Will I get sick if I swim?

Updated suitability for recreation grades for fresh and coastal waters in the Wellington region

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Cover photo: Kids swimming in a tributary of the Ruamahanga River (M Velde)

Executive summary

This report presents revised Suitability for Recreation Grades (SFRGs) for fresh and coastal waters in the Wellington region. These grades are based on microbiological water quality data collected during routine weekly monitoring over the 2006/07 to 2010/11 summer bathing seasons and a re-evaluation of the susceptibility of each of the region's recreational sites to faecal contamination undertaken in consultation with territorial and public health authorities.

A SFRG describes the general condition of the water at a site at any given time based on both microbiological risk and actual indicator bacteria counts determined through routine water quality monitoring over a five-year period; it 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.

Of the 100 recreational water quality sites monitored across the Wellington region between 2006/07 and 2010/11, 60 sites have SFRGs of 'good' or better (utilising 'dry weather' SFRGs for freshwater – modified grades which exclude wet weather/high river flow conditions when recreation is less likely to occur). These sites include freshwater sites in catchments dominated by forest and scrub, coastal sites adjoining catchments dominated by scrub and low intensity agricultural land use, and coastal sites in urban areas where stormwater is protected from sewage contamination.

Across the region, 35 sites have been assigned SFRGs of 'fair' or 'poor'. At these sites the principal source of faecal contamination has been identified as either runoff from intensive agricultural or urban land use, stock access to streams or, more commonly in the case of coastal sites, discharges of urban stormwater contaminated with sewage.

Five sites on the Ruamahanga River have been assigned interim SFRGs of 'fair' or 'poor' due to uncertainty around the influence of discharges from municipal wastewater treatment plants. The SFRGs for these sites will need to be reviewed as information on the pathogen removal efficiency of the treatment plants becomes available or as the discharges are progressively moved to land.

Contents

Executive summary **i**

1. Introduction **1**
1.1 Report outline 1

2. Overview to grading recreational waters **3**
2.1 Suitability for Recreation Grades 3
2.1.1 Sanitary Inspection Category (SIC) 6
2.1.2 Microbiological Assessment Category (MAC) 6
2.2 Limitations 8
2.3 Review of monitoring sites 8

3. Suitability for recreation – fresh waters **9**
3.1 Introduction 9
3.1.1 Monitoring protocol 9
3.1.2 Deriving Suitability for Recreation Grades 10
3.2 Kapiti rivers 12
3.2.1 Microbiological risk factors 12
3.2.2 Microbiological water quality results 14
3.2.3 Suitability for recreation 14
3.2.4 Review of monitoring sites 15
3.3 Hutt, Pakuratahi and Wainuiomata rivers 15
3.3.1 Microbiological risk factors 16
3.3.2 Microbiological water quality results 18
3.3.3 Suitability for recreation 19
3.3.4 Review of monitoring sites 19
3.4 Wairarapa rivers 20
3.4.1 Microbiological risk factors 20
3.4.2 Microbiological water quality results 24
3.4.3 Suitability for recreation 25
3.4.4 Review of monitoring sites 26
3.5 Synthesis 27

4. Suitability for recreation – coastal waters **29**
4.1 Introduction 29
4.1.1 Monitoring protocol 30
4.1.2 Deriving Suitability for Recreation Grades 30
4.2 Kapiti 31
4.2.1 Microbiological risk factors 31
4.2.2 Microbiological water quality results 33
4.2.3 Suitability for Recreation Grades 33
4.2.4 Review of monitoring sites 33
4.3 Porirua 35
4.3.1 Microbiological risk factors 35
4.3.2 Microbiological water quality results 37
4.3.3 Suitability for Recreation Grades 37
4.3.4 Review of monitoring sites 37
4.4 Wellington city 39

4.4.1 Microbiological risk factors 39
4.4.2 Microbiological water quality results 41
4.4.3 Suitability for Recreation Grades 41
4.4.4 Review of monitoring sites 41
4.5 Hutt 43
4.5.1 Microbiological risk factors 43
4.5.2 Microbiological water quality results 45
4.5.3 Suitability for Recreation Grades 45
4.5.4 Review of monitoring sites 47
4.6 Wairarapa 47
4.6.1 Microbiological risk factors 48
4.6.2 Microbiological water quality results 48
4.6.3 Suitability for Recreation Grades 50
4.6.4 Review of monitoring sites 50
4.7 Synthesis 50

5. Discussion 52
5.1 SFRGs in 2010/11 compared with 2005/06 52
5.2 Limitations associated with the SFRG process 53

6. Conclusions 56
6.1 Recommendations 56

References 58

Acknowledgements 60

Appendix 1: Recreational water quality monitoring sites 61

Appendix 2: Microbiological risk assessments 63

Appendix 3: River flow estimation methods 85

Appendix 4: Water quality results, 2006/07–2010/11 summers 86
(a) Recreational water quality in fresh waters 86
(b) Recreational water quality in coastal waters 89

Appendix 5: Comparison of SIC, MAC and SFRG grades between periods 2001/02–2005/06 and 2006/07–2010/11 100
(a) Freshwater sites 100
(b) Coastal sites 100

1. Introduction

The Wellington region boasts an extensive coastline and many rivers that are highly valued for a wide range of contact recreation activities. Together with the region's territorial authorities, Greater Wellington Regional Council (Greater Wellington) monitors microbiological water quality at designated recreational sites across the region 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 coastal waters for recreation.

This report presents revised Suitability for Recreation Grades (SFRGs) for fresh and coastal waters in the Wellington region, providing an update to the original grades reported by Milne and Wyatt (2006)[1]. A SFRG describes the general condition of the water at a site at any given time based on both microbiological risk and actual indicator bacteria counts determined through routine water quality monitoring over a five-year period. This 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 SFRGs presented in this report have been derived from microbiological water quality data collected during routine weekly monitoring over the 2006/07 to 2010/11 summer bathing seasons and a re-evaluation of the susceptibility of each of the region's recreational sites to faecal contamination. This re-evaluation of microbiological risk factors was undertaken during August and September 2011 in consultation with the region's territorial and public health authorities. During this time territorial and public health authorities were also consulted regarding a review of the recreational water quality monitoring site network; the results of this consultation are also summarised here.

Although this report evaluates microbiological water quality, unlike the report of Milne and Wyatt (2006), it does not assess compliance of microbiological water quality monitoring results against national guidelines for recreation. The reader should consult Greenfield et al. (2012) for this assessment.

1.1 Report outline

The report comprises six sections:

- Section 2 outlines the process used to identify SFRGs for recreational water quality monitoring sites in the Wellington region.
- Section 3 briefly outlines the sampling and data analysis protocols used for freshwater monitoring sites and presents SFRGs derived for each freshwater site. Results of the freshwater recreational water quality monitoring site network review are also summarised.

[1] Milne and Wyatt (2006) reported the original SFRGs for recreational waters in the Wellington region based on microbiological water quality data collected over the 2001/02 to 2005/06 summers. The SFRGs have since been updated annually by Greater Wellington in annual *On the beaches* publications (eg, see Morar & Warr 2011), but these annual revisions are limited to the updating of only the microbiological water quality component of the SFRG. See Section 2.1 for more detail.

- Section 4 briefly outlines the sampling and data analysis protocols used for coastal monitoring sites and presents SFRGs derived for each coastal site. Results of the coastal recreational water quality monitoring site network review are also summarised.

- Section 5 discusses the main findings from Sections 3 and 4, and briefly compares the revised SFRGs to those first derived in 2006. The primary sources of microbiological contamination of the region's fresh and coastal waters are discussed and limitations of the SFRG process outlined.

- Section 6 presents conclusions and recommendations.

2. Overview to grading recreational waters

Recreational water quality monitoring and reporting in the Wellington region is undertaken in accordance with the 2003[2] Ministry for the Environment (MfE) and the Ministry of Health (MoH) microbiological water quality guidelines for marine and freshwater recreational areas. These guidelines use a combination of catchment risk grading and measurement of indicator bacteria counts to assign a Suitability for Recreation Grade (SFRG) for each site. Indicator bacteria used to assess water quality for contact recreation are:

- Freshwater (including estuarine waters): *Escherichia coli (E. coli)*
- Marine waters: Enterococci

These indicator bacteria are found in the gut of warm blooded animals and although not always harmful themselves, provide an indication of the potential presence of harmful pathogens[3] from faecal contamination.

In addition to the process for identification of SFRG grades, the MfE/MoH (2003) guidelines identify bacteriological 'trigger' values against which weekly measurements of indicator bacteria counts can be compared to help water managers determine when management intervention is required. The 'trigger' values underpin a three-tier management framework analogous to traffic lights. See Greenfield et al. (2012) for a detailed analysis of the compliance of results from routine water samples collected from each monitoring site with these trigger values.

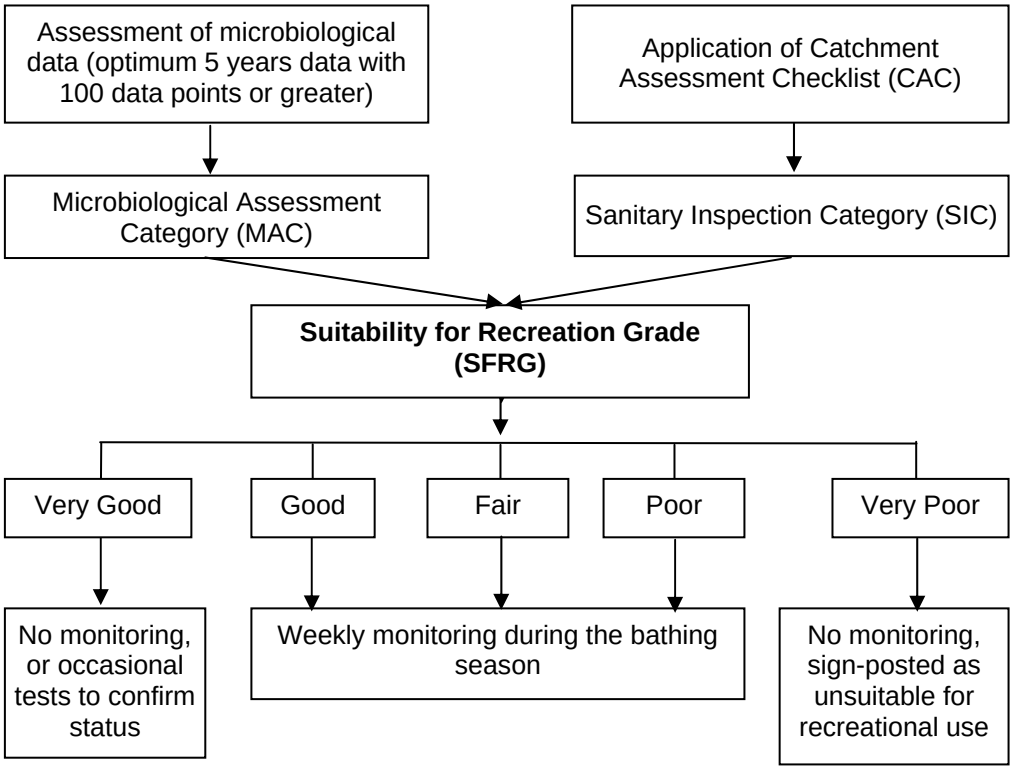
2.1 Suitability for Recreation Grades

Identification of a SFRG 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 obtain an overall grade (Figure 2.1).

The SFRG describes the general condition of the water at a site at any given time, based on both 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' (Table 2.1). 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 from runoff. Consequently, weekly water quality monitoring at these middle-range sites is recommended during the bathing season (November to March inclusive).

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

[3] Indicator bacteria are monitored because individual pathogenic organisms (eg, salmonella, campylobacter, cryptosporidium, and giardia) are often present in very low numbers, can be hard to detect, and the analytical tests are expensive.



(Source: after MfE/MoH (2003), p. C3)

Figure 2.1: Overview of the bathing site grading process and surveillance requirements

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.

Table 2.1: Description of Suitability for Recreation Grades (SFRGs)

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

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.

2.1.1 Sanitary Inspection Category (SIC)

The SIC allows the principal source of faecal contamination (eg, 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 (eg, 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 2.2, together with the SIC value associated with each hazard. It is important to note that only 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.

Greater Wellington completed CACs for the majority of the region's coastal recreational water quality monitoring sites in 2002, along with preliminary CACs for freshwater monitoring sites. The microbiological hazard component of the CACs were revisited and updated in the original grading report by Milne and Wyatt (2006) drawing on information 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 wastewater/stormwater infrastructure staff at selected territorial authorities.

The review of microbiological risk factors undertaken to revise the SIC values for this report followed a similar process and culminated with individual meetings with the region's territorial authorities and public health agencies. These meetings were held during August and September 2011. Note that as part of the review of freshwater SFRGs, SIC grades for some microbiological hazards were modified to allow consideration of their influence in dry weather conditions only (see Section 3.1.2 for details).

2.1.2 Microbiological Assessment Category (MAC)

The MAC value is established by taking the 95th percentile value from an existing or collected set of microbiological water quality data. The MfE/MoH (2003) guidelines state that ideally there should be 100 data points or greater, collected over the previous five years. However, it is feasible to consider grading with a minimum of 20 data points collected over one full bathing season; in such cases the SFRG is deemed *interim* until five years of microbiological water quality data have been collected.

The MAC values presented in this report are based on data collected during routine monitoring over the 2006/07 to 2010/11 summer bathing seasons. Any exceptions to this (eg, more recently established site for which there is less than five years of monitoring data) are noted in the presentation of the SFRGs in Sections 3 and 4.

Table 2.2: Microbiological hazards and associated SIC grades for fresh and coastal waters. Only 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.

(Source: Adapted from figures H2 and H3 of MfE/MoH 2003)

	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 runoff	High / Moderate[1]
8	Focal points of drainage from low intensity land use	Moderate / Low[1]
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 (eg, forest or bush runoff)	Low / Very Low[1]
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[2]	Moderate[3]
17	Communal sewage disposal with tertiary treatment	Moderate
18	Intensive agricultural land use and potential for direct runoff	Moderate
19	Focal points of drainage from low intensity land use	Low
20	Unrestricted stock access to waterways[2]	Moderate[3]
21	Dense birdlife near the area[2]	Moderate[3]
22	Faecal contamination from feral animals (eg, forest or bush runoff)	Very Low
	Microbiological hazards – coastal 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 runoff	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[2]	Low[3]
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[2]	Moderate[3]
15	Intensive agricultural land use and potential for direct runoff	Moderate
16	Faecal contamination from feral animals (eg, forest or bush runoff)	Very Low
17	Focal points of drainage from low intensity land use	Low

[1] Estimated SIC value (by Greater Wellington staff) applicable in dry weather conditions only.

[2] Represents an additional hazard considered by Greater Wellington staff.

[3] Estimated SIC value (by Greater Wellington staff).

2.2 Limitations

The MfE/MoH (2003) guidelines do not cover toxic chemicals such as heavy metals or toxic algal blooms, which in certain places and under certain conditions may pose a significant risk to contact recreation. While guidelines are now available for toxic cyanobacteria in fresh waters (MfE/MoH 2009), these are interim guidelines only and do not address potentially toxic algal blooms in marine waters; such blooms have occurred in marine recreational waters in the Wellington region in the past.

It is difficult to accurately assess the true effect on human health from contact with contaminated recreational waters as many of the associated illnesses are mild and no records are kept of their occurrence (i.e. no medical attention is sought and no formal reporting of illness is provided) (MfE/MoH 2003).

SFRGs identified for recreational water quality monitoring sites in the Wellington region are indicative of microbiological water quality during the *summer bathing season* only (ie, November to March inclusive).

2.3 Review of monitoring sites

At the same time as SFRGs were re-assessed with the region's territorial authorities and Regional Public Health in August and September 2011, the opportunity was taken to review the recreational water quality monitoring site network. The review addressed the degree of recreational use of each site, representation of particular beaches and river reaches, and the possible addition of new sites (including recreational shellfish water quality monitoring sites). The outcomes of these discussions, which were largely implemented for start the 2011/12 summer bathing season, are summarised in Sections 3 and 4. Note that while this has resulted in a reduction in the number of freshwater and coastal recreation sites being monitored (from 23 to 22 and 77 to 61, respectively), the SFRGs presented in this report address all 100 recreation sites monitored as at the end of the 2010/11 summer bathing season.

3. Suitability for recreation – fresh waters

3.1 Introduction

Recreational water quality is currently monitored at 23 river sites across the Wellington region (Figure 3.1, Appendix 1)[4]. 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, seven in the Hutt Valley and Wainuiomata, and 12 in the Wairarapa.

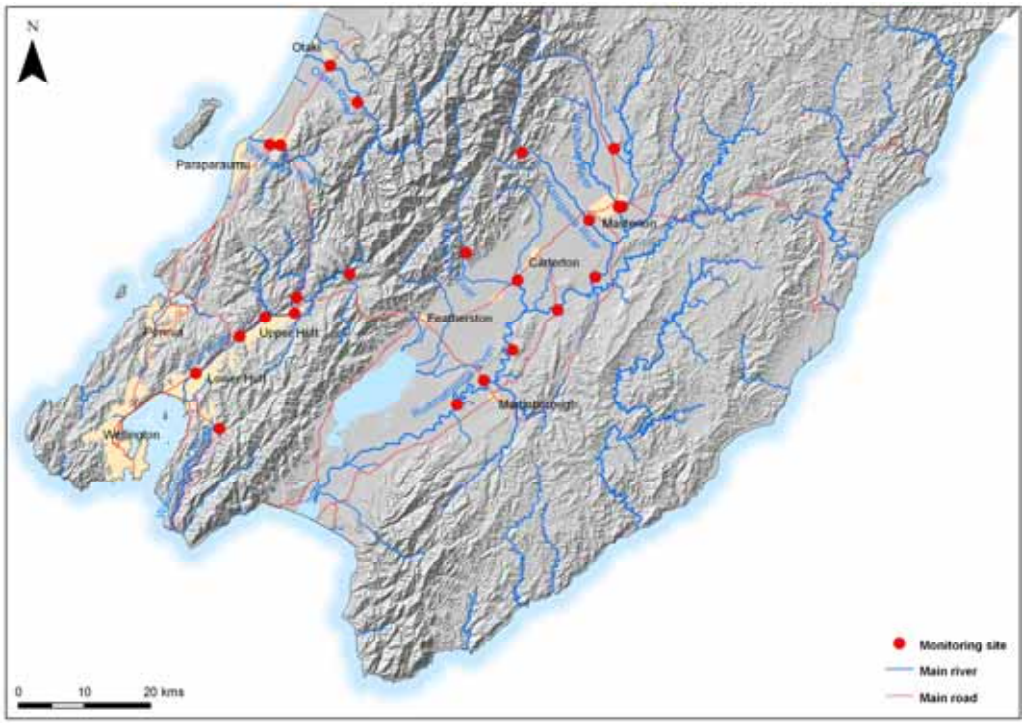


Figure 3.1: River recreational water quality monitoring sites in the Wellington region (as at 31 March 2011)

This section provides a brief overview of the sampling protocols and guidelines used for monitoring freshwater recreation sites in the Wellington region as well as the approach taken to update the existing Suitability for Recreation Grades (SFRGs). SFRGs are presented for rivers in each of three areas: Kapiti, Hutt and the Wairarapa. The outcomes of the review of the river recreational water quality monitoring site network are also outlined.

3.1.1 Monitoring protocol

Sites are sampled weekly during the bathing season (November to March inclusive) for a minimum of 20 weeks, with the exception of the Otaki River at Pots and the Waiohine River at Gorge which, from November 2006, have been sampled monthly under Greater Wellington's Rivers State of the Environment (RSoE) monitoring programme[5]. On each occasion a single water sample is

[4] As at the end of the 2010/11 summer bathing season – see Section 2.3.

[5] Historically these sites were sampled separately under two Greater Wellington water quality monitoring programmes; recreational water quality and RSoE water quality. As both river sites have a 'very low' to 'low' risk of microbiological contamination and a high level of compliance with recreational water quality guidelines, Milne and Wyatt (2006) recommended that routine weekly sampling under the recreational water quality monitoring programme cease; the monthly microbiological water quality results obtained from these sites under the RSoE monitoring programme are now used to assess recreational water quality.

collected 0.2 m below the surface in 0.5 m water depth and analysed for the indicator bacteria *Escherichia coli* (*E. coli*). Measurements of water temperature and turbidity, and visual estimates of periphyton (algae and cyanobacteria) cover, are also made at each river site (see Greenfield et al. 2012 for details).

3.1.2 Deriving Suitability for Recreation Grades

The process to grade the suitability of recreational waters from a public health perspective was outlined in Section 2.1 and involves combining a qualitative assessment of the susceptibility of a recreational site to faecal contamination (the SIC component) with direct measurements of the appropriate bacteriological indicator at the site (the MAC component). The SIC and MAC categories used to identify SFRGs for fresh waters are shown in Table 3.1 (and the five different SFRGs were explained in detail earlier in Table 2.1, Section 2.1).

Table 3.1: MfE/MoH (2003) Suitability for Recreation Grades (SFRGs) 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 indicator bacteria that require verification.

During the establishment of SFRG grades for river sites in the Wellington region, Milne and Wyatt (2006) identified that SFRGs for many sites were 'poor' or 'very poor' due to the influence of a small number of elevated *E. coli* results recorded following heavy rainfall. As such, SFRGs for these sites were considered to be more representative of wet weather conditions when contact recreation was less likely to occur. Consequently during re-assessment of the SFRGs in 2011/12, two SFRGs were derived for each freshwater site: one based on all flow conditions (ie, utilising all routine *E. coli* sample results) and one based on 'dry weather' conditions only (ie, utilising all *E. coli* data from routine sampling events at or below median river flow). Microbiological risk factors and corresponding SIC values, together with MAC values, were derived under both conditions and combined to obtain the two grades. SIC values for microbiological risk factors involving runoff from urban and rural land uses were modified to take into account the reduced risk of influence during dry weather (see Table 2.2) and *E. coli* indicator counts associated with high river flows were excluded when calculating the MAC value for each river site

(Greenfield et al. (2012) present detailed graphics on the effects of different river flows/conditions on *E. coli* counts).

The MfE/MoH (2003) guidelines allow for modification of a SFRG grade in this way if the modified grade better reflects the water quality conditions the public are usually exposed to and is verified by the Regional Medical Officer of Health. The caveat is that modified grades should only be used where occasional and predictable contamination events are identified (eg, heavy rainfall) and interventions can be demonstrated to be effective in discouraging recreational use during these times. This requires adequate communication to river users of the increased risk of microbial contamination through such things as signage at affected sites, media releases and website postings.

(a) Data analysis

All *E. coli* results were evaluated in accordance with the MfE/MoH (2003) microbiological water quality guidelines for fresh waters (Table 3.1), with the MAC grade (ie, the 95th percentile *E. coli* count) calculated using the recommended Hazen percentile method. Prior to data analysis, *E. coli* counts below the laboratory detection limit were halved apart from those where the detection limit was <1 cfu/100mL in which case a value of 1 cfu/100mL was used.

Only *E. coli* data generated from routine water sampling events over the five most recent summers (2006/07 to 2010/11) were used in the calculation of the MAC[6]. For the two sites where *E. coli* testing is only undertaken monthly (Otaki River at 'the Pots' and Waiohine River at Gorge), a longer data period was drawn on (from 2002/03 to 2010/11) to ensure a robust MAC grade could be calculated.

It should be noted that the 'dry weather' SFRGs presented in this section can only be considered *interim* grades; this is because the removal of *E. coli* data from sampling events above median river flow (see Section 3.1.2(c)) reduced the data set for each site to n<100; according to the MfE/MoH (2003) guidelines, at least 100 data points must be used to derive a SFRG.

As noted in Section 2.1.1, the SIC grades used to derive the SFRGs follow a re-evaluation of the microbiological risk factors undertaken in consultation with the region's territorial and public health authorities. Appendix 2 documents the complete assessment of the microbiological risk factors present at each site.

(b) Land cover information

Estimates of land cover in the catchment upstream of each river monitoring site were obtained from the interpretation of aerial photographs taken in 2008 and published by the Ministry for the Environment (2010). Intensive agricultural land use was identified as the principal source of contamination when a total of 15% or more of the upstream catchment consisted of high producing pastoral land cover.

[6] The MfE/MoH (2003) microbiological water quality guidelines require repeat (follow-up) water sampling in the event of a routine sample result returning an *E. coli* count above the amber/alert mode of the guidelines (260 cfu/100mL).

(c) River flow analysis

E. coli data were assessed against an estimate of river flow at the time of sampling derived using actual data from flow sites either at the monitoring site or nearby (see Appendix 3 for methods).

E. coli sample results were assigned into one of four estimated river flow categories: less than half median, half median to median, median to three times median, and greater than three times median flow. Only *E. coli* results recorded from sampling events at or below median flow were used to derive the 'dry weather' SFRGs presented in Sections 3.2 to 3.4; this approach, documented in Greenfield et al. (2012), is consistent with the approach of Ausseil and Clark (2007) who considered that primary contact recreation in the Wanganui-Manawatu region was most likely to occur at or below median river flows.

3.2 Kapiti rivers

Recreational water quality monitoring is undertaken on two rivers in the Kapiti Coast district: the Otaki and the Waikanae (Figure 3.2).

