paraparaumu Beach @ Ngapotiki Street	Paraparaumu Beach @ Nathan Avenue
		PH27	PH27a	PH24	PH24a	PH22	PH21a	PH20	PH19	PH11	PH10
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Rivers, streams or drains	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)

Continue below if streams/drains present, otherwise go to question 19

To what degree are these rivers, streams or drains affected, or likely to be affected by:

		Waitohu S 1.2 km N	Waitohu S 2.5 km N Otaki R 1.25 km S	Otaki R 3.8 km N Mangaone S 80m N	Otaki R 4.3 km N Mangaone S 700m N	Stream 800m N	Ngarara S 600m S	Waikanae R 2km S Ngarara S 400m N	Waikanae R 0.65km S	Waikanae R 0.9 km N	Waikanae R 1.7 km N Tikotu S 0.85 km S
12	Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14	Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19	**Of the factors listed 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	18	18	16	16	18	16	16	16	16	3/16

Other influences:

20	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21	Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) The primary influence on water quality can vary - in most cases, rivers/streams north of bathing sites influence water quality, even if they are some distance away (e.g., Otaki Beach), particularly during strong NW winds (keep the N to S current inshore). At other times (e.g., wet southerlies), stormwater may influence water quality, particularly at sites along Paraparaumu and Raumati Beaches (influence of stormwater unknown at some sites). Streams to the south of bathing sites may also influence water quality during strong southerlies.
3) Large rivers to the north of the Kapiti District (e.g., Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
4) Peka Peka Beach has exceeded the action guideline only once during heavy rainfall.
5) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach.

Kapiti marine sites (20) - page 2 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Paraparaumu Beach @ Maclean Park PH08	Paraparaumu Beach @ Toru Road PH07	Paraparaumu Beach @ Wharemauku Rd PH07a	Raumati Beach @ Tainui Street PH06b	Raumati Beach @ Marine Gardens PH06a	Raumati Beach @ Aotea Road PH05	Raumati Beach @ Hydes Road PH04	Paekakariki Beach @ Whareroa Road PH03	Paekakariki Beach @ Surf Club PH02	Paekakariki Beach @ Memorial Hall PH01
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Rivers, streams or drains	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)

Continue below if streams/drains present, otherwise go to question 19

	To what degree are these rivers, streams or drains affected, or likely to be affected by:	Waikanae R 2.7 km N Tikotu S 130 m N	Waikanae R 3.3 km N Tikotu S 700 m N	Waikanae R 3.9 km N Tikotu S 1.3 km N	Wharemauku S 650 m S	Wharemauku S 100 m N	Wharemauku S 1 km N	Wharemauku S 1.7 km N	Whareroa S 150 m N	Wainui S 120 m N	Wainui S 800 m N
12	Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14	Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19	**Of the factors listed 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	15	3/15	3/15	3	15	15/3	3	18	18	18

Other influences:

20	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21	Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) The primary influence on water quality can vary - in most cases, rivers/streams north of bathing sites influence water quality, even if they are some distance away (e.g., Otaki Beach), particularly during strong NW winds (keep the N to S current inshore). At other times (e.g., wet southerlies), stormwater may influence water quality, particularly at sites along Paraparaumu and Raumati Beaches (influence of stormwater unknown at some sites). Streams to the south of bathing sites may also influence water quality during strong southerlies.
3) Large rivers to the north of the Kapiti District (e.g., Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
4) Peka Peka Beach has exceeded the action guideline only once during heavy rainfall.
5) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach.

Porirua marine sites (14) - page 1 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

To what degree is the beach water quality affected, or likely to be affected by:	Pukerua Bay	Karehana Bay @ Cluny Road	Plimmerton Beach @ Bath Street	Plimmerton Beach @ Queens Avenue	South Beach @ Plimmerton	Pauatahanui Inlet @ Water Ski Club	Pauatahanui Inlet @ Motukaraka Point	Pauatahanui Inlet @ Browns Bay	Paremata Beach @ Pascoe Avenue	Porirua Harbour @ Rowing Club
	11	10	9	8	7	12	13	14	6	5
1 Direct discharge of untreated sewage onto/adjacent to bathing area	0	0	0	0	0	0	0	0	0	0
2 Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	1	1	1	1	1					
3 Urban stormwater protected from sewage ingress										
4 Discharges from on-site/other private sewage disposal systems (e.g., septic tank)										
5 Communal sewage disposal with primary or secondary treatment										
6 Communal sewage disposal with tertiary treatment										
7 Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)							1			
8 Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)						1				1
9 Water craft mooring or use		1				1			2	2
10 Focal points of drainage from low intensity rural/urban land use	2									
11 Rivers, streams or drains	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)