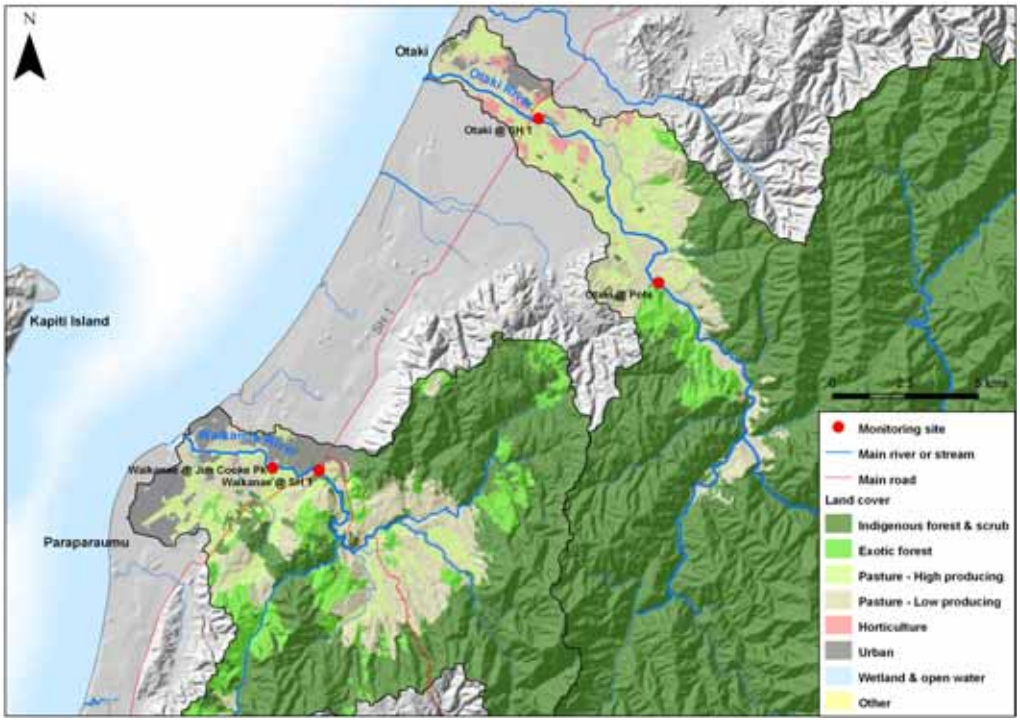


Figure 3.2: Location and catchment land cover of recreational water quality monitoring sites on the Otaki and Waikanae rivers

3.2.1 Microbiological risk factors

The upstream catchments of both Otaki River sites are dominated by indigenous forest while sites on the Waikanae River have significant areas of low producing pasture and exotic forestry within their catchments (Figure 3.3). Although the catchment above Otaki River at SH 1 is dominated by indigenous forest and scrub, the mid and lower reaches of the river run through areas of high and low producing pasture; runoff from these areas is likely to be the

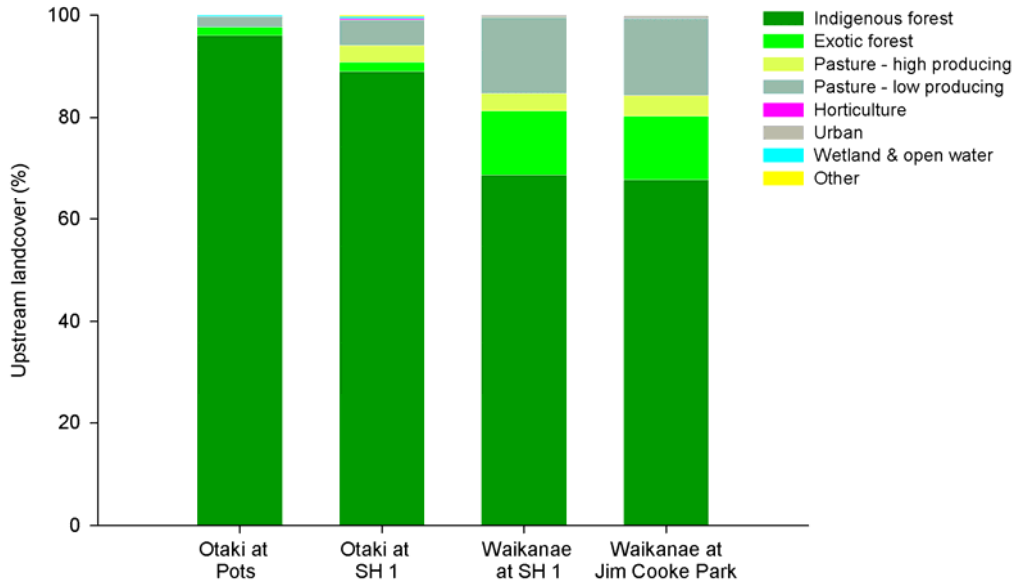


Figure 3.3: Predominant land cover types in the catchment area upstream of recreational river water quality monitoring sites on the Kapiti Coast

dominant source of contamination at this site. Land use within the immediate vicinity of the Waikanae River at Jim Cooke Park is urban. However, urban stormwater inputs at this site are likely to be relatively small and discharges or runoff from areas of high and low producing pasture in the upstream catchment are likely to be the main source of contamination at this site.The Paraparaumu Wastewater Treatment Plant, which services the townships of Waikanae, Paraparaumu and Raumati South (estimated combined population of 30,000), discharges into the lower reaches of the Waikanae River via the Mazengarb Drain. However, the effect of the discharge on the Waikanae River is not captured in the freshwater component of Greater Wellington's recreational water quality monitoring programme as the confluence of the Mazengarb Drain with the Waikanae River is downstream of both river monitoring sites.

The principal sources of faecal contamination and corresponding SIC grades across all flows and during 'dry weather' conditions for each site are shown in Table 3.2. Refer to Appendix 2 for a complete assessment of the risk factors present at each site.

Table 3.2: Principal sources of faecal contamination and corresponding SIC grades identified for recreational water quality monitoring sites on the Otaki and Waikanae rivers during both all flow conditions and 'dry weather' (at or below median river flow) conditions

Site	All flows		'Dry weather'	
	Main source of contamination	SIC	Main source of contamination	SIC
Otaki R @ Pots	Potential for run-off from feral animals	Low	Potential for run-off from feral animals	Very low
Otaki R @ SH 1	Focal points of drainage, as run-off from low-intensity rural catchment	Moderate	Focal points of drainage, as run-off from low-intensity rural catchment	Low
Waikanae R @ SH 1	Focal points of drainage, as run-off from low-intensity rural catchment	Moderate	Focal points of drainage, as run-off from low-intensity rural catchment	Low
Waikanae R @ Jim Cooke Park	Focal points of drainage, as run-off from low-intensity rural/urban catchment	Moderate	Focal points of drainage, as run-off from low-intensity rural/urban catchment	Low

3.2.2 Microbiological water quality results

The MAC values for each site generated from the results of routine water quality monitoring over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 3.3. Comparison of MAC values calculated from results collected during 'dry weather' to those across all flows show that microbiological water quality at Waikanae River monitoring sites deteriorates during heavy rain and high river flows. In contrast, water quality in the Otaki River is consistently good – even during rainfall.

Table 3.3: MAC values for all flows and 'dry weather' (at or below median river flow) conditions for recreational sites on the Otaki and Waikanae rivers, based on routine water quality monitoring over the 2005/06 to 2010/11 summer bathing seasons

Site	All flows		'Dry weather'	
	MAC (95th %ile)	*n*	MAC (95th %ile)	*n*
Otaki R @ Pots	A (85)[1]	111	A (44)[1]	69
Otaki R @ SH 1	B (234)	103	B (220)	70
Waikanae R @ SH 1	C (353)	103	B (183)	65
Waikanae R @ Jim Cooke Park	C (370)[2]	82	B (208)[2]	55

[1] Based on summer time data collected weekly from 2002/03 to 2005/06 and monthly from 2006/07 to 2010/11.

[2] Interim MAC grade based on 4 years of data.

3.2.3 Suitability for recreation

The SFRGs for each site, based on the combined SIC and MAC values at all flows and during dry weather, are summarised in Table 3.4. Lower SFRGs for all flows at the two Waikanae River sites reflect both higher microbiological contamination risks above median river flows (due to the presence of low intensity agriculture in the upstream catchment area) and poorer MAC values.

Table 3.4: SFRGs across all flows and during 'dry weather' (at or below median river flow) conditions for recreational sites on the Otaki and Waikanae rivers

Site	SFRG (all flows)	SFRG ('Dry weather')
Otaki R @ Pots	Very Good[1]	Very Good[1]
Otaki R @ SH 1	Good	Good
Waikanae R @ SH 1	Fair	Good
Waikanae R @ Jim Cooke Park	Fair[2]	Good[2]

[1] Based on summer time data collected weekly from 2002/03 to 2005/06 and monthly from 2006/07 to 2010/11.
[2] Interim MAC grade based on 4 years of data.

3.2.4 Review of monitoring sites

All four monitoring sites on the Otaki and Waikanae rivers continue to be popular sites for swimming and other types of contact recreation (A. Robertson[7], pers. comm. 2011). No changes to the location or timing of recreational water quality monitoring in Kapiti rivers are recommended at this time.

3.3 Hutt, Pakuratahi and Wainuiomata rivers

Recreational water quality monitoring is undertaken at six sites in the Hutt River catchment; one on the Pakuratahi River and five on the main stem of the Hutt River (Figure 3.4). A single site is monitored on the Wainuiomata River.

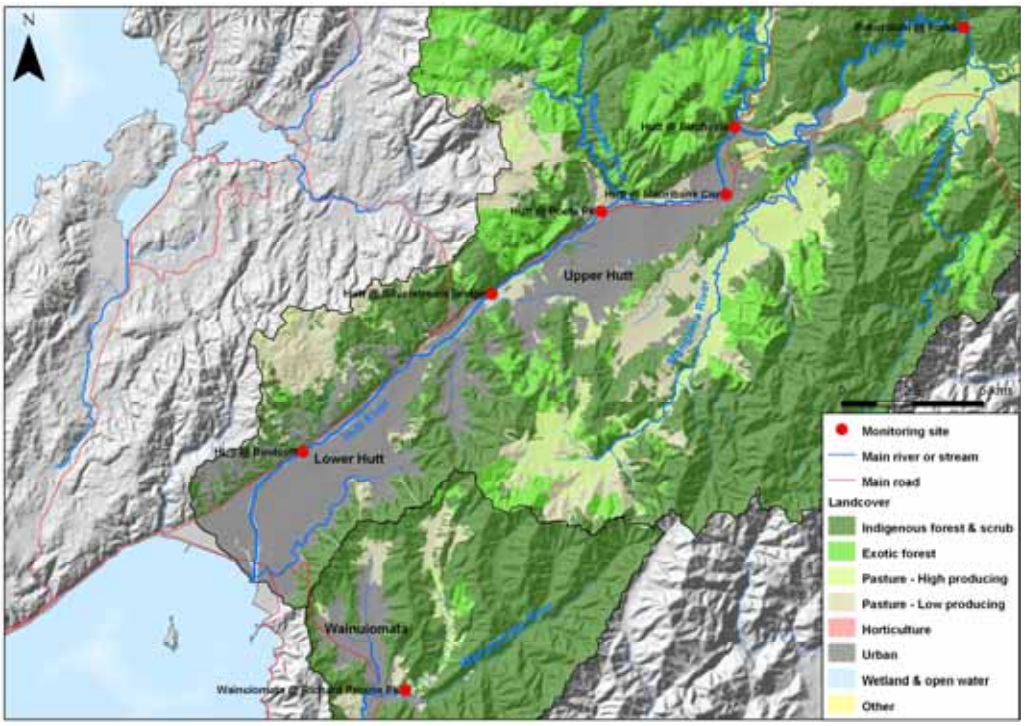


Figure 3.4: Location and catchment land cover of recreational water quality monitoring sites on the Pakuratahi, Hutt and Wainuiomata rivers

[7] Anne Robertson, Laboratory Manager, Kapiti Coast District Council.

3.3.1 Microbiological risk factors

Indigenous forest and scrub land cover dominates the upstream catchments of all sites on the Pakuratahi, Hutt and Wainuiomata rivers (Figure 3.5). However, land cover adjoining the main stems of these rivers as well as some of their tributaries is dominated by rural or urban land use.

Hutt River sites are affected by runoff from rural and urban land cover adjoining the river, as well as inputs from its four main tributaries; the Pakuratahi, Mangaroa, Akatarawa and Whakatikei rivers. High producing pasture dominates the Mangaroa River catchment and part of the lower Pakuratahi River catchment while the Akatarawa and Whakatikei river catchments are dominated by indigenous forest and scrub.

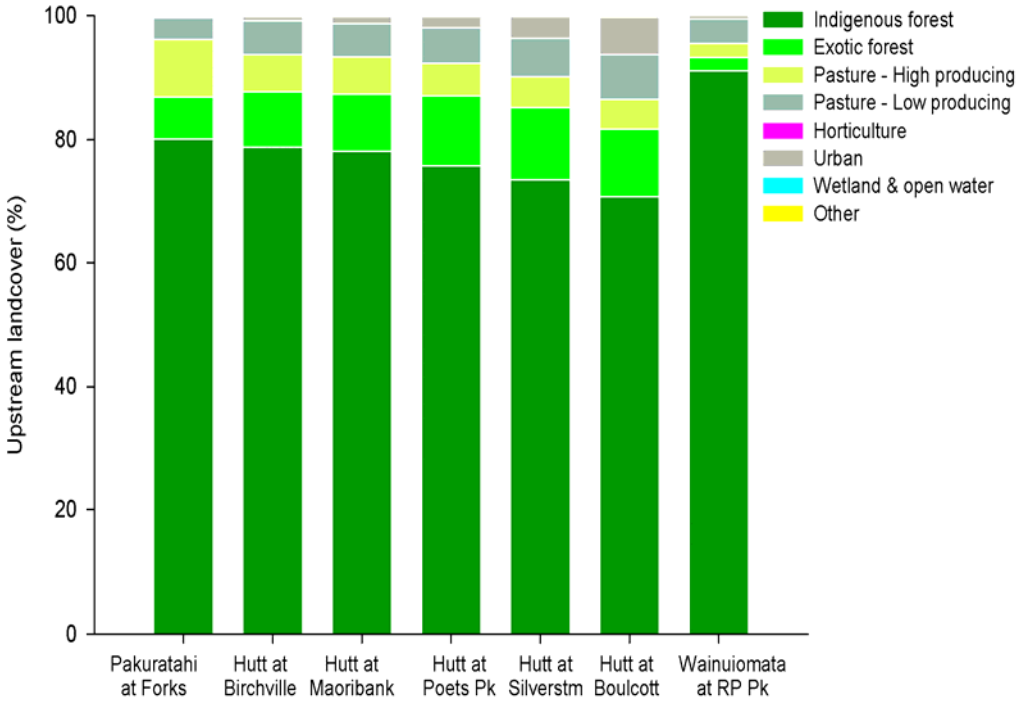


Figure 3.5: Predominant land cover types in the catchment area upstream of recreational river water quality monitoring sites in the Hutt Valley and Wainuiomata

Although land use in the lower reaches of the Pakuratahi River catchment is dominated by high producing pasture areas – including some dairying – these make up a small proportion of the overall catchment (approximately 9%). Accordingly, Pakuratahi River at Forks has been assigned all flows and dry weather SIC grades of 'moderate' and 'low', respectively, in line with the level of risk associated with low rather than high intensity agricultural land use (Table 3.5).

Table 3.5: Principal sources of faecal contamination and corresponding SIC grades identified for recreational river water quality monitoring sites in the Hutt Valley and Wainuiomata during both all flow conditions and 'dry weather' (at or below median river flow) conditions

Site	All flows		'Dry weather'	
	Main source of contamination	SIC	Main source of contamination	SIC
Pakuratahi R @ Forks	Focal points of drainage, as run-off from low-intensity agricultural catchment	Moderate	Focal points of drainage, as run-off from low-intensity agricultural catchment	Low
Hutt R @ Birchville	Discharge from Mangaroa River with intensive land use and unrestricted stock access to waterways	Moderate	Discharge from Mangaroa River with unrestricted stock access to waterways	Moderate
Hutt R @ Maoribank Corner	Urban stormwater protected from sewage ingress	Moderate	Focal points of drainage, as run-off from low-intensity agricultural/urban catchment	Low
Hutt R @ Poets Park	Discharge from Whakatikei River with focal points of drainage, as run-off from low-intensity rural catchment	Low	Discharge from Whakatikei River with focal points of drainage, as run-off from low-intensity rural catchment	Low
Hutt R @ Silverstream	Discharge of Mawaihakona Stream with urban stormwater protected from sewage ingress	Moderate	Discharge of Mawaihakona Stream with dense birdlife	Moderate
Hutt R @ Boulcott	Urban stormwater protected from sewage ingress	Moderate	Urban stormwater protected from sewage ingress	Moderate
Wainuiomata R @ RP Park	Discharge from Wainuiomata Stream affected by runoff from rural land/unrestricted stock access, and possible discharges from septic tanks	Moderate	Discharge from Wainuiomata Stream with unrestricted stock access to waterways and possible discharges from septic tanks)	Moderate

As the Hutt River runs through urban areas of Upper Hutt and Lower Hutt it receives urban stormwater at multiple locations (both directly and indirectly via tributary streams or drains). Stormwater infrastructure in the Hutt River catchment is generally considered to be protected from sewage contamination apart from during extreme rainfall events (S Hutchison[8], pers. comm. 2011). During heavy rainfall events, the sewer and stormwater network becomes overloaded with surface runoff and during these times Hutt City Council exercises its resource consent to discharge untreated (diluted) sewage into the Hutt River at two points (Silverstream and Barber Grove in Moera). Overflow notifications provided to Greater Wellington's Environmental Regulation Department indicate that between 2009 and 2011 the maximum number of sewage discharges per year varied from four at Barber Grove (2009) to seven at the Silverstream scour valve (also in 2009). Apart from one discharge at Barber Grove in December 2009[9], all of these discharges occurred during heavy rainfall and high river flows. Although these discharges of untreated

[8] Steve Hutchison, Environmental Engineer, MWH New Zealand Ltd.

[9] On 1 December 2009 untreated sewage was discharged from the Barber Grove scour valve to the Hutt River for 9 hours due to a pump station blockage.

sewage represent significant point sources of pathogens, they generally occur during very heavy or sustained rainfall events when contact recreation is unlikely; therefore they are not considered to be the principal source of contamination at any Hutt River recreation sites. Rather, general runoff from urban and agricultural areas is thought to be the predominant risk to public health at these sites. Note that in the case of the Poet Park site, the risk is considered lower, reflecting the dilution effect provided by the higher quality water discharged upstream from the Whakatikei River; this river drains a predominantly native bush catchment and has low concentrations of *E. coli*, even during heavy rainfall (see Perrie et al. 2012).

The catchment above the Wainuiomata River at Richard Prouse Park has a very high proportion of indigenous forest and scrub (91%). However, the site lies immediately below the confluence of the Wainuiomata Stream which is likely to be affected by stock access to stream banks. The Wainuiomata Stream may also be affected by contamination from on-site wastewater treatment systems although this requires further investigation (see Greenfield et al. 2012).

The principal source of faecal contamination and corresponding SIC grades across all flows and during 'dry weather' for each site is shown in Table 3.5. Refer to Appendix 2 for a complete assessment of the microbiological risk factors present at each site.

3.3.2 Microbiological water quality results

The MAC values for each site generated from the results of routine water quality monitoring over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 3.6. At all but two sites, an improvement in MAC value occurred when *E. coli* counts obtained from sampling above median flow conditions were excluded. At Hutt River at Boulcott and Wainuiomata River at Richard Prouse Park microbiological results fell into the 'D' MAC category regardless of river flow. This highlights that microbiological water quality at these two sites can be compromised in all flow conditions.

Table 3.6: MAC values for all flows and 'dry weather' (at or below median river flow) conditions for recreational sites on the Hutt, Pakuratahi and Wainuiomata rivers, based on routine water quality monitoring over the 2005/06 to 2010/11 summer bathing seasons

Site	All flows		'Dry weather'	
	MAC (95th %ile)	*n*	MAC (95th %ile)	*n*
Pakuratahi R @ Forks	D (637)	103	C (271)	84
Hutt R @ Birchville	D (779)	103	B (181)	69
Hutt R @ Maoribank Corner	D (1,127)	103	B (240)	70
Hutt R @ Poets Park	C (422)	103	B (140)	70
Hutt R @ Silverstream	D (860)	101	C (320)	70
Hutt R @ Boulcott	D (1,345)	101	D (594)	71
Wainuiomata R @ RP Park	D (716)[1]	82	D (585)	65

[1] Interim MAC grade based on 4 years of data.

3.3.3 Suitability for recreation

When SIC and MAC values were combined, 'dry weather' SFRG grades for Pakuratahi, Hutt and Wainuiomata rivers sites ranged from 'good' at Hutt River sites at Birchville, Maoribank Corner and Poets Park to 'poor' at Hutt River at Boulcott and Wainuiomata River at Richard Prouse Park (Table 3.7).

Table 3.7: SFRGs across all flows and during 'dry weather' (at or below median river flow) conditions for recreational sites on the Hutt, Pakuratahi and Wainuiomata rivers

Site	SFRG (all flows)	SFRG ('Dry weather')
Pakuratahi R @ Forks	Poor	Fair
Hutt R @ Birchville	Poor	Good
Hutt R @ Maoribank Corner	Poor	Good
Hutt R @ Poets Park	Fair	Good
Hutt R @ Silverstream	Poor	Fair
Hutt R @ Boulcott	Poor	Poor
Wainuiomata R @ RP Park	Poor[1]	Poor[1]

[1] Interim SFRG based on 4 years of data.

3.3.4 Review of monitoring sites

Apart from Hutt River at Boulcott all sites monitored on the Pakuratahi, Hutt and Wainuiomata rivers are still considered to be popular sites for swimming and other types of contact recreation. Changes to the channel at Hutt River at Boulcott over the last few years means that this reach is now a shallow run with no deep pools for swimming and is rarely used. It was agreed with Hutt City Council staff present at the SFRG review meeting in September 2011 that monitoring cease at Hutt River at Boulcott and instead be undertaken at a site near the Melling Bridge. The pool to the north of Melling Bridge is considered to be one of the most popular swimming spots in the lower reaches of the Hutt River (D. Bentley[10] and T. Walls[11] pers. comm. 2011).

It is also noted that parts of the Akatarawara River can be popular for recreation, with Greater Wellington's existing Regional Freshwater Plan (WRC 1999) citing water quality in the lower reaches to be managed for this purpose. However, regular weekly monitoring over the summer bathing season is not warranted because microbiological water quality in the lower reaches of this river is already assessed at monthly intervals as part of Greater Wellington's Rivers State of the Environment (Rivers SoE) monitoring programme – the results to date confirm that *E. coli* counts seldom exceed 100 cfu/100mL, irrespective of rainfall (see Perrie et al. 2012). The low risk of microbiological contamination is not surprising given the upstream catchment is predominantly under native bush cover.

[10] Dean Bentley, Senior Environmental Health Officer, Hutt City Council.
[11] Thane Walls, Hutt River Ranger, Greater Wellington.

3.4 Wairarapa rivers

In the Wairarapa 12 sites are monitored as part of Greater Wellington's recreational water quality programme. These include seven sites along the main stem of the Ruamahanga River and five within the Waipoua, Waingawa and Waiohine river catchments (Figure 3.6).

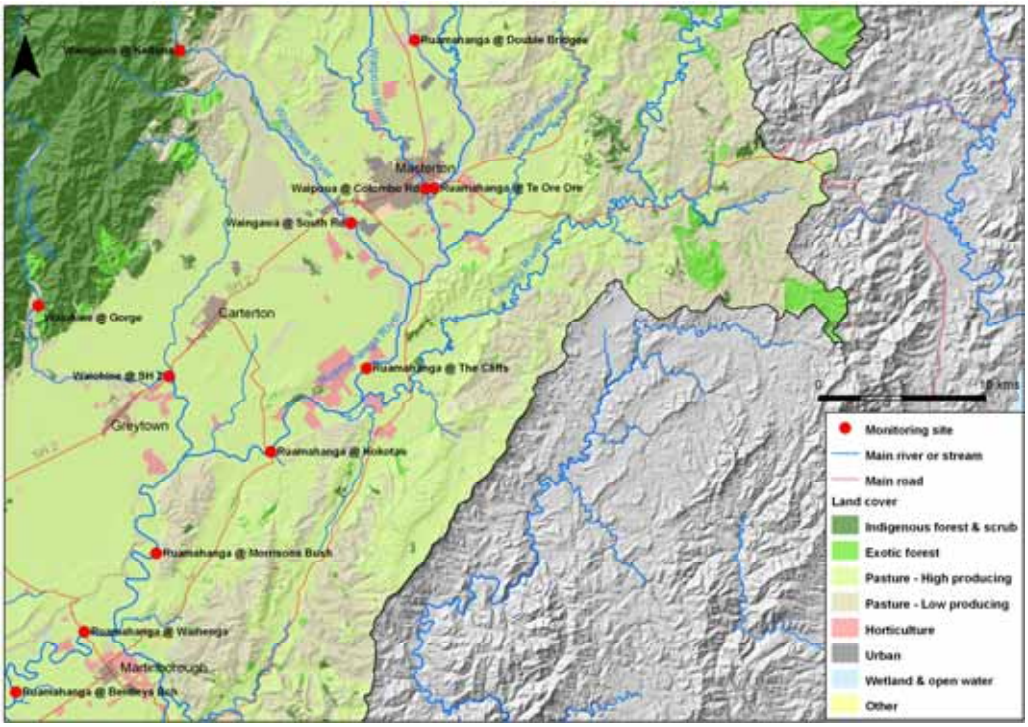


Figure 3.6: Location and catchment land cover of recreational water quality monitoring sites in the Wairarapa

3.4.1 Microbiological risk factors

The Waipoua, Waingawa and Waiohine rivers have their headwaters in the Tararua Range before flowing though low-lying farmland into the Ruamahanga River. The Ruamahanga River is the largest river in the Wellington region and has a total catchment area of 3,418 km^2. The river rises in the northern Tararua Range, and flows the length of the Wairarapa Valley before reaching the sea at Palliser Bay. As well as the Waipoua, Waingawa and Waiohine rivers that drain the Tararua Range, the Ruamahanga River has several large tributaries that drain the eastern Wairarapa hill country and the Haurangi Range, including the Kopuaranga, Whangaehu, Taueru, Huangarua and Tauanui rivers.