Continue below if streams/drains present, otherwise go to question 19

To what degree are these rivers, streams or drains affected, or likely to be affected by:	Stream 50 m E	Drain at Cluny Rd	Taupo S 350 m S	Taupo S 200 m S	Taupo S 100 m N	Streams 15m W & 50m E	Small stream at site: Kakaho S 600 m NW	Browns S 20 mE	Drain at site	Stream 75 m E of site
12 Discharges of primary or secondary treated human effluent	0	0	0	0	0	0	0	0	0	0
13 Communal sewage disposal with tertiary treatment	0	0	0	0	0	0	0	0	0	0
14 Stormwater outlets with potential sewage contamination	0	0	2	2	2	0	0	2	0	0
15 Urban stormwater protected from sewage ingress	0	2	2	2	2	0	0	2	2	2
16 High intensity agriculture, feral animal/bird populations	1	0	2	2	2	2	2	0	0	0
17 Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	2	0	0	0	0	1	1	0	0	0
18 Focal points of drainage from low intensity land use	2	1	1	1	1	2	1	0	0	0
19 **Of the factors listed 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	18	15	16/3	16	16	16	16	15	15	15

Other influences:

	Pukerua Bay	Karehana Bay @ Cluny Road	Plimmerton Beach @ Bath Street	Plimmerton Beach @ Queens Avenue	South Beach @ Plimmerton	Pauatahanui Inlet @ Water Ski Club	Pauatahanui Inlet @ Motukaraka Point	Pauatahanui Inlet @ Browns Bay	Paremata Beach @ Pascoe Avenue	Porirua Harbour @ Rowing Club
20 Does rainfall trigger contamination events?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
21 Does water quality change with currents, tide or wind?										
22 Does microbial water data ever exceed action guidelines?										
23 Have illnesses ever been notified from this area?	N	N	N	N	N	N	N	N	N	N

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) Sewage pump stations are located in close proximity to Pukerua Bay, Karehana Bay, Pauatahanui Inlet at Browns Bay and Titahi Bay at Bay Drive - can overflow in very heavy rain events.
3) Sewer pump station and sewer mains would influence Taupo Stream in major storm events (Tracey Fleming, PCC, pers. comm., 2006).
4) There have been several cases in the past two years of domestic sewage connections directly to Browns Stream & the Whitby Lakes (Duck Creek catchment).

Porirua marine sites (14) - page 2 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Titahi Bay @ Bay Drive			Titahi Bay @ Toms Road			Titahi Bay @ South Beach Access Road			Onehunga Bay		
		2			3			4			1		
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0	1	2	0	1	2	0	1	2	0	1	2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0	1	2	0	1	2	0	1	2	0	1	2
3	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0	1	2	0	1	2	0	1	2	0	1	2
5	Communal sewage disposal with primary or secondary treatment	0	1	2	0	1	2	0	1	2	0	1	2
6	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0	1	2	0	1	2	0	1	2	0	1	2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0	1	2	0	1	2	0	1	2	0	1	2
9	Water craft mooring or use	0	1	2	0	1	2	0	1	2	0	1	2
10	Focal points of drainage from low intensity land use	0	1	2	0	1	2	0	1	2	0	1	2
11	Rivers, streams or drains	0	(1	2)	0	(1	2)	0	(1	2)	0	(1	2)

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Continue below if streams/drains present, otherwise go to question 19

	To what degree are these rivers, streams or drains affected, or likely to be affected by:	Stream/drain at site			Stream/drain at site			Stream/drain at site			Stream at site		
12	Discharges of primary or secondary treated human effluent	0	1	2	0	1	2	0	1	2	0	1	2
13	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2	0	1	2
14	Stormwater outlets with potential sewage contamination	0	1	2	0	1	2	0	1	2	0	1	2
15	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2	0	1	2
16	High intensity agriculture, feral animal/bird populations	0	1	2	0	1	2	0	1	2	0	1	2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2	0	1	2
18	Focal points of drainage from low intensity land use	0	1	2	0	1	2	0	1	2	0	1	2

19	**Of the factors listed 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	15	15	15	18

Other influences:

20	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
21	Does water quality change with currents, tide or wind?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
22	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
23	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) Sewage pump stations are located in close proximity to Pukerua Bay, Karehana Bay, Pauatahanui Inlet at Browns Bay and Titahi Bay at Bay Drive - can overflow in very heavy rain events.
3) Drains carrying urban stormwater discharge at the Titahi Bay bathing sites - Bay Drive has the largest catchment area, South Beach may have a permanent (piped stream?) flow (an elevated faecal bacteria count was recorded at the outlet in May 2006).
4) Although Onehunga Bay drains low-intensity rural land (Whitireia Park), the area of rural land is significant and so a "moderate" (as opposed to "low") SIC grade has been awarded.