Indigenous forest and scrub cover is close to 100% upstream of the Waingawa River at Kaituna and Waiohine River at Gorge sites (Figure 3.7). In the case of Waingawa River at Kaituna, although virtually all of the upstream catchment is forested, land cover in the immediate vicinity of the river is dominated by sheep farms and grazing land. Runoff from these agricultural areas is considered to be the main microbiological risk factor at this site during wet weather (Table 3.8).

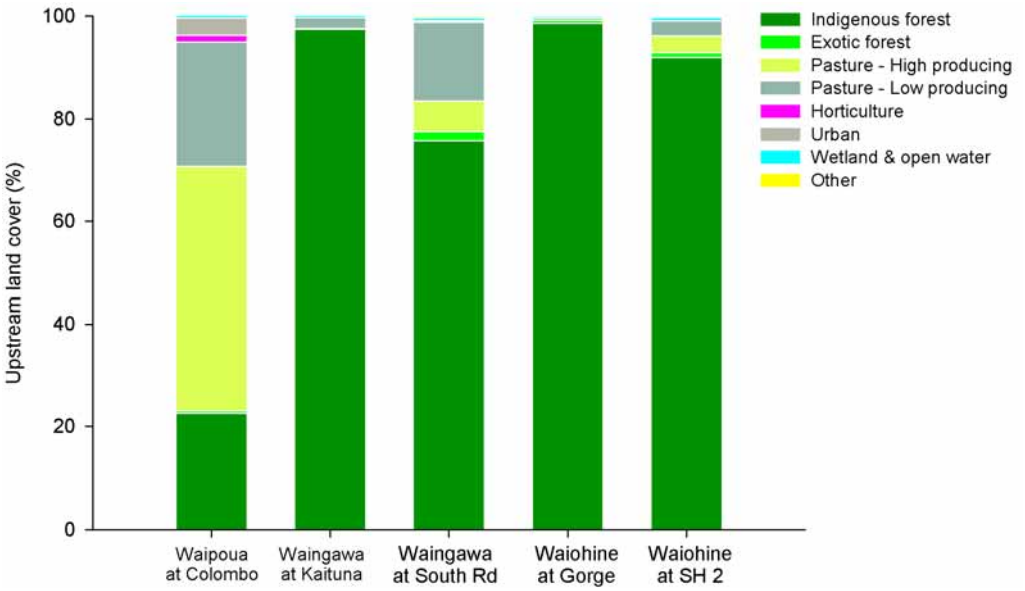


Figure 3.7: Predominant land cover types in the catchment area upstream of recreational water quality monitoring sites on the Waipoua, Waingawa and Waiohine rivers

Indigenous forest and scrub are also dominant in the catchments of Waingawa River at South Road, Waiohine River at SH 2 and Ruamahanga River at Double Bridges – although significant areas of high and low producing pasture are also present in the lower reaches of these catchments. There are no major surface water tributaries to the Waingawa and Waiohine rivers between the point where they exit the Tararua Range and the recreational water quality monitoring sites in the lower reaches (Waiohine at SH 2 is upstream of the confluence of the highly degraded Mangatarere Stream). In addition, recent modelling of groundwater in the Wairarapa Valley suggests that both of these rivers lose water to groundwater as they flow across the Wairarapa plains in the area upstream of these monitoring sites (Gyopari & McAlister 2010a; 2010b). This means that despite the significant areas of agricultural land use that adjoin these sites, inputs of contaminated surface and groundwater are likely to be minimal. To reflect this, the 'all flows' SIC for these sites as well as the Waingawa River at Kaituna, is set at 'low to moderate'.

At Ruamahanga River at Double Bridges, microbiological water quality is likely to be affected by contaminated runoff from agricultural land use during rainfall events. During dry weather, stock access to tributaries that enter the river immediately upstream of this site is likely to be the primary microbiological risk factor (Greenfield et al. 2012).

Land cover upstream of Waipoua River at Colombo Road and all remaining Ruamahanga River monitoring sites is dominated by agricultural land use (high producing pasture in the upstream catchment ranges from around 30–40%) (Figure 3.8). During heavy rainfall, contaminated runoff from intensive agricultural land use is likely to be the key microbiological risk factor at these sites.

Table 3.8: Principal sources of faecal contamination and corresponding SIC grades identified for recreational water quality monitoring sites on Wairarapa rivers during both all flow conditions and 'dry weather' (at or below median river flow) conditions

Site	All flows		'Dry weather'	
	Main source of contamination	SIC	Main source of contamination	SIC
Waipoua R @ Colombo Road	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	Moderate
Waingawa R @ Kaituna	Focal points of drainage, as runoff from low-intensity rural catchment	Low/ Moderate	Potential for runoff from feral animals	Low
Waingawa R @ South Road	Focal points of drainage, as runoff from low-intensity rural catchment	Low/ Moderate	Focal points of drainage, as runoff from low-intensity rural catchment	Low
Waiohine R @ Gorge	Potential for runoff from feral animals	Low	Potential for runoff from feral animals	Very low
Waiohine R @ SH 2	Focal points of drainage, as run-off from low-intensity rural catchment	Low/ Moderate	Focal points of drainage, as runoff from low-intensity rural catchment	Low
Ruamahanga R @ Double Bridges	Focal points of drainage, as run-off from low-intensity rural catchment	Moderate	Discharge from unnamed tributary immediately upstream with unrestricted stock access to waterways	Moderate
Ruamahanga R @ Te Ore Ore	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Discharge from Henley lake immediately upstream with urban storm water protected from sewage and dense birdlife	Moderate
Ruamahanga River @ The Cliffs	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Communal sewage disposal with secondary treatment	High
Ruamahanga R @ Kokotau	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Discharge of unnamed tributaries immediately upstream with unrestricted stock access to waterways	Moderate
Ruamahanga R @ Morrisons Bush	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Discharge of unnamed tributary ~800m upstrream with unrestricted stock access to waterway	Moderate
Ruamahanga R @ Waihenga	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Discharge of Huangarua River ~1.7 km upstream with unrestricted stock access to waterways	Moderate
Ruamahanga R @ Bentleys Beach	Intensive agricultural land use in immediate catchment & potential run-off of untreated animal effluent	High	Communal sewage disposal with secondary treatment	High

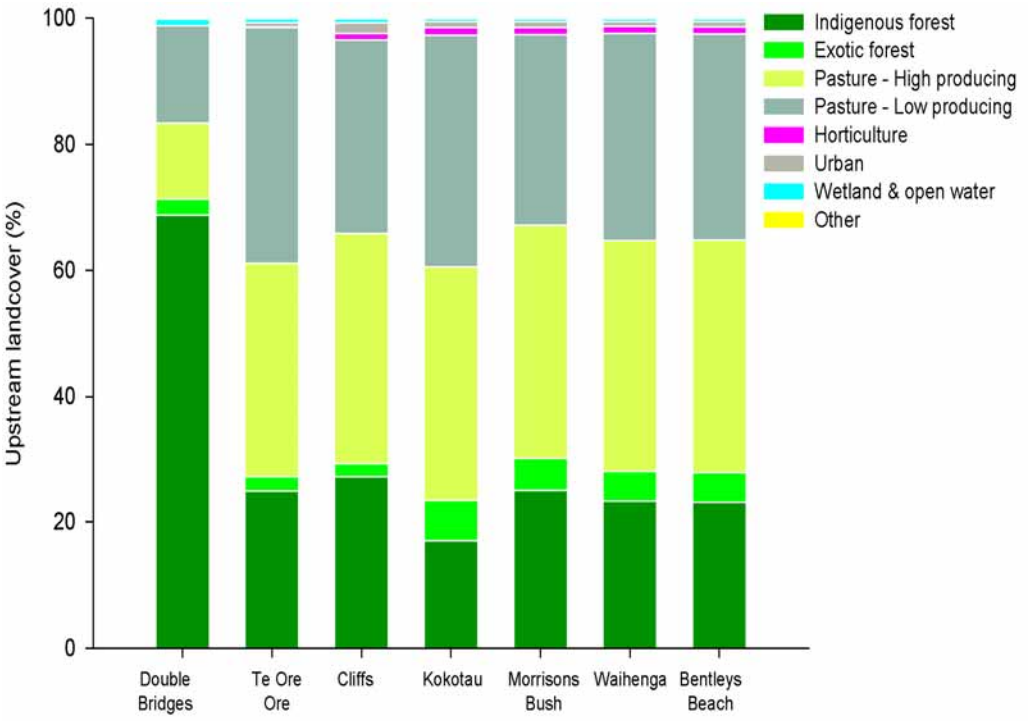


Figure 3.8: Predominant land cover types in the catchment area upstream of recreational water quality monitoring sites on the Ruamahanga River

Urban areas of Masterton adjoin the lower reaches of the Waipoua River and Masterton District Council (MDC) holds resource consent to discharge stormwater into the lower reaches of the Waipoua River via a number of outfalls, including from the Queen Elizabeth Park which discharges to the river approximately 400 m upstream of the Colombo Road site. These stormwater discharges are considered to be protected from sewage contamination in all but extreme rainfall events (D. John[12], pers. comm. 2011). MDC also holds a consent to discharge untreated sewage to a trench system near the Waipoua River at the Colombo Road bridge during extreme weather events. In the past there have been discharges from this system to the river but recent upgrades to the sewerage infrastructure in this area means that such discharges are now highly unlikely to occur (D. John, pers. comm. 2011) – and certainly not at times when people would use the river for recreation.

Urban stormwater inputs to Henley Lake are likely to impact on recreational water quality in the Ruamahanga River at Te Ore Ore; this site is situated 60 m downstream of the Henley Lake discharge to the river. Henley Lake also supports a large wildfowl population and this is considered to be the primary microbiological risk factor for the Ruamahanga River at Te Ore Ore during 'dry weather'.

The Ruamahanga River also receives secondary treated wastewater from a number of townships either directly or indirectly via tributary rivers or streams as follows:

[12] David John, Environmental Services Manager, Masterton District Council.

- Masterton: treated wastewater is discharged into the Makoura Stream, which flows a short distance prior to entering the Ruamahanga River above Wardell's Bridge.

- Carterton: treated wastewater is discharged into the Mangatarere Stream which flows into the Waiohine River below SH 2. During December to March the wastewater is required to be discharged to land, except where high inflows to the WWTP prevent this.

- Greytown: treated wastewater is discharged into the Papawai Stream, approximately 1.5 km from its confluence with the Ruamahanga River upstream of Morrisons Bush.

- Martinborough: treated wastewater is discharged directly into the Ruamahanga River, approximately 2.5 km downstream of Waihenga Bridge.

In addition to the municipal WWTP discharges, Rathkeale College has consent to discharge treated wastewater to a tributary of the Ruamahanga River approximately 7 km upstream of the Ruamahanga River at Te Ore Ore.

Discharges of secondary treated municipal wastewater are considered to be the primary microbiological risk factor during dry weather for Ruamahanga River at Cliffs and Ruamahanga River at Bentley's Beach. The Cliffs site lies approximately 7 km downstream of the Masterton WWTP discharge while the Bentley's Beach site is located approximately 11 km downstream of the Martinborough WWTP discharge.

At the remaining Ruamahanga River sites (Kokotau, Morrisons Bush and Waihenga), stock access to tributary streams is considered to constitute a greater microbiological contamination risk during dry weather than WWTP discharges, as these sites are located 15 km or more downstream of the sewage discharges.

3.4.2 Microbiological water quality results

The MAC values for each Wairarapa river monitoring site generated from the results of routine water quality monitoring over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 3.9. At all but four sites MAC values improved when *E. coli* counts from samples collected during high (ie, above median) river flows were excluded. The exceptions were Waingawa River at South Road and both sites on the Waiohine River which achieved 'A' MAC values under all conditions, and the Ruamahanga River at Double Bridges which fell into the 'C' MAC category even during dry weather. This latter finding (Double Bridges) is consistent with previous reporting for this site (eg, Milne & Wyatt (2006); Stansfield (2000)) and confirms that there is an ongoing source of dry weather microbiological contamination that periodically affects this site.

Caution must be exercised when interpreting *E. coli* results from the Ruamahanga River sites located downstream of WWTP discharges. This is because wastewater treatment processes often effectively reduce microbial indicators such as *E. coli* but are less effective at removing pathogens such as

viruses – which can result in pathogens being present even when indicator bacteria counts are low (MfE/MoH 2003). To our knowledge no formal assessments have been undertaken into the pathogen removal effectiveness of Wairarapa WWTPs and until this information is available conservative SFRGs need to be applied to recreation sites downstream of the discharges. This conservatism has been reflected in the 'moderate' and 'high' dry weather SIC grades assigned to these sites (Table 3.8).

Table 3.9: MAC values for all flows and 'dry weather' (at or below median river flow) conditions for recreational sites on Wairarapa rivers, based on routine water quality monitoring over the 2005/06 to 2010/11 summer bathing seasons

Site	All flows		'Dry weather'	
	MAC (95th %ile)	*n*	MAC (95th %ile)	*n*
Waipoua R @ Colombo Rd	D (775)	103	C (325)	75
Waingawa R @ Kaituna	B (171)	103	A (65)	70
Waingawa R @ South Rd	A (113)	103	A (110)	70
Waiohine R @ Gorge	A (87)[1]	108	A (50)[1]	67
Waiohine R @ SH 2	A (76)	103	A (47)	69
Ruamahanga R @ Double Bridges	C (326)	103	C (526)	68
Ruamahanga R @ Te Ore Ore	D (1,066)	103	C (476)	74
Ruamahanga R @ The Cliffs	C (523)	103	A (85)	72
Ruamahanga R @ Kokotau	D (1,000)	103	B (140)	72
Ruamahanga R @ Morrisons Bush	C (500)	103	A (99)	76
Ruamahanga R @ Waihenga	D (614)	103	A (116)	75
Ruamahanga R @ Bentleys Beach	D (567)	103	B (152)	74

[1] Based on summer time data collected weekly from 2002/03 to 2005/06 and monthly from 2006/07 to 2010/11.

3.4.3 Suitability for recreation

When SIC and MAC values were combined, 'dry weather' SFRG grades for Wairarapa river sites ranged from 'very good' at Waingawa and Waiohine river sites to 'poor' at Ruamahanga River at Cliffs and Ruamahanga River at Bentley's Beach (Table 3.10). Note that to reflect the low to moderate risk of contamination from agricultural land adjoining Waingawa River at South Road and Waiohine River at SH 2 (see Section 3.4.1), these sites have been assigned all flows SFRGs of 'good', despite the 'A' MAC grades indicating that these sites should be graded 'very good' (refer to Table 3.1).

The disparity between the dry weather SIC and MAC categories identified for Ruamahanga River sites from the Cliffs downstream (ie, assignment of SIC categories of 'high' or 'moderate' vs MAC categories of 'A' or 'B' that indicate low faecal contamination) is a result of the uncertainty around pathogen removal effectiveness of the Wairarapa WWTPs. These combinations of SIC and MAC are identified by the MfE/MoH (2003) guidelines as 'unexpected' (see Table 3.1) and mean that either the SIC or MAC need to be reassessed for these sites. To undertake this reassessment, information on the pathogen removal capacity of WWTPs will need to be obtained. In the meantime, dry weather SFRGs of 'poor' for Ruamahanga River at the Cliffs and Bentley's Beach and 'fair' for Ruamahanga River at Kokotau, Morrisons Bush and Waihenga are recommended. These SFRGs should be considered as *interim* grades and are conservative.

Table 3.10: SFRGs across all flows and during 'dry weather' (at or below median river flow) conditions for recreational sites on rivers in the Wairarapa

Site	SFRG (all flows)	SFRG ('Dry weather')
Waipoua R @ Colombo Rd	Very poor	Fair
Waingawa R @ Kaituna	Good	Very good
Waingawa R @ South Rd	Good[1]	Very good
Waiohine R @ Gorge	Very good	Very good
Waiohine R @ SH 2	Good[1]	Very good
Ruamahanga R @ Double Bridges	Fair	Fair
Ruamahanga R @ Te Ore Ore	Very poor	Fair
Ruamahanga R @ The Cliffs	Poor	Poor[2]
Ruamahanga R @ Kokotau	Very poor	Fair[2]
Ruamahanga R @ Morrisons Bush	Poor	Fair[2]
Ruamahanga R @ Waihenga	Very poor	Fair[2]
Ruamahanga R @ Bentleys Beach	Very poor	Poor[2]

[1] Manually adjusted downwards from 'Very good' to 'good' (see text for explanation).

[2] Interim SFRG that has been altered to reflect the uncertainty associated with the effect of upstream municipal wastewater treatment plant discharges on public health.

It should be noted that in 2009, MDC's resource consent to discharge treated wastewater from Masterton was renewed with the requirement that from 2013 onwards, wastewater be progressively discharged to land. Furthermore, from December 2014, no wastewater can be discharged to the Ruamahanga River during periods of less than median river flow during summer (1 November to 30 April) and less than half median flow during winter (1 May to 31 October). Although no new consent requirements are in place as yet for the Carterton, Greytown and Martinborough WWTPs, the current river-based discharges from these WWTPs are all in the process of being assessed for their long-term sustainability. Similar approaches to that of Masterton are being explored, the aim being to ensure wastewater is discharged to land when stream and river flows are low. Review of interim SFRGs for affected Ruamahanga River sites will need to take into account these improvements as they occur (ie, once the Masterton WWTP discharge shifts to land, the 'dry weather' SIC grade for the Cliffs site will improve from 'high' to 'moderate', resulting in an improved SFRG of 'fair').

3.4.4 Review of monitoring sites

Apart from the Ruamahanga River at Bentley's Beach all Wairarapa river monitoring sites are still considered to be popular sites for contact recreation. Although Bentley's Beach is used as an access point for canoeists it is not considered to be a popular swimming spot (it has no sizeable pools) and no other popular recreation spots are known in the lower reaches of the Ruamahanga River (B. Johnson[13], pers. comm. 2011). Accordingly, it was agreed with South Wairarapa District Council staff present at the SFRG review meeting in September 2011 that monitoring at Bentley's Beach should cease, with the microbiological water quality data collected monthly from Greater Wellington's Rivers SoE monitoring site at Pukio (nearby) used as a surrogate to assess recreational water quality in the lower reaches of the Ruamahanga River.

[13] Bronwyn Johnson, Environmental Health Team Leader, South Wairarapa District Council.

The possibility of including a monitoring site on the Tauherenikau River was considered since swimming is known to occur in the river at the Hill Road camp ground and near the Lake Domain (and Greater Wellington's existing Regional Freshwater Plan (WRC 1999) cites water quality in the lower reaches to be managed for contact recreation). However, given the predominantly native vegetation cover in the upstream catchment, it was agreed at the SFRG review meeting that the risks of microbiological contamination in the vicinity of Hill Road are likely to be very low. In addition, monthly *E. coli* tests undertaken in the lower reaches at 'Websters' under Greater Wellington's Rivers SoE monitoring programme shows that microbiological water quality is very good, with *E. coli* counts seldom above 100 cfu/100mL, irrespective of rainfall (see Perrie et al. 2012). Therefore, rather than undertaking weekly monitoring, it is recommended that Rivers SoE data are used to assess recreational water quality in the Tauherenikau River.

3.5 Synthesis

Sites on the upper reaches of the Otaki River (Kapiti) and the Waingawa and Waiohine rivers (Wairarapa) have the best SFRGs of all 23 freshwater sites monitored in the Wellington region over the 2005/06 to 2010/11 summer bathing seasons. All five sites on these rivers were graded 'very good' during dry weather conditions and either 'good' or 'very good' when all flow conditions were considered (Figure 3.9). The upstream catchments of all of these sites are dominated by indigenous forest and scrub which means that even during heavy rainfall and high river flows the risk of microbiological contamination is very low.

Dry weather SFRGs of 'good' were identified for the Otaki River at SH 2, both sites on the Waikanae River and the three uppermost sites on the Hutt River. However, at all but the Otaki River at SH 2, the SFRGs for these sites reduce to 'fair' or 'poor' when wet weather/high flow conditions are included in the assessment. Although catchments above these sites are dominated by indigenous forest, significant areas of agricultural land use are also present and provide a source of contamination during wet weather.

The highest risk of microbiological contamination was identified at the Hutt River at Silverstream and Boulcott, the Wainuiomata River at Richard Prouse Park, the Waipoua River at Colombo Road, and all sites on the Ruamahanga River. All of these sites received SFRGs of 'fair' or 'poor', with the SFRGs at many sites reducing to 'very poor' when all flow (ie, wet weather) conditions are considered. Key sources of microbiological contamination at these sites are urban stormwater runoff (the Hutt River at both Silverstream and Boulcott) and intensive agricultural land use and stock access to rivers (the Wainuiomata River at Richard Prouse Park as well as sites on the Waipoua and Ruamahanga rivers). Contamination from on-site wastewater treatment systems may also be a problem at Wainuiomata River at Richard Prouse Park.

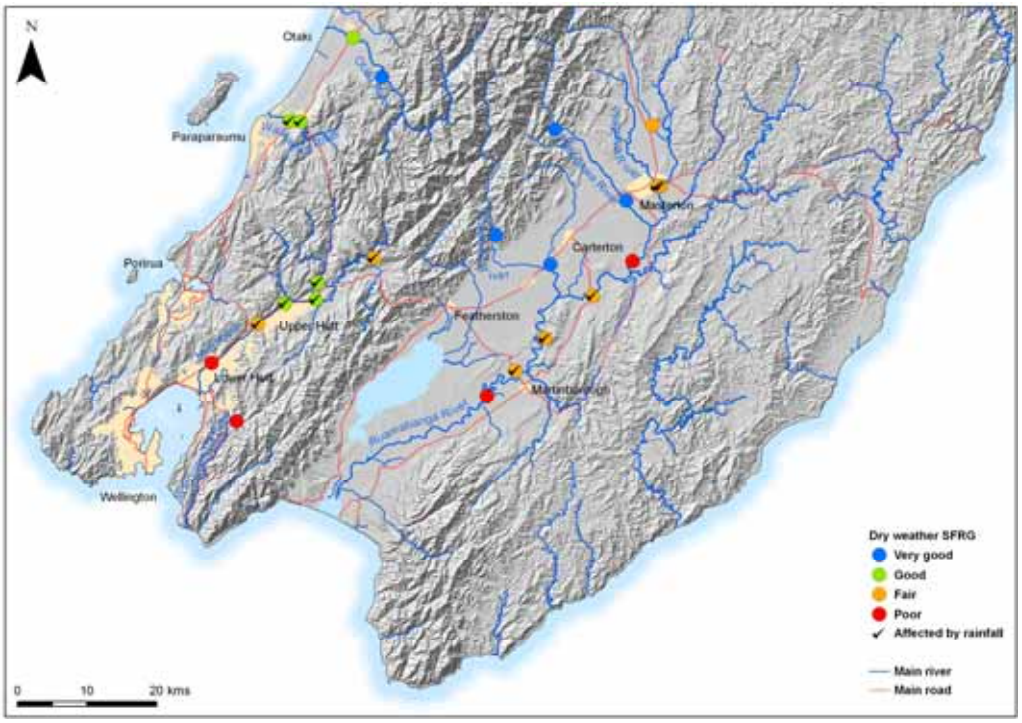


Figure 3.9: 'Dry weather' SRFGs for 23 river sites in the Wellington region derived from MAC values based on *E. coli* counts from routine sampling events coinciding with river flows at or below median between the 2006/07 and 2010/11 summer bathing seasons. Sites identified as being affected by rainfall are those where a significant increase in risk to public health occurs (eg, a change in SFRG from 'good' to 'fair' or worse, and from 'fair' to 'poor' or worse).

The dry weather SFRG of 'fair' for the Hutt River at Silverstream is somewhat inconsistent with the number of exceedances of the MfE/MoH (2003) action guideline reported for this site by Greenfield et al. (2012). The Hutt River at Silverstream had the highest number of action guideline exceedances (five) during low flow conditions of all river monitoring sites across the region yet receives a better dry weather SFRG grade than the Hutt River at Boulcott which is graded 'poor'. This highlights that, on occasion, exceedances of the MfE/MoH (2003) action guideline and SFRGs can provide conflicting or inconsistent indications of the risk to human health from contact recreation.

The risk to human health at Ruamahanga River sites downstream of municipal WWTP discharges is uncertain due to a lack of information on pathogen removal efficiency of the treatment plants. Although dry weather MAC values obtained from these sites indicate good microbiological water quality, SFRGs for these sites have been conservatively set at of 'poor' or 'fair'. These grades reflect the uncertainty around the effects of WWTP discharges (resulting in 'high' or moderate' SIC grades) and should be considered as interim until further information becomes available or the discharges shift to being land-based in the summer months.

4. Suitability for recreation – coastal waters

4.1 Introduction

Recreational water quality is currently monitored at 77 coastal sites across the Wellington region (Figure 4.1, Appendix 1) [14], as follows:

- Kapiti Coast District – 20 sites
- Porirua City – 15 sites
- Hutt City – 15 sites
- Wellington City – 22 sites
- Wairarapa – 5 sites

One site, Pauatahanui Inlet at Paremata Bridge (Porirua), was added to the programme in 2007/08. In 2009/10 three sites – Plimmerton Beach at Queens Avenue (Porirua), Paremata Beach at Pascoe Avenue (Porirua) and Kio Bay (Wellington) – were removed from the programme as they were either in close proximity to other sites or were no longer considered to be commonly used for recreation.