Hutt marine sites (15) - page 1 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

To what degree is the beach water quality affected, or likely to be affected by:		Petone Beach @ Water Ski Club	Petone Beach @ Sydney Street	Petone Beach @ Settlers Museum	Petone Beach @ Kiosk	Sorrento Bay	Lowry Bay @ Cheviot Road	York Bay	Days Bay @ Wellesley College	Days Bay @ Wharf	Days Bay @ Moana Road
		1	2	3	4	5	6	7	8	9	10
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Rivers, streams or drains	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2	0 (1) 2

Continue below if streams/drains present, otherwise go to question 19

To what degree are these rivers, streams or drains affected, or likely to be affected by:		Korokoro S 150 m W	Korokoro S 1 km E	Hutt R 2 km SE	Hutt R 1.1 km SE	Hutt R 1.8 km N-NW		Stream/drain at or near site	Stream/drain at or near site		
12	Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14	Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19	**Of the factors listed as 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	3	3	3	3	10	10	10	10	18	10

Other influences:

20	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21	Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.

2) On occasions during very heavy rainfall, treated sewage can be discharged to the lower Hutt River via the Waiwhetu Stream. Sewer overflows to the river also occur on occasion (e.g., Waione Street, Hinemoa St).

3) Sites draining the eastern hills may have some faecal contamination from feral animals but this is unlikely to affect water quality, unless in combination with run-off from general low-intensity land use during heavy rainfall.

4) Various stormwater/drain/stream outlets are present at most Eastern Bay sites, most are small and drain road areas, some are large (e.g., at Rona Bay), drain more built up areas and appear to have a semi-permanent flow (i.e., streams).

Hutt marine sites (15) - page 2 of 2

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Rona Bay @ Nth end of Cliff Bishop Park	Rona Bay @ Wharf	Robinson Bay @ HW Shortt Rec Ground	Robinson Bay @ Nikau Street	Camp Bay
		11	12	13	14	15
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Rivers, streams or drains	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)

Continue below if streams/drains present, otherwise go to question 19

	To what degree are these rivers, streams or drains affected, or likely to be affected by:	Stream/drain at site	Stream/drain at site			
12	Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14	Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19	**Of the factors listed as 1-10 and 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	15	15	10	10	None

Other influences:

20	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21	Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) Sites draining the eastern hills may have some faecal contamination from feral animals but this is unlikely to affect water quality, unless in combination with run-off from general low-intensity land use during heavy rainfall.
3) Various stormwater/drain/stream outlets are present at most Eastern Bay sites, most are small and drain road areas, some are large (e.g., at Rona Bay), drain more built up areas and appear to have a semi-permanent flow (i.e., streams).

Wellington marine sites (23) - page 1 of 3

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

To what degree is the beach water quality affected, or likely to be affected by:	Aotea Lagoon R29-090	Oriental Bay @ Freyberg Beach Q33-057	Oriental Bay @ Wishing Well Q34-114	Oriental Bay @ Band Rotunda Q34-113	Balaena Bay Q37-036	Kio Bay O38-045	Hataitai Beach M36-166	Shark Bay N42-002	Mahanga Bay P47-001	Scorching Bay O47-047
1 Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2 Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3 Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4 Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5 Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6 Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7 Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8 Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9 Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10 Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11 Rivers, streams or drains	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

Continue below if streams/drains present, otherwise go to question 19

To what degree are these rivers, streams or drains affected, or likely to be affected by:										
12 Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13 Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14 Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15 Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16 High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17 Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18 Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19 Of the factors listed 1-10 & 12-18 above, which factor has the primary influence on microbiological water quality of the site?	3	3	3	3	10	10	8	10	10	10

Other influences:

20 Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21 Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22 Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23 Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.

2) There are no stormwater outlets discharging directly into Aotea Lagoon or Oriental Bay but these areas are located in dense urban areas and there are significant stormwater outfalls in the vicinity of the inner harbour area (e.g., Frank Kitts Park, Taranaki St, Overseas Passenger Terminal).

3) Some sites (e.g., Breaker Bay and Princess Bay) require very heavy rain events for contamination to occur.

Wellington marine sites (23) - page 2 of 3

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

To what degree is the beach water quality affected, or likely to be affected by:	Worser Bay K46-034	Seatoun Beach @ Wharf I46-031	Seatoun Beach @ Inglis Street H48-024	Breaker Bay F47-002	Lyall Bay @ Tirangi Road G37-064	Lyall Bay @ Onepu Road F34-042	Lyall Bay @ Queens Drive F33-065	Princess Bay B32-016	Island Bay @ Old Bait Shed B28-036	Island Bay @ Surf Club B27-027
1 Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2 Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3 Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4 Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5 Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6 Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7 Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8 Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9 Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10 Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11 Rivers, streams or drains	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

Continue below if streams/drains present, otherwise go to question 19

To what degree are these rivers, streams or drains affected, or likely to be affected by:								Houghton Bay S 350 m NW		
12 Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13 Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14 Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15 Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16 High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17 Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18 Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2

19 Of the factors listed 1-10 & 12-18 above, which factor has the primary influence on microbiological water quality of the site?	10	10/3	10/3	None	3	3	3	10	10	3

Other influences:

20 Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21 Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22 Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23 Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) Seatoun Beach is probably mostly influenced by low level drainage from roading areas etc., but larger stormwater outfalls are present and may influence water quality at times.
3) Some sites (e.g., Breaker Bay and Princess Bay) require very heavy rain events for contamination to occur.
4) Water quality at Lyall Bay, Island Bay and in the Owhiro Stream may be influenced by sewer overflows during very heavy rain events - such events are rare.