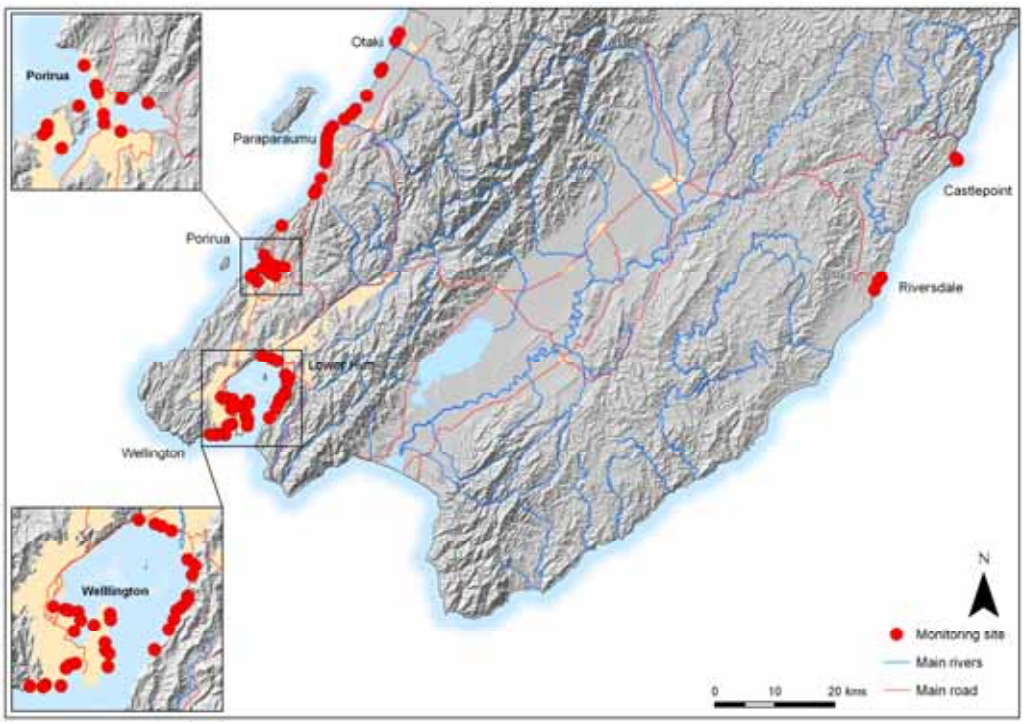


Figure 4.1: Coastal recreational water quality monitoring sites in the Wellington region (as at 31 March 2011)

This section provides a brief overview of the sampling protocols and guidelines used for monitoring coastal recreational sites in the Wellington region as well as the approach taken to update the existing Suitability for Recreation Grades (SFRGs) for each site based on routine monitoring results collected over the 2005/06 to 2010/11 summer bathing seasons. The outcomes of the review of the coastal recreational water quality monitoring site network (including

[14] As at the end of the 2010/11 summer bathing season – see Section 2.3.

recreational shellfish gathering water quality monitoring sites) are also outlined.

4.1.1 Monitoring protocol

Most sites are sampled weekly during the bathing season (November to March inclusive) for a minimum of 20 weeks. The exceptions are Breaker Bay (Wellington city), Princess Bay (Wellington city) and Riversdale Beach South (Wairarapa) which are sampled fortnightly, and Camp Bay (Hutt city) which is sampled monthly[15].

On each sampling occasion a single water sample is collected 0.2 m below the surface in 0.5 m water depth and analysed for enterococci indicator bacteria and, at nine sites designated as shellfish monitoring sites, faecal coliform bacteria. Observations of weather (including rainfall and wind direction and intensity) and the state of the tide, and visual estimates of seaweed cover, are also made at each site to assist with interpretation of the monitoring results (see Greenfield et al. 2012 for details).

4.1.2 Deriving Suitability for Recreation Grades

The process to grade the suitability of recreational waters from a public health perspective was outlined in Section 2.1 and involves combining a qualitative assessment of the susceptibility of a recreational site to faecal contamination (the SIC component) with direct measurements of the appropriate bacteriological indicator at the site (the MAC component). The SIC and MAC categories used to identify SFRGs for coastal waters are shown in Table 4.1 (and the five different SFRGs were explained in detail earlier in Table 2.1, Section 2.1).

Table 4.1: MfE/MoH (2003) Suitability for Recreation Grades (SFRG) for marine (coastal) 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).

[3] Implies non-sewage sources of indicator bacteria that require verification.

[15] Milne and Wyatt (2006) recommended the frequency of sampling reduce from weekly to fortnightly from 1 November 2006 because these sites have a 'very low' to 'low' risk of microbiological contamination and a high level of compliance with recreational water quality guidelines. The frequency of sampling at Camp Bay was reduced to monthly in November 2009 as indicator bacteria counts at this site were consistently below surveillance guideline (140 enterococci/ 100mL) indicating that the risk of bather illness is low.

(a) Data analysis

All enterococci results were assessed in accordance with the MfE/MoH (2003) microbiological water quality guidelines for marine waters (Table 4.1), with the MAC grade (ie, the 95th percentile enterococci count) calculated using the recommended Hazen percentile method. Prior to data analysis, enterococci counts below the laboratory detection limit were halved apart from those where the detection limit was <1 cfu/100mL in which case a value of 1 cfu/100mL was used.

Only enterococci data generated from routine water sampling events over the five most recent summers (2006/07 to 2010/11) were used in the calculation of the MAC[16]. For the three sites where enterococci testing ceased in 2009/10 (Plimmerton Beach at Queens Avenue, Paremata Bridge at Pascoe Avenue and Kio Bay) data from bathing seasons from 2004/05 to 2008/09 were drawn on to ensure a robust MAC grade could be calculated.

As noted in Section 2.1.1, the SIC grades used to derive the SFRGs follow a re-evaluation of the microbiological risk factors undertaken in consultation with the region's territorial and public health authorities. Appendix 2 documents the complete assessment of the microbiological risk factors present at each site.

(b) Land cover information

Land cover in the catchment upstream of each coastal monitoring site was obtained from the interpretation of aerial photographs taken in 2008 and published by the Ministry for the Environment (2010).

4.2 Kapiti

Recreational water quality is monitored at 20 coastal sites along the Kapiti Coast (Figure 4.2).

4.2.1 Microbiological risk factors

Land use along the coast at Otaki, Te Horo, Peka Peka and Paekakariki beaches is largely agricultural with small urban areas adjoining the beach at Otaki, Te Horo and Paekakariki. Agricultural land use is predominantly of low intensity apart from within the catchments of the Waitohu and Mangaone streams which discharge to Otaki Beach and Te Horo beaches, respectively. Both of these catchments have a high proportion of high intensity agricultural land use and *E. coli* counts in the lower reaches of both streams are elevated; based on monthly monitoring over July 2008 to June 2011 inclusive, median and 95th percentile counts in the Waitohu Stream at Norfolk Crescent were 300 and 2,075 cfu/100 ml, respectively, while median and 95th percentile counts in the Mangaone Stream at Sims Road Bridge were 430 and 1,275 cfu/100 ml, respectively (Perrie et al. 2012). Investigations using microbial source tracking tools at Te Horo Beach south of Mangaone Stream and sites on the Mangapouri Stream (a tributary of the Waitohu Stream) both suggest that ruminants and/or wildfowl are the most likely source of contamination at these locations (Cornelison et al. 2012; SKM 2011).

[16] The MfE/MoH (2003) microbiological water quality guidelines require repeat (follow-up) water sampling in the event of a routine sample result returning an enterococci count above the amber/alert mode of the guidelines (140 cfu/100mL).

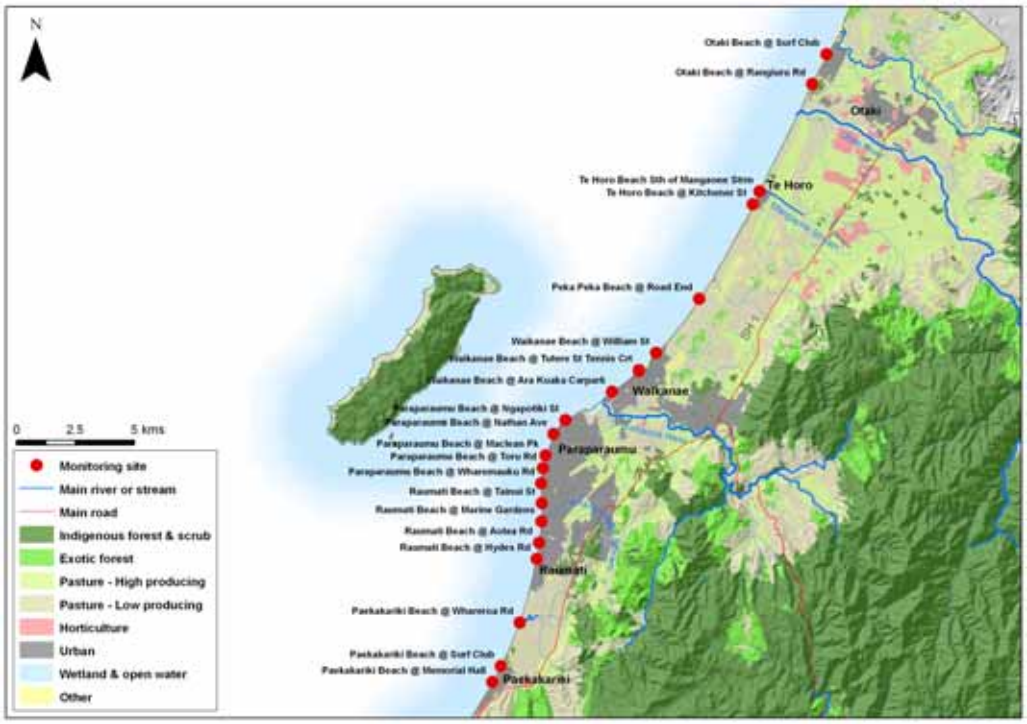


Figure 4.2: Location of coastal recreational water quality monitoring sites on the Kapiti Coast

Urban areas dominate the coast in the immediate vicinity of Waikanae, Paraparaumu and Raumati beaches and stormwater is discharged directly to these beaches at numerous points. The Waikanae River and the Ngarara, Wharemauku and Tikotu streams also discharge to the coast along these beaches; all of these receive stormwater discharges in their lower reaches. Although there are no known problems with the stormwater network in urban areas of the Kapiti Coast there is potential for sewage contaminated stormwater to be discharged on occasion, particularly during heavy rainfall (C. Hardy[17] and C. Welch[18], pers. comm. 2011). Bird populations that inhabit the Waikanae River mouth as well as the nearby Waimanu and Marina lagoons may be an additional source of faecal contamination to the lower Waikanae River.

The Paraparaumu Wastewater Treatment Plant (WWTP) discharges into the lower reaches of the Waikanae River via the Mazengarb Drain. As noted in Section 3.2.1, this WWTP provides secondary treatment and UV disinfection of wastewater from the townships of Waikanae, Paraparaumu and Raumati South. The degree of dilution this discharge receives before reaching the coast (it is discharged to the Mazengarb Drain which flows into the Waikanae River which, in turn, discharges to the coast) means that it has not be considered here as the principal source of microbiological contamination at Waikanae or Paraparaumu Beach monitoring sites. Urban stormwater discharges protected from sewage ingress as well as discharges from the Waikanae River and Tikotu and Wharemauku streams are considered to be the dominant microbiological hazards at these sites.

[17] Corinne Hardy, Infrastructure Projects Officer, Kapiti Coast District Council.
[18] Charlotte Welch, Environmental Consultant, SKM.

Te Horo, Peka Peka and Paekakariki townships are serviced by on-site wastewater systems while wastewater from Otaki township is treated and discharged to land. The risk of microbiological contamination at both Peka Peka and Paekakariki beaches is graded 'low' (Table 4.2).

4.2.2 Microbiological water quality results

The MAC values for each site generated from the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 4.2. The highest 95th percentile enterococci value was recorded at Te Horo Beach at Mangaone Stream mouth and corresponded to a 'C' grade. The lowest 95th percentile enterococci count was recorded at Paekakariki Beach at Memorial Hall and corresponded to an 'A' grade.

4.2.3 Suitability for Recreation Grades

The combination of SIC and MAC values for each coastal monitoring site resulted in SFRGs ranging from 'fair' (Otaki Beach at Surf Club, Te Horo Beach at both Mangaone Stream mouth and Kitchener Street, and Raumati Beach at Marine Gardens) to 'very good' (Paekakariki Beach at Memorial Hall) (Table 4.2). The majority (15 of 20) of sites received a grade of 'good'.

4.2.4 Review of monitoring sites

The following was discussed with Kapiti Coast District Council staff present at the SFRG review meeting in August 2011:

- Otaki Beach at Rangiuru Road and Raumati Beach at Hydes Road are not popular sites for swimming or shellfish collection (A. Robertson pers. comm. 2011) and monitoring at these sites should cease. Water quality monitoring for shellfish gathering undertaken at Raumati Beach at Hydes Road should be transferred to Raumati Beach at Tainui Street.
- Te Horo Beach is used mainly by the small local community (A. Robertson pers. comm. 2011) and it is considered that one site would adequately represent recreational water quality at this beach. Therefore it was decided that the monitoring sites at Te Horo Beach south of Mangaone Stream and Te Horo Beach at Kitchener St should be replaced with a single site at the main car parking area at Sea Road (this area has toilet facilities and is likely to be a key access point to the beach).
- Waikanae Beach at Tutere Street Tennis Courts has been included in the monitoring programme due to a past sewage discharge to the Waimeha Stream (A. Robertson pers. comm. 2011). As this discharge no longer occurs monitoring at this site should cease.
- Paraparaumu Beach is represented by five monitoring sites, all of which have SFRGs of 'good'. To reduce unnecessary monitoring effort at this beach monitoring at Paraparaumu Beach at Wharemauku Road should cease.
- Of the three sites monitored along Paekakariki Beach it is considered that the Memorial Hall site is the least popular for swimming (A. Robertson pers. comm. 2011). Given the low microbiological risk and consistently high water quality recorded at this site (ie, SFRG of 'very good'), it is considered appropriate that monitoring cease at this site.

Table 4.2: Primary sources of faecal contamination and corresponding SIC grades, as well as MAC grades and SFRGs, identified for coastal recreation water quality monitoring sites on the Kapiti Coast. MAC grades are based on the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons (*n*=103).

Site	Source of contamination category	SIC	MAC (95th %ile)	SFRG
Otaki Beach @ Surf Club	Discharge from Waitohu Stream 1.2 km N, affected by intensive agricultural land use and unrestricted stock access to waterways as well as urban stormwater protected from sewage ingress	Moderate	C (273)	Fair
Otaki Beach @ Rangiuru Rd	Focal points of drainage, as run-off from low-intensity urban/rural catchment	Low	B (185)	Good
Te Horo Beach S of Mangaone S	Discharge from Mangaone Stream 80 m N, affected by intensive agricultural land use and unrestricted stock access to waterways	Moderate	C (450)	Fair
Te Horo Beach @ Kitchener St	Discharge from Mangaone Stream 700 m N, affected by intensive agricultural land use and unrestricted stock access to waterways	Moderate	C (298)	Fair
Peka Peka Beach @ Road End	Focal points of drainage from low-intensity land use	Low	B (117)	Good
Waikanae Beach @ William St	Urban stormwater protected from sewage ingress	Moderate	B (114)	Good
Waikanae Beach @ Tutere St T.C.	Discharge from Ngarara Stream 400 m N, affected by intensive agricultural land use and unrestricted stock access to waterways as well as urban stormwater protected from sewage ingress	Moderate	B (113)	Good
Waikanae Beach @ Ara Kuaka C.P.	Urban stormwater protected from sewage ingress	Moderate	B (115)	Good
Paraparaumu Beach @ Ngapotiki St	Discharge from Waikanae River 900 m N, affected by urban stormwater protected from sewage ingress and dense bird life in the estuary and nearby lakes	Moderate	B (196)	Good
Paraparaumu Beach @ Nathan Ave	Discharge from Waikanae River 2km N, affected by urban stormwater protected from sewage ingress and dense bird life in the estuary and nearby lakes	Moderate	B (185)	Good
Paraparaumu Beach @ Maclean Pk	Discharge from Tikotu Stream 80 m N, affected by urban stormwater protected from sewage ingress	Moderate	B (187)	Good
Paraparaumu Beach @ Toru Rd	Urban stormwater protected from sewage ingress	Moderate	B (168)	Good
Paraparaumu Beach @ Wharemauku Rd	Urban stormwater protected from sewage ingress	Moderate	B (162)	Good
Raumati Beach @ Tainui St	Urban stormwater protected from sewage ingress	Moderate	B (118)	Good
Raumati Beach @ Marine Gardens	Discharge from the Wharemauku Stream 90 m N, affected by urban stormwater protected from sewage ingress and possibly by agricultural land use (see Greenfield et al. 2012 for more information)	Moderate	C (268)	Fair
Raumati Beach @ Aotea Rd	Urban stormwater protected from sewage ingress	Moderate	B (144)	Good
Raumati Beach @ Hydes Rd	Urban stormwater protected from sewage ingress	Moderate	B (110)	Good
Paekakariki Beach @ Whareroa Rd	Discharge from Whareroa Stream 150 m N, affected by runoff from low intensity rural catchment	Low	B (72)	Good
Paekakariki Beach @ Surf Club	Discharge from Wainui Stream 120 m N, affected by runoff from low intensity rural catchment	Low	B (64)	Good
Paekakariki Beach @ Memorial Hall	Focal points of drainage, as run-off from low-intensity urban/rural catchment	Low	A (40)	Very good

4.3 Porirua

Recreational water quality is monitored at 15 sites in the Porirua area (Figure 4.3).

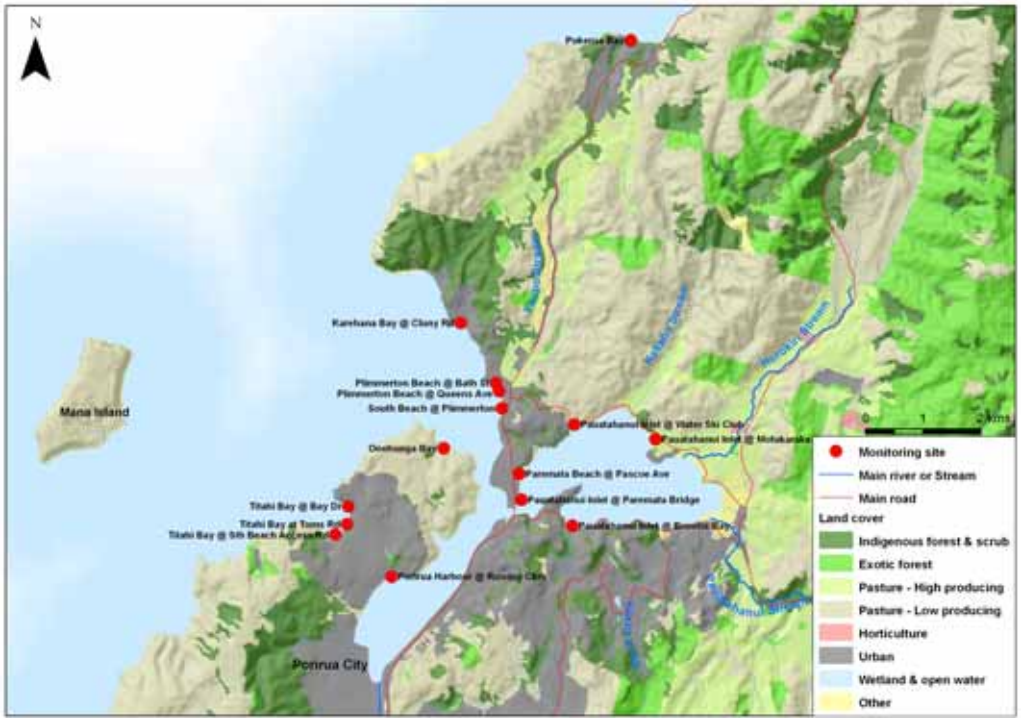


Figure 4.3: Location of coastal recreational water quality monitoring sites in the Porirua area

4.3.1 Microbiological risk factors

Most coastal monitoring sites in the Porirua area are bordered by urban areas of Porirua city and its outer suburbs. The exceptions are sites at Onehunga Bay and Pauatahanui Inlet at Motukaraka Point which are surrounded by low intensity agricultural land. The catchments of streams which discharge to the coast near monitoring sites are also generally dominated by urban land use with the exceptions being the Kakaho Stream and Taupo Stream. The catchment of the Kakaho Stream, which discharges close to the Pauatahanui Inlet at Motukaraka Point, is dominated by low intensity agricultural land use. Taupo Stream, which discharges at South Beach at Plimmerton, has low intensity agriculture in its upper catchment and urban land use in the lower catchment. This stream also supports a significant bird population due to the presence of Taupo Swamp in its middle and lower reaches.

Due to the predominance of urban land use adjoining coastal monitoring sites in the Porirua area, discharges of urban stormwater either directly to the coast or indirectly via tributary streams, are likely to be the main source of contamination at many monitoring sites. In general stormwater discharges in the Porirua area are considered to be protected from sewage contamination (J. Sutton[19], J. Gibb[20] and J. Saywell[21], pers. comm. 2011). However, high

[19] Jim Sutton, Manager Environmental Standards, Porirua City Council.
[20] John Gibb, Manager Waste and Water Services, Porirua City Council.

indicator bacteria counts recorded during dry weather and resultant follow up investigations at Porirua Harbour at Rowing Club and Titahi Bay at South Beach Access Road have highlighted that sewage contamination of stormwater likely occurs at these sites. A likely source of contamination at Porirua Harbour at Rowing Club is the un-named stream (known locally as 'Onepoto Drain') which enters the harbour approximately 50 m east of the Rowing Club. *E. coli* counts of up to 2,200 cfu/100mL were measured in this stream during an investigation undertaken by Porirua City Council (PCC) in March 2009. Subsequent to this investigation a number of illegal sewer connections to the stormwater network at newly constructed properties in the stream catchment were found. It is acknowledged that although these illegal connections have subsequently been fixed it is likely that other sources of contamination are also present. PCC is currently investigating potential sewer pump overflow sites and the performance of a septic tank still operating in the area (N. MacDonald[22], pers. comm. 2012).

The source of dry weather contamination at Titahi Bay at South Beach Access Road was investigated by PCC staff in December 2010. A water sample taken from the piped stream that discharges at this site was found to have an *E. coli* count of 62,000 cfu/100mL; microbial source tests performed on water samples taken at this time were found to have a 'strong positive' signal for human faecal contamination (Devane 2010). These results suggest that sewer/ stormwater infrastructure cross connections are present in the catchment of the stream that discharges at South Beach Access Road; despite ongoing investigations, PCC staff have not yet been able to identify the location of these cross connections (N. MacDonald, pers. comm. 2011).

High enterococci counts (ie, above the action/red mode of the MfE/MoH (2003) guidelines) have also been recorded on a number of occasions during dry weather at South Beach at Plimmerton (Greenfield et al. 2012). Contamination from the large bird population inhabiting Taupo Swamp has long been suspected as the primary source of this contamination. However, low levels of contamination from a human source was detected in one of four beach water samples collected at the stream mouth in February and March 2011 for microbial source analysis (Cornelison et al. 2012). Although no major problems have been identified with sewer and stormwater infrastructure in the area (J Sutton[23], pers. comm. 2011), there are several stormwater discharges to Taupo Stream and directly to South Beach and it is possible that, at times, discharges of contaminated stormwater contribute to faecal contamination at this site.

PCC has consent to discharge secondary treated and UV disinfected wastewater from Porirua city's WWTP via a short outfall at Rukutane Point, approximately 700 m southwest of Titahi Bay. This plant services an estimated population of 80,000 people across a catchment that takes in the northern suburbs of Wellington city and most of Porirua city. Given the location of the WWTP outfall in relation to Titahi Bay it is likely that south-westerly wind conditions combined with an incoming tide would bring the greatest risk of

[21] Joanna Saywell, Senior Engineer, Porirua City Council.
[22] Nick MacDonald, Senior Environmental Health Officer, Porirua City Council.
[23] Jim Sutton, Manager Environmental Standards, Porirua City Council.

contamination from the WWTP discharge to Titahi Bay. However, Greenfield et al. (2012) noted that all of the MfE/MoH (2003) action guideline exceedances recorded in Titahi Bay between the 2005/06 and 2009/10 summers coincided with northerly or northwest winds and most occurred on an outgoing tide; this suggests that the WWTP discharge was not contributing to contamination of Titahi Beach monitoring sites on these occasions. Wet weather monitoring undertaken by PCC at two sites in Titahi Bay during heavy rainfall events (as a condition of its resource consent for the WWTP discharge) also indicates no obvious contamination of Titahi Bay attributable to the Porirua WWTP.

4.3.2 Microbiological water quality results

The MAC values for each site generated from the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 4.3. MAC values ranged from 'B' at Onehunga Bay, Paremata Beach at Pascoe Avenue and Pauatahanui Inlet at Paremata Bridge to 'D' at South Beach at Plimmerton, Pauatahanui Inlet at Browns Bay, Porirua Harbour at Rowing Club and Titahi Bay at South Beach Access Road. Porirua Harbour at Rowing Club had the highest 95th percentile enterococci count (1,340 cfu/100mL) measured at any coastal monitoring site across the Wellington region. This site also had the lowest rate of compliance with the MfE/MoH (2003) surveillance (ie, 'safe swimming') guideline (83%) (Greenfield et al. 2012, and see Appendix 4). PCC has recognised, through the recently released Porirua Harbour and Catchment Strategy and Action Plan (PCC 2012), the need to improve stormwater and sewerage infrastructure in Porirua city, and in November 2011 implemented a water quality monitoring programme to help assess the performance of its infrastructure. Based on the ongoing exceedances of the MfE/MoH (2003) guidelines at the southern end of Titahi Bay (see Appendix 4), it is recommended that PCC extend its monitoring programme into this catchment.

4.3.3 Suitability for Recreation Grades

The combination of SIC and MAC values for coastal monitoring sites in Porirua resulted in SFRGs ranging from 'good' at three sites (Onehunga Bay, Paremata Beach at Pascoe Avenue and Pauatahanui Inlet at Paremata Bridge) to 'poor' at four sites (South Beach at Plimmerton, Pauatahanui Inlet at Browns Bay, Porirua Harbour at Rowing Club and Titahi Bay at South Beach Access Road) (Table 4.3). The remaining eight sites were graded 'fair'.

4.3.4 Review of monitoring sites

It is was agreed with PCC staff present at the SFRG review meeting in September 2011 that monitoring cease at three coastal recreational water quality monitoring sites in the Porirua area: Onehunga Bay, Pauatahanui Inlet at Motukaraka Point and Pauatahanui Inlet at Browns Bay. In the case of Onehunga Bay, although it is considered a very popular swimming spot (N. MacDonald, pers. comm. 2011), due to the low microbiological risk and consistently high water quality at this site (eg, Greenfield et al. (2012) note that this site did not exceed the action/red mode of the MfE/MoH (2003) guidelines on any occasion over the five summers between 2005/06 and 2009/10), on-going

Table 4.3: Primary sources of faecal contamination and corresponding SIC grades, as well as MAC grades and SFRGs, identified for coastal recreation water quality monitoring sites in Porirua. MAC grades are based on the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons (*n*=103 unless stated otherwise).

Site	Source of contamination category	SIC	MAC (95th %ile)	SFRG
Pukerua Bay	Discharge from unnamed stream 100m W, affected by urban stormwater protected from sewage ingress	Moderate	C (321)	Fair
Karehana Bay @ Cluny Rd	Urban stormwater protected from sewage ingress	Moderate	C (297)	Fair
Plimmerton Beach @ Bath St	Urban stormwater protected from sewage ingress	Moderate	C (317)	Fair
Plimmerton Beach @ Queens Ave	Urban stormwater protected from sewage ingress	Moderate	C (206)[1]	Fair[1]
South Beach @ Plimmerton	Discharge from Taupo Stream 100m N, affected by urban stormwater protected from sewage ingress and dense bird life in Taupo Swamp	Moderate	D (692)	Poor
Onehunga Bay	Focal points of drainage, as run-off from low-intensity rural catchment	Low	B (70)	Good
Pauatahanui Inlet @ Water Ski Club	Discharge of unnamed stream 15m W, affected by urban stormwater protected from sewage ingress	Moderate	C (283)	Fair
Pauatahanui Inlet @ Motukaraka Pt	Discharge of Kakaho Stream 600m NW, affected by unrestricted stock access to waterways	Moderate	C (215)	Fair
Pauatahanui Inlet @ Browns Bay	Discharge of Browns Stream 50m E, affected by urban stormwater protected from sewage ingress	Moderate	D (555)[1]	Poor[1]
Pauatahanui Inlet @ Paremata Br	Urban stormwater protected from sewage ingress	Moderate	B (124) [2]	Good[2]
Paremata Beach @ Pascoe Ave	Urban stormwater protected from sewage ingress	Moderate	B (199)[3]	Good[3]
Porirua Harbour @ Rowing Club	Discharge from unnamed stream 75m E, affected by urban stormwater with potential sewage contamination	Moderate	D (1,340)	Poor
Titahi Bay @ Bay Drive	Discharge from unnamed piped stream at site, affected by urban stormwater with potential sewage contamination	Moderate	C (370)	Fair
Titahi Bay @ Toms Rd	Discharge from unnamed piped stream at site, affected by urban stormwater with potential sewage contamination	Moderate	C (328)	Fair
Titahi Bay @ South Beach Access Rd	Discharge from unnamed piped stream at site, affected by urban stormwater with potential sewage contamination	Moderate	D (598)	Poor

[1] Interim SFRG as monitoring frequency reduced to fortnightly in 2010/11, *n*=93.

[2] Interim SFRG as monitoring only began at this site in 2007/08, *n*=81.

[3]As monitoring at this site stopped at the end of the 2008/09 bathing season the MAC grade was calculated from routine data collected over the five bathing seasons between 2004/05 and 2008/09.

monitoring is considered unnecessary. In terms of the two Pauatahanui Inlet sites, neither are highly used for recreation (compared with sites at Paremata Bridge and the Water Ski Club) and this is already reflected in a reduced frequency of monitoring at Browns Bay in recent years (fortnightly since 2010/11); the main reason for continuing some sampling at this site had been to track potential infrastructure-related contamination from Browns Stream. This was no longer necessary as from November 2011 PCC has been monitoring the outflow from Browns Stream as part of its infrastructure-related water quality monitoring programme.

It was identified that there is a popular area for shellfish collection in the Onepoto Arm of Porirua Harbour near the railway line at Paremata. Although microbiological water quality is likely to be relatively good in this area due to tidal exchange at the nearby SH 1 bridge (N. MacDonald, pers. comm. 2011) – which suggests regular monitoring may not be warranted – in light of aspirations in the Porirua Harbour and Catchment Strategy and Action Plan around shellfish collection from the harbour, it is recommended that the possibility of establishing a monitoring site for recreational shellfish gathering in this area be further investigated.

4.4 Wellington city

Recreational water quality is monitored at 22 coastal sites around Wellington city (Figure 4.4).

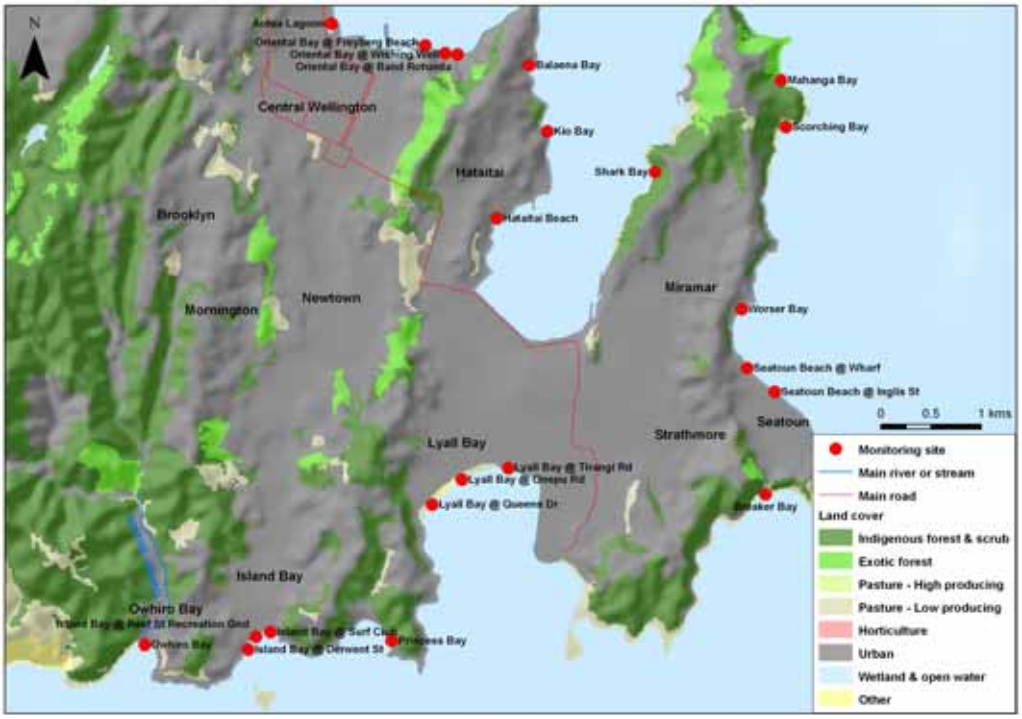


Figure 4.4: Location of coastal recreational water quality monitoring sites in Wellington city

4.4.1 Microbiological risk factors

Urban areas of central Wellington city and its outer lying suburbs dominate land cover around many coastal monitoring sites in Wellington Harbour and

Wellington's south coast. The exceptions are Shark, Mahanga, Scorching, Breaker and Princess bays which have small, steep catchments dominated by scrub. Most streams that previously discharged to the coast close to these sites have been piped and integrated into the stormwater system with the exception of Owhiro Stream which discharges to Owhiro Bay.

Stormwater is discharged at multiple locations to Wellington Harbour and the south coast. Monitoring sites close to large stormwater outfalls include those at Seatoun Beach, and Oriental, Lyall and Island bays. Stormwater infrastructure in these areas is considered to be protected from sewage inflows apart from at times of very high or sustained rainfall when excessive stormwater entering the wastewater network results in increased potential for sewage contamination (I. Idris[24] and N. Urlich[25], pers comm. 2011). Wellington City Council (WCC) exercises resource consents for all stormwater discharges from its network.

The Owhiro Stream catchment includes the suburbs of Brooklyn and Mornington and receives both urban stormwater and runoff from three operative landfills. On-going elevated enterococci counts (ie, above the surveillance mode of the MfE/MoH (2003) guidelines) recorded in Owhiro Bay during the 2009/10 bathing season were attributed to the outflow from the Owhiro Stream following investigation by Capacity, on behalf of WCC. However, microbial source tracking analysis has not provided conclusive identification of the source of elevated indicator bacteria counts in Owhiro Bay or the Owhiro Stream. A weak signal for human faecal contamination was identified in one sample taken from Owhiro Bay in February 2010 (Kirs 2010). Faecal sterol analysis of samples taken over three consecutive days in May 2010 also gave inconclusive results but suggested possible contamination from both bird (at times large populations of seagulls congregate at Owhiro Bay) and human sources (Gilpin 2010). During and shortly after the 2009/10 summer bathing season, Capacity identified and subsequently fixed a number of significant faults in the sewer system in the Owhiro Bay catchment. However, frequent exceedances of either the alert or action guideline during the 2010/11 bathing season suggest that sewage contamination together with faecal contamination from urban stormwater and wildfowl is still a problem at Owhiro Bay.

Effluent from the Moa Point WWTP, which services the majority of Wellington city, is discharged into Cook Strait via a 1.8 km long outfall east of Lyall Bay. At times of very heavy or sustained rainfall, high volumes of wastewater arriving at the WWTP (as a result of stormwater infiltrating into the sewer network) can exceed the available storage, resulting in the discharge of only partially treated effluent. However, due to the length of the Moa Point outfall and the dilution the effluent receives the principal risk of microbiological contamination in Lyall Bay is considered to be urban stormwater discharges (Table 4.4).

[24] Iqbal Idris, Senior Project Manager, Wellington Water Management (Capacity) Ltd.
[25] Nick Urlich, Engineer Investigations and Design, Wellington Water Management (Capacity) Ltd.

4.4.2 Microbiological water quality results

The MAC values for each site generated from the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 4.4. The highest 95th percentile result (618 cfu/100mL) was recorded at Owhiro Bay and corresponded to a 'D' grade. The lowest 95th percentile enterococci count was recorded at Princess Bay (4 cfu/100mL) and corresponded to an 'A' grade. The majority of sites had MAC grades of 'B' reflecting a moderate risk of microbiological contamination associated with urban stormwater runoff.

4.4.3 Suitability for Recreation Grades

SFRGs for coastal monitoring sites in Wellington city ranged from 'very good' at four sites (Balaena Bay, Scorching Bay, Breaker Bay and Princess Bay) to 'poor' at Owhiro Bay, with most sites (16 of 22) receiving a SFRG of 'good' (Table 4.4). Although stormwater inputs into Lyall Bay resulted in a SIC grade of 'moderate' for all three Lyall Bay monitoring sites, very low 95th percentile enterococci results were recorded at both Onepu Road and Queen's Drive, translating into an 'A' MAC grade (this was also the case for Island Bay at Derwent Street). This combination of SIC and MAC is unexpected and results in an undefined SFRG according to the MfE/MoH (2003) guidelines (refer Table 4.1). Although the MAC grade indicates a very low risk of microbiological contamination, given the stormwater inputs into the bay as well as the proximity of the Moa Point WWTP SFRGs of 'good' were conservatively assigned to these sites.

4.4.4 Review of monitoring sites

There was discussion with Capacity staff present at the SFRG review meeting in September 2011 about the three Island Bay monitoring sites (which all yielded different MAC grades). It was agreed that monitoring at Island Bay at Derwent Street should cease[26], with recreational water quality in the bay adequately represented by the sites adjacent to the Surf Club and Reef Street Recreation Ground.

Given that both Breaker Bay and Princess Bay have retained their SFRGs of 'very good', the need for continued monitoring at these sites should probably be revisited[27] – especially at Breaker Bay where the risk of microbiological contamination appears to be very low. It is noted that Balaena Bay and Scorching Bay also returned SFRGs of 'very good', suggesting that the frequency of sampling at these sites could also be reviewed. However, in the case of Scorching Bay, which is heavily used by the public and a popular location for triathlons and other sports events, the current monitoring frequency (weekly in summer and monthly in winter) is probably justified.

[26] Although monitoring would cease under Greater Wellington and WCC's joint recreational water quality monitoring programme, monitoring at this site is still currently required under WCC's global stormwater discharge consent.

[27] Monitoring at these sites is already less frequent relative to other sites – summer sampling was dropped from weekly to fortnightly in accordance with the recommendations of Milne and Wyatt (2006).

Table 4.4: Primary sources of faecal contamination and corresponding SIC grades, as well as MAC grades and SFRGs, identified for coastal recreation water quality monitoring sites in Wellington city. MAC grades are based on the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons (*n*=103, unless indicated otherwise).

Site	Source of contamination category	SIC	MAC (95th %ile)	SFRG
Aotea Lagoon	Urban stormwater protected from sewage ingress	Moderate	B (184)	Good
Oriental Bay @ Freyberg Beach	Urban stormwater protected from sewage ingress	Moderate	B (59)	Good
Oriental Bay @ Wishing Well	Urban stormwater protected from sewage ingress	Moderate	B (200)	Good
Oriental Bay @ Band Rotunda	Urban stormwater protected from sewage ingress	Moderate	B (123)	Good
Balaena Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	A (32)	Very good
Kio Bay	Urban stormwater protected from sewage ingress	Moderate	B (120)[1]	Good[1]
Hataitai Beach	Urban stormwater protected from sewage ingress	Moderate	B (49)	Good
Shark Bay	Urban stormwater protected from sewage ingress	Moderate	B (71)	Good
Mahanga Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	B (54)	Good
Scorching Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	A (32)	Very good
Worser Bay	Urban stormwater protected from sewage ingress	Moderate	B (41)	Good
Seatoun Beach @ Wharf	Urban stormwater protected from sewage ingress	Moderate	B (63)	Good
Seatoun Beach @ Inglis St	Urban stormwater protected from sewage ingress	Moderate	B (78)	Good
Breaker Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	A (8)[2]	Very good[2]
Lyall Bay @ Tirangi Rd	Urban stormwater protected from sewage ingress	Moderate	B (131)	Good
Lyall Bay @ Onepu Rd	Urban stormwater protected from sewage ingress	Moderate	A (39)	Good[3]
Lyall Bay @ Queens Drive	Urban stormwater protected from sewage ingress	Moderate	A (32)	Good[3]
Princess Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	A (4)[2]	Very good[2]
Island Bay @ Surf Club	Urban stormwater protected from sewage ingress	Moderate	C (271)	Fair
Island Bay @ Reef St Recreation Grd	Urban stormwater protected from sewage ingress	Moderate	B (148)	Good
Island Bay @ Derwent St	Urban stormwater protected from sewage ingress	Moderate	A (29)	Good[3]
Owhiro Bay	Discharge from Owhiro Strm 50 m W - urban stormwater with potential sewage contam.	Moderate	D (618)	Poor

[1] As monitoring at this site stopped at the end of the 2008/09 bathing season, the MAC grade was calculated from routine data collected over the five summer bathing seasons between 2004/05 and 2008/09.
[2] This is an interim SFRG as monitoring at this site is undertaken fortnightly, *n*=53.
[3] This combination of SIC and MAC grades is unexpected and gives a 'not determined' SFRG. Based on knowledge of microbiological risks at these sites they have been assigned an SFRG of 'good' (see section 4.4.3 for detail).

4.5 Hutt

Recreational water quality is monitored at 15 coastal sites in the Hutt area (Figure 4.5).

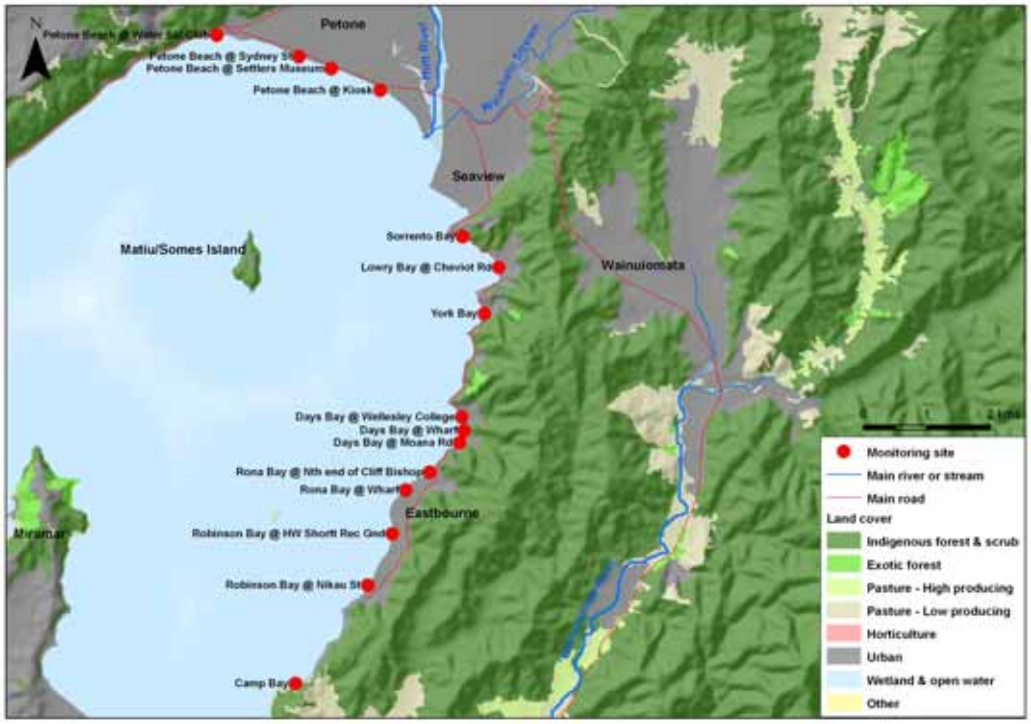


Figure 4.5: Location of coastal recreational water quality monitoring sites in Hutt city

4.5.1 Microbiological risk factors

Urban areas of the suburb of Petone adjoin Petone Beach. Sorrento, Lowry, York, Days, Rona and Robinson bays have similar catchment characteristics, with low density residential areas located in the immediate vicinity of each bay and indigenous forest and scrub dominating the surrounding hills. The catchment of Camp Bay is dominated by scrub.

The Korokoro Stream drains into the western end of Petone Beach and has a catchment dominated by scrub and regenerating indigenous forest. The Hutt River (including the Waiwhetu Stream) discharges to Wellington Harbour at the eastern end of Petone Beach and drains a catchment of approximately 638 km^2 comprising a mixture of indigenous forest and scrubland, farmland and urban areas (refer Section 3.3.1). Several first order streams drain into the bays along the eastern harbour. These small streams are dominated by regenerating indigenous forest and scrub in their middle and upper catchments but in many cases have been integrated into stormwater infrastructure as they flow through urban areas in their lower catchments.

All coastal monitoring sites in the Hutt area apart from Camp Bay are affected to some degree by urban stormwater discharges. For example, urban stormwater is discharged via a number of outfalls along Petone Beach as well as Lowry, Rona and Robinson bays. A small amount of urban stormwater is

also discharged to Sorrento, York and Days bays – mostly via roadside drains and streams which have been integrated into the stormwater system. It is considered that these stormwater discharges are generally protected from sewage ingress (B. Gebreselassie[28], N. Urlich and I. Idris, pers. comm. 2011). However, exceedances of the alert and action modes of the MfE/MoH (2003) guidelines during dry weather at some Robinson Bay and Rona Bay sites suggest that sewage contamination may be an issue at times (Greenfield et al. 2012). The source of contamination at these sites requires further investigation, particularly at Robinson Bay at HW Shortt Recreation Ground; this site exceeded the MfE/MoH (2003) action/red mode on eight routine sampling occasions over the 2006/07 to 2010/11 summer bathing seasons (Appendix 4).

The Hutt River can significantly influence microbiological water quality at coastal monitoring sites near its mouth and along the Eastbourne coast, particularly during heavy or prolonged rainfall (Table 4.5). For example, Greenfield et al. (2012) report that during southerly storms, the Hutt River outflow is pushed along the Petone foreshore and can affect water quality at all four monitoring sites along Petone Beach. The Hutt River is affected by runoff from urban and rural areas, as well as discharges of untreated sewage during extreme rainfall events (and in its lower reaches at Boulcott, the river has a 'dry weather' MAC of 'D' – see Section 3.3.1 for more detail). Water quality in the Waiwhetu Stream – which discharges into the mouth of the Hutt River – is particularly poor (median and maximum *E. coli* counts of 310 cfu/100mL and 8,000 cfu/100mL, respectively at Wainuiomata Hill Bridge (Perrie et al. 2012)[29]). This stream drains a heavily urbanised catchment and receives consented overflows of untreated sewage at Malone Road and Hinemoa Street during very high rainfall events. Discharges of untreated sewage have occurred from these points between zero and eight times per year between July 1999 and March 2010 (Osmond 2010) but in recent years have decreased due to extensive works undertaken by Hutt City Council (HCC).

The Hutt River also on occasion receives treated wastewater from HCC's WWTP, via the Waiwhetu Stream. Located at Seaview in Lower Hutt the WWTP provides secondary treatment and UV disinfection of wastewater from Upper Hutt, Lower Hutt, Wainuiomata and the Eastern Bays (a population of approximately 143,800) prior to being pumped 18 km through the main outfall pipeline to Pencarrow Head for discharge to the open coast via a short outfall (MWH 2011). During heavy or prolonged rainfall events, when the capacity of the main outfall pipeline and storage tanks at the WWTP is exceeded, treated sewage from the WWTP is discharged directly to the tidal reaches of Waiwhetu Stream upstream of the Port Road Bridge. Over the eight years to March 2011, there was an average of 4.4 wet weather discharge events per year (MWH 2011).

Treated sewage is also discharged to the Waiwhetu Stream (and therefore Wellington Harbour) on occasion in dry weather when maintenance works are undertaken on the main outfall pipeline that carries treated wastewater from the

[28] Bruck Gebreselassie, Investigations Engineer, Wellington Water Management (Capacity) Ltd.

[29] Based on monthly monitoring over July 2008 to June 2011 inclusive under Greater Wellington's Rivers SoE monitoring programme.

Seaview WWTP to the outfall at Pencarrow; this pipeline has experienced a number of leaks over its lifetime, including 47 leaks of the rubber ring joints (MWH 2011). The most significant leaks in recent years occurred in late March 2009 when an equipment failure at the main pump station caused a pressure surge through the pipeline (MWH 2011). Works undertaken to fix the leaks to the main outfall pipeline require the pipeline to be purged via discharges from scour valves at various points along the eastern harbour. HCC has recently applied for resource consent from Greater Wellington to undertake ongoing maintenance of the main outfall pipeline which will involve intermittent discharges of treated sewage along the eastern harbour coast and to the Waiwhetu Stream. Planned maintenance discharges are proposed to be restricted to between 1 June and 31 July each year while up to three emergency repairs each year may need to be undertaken outside of this period (including during the summer bathing season) (MWH 2011).

While the discharges of both treated and untreated wastewater are expected at times to affect microbiological water quality along Petone Beach and eastern harbour bays, they do not represent the principal microbiological risk to coastal bathing sites in Hutt city; the discharges are relatively infrequent and generally occur at times of heavy or prolonged rainfall (in the case of emergency overflows) or during winter months (in the case of planned maintenance discharges from Seaview WWTP and main outfall pipeline) when contact recreation is less likely to occur. Knowledge of catchment activities as well as existing microbiological data suggest that the primary risk of microbiological contamination at coastal monitoring sites in the Hutt area is from that associated with urban stormwater discharges protected from sewage ingress (Table 4.5).

4.5.2 Microbiological water quality results

The MAC values for each site generated from the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 4.5. The highest 95th percentile result (693 cfu/100mL) was recorded at Robinson Bay at HW Shortt Rec Ground and corresponded to a ‘D’ grade. The lowest 95th percentile enterococci count was recorded at Camp Bay 62 cfu/100mL) and corresponded to a ‘B’ grade. Eight sites had a MAC grade of ‘C’.

4.5.3 Suitability for Recreation Grades

The combination of SIC and MAC values for coastal monitoring sites in Hutt city resulted in SFRGs ranging from ‘good’ at five sites (Sorrento Bay, York Bay, Days Bay at Moana Road, Robinson Bay at Nikau Street and Camp Bay) to ‘poor’ at Robinson Bay at HW Shortt Rec Ground (Table 4.6). Most sites (9 of 15) had a SFRG of ‘fair’, including all four Petone Beach sites and both Rona Bay monitoring sites.