Wellington marine sites (23) - page 3 of 3

Key (questions 1-18):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 20-23):
Y = yes
N = no
? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Island Bay @ Reef St Rec Ground B27-026			Island Bay @ Derwent Street B26-090			Owhiro Bay B22-018		
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0	1	2	0	1	2	0	1	2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0	1	2	0	1	2	0	1	2
3	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0	1	2	0	1	2	0	1	2
5	Communal sewage disposal with primary or secondary treatment	0	1	2	0	1	2	0	1	2
6	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0	1	2	0	1	2	0	1	2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0	1	2	0	1	2	0	1	2
9	Water craft mooring or use	0	1	2	0	1	2	0	1	2
10	Focal points of drainage from low intensity land use	0	1	2	0	1	2	0	1	2
11	Rivers, streams or drains	0	1	2	0	1	2	0	1	2

↓ ↓ ↓

Continue below if streams/drains present, otherwise go to question 19

	To what degree are these rivers, streams or drains affected, or likely to be affected by:									
12	Discharges of primary or secondary treated human effluent	0	1	2	0	1	2	0	1	2
13	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2	0	1	2
14	Stormwater outlets with potential sewage contamination	0	1	2	0	1	2	0	1	2
15	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2
16	High intensity agriculture, feral animal/bird populations	0	1	2	0	1	2	0	1	2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0	1	2	0	1	2	0	1	2
18	Focal points of drainage from low intensity land use	0	1	2	0	1	2	0	1	2

19	**Of the factors listed 1-10 & 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	3	3	15

Other influences:

20	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?
21	Does water quality change with currents, tide or wind?	Y	N	?	Y	N	?	Y	N	?
22	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?
23	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?

Comments:

1) No incidences of illness from bathing reported to health authorities.

2) Water quality at Island Bay and in the Owhiro Stream may be influenced by sewer overflows during very heavy rain events - such events are rare.

Wairarapa marine sites (5)

Key (questions 1-19):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 21-24):
Y = yes
N = no
? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Castlepoint Beach @ Castlepoint Stream	Castlepoint Beach @ Smelly Creek	Riversdale Beach @ Lagoon Mouth	Riversdale Beach Between the Flags	Riversdale Beach South
		C1	C2	C3	C5	C5x
1	Direct discharge of untreated sewage onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
2	Stormwater outlets with potential sewage contamination/combined stormwater outlet onto/adjacent to bathing area	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
3	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
4	Discharges from on-site/other private sewage disposal systems (e.g., septic tank)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
5	Communal sewage disposal with primary or secondary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
6	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (e.g., dairying, piggeries)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
9	Water craft mooring or use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
10	Focal points of drainage from low intensity urban/rural land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
11	Rivers, streams or drains	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)	0 (1 2)
		↓	↓	↓	↓	↓
	To what degree are these rivers, streams or drains affected, or likely to be affected by:	Continue below if streams/drains present, otherwise go to question 19				
12	Discharges of primary or secondary treated human effluent	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
13	Communal sewage disposal with tertiary treatment	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
14	Stormwater outlets with potential sewage contamination	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
15	Urban stormwater protected from sewage ingress	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
16	High intensity agriculture, feral animal/bird populations	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
17	Potential for faecal contamination by feral animals (e.g., forest or bush run-off)	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
18	Focal points of drainage from low intensity land use	0 1 2	0 1 2	0 1 2	0 1 2	0 1 2
19	**Of the factors listed 1-10 & 12-18 above, which factor has the primary influence on microbiological water quality of the site?**	16	16	16	10	None
	Other influences:					
20	Does rainfall trigger contamination events?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
21	Does water quality change with currents, tide or wind?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
22	Does microbial water data ever exceed action guidelines?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?
23	Have illnesses ever been notified from this area?	Y N ?	Y N ?	Y N ?	Y N ?	Y N ?

Comments:

1) No incidences of illness from bathing reported to health authorities.
2) Most sites require very heavy rain events for contamination to occur.
3) Groundwater is thought to discharge along the lower part of Riversdale Beach - while it is vulnerable to contamination (thin sand aquifer), it is unlikely to significantly influence water quality at the beach.