Table 4.5: Primary sources of faecal contamination and corresponding SIC grades, as well as MAC grades and SFRGs, identified for coastal recreation water quality monitoring sites in Hutt city. MAC grades are based on the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons (*n*=103, unless stated otherwise).

Site	Source of contamination category	SIC	MAC (95th %ile)	SFRG
Petone Beach @ Water Ski Club	Discharge from Hutt River 3.7 km E, affected by urban stormwater protected from sewage ingress	Moderate	C (219)	Fair
Petone Beach @ Sydney St	Discharge from Hutt River 2.3 km E, affected by urban stormwater protected from sewage ingress	Moderate	C (466)	Fair
Petone Beach @ Settlers Museum	Discharge from Hutt River 2 km E, affected by urban stormwater protected from sewage ingress	Moderate	C (265)	Fair
Petone Beach @ Kiosk	Discharge from Hutt River 1 km E, affected by urban stormwater protected from sewage ingress	Moderate	C (204)	Fair
Sorrento Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	B (110)	Good
Lowry Bay @ Cheviot Rd	Urban stormwater protected from sewage ingress	Moderate	C (210)	Fair
York Bay	Focal points of drainage, as run-off from low-intensity urban catchment	Low	B (137)	Good
Days Bay @ Wellesley College	Discharge from piped stream 40 m S, affected by urban stormwater protected from sewage ingress	Moderate	C (248)	Fair
Days Bay @ Wharf	Discharge from piped stream 40 m S, affected by urban stormwater protected from sewage ingress	Moderate	C (220)	Fair
Days Bay @ Moana Rd	Urban stormwater protected from sewage ingress	Moderate	B (175)	Good
Rona Bay @ N end of Cliff Bishop Pk	Urban stormwater protected from sewage ingress	Moderate	C (219)	Fair
Rona Bay @ Wharf	Urban stormwater protected from sewage ingress	Moderate	C (272)	Fair
Robinson Bay @ HW Shortt Rec Grd	Urban stormwater protected from sewage ingress	Moderate	D (693)	Poor
Robinson Bay @ Nikau St	Urban stormwater protected from sewage ingress	Moderate	B (103)	Good
Camp Bay	Focal points of drainage, as run-off from low-intensity rural catchment	Low	B (62)[1]	Good[1]

[1] Represents an interim SFRG as sampling has been undertaken monthly from November 2009, *n*=43.

4.5.4 Review of monitoring sites

It was agreed with HCC and Capacity staff present at the SFRG review meeting in September 2011 that monitoring cease at two coastal recreational water quality monitoring sites in the Hutt area: Petone Beach at Settlers Museum and Camp Bay. It was noted that water quality monitoring indicated all four Petone Beach sites had the same MAC grade ('C') and therefore Petone Beach could be adequately represented by three sites. Camp Bay is not considered to be a popular site for swimming nor shellfish gathering; further it was noted that sampling at this site has already been reduced to monthly intervals since November 2009 (reflecting both its generally high water quality and relatively low recreational usage).

There was also discussion about the need for three monitoring sites in Days Bay and whether the site at Moana Road was necessary; Greenfield et al. (2012) note that this site exceeded the action mode (280 cfu/100mL) of the MfE/MoH (2003) guidelines only once over the 2005/06 to 2009/10 summer bathing seasons. However, with Days Bay considered the primary recreational beach in Eastbourne, it was agreed to retain all three monitoring sites at the current time.

4.6 Wairarapa

Recreational water quality is monitored at five sites along the Wairarapa coast (Figure 4.6).

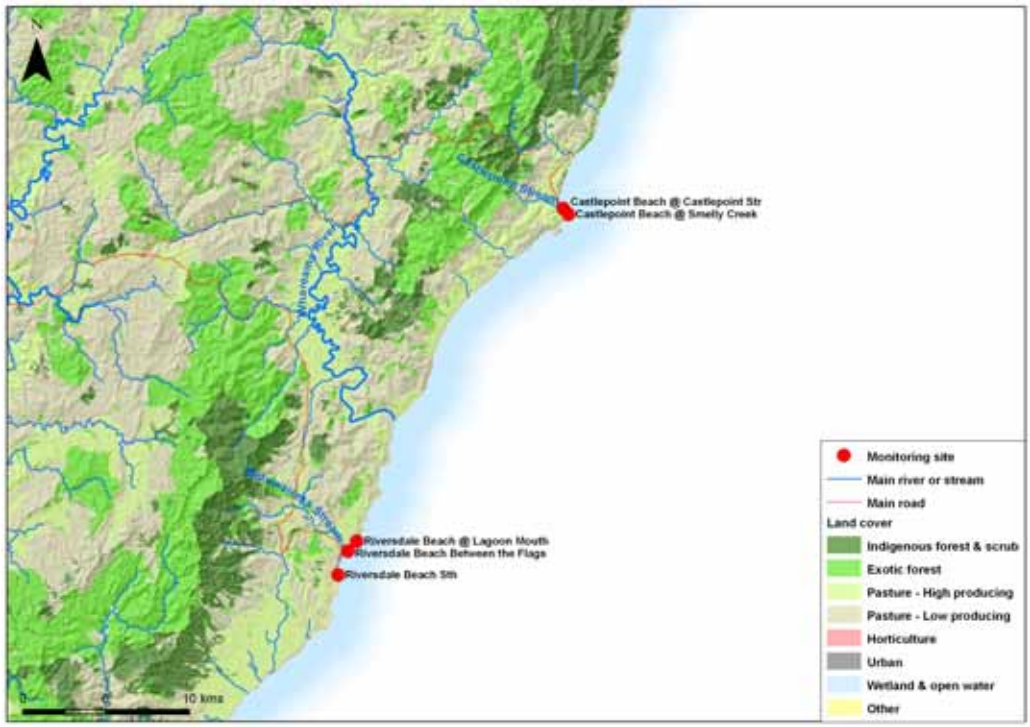


Figure 4.6: Location of coastal recreational water quality monitoring sites in the Wairarapa

4.6.1 Microbiological risk factors

Castlepoint and Riversdale beaches are immediately bordered by their respective settlements, beyond which sheep and beef farmland and pine forestry are the dominant land uses. Castlepoint Stream, which discharges to the coast halfway along Castlepoint Beach, provides the only significant freshwater input to Castlepoint Beach, although during heavy rain fall an ephemeral stream known as 'Smelly Creek' drains stormwater from Castlepoint settlement to the south end of the beach. Monitoring undertaken during summer bathing seasons between December 2005 and March 2011 has shown that Castlepoint Stream can experience elevated *E. coli* counts (median 151 cfu/100mL, maximum 12,800 cfu/100mL). Masterton District Council (MDC) has a resource consent to discharge secondary treated wastewater from the Castlepoint WWTP to Castlepoint Stream during the winter months. The WWTP, which comprises an oxidation pond and wetland system, should not discharge to Castlepoint Stream during the summer bathing season, although surface runoff maybe possible in very wet weather (P. Pickford[30], pers. comm. 2011). While runoff from low intensity rural land use to the Castlepoint Stream is considered to be the primary source of contamination to Castlepoint Beach (Table 4.6), a 'moderate' SIC grade has been conservatively assigned to Castlepoint Beach at Castlepoint Stream to take into account the possibility of occasional discharges from the WWTP to Castlepoint Stream during the summer bathing season.

At Riversdale Beach, the primary freshwater input is the Motuwaireka Stream, which drains to the coast via the Motuwaireka Lagoon towards the north end of the beach. Indicator bacteria counts are often high in the Motuwaireka Lagoon (Milne 2005) and permanent health warning signage is in place. Poor water quality in the Motuwaireka Lagoon has historically been attributed to contamination from septic tanks in the area, a decommissioned landfill in the mid reaches of the catchment, waterfowl and agricultural runoff (Stansfield 2000). In November 2011 MDC commissioned new municipal oxidation ponds to treat and discharge the settlement's wastewater to land. Connection of the majority of Riversdale residents to the WWTP is scheduled to be completed by September 2012. Although runoff from low intensity land use into Motuwaireka Stream is considered to be the primary source of contamination to Riversdale Beach (Table 4.6), a conservative SIC grade of 'moderate' has been assigned to Riversdale Beach at Lagoon Mouth to take into account possible on-going septic tank discharges to the Motuwaireka Stream while Riversdale residents connect to the WWTP.

4.6.2 Microbiological water quality results

The MAC values for each site generated from the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons are presented in Table 4.6. The highest 95th percentile result was recorded at Castlepoint Beach at Castlepoint Stream (150 cfu/100mL) and corresponded to a 'B' grade. The lowest 95th percentile enterococci count was recorded at Riversdale Beach South (12 cfu/100mL) and corresponded to an 'A' grade.

[30] Paula Pickford, Senior Resource Officer, Greater Wellington.

Table 4.6: Primary sources of faecal contamination and corresponding SIC grades, as well as MAC grades and SFRGs, identified for coastal recreation water quality monitoring sites in the Wairarapa. MAC grades are based on the results of routine sampling over the 2006/07 to 2010/11 summer bathing seasons (*n*=103, unless stated otherwise).

Site	Source of contamination category	SIC	MAC (95th %ile)	SFRG
Castlepoint Beach @ Castlepoint S	Discharge from Castlepoint Stream at site, affected by runoff from low-intensity rural catchment (but also some potential for discharges from secondary treated sewage)	Moderate[1]	B (150)	Good
Castlepoint Beach @ Smelly Creek	Focal points of drainage, as run-off from low-intensity rural catchment	Low	A (39)	Very good
Riversdale Beach @ Lagoon Mouth	Discharge from Motuwaireka Stream 500 mS, affected by runoff from low intensity rural catchment and faecal inputs from waterfowl (but also some potential for discharges from septic tanks and decommissioned landfill)	Moderate[1]	B (72)	Good
Riversdale Beach Between the Flags	Focal points of drainage, as run-off from low-intensity rural catchment	Low	A (24)	Very good
Riversdale Beach South	Focal points of drainage, as run-off from low-intensity rural catchment	Low	A (12) [2]	Very good[2]

[1] Conservative SIC to account for possible influence from WWTP/septic tank discharges.

[2] Interim SFRG as monitoring undertaken fortnightly at this site, *n*=54.

4.6.3 Suitability for Recreation Grades

SFRGs for Wairarapa coastal monitoring sites ranged from 'very good' at three sites to 'good' two sites (Table 4.6).

4.6.4 Review of monitoring sites

It was agreed with staff representing district councils in the Wairarapa at the SFRG review meeting in September 2011 that monitoring cease at Riversdale Beach at Lagoon Mouth and Riversdale Beach South. Most of the swimming at Riversdale Beach occurs between the Flags and monitoring at this site is sufficient to assess microbiological water quality at the beach. Greater Wellington will continue to monitor water quality in Motuwaireka Lagoon at the same time as monitoring the beach.

4.7 Synthesis

Based on revised SIC grades, and updated MAC grades calculated from the results of routine water quality monitoring over the 2006/07 to 2010/11 summer bathing seasons, SFRGs for the 77 coastal recreational water quality monitoring sites in the Wellington region range from 'very good' to 'poor' (Figure 4.7). In total, 49 of the 77 (64%) monitoring sites have SFRGs of 'good' or better (Table 4.7). Many of these sites are located along the Kapiti and Wairarapa coasts as well as in Wellington city and are adjoined by catchments dominated by low intensity land use or urban catchments where stormwater is protected from sewage contamination.

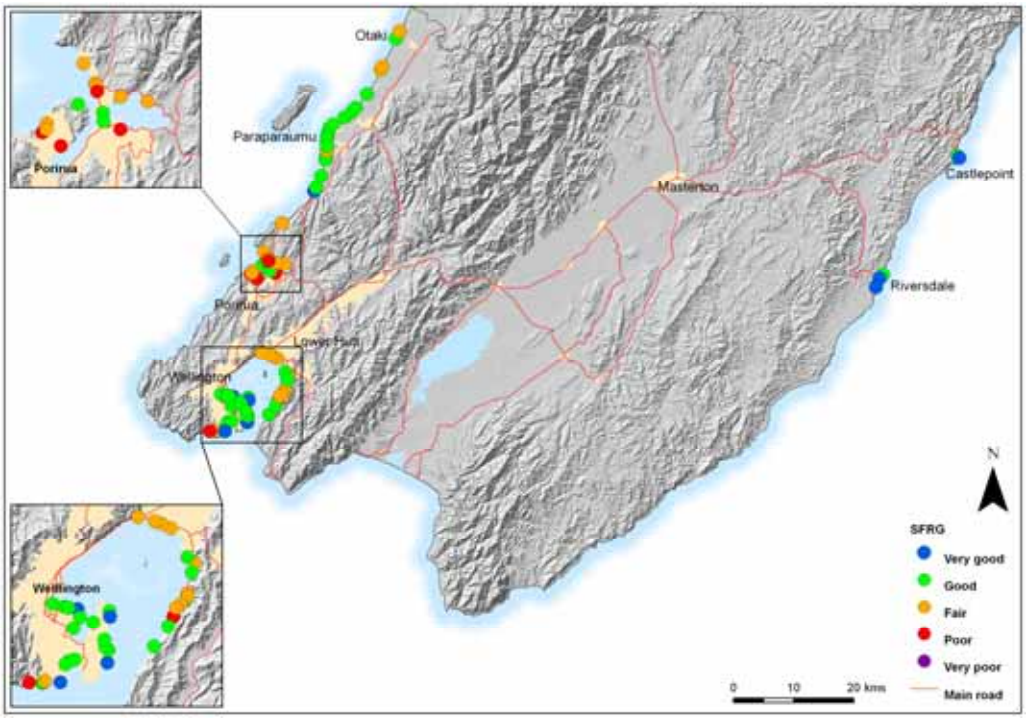


Figure 4.7: Revised SFRGs for coastal recreational water quality monitoring sites in the Wellington region, derived from MAC values based on routine sampling results collected over the 2006/07 to 2010/11 summer bathing seasons

Table 4.7: Distribution of SFRGs at coastal recreational water quality monitoring sites across the Wellington region

SFRG	Kapiti (20 sites)	Porirua (15 sites)	Wellington (22 sites)	Hutt (15 sites)	Wairarapa (5 sites)	Total
Very good	1	0	4	0	3	8
Good	15	3	16	5	2	41
Fair	4	8	1	9	0	22
Poor	0	4	1	1	0	6
Very poor	0	0	0	0	0	0

Twenty eight coastal sites have SFRGs of 'fair' or 'poor', most of which (22/28) are located in Porirua and Hutt city (Petone and Eastbourne). At many of these sites, general runoff from large urban catchments or contamination of urban stormwater with sewage has been identified as the principal source of contamination. In contrast, runoff from intensive agriculture in adjoining catchments has been identified as a key source of contamination at some sites along Otaki and Te Horo beaches.

At all but one of the six sites graded 'poor' (South Beach at Plimmerton), sewage contamination of stormwater discharged either directly or indirectly to the coast is likely to be impacting on microbiological water quality. This is discussed further in Greenfield et al. (2012).

Although not identified as the primary source of contamination at any coastal site it is important to note that discharges of both treated and untreated sewage from municipal WWTPs occur in the vicinity of Paraparaumu Beach, Titahi Bay, Lyall Bay, Hutt River mouth and Castlepoint Beach. While the level of treatment, timing and dilution of these discharges mean that they are unlikely to be a significant risk to human health at coastal monitoring sites in their vicinity, it is important that information on the pathogen removal ability of these WWTPs be sought in order to increase confidence in recreational water quality monitoring results to safeguard public health.

5. Discussion

This section provides a brief comparison of the revised SFRGs with those originally derived by Milne and Wyatt (2006). It also outlines some limitations and issues associated with the beach grading process.

5.1 SFRGs in 2010/11 compared with 2005/06

Following the end of the 2005/06 summer bathing season Milne and Wyatt (2006) graded 23 fresh water sites and 76 coastal sites, utilising microbiological water quality data collected over the preceding five summer bathing seasons. The SFRGs for those sites that were still monitored as at the end of the 2010/11 summer are summarised in Tables 5.1 and 5.2, along with the revised grades presented in this report. Note that SFRGs used to compare the two periods at freshwater sites are those based on all flows as 'dry weather' SFRGs were not determined in 2006.

In 2012 there were slightly more freshwater sites with SFRGs of 'good' or better (6 rather than 4) and slightly less sites with SFRGs of 'fair' or worse (15 rather than 18) than in 2006 for the 22 freshwater sites assigned grades in both years (Table 5.1). Between these two time periods, SFRGs at eight sites improved by one grade (Appendix 5). However, in most cases these improvements are likely to be related to differences in rainfall and flow patterns over the two periods (for example the 2001/02–2005/06 period included the very wet summer of 2003/04) rather than a reduction in sources of contamination. The exceptions are Waikanae River at SH 1 and Ruamahanga at Double Bridges where a significant decrease in *E. coli* counts was detected once variation in river flow had been accounted for. The reasons for these decreases are unclear but could be related to improved land use practises or reduced stock access to nearby tributaries (Greenfield at al. 2012).

There has also been an overall improvement in SFRGs at coastal monitoring sites between the two periods with the number of sites graded 'good' or better increasing in 2012 compared to 2006 (47 compared to 42) and the number of sites graded 'fair' or worse decreasing (28 compared to 33). Between these two periods SFRGs improved at 21 sites and declined at 13 sites (Appendix 5). For almost all of these sites the improvement or deterioration was by one grade only[31] and occurred due to a change in MAC rather than a change in SIC[32]. It is likely that, as for freshwater sites, many of these changes in SFRGs are related to differences in rainfall patterns over the two periods rather than changes in the sources of contamination. However, improvements at sites at Hataitai Beach and Oriental Bay could potentially be related to improvements in stormwater and sewer infrastructure that have been undertaken in these areas (Greenfield et al. 2012). Conversely it is likely the deterioration of SFRGs from 'fair' to 'poor' at Titahi Bay at South Beach Access Rd, Owhiro Bay and Robinson Bay at HW Shortt Rec Ground is related to increased contamination from stormwater/sewer infrastructure.

[31] The SFRG at Onehunga Bay improved from 'poor' in 2006 to 'good' in 2012. It is suspected that this improvement is related to changes in sampling personnel and practises rather than a change in contamination sources (Greenfield et al. 2012).
[32] The SFRG at Camp Bay declined from 'very good' in 2006 to 'good' in 2012 due to the SIC being modified from 'very low' to 'low'.

Table 5.1: Summary of SFRGs for river recreational water quality monitoring sites across the Wellington region determined by Milne and Wyatt (2006) and in this report. The summary only includes sites monitored in both grading reports and is limited to 'all flow' conditions.

SFRG	Kapiti (3 sites)		Hutt (6 sites)		Wairarapa (12 sites)		Total	
	2006	2012	2006	2012	2006	2012	2006	2012
Very good	0	1	0	0	1	1	1	2
Good	1	1	0	0	2	3	3	4
Fair	1	1	0	1	1	1	2	3
Poor	1	0	6	5	1	2	9	7
Very poor	0	0	0	0	7	5	7	5

Table 5.2: Summary of SFRGs for coastal recreational water quality monitoring sites across the Wellington region determined by Milne and Wyatt (2006) and in this report. The summary only includes sites monitored in both grading reports.

SFRG	Kapiti (20 sites)		Porirua (14 sites)		Wellington (21 sites)		Hutt (15 sites)		Wairarapa (5 sites)		Total	
	2006	2012	2006	2012	2006	2012	2006	2012	2006	2012	2006	2012
Very good	0	1	0	0	2	4	1	0	1	3	4	8
Good	9	15	3	2	15	15	8	5	3	2	38	39
Fair	11	4	5	8	4	1	6	9	1	0	27	22
Poor	0	0	6	4	0	1	0	1	0	0	6	6
Very poor	0	0	0	0	0	0	0	0	0	0	0	0

5.2 Limitations associated with the SFRG process

On the whole, the process for assigning a SFRG to a recreational water quality monitoring site outlined in the MfE/MoH (2003) guidelines is relatively robust and transparent. However, during the process of re-assessing SFRGs for sites in the Wellington region a number of limitations and potential improvements were identified. These are outlined below.

- It is clear that at freshwater sites, SFRGs at all but the least impacted (ie, forested) sites are primarily driven by high counts of *E. coli* recorded during periods of heavy rainfall and high river flows; these grades do not reflect the time when most contact recreation is likely to occur. Although note H(xii) of the MfE/MoH (2003) guidelines suggests that where this occurs it is acceptable to modify the SFRG, detailed guidance on how this should be done is not provided. The approach taken in this report – to remove *E. coli* counts from water samples taken above median rivers flows – is considered relatively robust but it would be helpful if a methodology could be introduced for all regional councils to follow, particularly if freshwater SFRGs are, as recently indicated by the Ministry for the Environment, to be used as a national reporting tool (L. Baker[33], pers. comm. 2011). This methodology would also need to consider the minimum number of sampling points required; according to the existing national guidelines, the 'dry weather' SFRGs presented in this report can

[33] Lucy Baker, Senior Analyst, Ministry for the Environment.

only be considered as *interim* grades, because the removal of high flow *E. coli* results reduced the data set for each site to less than 100 data points.

- Although SFRGs for coastal monitoring sites are generally considered to be less influenced by high indicator bacteria counts associated with heavy or prolonged rainfall, it is likely that determination of 'dry weather' SFRGs for coastal sites may also useful or necessary to better represent the microbiological risk at the time when contact recreation is most likely. Detailed guidance on a procedure to modify SFRGs for coastal sites based on rainfall prior to sampling would be useful.

- Some potential microbiological hazards are not included in notes H (iv) and (vii) of the MfE/MoH (2003) guidelines. These include rivers/streams that drain to bathing sites that are affected by urban stormwater protected from sewage ingress, unrestricted stock access to water waterways and dense birdlife. In this report, where these hazards were identified as the primary source of microbiological risk, SIC grades had to be estimated (see Table 2.2).

- More guidance regarding determination of SFRGs for sites affected by discharges of treated sewage (eg, 'The Cliffs' and 'Bentleys Beach' on the Ruamahanga River and, to a lesser extent Lyall Bay on Wellington city's south coast and Paraparaumu Beach in Kapiti) would be useful. The guidelines state that the grading process is not applicable in this situation (because wastewater treatment plants may treat effluent to a level where the indicator bacteria concentrations are very low, but pathogens such as viruses and protozoa may still be present at substantial concentrations, effectively changing the indicator/pathogen ratio) but no information is given on the steps that should be taken to determine a grade for these sites. This is considered a major limitation of the guidelines, especially since most regions in New Zealand have river or coastal waters that receive treated sewage discharges.

- The guidelines stipulate that a minimum of 100 data points are needed to determine a full SFRG for a site. However, where sites have been graded 'very good' the recommendation for reduced frequency of monitoring automatically means that future revised grades will be based on fewer microbiological water quality results, resulting in *interim* SFRGs. It would be useful to clarify the suggested change in monitoring regime to sites that have been graded 'very good' and the process to follow in revising these grades.

- Analysis of microbiological water quality data and derivation of SFRGs are limited to routine monitoring data collected during the official bathing season (November to March inclusive). While this reflects the time of greatest usage, it overlooks the fact that many recreational sites, particularly coastal sites in urban areas (eg, Oriental Bay and Scorching Bay in Wellington city), are utilised year-round and water quality is often poorer outside of the summer period (owing largely to higher rainfall). For example, Milne and Wyatt (2006) demonstrated that Island Bay monitoring sites on Wellington city's south coast exceed the alert and

action modes of the MfE/MoH (2003) guidelines more frequently during the winter months and, if these results were included in SFRG derivation, then lower SFRGs would be assigned to these sites. It is therefore important to ensure that the appropriate application of SFRGs is clearly communicated to the public, along with the need to take more care outside of the bathing season.

- Occasionally the number of MfE/MoH (2003) action guideline exceedances recorded at a monitoring site can be inconsistent with the SFRG assigned to that site (eg, Hutt River at Silverstream), resulting in uncertainty around risk to human health from contact recreation. Guidance on what should be done in these instances would be useful.

- It needs to be remembered – and ideally be somehow accommodated in public communication – that the SFRG process only relates to microbiological water quality risks. In the Wellington region – as in many regions of New Zealand – toxic benthic cyanobacteria present a very real health risk to recreational users of some rivers (eg, Hutt and Waipoua rivers).

6. Conclusions

Of the 100 recreational water quality site monitored across the Wellington region as at the end of the 2010/11 summer bathing season, 60 sites have SFRGs of 'good' or better (utilising the 'dry weather' SFRGs for freshwater sites). These sites include freshwater sites in catchments dominated by forest and scrub, coastal sites adjoining catchments dominated by scrub and low intensity agricultural land use, as well as coastal sites in urban areas where stormwater is protected from sewage contamination. These sites include those on the Otaki, Waikanae, Waingawa and Waiohine rivers as well as many coastal sites around Wellington city and on the Kapiti and Wairarapa coasts.

Across the region, 35 sites have been assigned SFRGs of 'fair' or 'poor'. At these sites the principal source of contamination has been identified as either runoff from intensive agricultural or urban land use, stock access to streams or, more commonly in the case of coastal sites, discharges of urban stormwater contaminated with sewage. These sites include those on the Pakuratahi, Wainuiomata, Waipoua and Ruamahanga rivers, sites on the lower reaches of the Hutt River, as well as many coastal sites around Porirua and Hutt cities.

Five sites on the Ruamahanga River have been assigned interim SFRGs of 'fair' or 'poor' due to uncertainty around the influence of discharges from municipal WWTPs upstream of these sites. SFRGs for these sites will need to be reviewed as information on the pathogen removal efficiency of the WWTPs becomes available or as the discharges are progressively moved to land.

6.1 Recommendations

1. Adopt the use of 'dry weather' SFRGs in reporting on recreational water quality at freshwater monitoring sites. Use of these 'dry weather' grades should be accompanied with identification of sites where there is a significant deterioration in microbiological water quality follow periods of heavy or prolonged rainfall.

2. Increase the prominence and communication of SFRGs to the public via Greater Wellington's recreational water quality webpage and inclusion in annual *On the beaches* monitoring reports.

3. In collaboration with Territorial Authorities and Regional Public Health:

   - identify a strategy to communicate the high risk to public health of swimming at specific freshwater and coastal sites up to 48 hours after heavy rainfall; and
   - collate existing information on the pathogen removal capacity of WWTPs at Paraparaumu, Titahi Bay, Moa Point, Seaview and in the Wairarapa, and modify SFRGs accordingly.

4. Make use of microbiological water quality results from the monthly Rivers State of the Environment monitoring programme to assess recreational water quality on the lower reaches of the Akatarawa River (above the Hutt River confluence) and Tauherenikau River (at Websters) and include these results in future recreational water quality monitoring reports.

5. Investigate the possibility of adding an additional recreational shellfish gathering water quality monitoring site in Porirua Harbour near the railway line at Paremata.

6. Continue to review and update MAC grades and SFRGs annually upon the conclusion of each summer bathing season.

7. Review microbiological risk assessments (SIC grades) for freshwater and coastal recreational water quality monitoring sites again in five years time (ie, after the 2015/16 summer) – or sooner if new information becomes available indicating a change in microbiological risk at one or more sites.

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Appendix 1: Recreational water quality monitoring sites

Area	Site name	NZTM co-ordinates		Type
		Easting	Northing	
Kapiti	Otaki River @ State Highway 1	1781309	5484406	Freshwater
Kapiti	Otaki River @ Pots	1785444	5478749	Freshwater
Kapiti	Waikanae River @ Jim Cooke Park	1772155	5472377	Freshwater
Kapiti	Waikanae River @ State Highway 1	1773752	5472296	Freshwater
Kapiti	Otaki Beach @ Surf Club	1778622	5488330	Coastal[1]
Kapiti	Otaki Beach @ Rangiuru Road	1778010	5487069	Coastal
Kapiti	Te Horo Beach S of Mangaone Stream	1775779	5482478	Coastal
Kapiti	Te Horo Beach @ Kitchener Street	1775495	5481933	Coastal
Kapiti	Peka Peka Beach @ Road End	1773215	5477905	Coastal[1]
Kapiti	Waikanae Beach @ William Street	1771388	5475584	Coastal
Kapiti	Waikanae Beach @ Tutere St Tennis Courts	1770655	5474862	Coastal
Kapiti	Waikanae Beach @ Ara Kuaka Carpark	1769514	5473978	Coastal
Kapiti	Paraparaumu Beach @ Ngapotiki Street	1767543	5472762	Coastal
Kapiti	Paraparaumu Beach @ Nathan Avenue	1767033	5472174	Coastal
Kapiti	Paraparaumu Beach @ Maclean Park	1766694	5471267	Coastal
Kapiti	Paraparaumu Beach @ Toru Road	1766577	5470715	Coastal
Kapiti	Paraparaumu Beach @ Wharemauku Road	1766503	5470070	Coastal
Kapiti	Raumati Beach @ Tainui Street	1766531	5469229	Coastal
Kapiti	Raumati Beach @ Marine Gardens	1766516	5468441	Coastal
Kapiti	Raumati Beach @ Aotea Road	1766414	5467529	Coastal
Kapiti	Raumati Beach @ Hydes Road	1766318	5466835	Coastal[1]
Kapiti	Paekakariki Beach @ Whareroa Road	1765598	5464128	Coastal
Kapiti	Paekakariki Beach @ Surf Club	1764791	5462273	Coastal
Porirua	Pukerua Bay	1759058[2]	5456278	Coastal
Porirua	Karehana Bay @ Cluny Road	1756093	5451360	Coastal
Porirua	Plimmerton Beach @ Bath Street	1756706	5450316	Coastal
Porirua	Plimmerton Beach @ Queens Avenue	1756758	5450177	Coastal
Porirua	South Beach @ Plimmerton	1756810	5449874	Coastal
Porirua	Paremata Beach @ Pascoe Avenue	1757116	5448733	Coastal
Porirua	Pauatahanui Inlet @ Water Ski Club	1758074	5449593	Coastal
Porirua	Pauatahanui Inlet @ Motukaraka Point	1759486	5449338	Coastal[1]
Porirua	Pauatahanui Inlet @ Browns Bay	1758039	5447833	Coastal[1]
Porirua	Porirua Harbour @ Rowing Club	1754891	5446947	Coastal[1]
Porirua	Titahi Bay @ Bay Drive	1754132	5448169	Coastal
Porirua	Titahi Bay at Toms Road	1754110	5447857	Coastal
Porirua	Titahi Bay @ South Beach Access Road	1753906	5447682	Coastal
Porirua	Onehunga Bay	1755796	5449181	Coastal
Porirua	Pauatahanui Inlet @ Paremata Bridge	1757153	5448284	Coastal
Wellington	Aotea Lagoon	1748985	5427683	Coastal
Wellington	Oriental Bay @ Freyberg Beach	1749920	5427464	Coastal
Wellington	Oriental Bay @ Wishing Well	1750118	5427386	Coastal
Wellington	Oriental Bay @ Band Rotunda	1750243	5427375	Coastal
Wellington	Balaena Bay	1750958	5427267	Coastal
Wellington	Kio Bay	1751139	5426602	Coastal
Wellington	Hataitai Beach	1750632	5425730	Coastal
Wellington	Shark Bay	1752211	5426197	Coastal[1]
Wellington	Mahanga Bay	1753468	5427115	Coastal[1]
Wellington	Scorching Bay	1753517	5426647	Coastal
Wellington	Worser Bay	1753074	5424823	Coastal
Wellington	Seatoun Beach @ Wharf	1753129	5424234	Coastal
Wellington	Seatoun Beach @ Inglis Street	1753405	5423994	Coastal

Area	Site name	NZTM co-ordinates		Type
		Easting	Northing	
Wellington	Breaker Bay	1753312	5422970	Coastal
Wellington	Lyall Bay @ Tirangi Road	1750747	5423230	Coastal
Wellington	Lyall Bay @ Onepu Road	1750286	5423116	Coastal
Wellington	Lyall Bay @ Queens Drive	1749990	5422868	Coastal
Wellington	Princess Bay	1749586	5421504	Coastal
Wellington	Island Bay @ Surf Club	1748377	5421590	Coastal
Wellington	Island Bay @ Reef St Recreation Ground	1748229	5421542	Coastal
Wellington	Island Bay @ Derwent Street	1748155	5421415	Coastal
Hutt	Hutt River @ Birchville	1776196	5449091	Freshwater
Hutt	Hutt River @ Boulcott	1760920	5437569	Freshwater
Hutt	Hutt River @ Maoribank Corner	1775882	5446696	Freshwater
Hutt	Hutt River @ Poets Park	1771461	5446092	Freshwater
Hutt	Hutt River @ Silverstream Bridge	1767598	5443172	Freshwater
Hutt	Pakuratahi River @ Forks	1784288	5452620	Freshwater
Hutt	Wainuiomata River @ Richard Prouse Park	1764536	5429141	Freshwater
Hutt	Petone Beach @ Water Ski Club	1755744	5434591	Coastal
Hutt	Petone Beach @ Sydney Street	1757045	5434248	Coastal
Hutt	Petone Beach @ Settlers Museum	1757555	5434056	Coastal
Hutt	Petone Beach @ Kiosk	1758326	5433711	Coastal
Hutt	Sorrento Bay	1759632	5431384	Coastal[1]
Hutt	Lowry Bay @ Cheviot Road	1760206	5430891	Coastal
Hutt	York Bay	1759977	5430160	Coastal
Hutt	Days Bay @ Wellesley College	1759616	5428529	Coastal
Hutt	Days Bay @ Wharf	1759654	5428313	Coastal
Hutt	Days Bay @ Moana Road	1759582	5428120	Coastal
Hutt	Rona Bay @ N end of Cliff Bishop Park	1759109	5427654	Coastal
Hutt	Rona Bay @ Wharf	1758730	5427371	Coastal
Hutt	Robinson Bay @ HW Shortt Rec Ground	1758519	5426674	Coastal
Hutt	Robinson Bay @ Nikau Street	1758131	5425856	Coastal
Hutt	Camp Bay	1756990	5424288	Coastal
Wairarapa	Ruamahanga River @ Bentleys Beach	1800534	5432813	Freshwater
Wairarapa	Ruamahanga River @ Double Bridges	1824350	5471775	Freshwater
Wairarapa	Ruamahanga River @ Kokotau	1815756	5447191	Freshwater
Wairarapa	Ruamahanga River @ Morrisons Bush	1808918	5441108	Freshwater
Wairarapa	Ruamahanga River @ Te Ore Ore	1825529	5462917	Freshwater
Wairarapa	Ruamahanga River @ The Cliffs	1821476	5452180	Freshwater
Wairarapa	Ruamahanga River @ Waihenga	1804610	5436461	Freshwater
Wairarapa	Waingawa River @ Kaituna	1810326	5471149	Freshwater
Wairarapa	Waingawa River @ South Road	1820550	5460878	Freshwater
Wairarapa	Waiohine River @ Gorge	1801853	5455936	Freshwater
Wairarapa	Waiohine River @ State Highway 2	1809665	5451711	Freshwater
Wairarapa	Waipoua River @ Colombo Road	1824996	5462889	Freshwater
Wairarapa	Castlepoint Beach @ Castlepoint Stream	1871366	5467559	Coastal
Wairarapa	Castlepoint Beach @ Smelly Creek	1871670	5467202	Coastal
Wairarapa	Riversdale Beach @ Lagoon Mouth	1858965	5447543	Coastal
Wairarapa	Riversdale Beach Between the Flags	1858435	5446948	Coastal
Wairarapa	Riversdale Beach South	1857834	5445514	Coastal

[1] Water quality is also monitored for recreational shellfish gathering purposes.

Appendix 2: Microbiological risk assessments

Kapiti freshwater sites [4]

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
Y = yes
N = no
? = not known

		Otaki R @ The Pots			Otaki R @ SH 1			Waikanae R @ SH 1			Waikanae R @ Jim Cooke Park		
To what degree is water quality at the bathing site affected, or likely to be affected by:		FCR01			FCR02			FCR03			FCR04a		
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 (eg, 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 (eg, 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 run-off from feral animals (e.g,. forest or bush)	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

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Continue below if stream/drain/wetland present, otherwise go to question 23

Is the water quality of the stream, drain or wetland affected or likely to be affected by:		Unnamed trib.~1km u/s			Unnamed trib.~2km u/s			Unnamed trib. ~300m u/s					
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, 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	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	12			8			8			8		
Other influences:													
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Comments:

1) Very heavy rainfall (>10 mm in 24 hours) required to trigger action level events in the Waikanae River, heavier again for the Otaki River

Hutt freshwater sites [7] (page 1 of 2)

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
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 @ Forks			Hutt R @ Birchville			Hutt R @ Maoribank			Hutt R @ Poets Park		
		FCR05			FCR06			FCR07			FCR08		
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 (eg, 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 (eg, 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 run-off from feral animals (e.g,. forest or bush)	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)

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Continue below if stream/drain/wetland present, otherwise go to question 23

Is the water quality of the stream, drain or wetland affected or likely to be affected by:		Farm Crk & Kaitoke S ~1km u/s			Mangaroa R ~2.5 km u/s			Mangaroa R~ 5 km u/s			Whakatikei R ~ 800m u/s		
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, 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	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	8			18, 20			3,18,20			19		

Other influences:													
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Hutt freshwater sites [7] (page 2 of 2)

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
Y = yes
N = no
? = not known

	To what degree is water quality at the bathing site affected, or likely to be affected by:	Hutt R @ Silverstream			Hutt R @ Boulcott			Wainuiomata R @ Richard Prouse Pk		
		FCR09			FCR10			FCR11		
1	Direct discharge of untreated sewage/animal wastes at/upstream of site	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
3	Urban stormwater protected from sewage ingress	0	1	2	0	1	2	0	1	2
4	Discharges from on-site/private sewage systems (eg, septic tanks)	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 (eg, dairying, piggeries)	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
9	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2
10	Incidence and density of birdlife	0	1	2	0	1	2	0	1	2
11	Water craft mooring or use	0	1	2	0	1	2	0	1	2
12	Potential for run-off from feral animals (e.g,. forest or bush)	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)

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Continue below if stream/drain/wetland present, otherwise go to question 23

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:	Mawaihakona S ~600m u/s						Wainuiomata S 60m u/s		
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, septic tanks)	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
16	Urban stormwater protected from sewage ingress	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
18	High intensity agriculture/rural activities, density of feral animal/bird populations	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
20	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	16, 21	3	14,20

	Other influences:									
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?

Wairarapa freshwater sites [12] (page 1 of 3)

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
Y = yes
N = no
? = not known

	To what degree is water quality at the bathing site affected, or likely to be affected by:	Waipoua R @ Colombo Rd			Waingawa R @ Kaituna			Waingawa R @ South Rd			Waiohine R @ Gorge		
		R11			R3			R4			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
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 (eg, 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 (eg, 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 run-off from feral animals (e.g,. forest or bush)	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)

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Continue below if stream/drain/wetland present, otherwise go to question 20

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:	QEII Lake 300m u/s						Tribs. ~200 & 700m u/s					
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, 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	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	7	8,12	8	12

	Other influences:												
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Wairarapa freshwater sites [12] (page 2 of 3)

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
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 @ Double Bridges			Ruamahanga R @ Te Ore Ore			Ruamahanga R @ The Cliffs		
		R8			R1			R2			R5		
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 (eg, 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 (eg, 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 run-off from feral animals (e.g,. forest or bush)	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)

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Continue below if stream/drain/wetland present, otherwise go to question 20

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:				Unnamed trib. ~150m u/s			Henley Lake ~60m u/s			Several tribs. immediately u/s		
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, 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	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	8			8,18, 20			7,16,21			5,7,18,20		

	Other influences:												
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Wairarapa freshwater sites [12] (page 3 of 3)

applies across 'all flows' and 'dry weather' | applies across all flows | applies during 'dry weather' only

Key (questions 1-22):
0 = not present
1 = present, but unlikely to affect water quality
2 = present, and likely to affect water quality

Key (questions 24-26):
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 @ Kokotau			Ruamahanga R @ Morrisons Bush			Ruamahanga R @ Waihenga			Ruamahanga R @ Bentleys Beach		
		R6			R9			R10			R12		
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 (eg, 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 (eg, 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 run-off from feral animals (e.g,. forest or bush)	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)

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Continue below if stream/drain/wetland present, otherwise go to question 20

	Is the water quality of the stream, drain or wetland affected or likely to be affected by:	Unnamed trib. immediately u/s			Unnamed trib. ~800m u/s			Huangarua R ~1.7 km u/s					
14	Discharges of untreated, primary or secondary treated human effluent, on-site/other private sewage systems (eg, 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	Unrestricted stock access to waterways	0	1	2	0	1	2	0	1	2	0	1	2
21	Dense birdlife near the area	0	1	2	0	1	2	0	1	2	0	1	2
22	Potential for run-off from feral animals	0	1	2	0	1	2	0	1	2	0	1	2

23	Of the factors listed 1-22 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-22)	7,18,20			7,18,20			7,18,20			5, 7		

	Other influences:												
24	Does rainfall trigger contamination events?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
25	Does microbial water data ever exceed action guidelines?	Y	N	?	Y	N	?	Y	N	?	Y	N	?
26	Have illnesses ever been notified from this area?	Y	N	?	Y	N	?	Y	N	?	Y	N	?

Kapiti marine sites [20] (page 1 of 4)

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 Rd			Te Horo Beach S of Mangaone Stream			Te Horo Beach @ Kitchener St			Peka Peka Beach @ Road End		
		PH27			PH27a			PH24			PH24a			PH22		
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 (eg, 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 (eg, 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)

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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:	Waitohu S 1.2 km N			Otaki R 1.25 km S			Mangaone S 80m N			Mangaone S 700m N			Stm 800m 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	15, 16			10			16			16			10		
	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) Large rivers to the north of the Kapiti District (eg, Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
3) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach

Kapiti marine sites [20] (page 2 of 4)

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:	Waikanae Beach @ William St			Waikanae Beach @ Tutere St Tennis Courts			Waikanae Beach @ Ara Kuaka Carpark			Paraparaumu Beach @ Ngapotiki St			Paraparaumu Beach @ Nathan Avenue		
		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
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 (eg, 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 (eg, 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)

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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:	Ngarara S 600m S			Ngarara S 400m N			Waikanae R 0.65km S			Waikanae R 0.9 km N			Waikanae R 2 km 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3			15,16			3			15,16			15,16		

	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) Large rivers to the north of the Kapiti District (eg, Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
3) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach

Kapiti marine sites [20] (page 3 of 4)

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	Paraparaumu Beach @ Toru Rd	Paraparaumu Beach @ Wharemauku Rd	Raumati Beach @ Tainui St	Raumati Beach @ Marine Gardens
		PH08	PH07	PH07a	PH06b	PH06a
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 (eg, 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 (eg, 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)

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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:	Tikotu S 80 m N	Tikotu S 700 m N		Wharemauku S 650 m S	Wharemauku S 90 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	15	3	3	3	15,16

	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) Large rivers to the north of the Kapiti District (eg, Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
3) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach

Kapiti marine sites [20] (page 4 of 4)

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:	Raumati Beach @ Aotea Rd	Raumati Beach @ Hydes Rd	Paekakariki Beach @ Whareroa Rd	Paekakariki Beach @ Surf Club	Paekakariki Beach @ Memorial Hall
		PH05	PH04	PH03	PH02	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
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 (eg, 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 (eg, 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)

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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:	Wharemauku S 1 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	3	18	18	10

	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) Large rivers to the north of the Kapiti District (eg, Manawatu R, Rangitikei R) are known to influence water quality at some sites at times, particularly during strong northerlies.
3) Ngarara Stream becomes part of the Waimeha Stream just before discharging onto Waikanae Beach

Porirua marine sites [15] (page 1 of 3)

Key (questions 1-18):	Key (questions 20-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Pukerua Bay	Karehana Bay @ Cluny Rd	Plimmerton Beach @ Bath St	Plimmerton Beach @ Queens Ave	South Beach @ Plimmerton
		11	10	9	8	7
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 (eg, 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 (eg, 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)

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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:	Unnamed Stm 100m W	Unnamed piped Stm 60m W	Taupo Stm 350m S	Taupo Stm 200m S	Taupo Stm 100m 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	15	3,15	3	3	15,16

	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) 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.

Porirua marine sites [15] (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

		Pauatahanui Inlet @ Water Ski Club			Pauatahanui Inlet @ Motukaraka Point			Pauatahanui Inlet @ Browns Bay			Paremata Beach @ Pascoe Ave			Pauatahanui Inlet @ Paremata Bridge		
To what degree is the beach water quality affected, or likely to be affected by:		12			13			14			6					
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 (eg, 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 (eg, 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)

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

		Stms 15m W & 50m E			Unnamed Stm 10m NE & Kakaho Stm 600m NE			Browns Stm 20m E								
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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	15			16			15			3			3		

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) 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.

Porirua marine sites [15] (page 3 of 3)

Key (questions 1-18):	Key (questions 30-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = not known

		Porirua Harbour @ Rowing Club			Titahi Bay @ Bay Drive			Titahi Bay @ Toms Rd			Titahi Bay @ South Beach Access Rd			Onehunga Bay		
To what degree is the beach water quality affected, or likely to be affected by:		5			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	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 (eg, 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 (eg, 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

		Unnamed SStm 7m E			Stm at site			Stm at site			Stm at site					
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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	14			14			14			14			10		

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) 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.

Wellington marine sites [22] (page 1 of 5)

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	Oriental Bay @ Freyberg Beach	Oriental Bay @ Wishing Well	Oriental Bay @ Band Rotunda	Balaena Bay
		R29-090	Q33-057	Q34-114	Q34-113	Q37-036
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 (eg, 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 (eg, 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

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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:					
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	3	3	3	10

	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 ?

Wellington marine sites [22] (page 2 of 5)

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:	Kio Bay			Hataitai Beach			Shark Bay			Mahanga Bay			Scorching Bay		
		O38-045			M36-166			N42-002			P47-001			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
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 (eg, 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 (eg, 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

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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:															
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	3	3	10	10

	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	?

Wellington marine sites [22] (page 3 of 5)

Key (questions 1-18):	Key (questions 20-23):
0 = not present 1 = present, but unlikely to affect water quality 2 = present, and likely to affect water quality	Y = yes N = no ? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Worser Bay			Seatoun Beach @ Wharf			Seatoun Beach @ Inglis St			Breaker Bay			Lyall Bay @ Tirangi Rd		
		K46-034			I46-031			H48-024			F47-002			G37-064		
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 (eg, 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 (eg, 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

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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:															
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	3	3	10	3

	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	?

Wellington marine sites [22] (page 4 of 5)

Key (questions 1-18):	Key (questions 20-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Lyall Bay @ Onepu Rd F34-042			Lyall Bay @ Queens Drive F33-065			Princess Bay B32-016			Island Bay @ Surf Club B27-027			Island Bay @ Reef St Rec Ground B27-026		
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 (eg, 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 (eg, 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

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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:															
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	3	10	3	3

	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	?

Wellington marine sites [22] (page 5 of 5)

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	Island Bay @ Derwent St			Owhiro Bay		
To what degree is the beach water quality affected, or likely to be affected by:		B26-090			B22-018		
1	Direct discharge of untreated sewage onto/adjacent to bathing area	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
3	Urban stormwater protected from sewage ingress	0	1	2	0	1	2
4	Discharges from on-site/other private sewage disposal systems (eg, septic tank)	0	1	2	0	1	2
5	Communal sewage disposal with primary or secondary treatment	0	1	2	0	1	2
6	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2
7	Intensive agricultural landuse in immediate catchment & potential run-off of untreated animal effluent (eg, dairying, piggeries)	0	1	2	0	1	2
8	Incidence & density of birdlife (esp. where lagoons/estuarine conditions exist)	0	1	2	0	1	2
9	Water craft mooring or use	0	1	2	0	1	2
10	Focal points of drainage from low intensity land use	0	1	2	0	1	2
11	Rivers, streams or drains	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:					Owhiro Stream 50m W		
12	Discharges of primary or secondary treated human effluent	0	1	2	0	1	2
13	Communal sewage disposal with tertiary treatment	0	1	2	0	1	2
14	Stormwater outlets with potential sewage contamination	0	1	2	0	1	2
15	Urban stormwater protected from sewage ingress	0	1	2	0	1	2
16	High intensity agriculture, feral animal/bird populations	0	1	2	0	1	2
17	Potential for run-off from feral animals	0	1	2	0	1	2
18	Focal points of drainage from low intensity land use	0	1	2	0	1	2

19	Of the factors listed 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	10	14

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

Hutt marine sites (15) (page 1 of 3)

Key (questions 1-18):	Key (questions 20-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = 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		
		1			2			3			4			5		
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 (eg, 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 (eg, 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)

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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:	Hutt R, 3.7 km E and Korokoro S, 300m E			Hutt R, 2.3 km E			Hutt R 2km E			Hutt R 1km E			Hutt R 1.5 km 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	15			15			15			15			10		
	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	?

Hutt marine sites (15) (page 2 of 3)

Key (questions 1-18):	Key (questions 20-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = not known

	To what degree is the beach water quality affected, or likely to be affected by:	Lowry Bay @ Cheviot Rd	York Bay	Days Bay @ Wellesley College	Days Bay @ Wharf	Days Bay @ Moana Rd
		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
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 (eg, 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 (eg, 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)

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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:	Hutt R 2.5 km N	Hutt R 3 km N	Piped stream 40m S	Piped stream 40m S	Piped stream 80m 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
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3	10	15	15	3

	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 ?

Hutt marine sites (15) (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

		Rona Bay @ Nth end of Cliff Bishop Park			Rona Bay @ Wharf			Robinson Bay @ HW Shortt Rec Ground			Robinson Bay @ Nikau St			Camp Bay		
To what degree is the beach water quality affected, or likely to be affected by:		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 (eg, 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 (eg, 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:																
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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	3			3			3			3			10		

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	?

Wairarapa marine sites [5]

Key (questions 1-18):	Key (questions 20-23):
0 = not present	Y = yes
1 = present, but unlikely to affect water quality	N = no
2 = present, and likely to affect water quality	? = 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 (eg, 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 (eg, 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 17

	To what degree are these rivers, streams or drains affected, or likely to be affected by:	Castlepoint S at site	Smelly Crk at site	Motuwaireka S, 500m S	Motuwaireka S, 50m N	Unnamed S 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 run-off from feral animals	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 1-18 above, which factor has the primary influence on microbiological water quality of the site? (please enter a number 1-18)	18	10	18	10	10

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 ?

Appendix 3: River flow estimation methods

Site name	Corresponding flow site(s) and derivation
Otaki R at Pots	= Otaki River at Pukehinau
Otaki R SH1	= Otaki River at Pukehinau lag (1 hour)
Waikanae R at SH1	= Waikanae River at Water Treatment Plant lag (0.33 hours)
Waikanae R at Jim Cooke Park	= Waikanae River at Water Treatment Plant lag (0.5 hours)
Pakuratahi R at Forks	= Pakuratahi River at Truss Bridge lag (3 hours)
Hutt R at Birchville	= Hutt River at Birchville
Hutt R at Maoribank	= Hutt River at Birchville lag (0.5 hours)
Hutt R at Poets Park	= Hutt River at Birchville lag (0.75 hours)
Hutt R at Silverstream	= Hutt River at Taita Gorge lag (-0.5 hours)
Hutt R at Boulcott	= Hutt River at Taita Gorge lag (1 hour) If Taita Gorge flow <12 m^3/s then Boulcott = Taita Gorge flow * 1.0873 – 1.1234 If Taita Gorge flow ≥ 12 m^3/s Boulcott = Taita Gorge flow * 1.1122 – 1.9398
Wainuiomata R at Richard Prouse Pk	= Wainuiomata River at Manuka Track lag (0.5 hours)
Waipoua R at Colombo Rd	= Mikimiki lag (3 hours) * 1.547 - 0.2754
Waingawa R at Kaituna	= Waingawa River at Kaituna
Waingawa R at South Rd	= Waingawa River at Kaituna lag (1.5 hours) * 1.3743 – 0.914
Waiohine R at Gorge	= Waiohine River at Gorge
Waiohine R at SH2	= Waiohine River at Gorge lag (3 hours) * 1.057 – 1.69
Ruamahanga R at Double Bridges	= Ruamahanga River at Mt Bruce lag (2 hours)
Ruamahanga R at Te Ore Ore	= ((Ruamahanga River at Mt Bruce lag [3 hours] + Ruamahanga River at Wardells lag [-1 hours]) / 2) * 1.308 – 1.218
Ruamahanga R at Cliffs	= Waingawa River at Kaituna lag (2.7 hours) * 1.3 + Ruamahanga River at Wardells lag (0.7 hours)
Ruamahanga R at Kokotau	= Waingawa River at Kaituna lag (4 hours) * 1.3 + Ruamahanga River at Wardells lag (2.0 hours)
Ruamahanga R at Morrisons Bush	= Ruamahanga River at Waihenga Bridge lag (-1.5 hours)
Ruamahanga R at Waihenga	= Ruamahanga River at Waihenga Bridge
Ruamahanga R at Bentleys Beach	= Ruamahanga River at Waihenga Bridge lag (3 hours)

Appendix 4: Water quality results, 2006/07–2010/11 summers

(a) Recreational water quality in fresh waters

Summary of *E. coli* counts obtained from routine weekly monitoring over the 2006/07 to 2010/11 summer bathing seasons against the MfE/MoH (2003) surveillance, alert and action levels for freshwater recreational areas (see Greenfield et al. (2012) for more information).

(i) Kapiti Coast

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
OTAKI RIVER AT THE POTS								
2006/07	5	100.0	0	0.0	0	0.0	5	100
2007/08	5	100.0	0	0.0	0	0.0	5	100
2008/09	5	100.0	0	0.0	0	0.0	5	100
2009/10	5	100.0	0	0.0	0	0.0	5	100
2010/11	5	100.0	0	0.0	0	0.0	5	100
Total	25	100.0	0	0.0	0	0.0	25	
OTAKI RIVER AT SH 1								
2006/07	19	90.5	2	9.5	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	99	96.1	3	2.9	1	1.0	103	
WAIKANAE RIVER AT SH 1								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	96	93.2	4	3.9	3	2.9	103	
WAIKANAE RIVER AT JIM COOKE PARK								
2006/07	NS	-	NS	-	NS	-	-	-
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	19	90.5	1	4.8	1	4.8	21	100
2009/10	17	85.0	2	10.0	1	5.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	76	92.7	4	4.9	2	2.4	82	

(ii) Hutt River catchment

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PAKURATAHI RIVER AT FORKS								
2006/07	19	90.5	0	0.0	2	9.5	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	18	85.7	1	4.8	2	9.5	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	94	91.3	3	2.9	6	5.8	103	

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
HUTT RIVER AT BIRCHVILLE								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	18	85.7	1	4.8	2	9.5	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	93	90.3	3	2.9	7	6.8	103	
HUTT RIVER AT MAORIBANK CORNER								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	18	85.7	1	4.8	2	9.5	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	92	89.3	3	2.9	8	7.8	103	
HUTT RIVER AT POETS PARK								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	19	90.5	0	0.0	2	9.5	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	96	93.2	3	2.9	4	3.9	103	
HUTT RIVER AT SILVERSTREAM								
2006/07	18	85.7	0	0.0	3	14.3	21	100
2007/08	18	85.7	2	9.5	1	4.8	21	100
2008/09	15	71.4	2	9.5	4	19.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	88	85.4	5	4.9	10	9.7	103	
HUTT RIVER AT BOULCOTT								
2006/07	18	85.7	0	0.0	3	14.3	21	100
2007/08	12	57.1	6	28.6	3	14.3	21	100
2008/09	18	85.7	0	0.0	3	14.3	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	85	82.5	6	5.8	12	11.7	103	
WAINUIOMATA RIVER AT RICHARD PROUSE PARK								
2006/07	NS	-	NS	-	NS	-	-	-
2007/08	18	85.7	1	4.8	2	9.5	21	100
2008/09	17	81.0	0	0.0	4	19.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	17	85.0	2	10.0	1	5.0	20	100
Total	71	86.6	3	3.7	8	9.8	82	

(iii) Wairarapa – Ruamahanga River

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
RUAMAHANGA RIVER AT DOUBLE BRIDGES								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	98	95.1	1	1.0	4	3.9	103	

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
RUAMAHANGA RIVER AT TE ORE ORE								
2006/07	15	71.4	1	4.8	5	23.8	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	90	87.4	4	3.9	9	8.7	103	
RUAMAHANGA RIVER AT THE CLIFFS								
2006/07	19	90.5	0	0.0	2	9.5	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	96	93.2	2	1.9	5	4.9	103	
RUAMAHANGA RIVER AT KOKOTAU								
2006/07	17	81.0	2	9.5	2	9.5	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	16	80.0	1	5.0	3	15.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	90	87.4	4	3.9	9	8.7	103	
RUAMAHANGA RIVER AT MORRISONS BUSH								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	18	85.7	2	9.5	1	4.8	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	93	90.3	6	5.8	4	3.9	103	
RUAMAHANGA RIVER AT WAIHENGA								
2006/07	19	90.5	0	0.0	2	9.5	21	100
2007/08	18	85.7	2	9.5	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	93	90.3	3	2.9	7	6.8	103	
RUAMAHANGA RIVER AT BENTLEYS BEACH								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	18	85.7	1	4.8	2	9.5	21	100
2008/09	19	90.5	1	4.8	1	4.8	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	91	88.3	5	4.9	7	6.8	103	

(iv) Wairarapa cont...

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
WAIPOUA RIVER AT COLOMBO ROAD								
2006/07	18	85.7	2	9.5	1	4.8	21	100
2007/08	18	85.7	2	9.5	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	17	85.0	0	0.0	3	15.0	20	100
Total	93	90.3	4	3.9	6	5.8	103	

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
WAINGAWA RIVER AT KAITUNA								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	100	97.1	2	1.9	1	1.0	103	
WAINGAWA RIVER AT SOUTH ROAD								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
WAIOHINE RIVER AT GORGE								
2006/07	5	100.0	0	0.0	0	0.0	5	100
2007/08	5	100.0	0	0.0	0	0.0	5	100
2008/09	5	100.0	0	0.0	0	0.0	5	100
2009/10	5	100.0	0	0.0	0	0.0	5	100
2010/11	4	80	0	0	1	20	5	100
Total	24	96.0	0	0.0	1	4.0	25	
WAIOHINE RIVER AT SH 2								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	101	98.1	0	0.0	2	1.9	103	

(b) Recreational water quality in coastal waters

Summary of enterococci counts obtained from routine weekly monitoring over the 2006/07 to 2010/11 summer bathing seasons against the MfE/MoH (2003) surveillance, alert and action levels for coastal recreational waters.

(i) Kapiti Coast

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
OTAKI BEACH AT SURF CLUB								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	2	1.9	4	3.9	103	
OTAKI BEACH AT RANGIURU ROAD								
2006/07	19	90.5	0	0.0	2	9.5	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	1	1.0	4	3.9	103	

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
TE HORO BEACH SOUTH OF MANGAONE STREAM								
2006/07	16	76.2	4	19.0	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	16	80.0	2	10.0	2	10.0	20	100
Total	90	87.4	6	5.8	7	6.8	103	
TE HORO BEACH AT KITCHENER STREET								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	97	94.2	1	1.0	5	4.9	103	
PEKA PEKA BEACH								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	99	96.1	1	1.0	3	2.9	103	
WAIKANAE BEACH AT WILLIAM STREET								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	99	96.1	2	1.9	2	1.9	103	
WAIKANAE BEACH AT TUTERE STREET TENNIS COURTS								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	99	96.1	2	1.9	2	1.9	103	
WAIKANAE BEACH AT ARA KUAKA CARPARK								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
PARAPARAUMU BEACH AT NGAPOTIKI STREET								
2006/07	18	85.7	2	9.5	1	4.8	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	95	92.2	5	4.9	3	2.9	103	
PARAPARAUMU BEACH AT NATHAN AVENUE								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	18	85.7	1	4.8	2	9.5	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	96	93.2	4	3.9	3	2.9	103	
PARAPARAUMU BEACH AT MACLEAN PARK								
2006/07	19	90.5	0	0.0	2	9.5	21	100
2007/08	19	90.5	2	9.5	0	0.0	21	100
2008/09	19	90.5	2	9.5	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	94	91.3	6	5.8	3	2.9	103	
PARAPARAUMU BEACH AT TORU ROAD								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	98	95.1	2	1.9	3	2.9	103	
PARAPARAUMU BEACH AT WHAREMAUKU ROAD								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	2	9.5	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	17	85.0	3	15.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	5	4.9	1	1.0	103	
RAUMATI BEACH AT TAINUI STREET								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
RAUMATI BEACH AT MARINE GARDENS								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	19	90.5	2	9.5	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	95	92.2	3	2.9	5	4.9	103	
RAUMATI BEACH AT AOTEA STREET								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	18	90.0	2	10.0	0	0.0	20	100
Total	98	95.1	3	2.9	2	1.9	103	
RAUMATI BEACH AT HYDES ROAD								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	2	9.5	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	98	95.1	4	3.9	1	1.0	103	
PAEKAKARIKI BEACH AT WHAREROA ROAD								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	1	1.0	0	0.0	103	
PAEKAKARIKI BEACH AT SURF CLUB								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	101	98.1	0	0.0	2	1.9	103	
PAEKAKARIKI BEACH AT MEMORIAL HALL								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	102	99.0	1	1.0	0	0.0	103	

(ii) Porirua city

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PUKERUA BAY								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	1	1.0	5	4.9	103	
KAREHANA BAY								
2006/07	18	85.7	2	9.5	1	4.8	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	17	81.0	2	9.5	2	9.5	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	93	90.3	5	4.9	5	4.9	103	
PLIMMERTON BEACH AT BATH STREET								
2006/07	18	85.7	1	4.8	2	9.5	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	19	90.5	0	0.0	2	9.5	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	94	91.3	3	2.9	6	5.8	103	
PLIMMERTON BEACH AT QUEENS AVENUE								
2006/07	18	85.7	1	4.8	2	9.5	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	19	90.5	1	4.8	1	4.8	21	100
2009/10	NS	-	NS	-	NS	-	-	-
2010/11	NS	-	NS	-	NS	-	-	-
Total	57	90.5	3	4.8	3	4.8	63	
SOUTH BEACH AT PLIMMERTON								
2006/07	16	76.2	2	9.5	3	14.3	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	16	76.2	2	9.5	3	14.3	21	100
2009/10	13	65.0	3	15.0	4	20.0	20	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2010/11	16	80.0	1	5.0	3	15.0	20	100
Total	81	78.6	8	7.8	14	13.6	103	
PAUATAHANUI INLET AT WATER SKI CLUB								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	16	76.2	2	9.5	3	14.3	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	17	85.0	3	15.0	0	0.0	20	100
Total	93	90.3	5	4.9	5	4.9	103	
PAUATAHANUI INLET AT MOTUKARAKA POINT								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	17	81.0	3	14.3	1	4.8	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	93	90.3	7	6.8	3	2.9	103	
PAUATAHANUI INLET AT BROWNS BAY								
2006/07	16	76.2	4	19.0	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	15	71.4	4	19.0	2	9.5	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	9	90.0	0	0.0	1	10.0	10	100
Total	79	84.9	8	8.6	6	6.5	93	
PAUATAHANUI – PAREMATA BRIDGE								
2006/07	NS	-	NS	-	NS	-	-	-
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	18	94.7	0	0.0	1	5.3	19	100
Total	79	97.5	0	0.0	2	2.5	81	100
PAREMATA BEACH AT PASCOE AVENUE								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	18	85.7	2	9.5	1	4.8	21	100
2009/10	NS	-	NS	-	NS	-	-	-
2010/11	NS	-	NS	-	NS	-	-	-
Total	58	92.1	2	3.2	3	4.8	63	
PORIRUA HARBOUR AT THE ROWING CLUB								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	17	81.0	1	4.8	3	14.3	21	100
2008/09	13	61.9	3	14.3	5	23.8	21	100
2009/10	16	80.0	1	5.0	3	15.0	20	100
2010/11	12	60.0	2	10.0	6	30.0	20	100
Total	78	75.7	8	7.8	17	16.5	103	
TITAHI BAY AT BAY DRIVE								
2006/07	18	85.7	2	9.5	1	4.8	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	18	85.7	2	9.5	1	4.8	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	17	85.0	0	0.0	3	15.0	20	100
Total	90	87.4	5	4.9	8	7.8	103	
TITAHI BAY AT TOMS ROAD								
2006/07	18	85.7	1	4.8	2	9.5	21	100
2007/08	18	85.7	2	9.5	1	4.8	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	94	91.3	3	2.9	6	5.8	103	
TITAHI BAY AT SOUTH BEACH ACCESS ROAD								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	2	9.5	0	0.0	21	100
2008/09	18	85.7	0	0.0	3	14.3	21	100
2009/10	15	75.0	1	5.0	4	20.0	20	100
2010/11	13	65.0	2	10.0	5	25.0	20	100
Total	84	81.6	6	5.8	13	12.6	103	
ONEHUNGA BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	1	1.0	0	0.0	103	

(iii) Wellington city

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
AOTEA LAGOON								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	18	85.7	0	0.0	3	14.3	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	2	10.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	2	1.9	4	3.9	103	
ORIENTAL BAY AT FREYBERG BEACH								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	0	0.0	1	1.0	103	
ORIENTAL BAY AT WISHING WELL								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	18	85.7	1	4.8	2	9.5	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	97	94.2	4	3.9	2	1.9	103	
ORIENTAL BAY AT BAND ROTUNDA								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
BALAENA BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
KIO BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	NS	-	NS	-	NS	-	-	-
2010/11	NS	-	NS	-	NS	-	-	-
Total	62	98.4	1	1.6	0	0.0	63	
HATAITAI BEACH								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	103	100.0	0	0.0	0	0.0	103	
SHARK BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	18	90.0	1	5.0	1	5.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
MAHANGA BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	0	0.0	1	1.0	103	
SCORCHING BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
WORSER BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
SEATOUN BEACH AT WHARF								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
SEATOUN BEACH AT INGLIS STREET								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
BREAKER BAY								
2006/07	11	100.0	0	0.0	0	0.0	11	100
2007/08	11	100.0	0	0.0	0	0.0	11	100
2008/09	11	100.0	0	0.0	0	0.0	11	100
2009/10	10	100.0	0	0.0	0	0.0	10	100
2010/11	10	100.0	0	0.0	0	0.0	10	100
Total	53	100.0	0	0.0	0	0.0	53	
LYALL BAY AT TIRANGI ROAD								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	99	96.1	1	1.0	3	2.9	103	
LYALL BAY AT ONEPU ROAD								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	101	98.1	1	1.0	1	1.0	103	
LYALL BAY AT QUEENS DRIVE								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	1	1.0	0	0.0	103	
PRINCESS BAY								
2006/07	11	100.0	0	0.0	0	0.0	11	100
2007/08	11	100.0	0	0.0	0	0.0	11	100
2008/09	11	100.0	0	0.0	0	0.0	11	100
2009/10	10	100.0	0	0.0	0	0.0	10	100
2010/11	10	100.0	0	0.0	0	0.0	10	100
Total	53	100.0	0	0.0	0	0.0	53	
ISLAND BAY AT SURF CLUB								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	1	1.0	5	4.9	103	
ISLAND BAY AT REEF STREET REC GROUND								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	1	1.0	4	3.9	103	
ISLAND BAY AT DERWENT STREET								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	1	4.8	0	0.0	21	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	1	1.0	0	0.0	103	
OWHIRO BAY								
2006/07	18	85.7	3	14.3	0	0.0	21	100
2007/08	17	81.0	1	4.8	3	14.3	21	100
2008/09	19	90.5	0	0.0	2	9.5	21	100
2009/10	8	40.0	3	15.0	9	45.0	20	100
2010/11	14	70.0	4	20.0	2	10.0	20	100
Total	76	73.8	11	10.7	16	15.5	103	

(iv) Hutt city

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
PETONE BEACH AT WATER SKI CLUB								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	97	94.2	1	1.0	5	4.9	103	
PETONE BEACH AT SYDNEY STREET								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	0	0.0	2	10.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	96	93.2	0	0.0	7	6.8	103	
PETONE BEACH AT SETTLERS MUSEUM								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	20	95.2	1	4.8	0	0.0	21	100
2009/10	19	95.0	1	5.0	0	0.0	20	100
2010/11	18	90.0	0	0.0	2	10.0	20	100
Total	95	92.2	3	2.9	5	4.9	103	
PETONE BEACH AT KIOSK								
2006/07	19	90.5	1	4.8	1	4.8	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	2	10.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	96	93.2	4	3.9	3	2.9	103	
SORRENTO BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	17	85.0	3	15.0	0	0.0	20	100
Total	98	95.1	3	2.9	2	1.9	103	
LOWRY BAY								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	18	85.7	0	0.0	3	14.3	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	0	0.0	5	4.9	103	
YORK BAY								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	2	1.9	3	2.9	103	
DAYS BAY AT WELLESLEY COLLEGE								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	19	90.5	0	0.0	2	9.5	21	100
2008/09	20	95.2	0	0.0	1	4.8	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	0	0.0	5	4.9	103	
DAYS BAY AT WHARF								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	18	85.7	0	0.0	3	14.3	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	98	95.1	0	0.0	5	4.9	103	
DAYS BAY AT MOANA ROAD								
2006/07	19	90.5	2	9.5	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	2	10.0	0	0.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	97	94.2	5	4.9	1	1.0	103	
RONA BAY AT NORTH END OF CLIFF BISHOP PARK								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	17	85.0	1	5.0	2	10.0	20	100
2010/11	19	95.0	0	0.0	1	5.0	20	100
Total	97	94.2	1	1.0	5	4.9	103	
RONA BAY AT WHARF								
2006/07	19	90.5	2	9.5	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	17	85.0	1	5.0	2	10.0	20	100
Total	94	91.3	5	4.9	4	3.9	103	
ROBINSON BAY AT HW SHORTT REC GROUND								
2006/07	18	85.7	0	0.0	3	14.3	21	100
2007/08	17	81.0	1	4.8	3	14.3	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	16	80.0	2	10.0	2	10.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	92	89.3	3	2.9	8	7.8	103	
ROBINSON BAY AT NIKAU STREET								
2006/07	20	95.2	1	4.8	0	0.0	21	100
2007/08	19	90.5	1	4.8	1	4.8	21	100

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	20	100.0	0	0.0	0	0.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	100	97.1	2	1.9	1	1.0	103	
CAMP BAY								
2006/07	10	90.9	0	0.0	1	9.1	11	100
2007/08	11	100.0	0	0.0	0	0.0	11	100
2008/09	11	100.0	0	0.0	0	0.0	11	100
2009/10	5	100.0	0	0.0	0	0.0	5	100
2010/11	5	9.1	0	0.0	0	0.0	5	100
Total	42	97.7	0	0.0	1	2.3	43	

(v) Wairarapa

Bathing season	Surveillance		Alert		Action		Total	
	No.	%	No.	%	No.	%	No.	%
CASTLEPOINT BEACH AT CASTLEPOINT STREAM								
2006/07	19	90.5	2	9.5	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	19	90.5	1	4.8	1	4.8	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	97	94.2	4	3.9	2	1.9	103	
CASTLEPOINT BEACH AT SMELLY CREEK								
2006/07	20	95.2	0	0.0	1	4.8	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	18	90.0	1	5.0	1	5.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
RIVERSDALE BEACH AT LAGOON MOUTH								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	20	95.2	0	0.0	1	4.8	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	19	95.0	1	5.0	0	0.0	20	100
Total	100	97.1	1	1.0	2	1.9	103	
RIVERSDALE BEACH BETWEEN THE FLAGS								
2006/07	21	100.0	0	0.0	0	0.0	21	100
2007/08	21	100.0	0	0.0	0	0.0	21	100
2008/09	21	100.0	0	0.0	0	0.0	21	100
2009/10	19	95.0	0	0.0	1	5.0	20	100
2010/11	20	100.0	0	0.0	0	0.0	20	100
Total	102	99.0	0	0.0	1	1.0	103	
RIVERSDALE BEACH SOUTH								
2006/07	10	100.0	0	0.0	0	0.0	10	100
2007/08	11	100.0	0	0.0	0	0.0	11	100
2008/09	11	100.0	0	0.0	0	0.0	11	100
2009/10	12	100.0	0	0.0	0	0.0	12	100
2010/11	10	100.0	0	0.0	0	0.0	10	100
Total	54	100.0	0	0.0	0	0.0	54	

Appendix 5: Comparison of SIC, MAC and SFRG grades between periods 2001/02–2005/06 and 2006/07–2010/11

(a) Freshwater sites

Bathing site	SIC grade		MAC grade		SFRG	
	2001/02 – 2005/06	2006/07– 2010/11	2001/02– 2005/06	2006/07– 2010/11	2001/02– 2005/06	2006/07– 2010/11
Kapiti						
Otaki R @ Pots	Low	Low	B(196)	A (85)[1]	Good	Very Good[1]
Otaki R @ SH 1	Moderate	Moderate	C(340)	B (234)	Fair	Good
Waikanae R @ SH 1	Moderate	Moderate	D(789)	C (353)	Poor	Fair
Waikanae R @ Jim Cooke Park	–	Moderate	–	C (370)[2]	–	Fair[2]
Hutt & Wainuiomata						
Pakuratahi R @ Forks	Moderate	Moderate	D(645)	D (637)	Poor	Poor
Hutt R @ Birchville	Moderate	Moderate	D(1,215)	D (779)	Poor	Poor
Hutt R @ Maoribank Corner	Moderate	Moderate	D(724)	D (1,127)	Poor	Poor
Hutt R @ Poets Park	Moderate	Low	D(666)	C (422)	Poor	Fair
Hutt R @ Silverstream	Moderate	Moderate	D(1,120)	D (860)	Poor	Poor
Hutt R @ Boulcott	Moderate	Moderate	D(1,415)	D (1,345)	Poor	Poor
Wainuiomata R @ RP Park	–	Moderate	–	D (716) [1]	–	Poor[1]
Wairarapa						
Ruamahanga R @ Double	Mod/High	Moderate	D(618)	C (326)	Poor	Fair
Ruamahanga R @ Te Ore Ore	High	High	D(1,700)	D (1,066)	Very poor	Very Poor
Ruamahanga R @ The Cliffs	High	High	D(1,589)	C (523)	Very poor	Poor
Ruamahanga R @ Kokotau	High	High	D(2,533)	D (1,000)	Very poor	Very Poor
Ruamahanga R @ Morrisons	High	High	D(1,209)	C (500)	Very poor	Poor
Ruamahanga R @ Waihenga	High	High	D(1,571)	D (614)	Very poor	Very Poor
Ruamahanga R @ Bentleys	High	High	D(1,233)	D (567)	Very poor[5]	Very Poor
Waipoua R @ Colombo Rd	High	High	D(1,244)	D (775)	Very Poor[5]	Very poor
Waingawa R @ Kaituna	Low	Low/mod	B(238)	B (171)	Good	Good
Waingawa R @ South Rd	Moderate	Low/mod	C(349)	A (113)	Fair	Good
Waiohine R @ Gorge (Gauge)	Low	Low	A(114)	A (87)[1]	Very good	Very good[1]
Waiohine R @ SH 2	Moderate	Low/mod	B(134)	A (76)	Good	Good

(b) Coastal sites

Bathing site	SIC grade		MAC grade		SFRG	
	2001/02– 2005/06	2006/07– 2010/11	2001/02– 2005/06	2006/07– 2010/11	2001/02– 2005/06	2006/07– 2010/11
Kapiti						
Otaki Beach @ Surf Club	Low	Moderate	B (110)	C (273)	Good	Fair
Otaki Beach @ Rangiuru Rd	Low	Low	B (187)	B (185)	Good	Good
Te Horo Beach S of Mangaone Strm	Moderate	Moderate	C (408)	C (450)	Fair	Fair
Te Horo Beach @ Kitchener St	Moderate	Moderate	C (252)	C (298)	Fair	Fair
Peka Peka Beach @ Rd End	Low	Low	B (102)	B (117)	Good	Good
Waikanae Beach @ William St	Moderate	Moderate	B (167)	B (114)	Good	Good
Waikanae Beach @ Tutere St T.C.	Moderate	Moderate	B (135)	B (113)	Good	Good
Waikanae Beach @ Ara Kuaka C.P.	Moderate	Moderate	C (236)	B (115)	Fair	Good
Paraparaumu Beach @ Ngapotiki St	Moderate	Moderate	C (340)	B (196)	Fair	Good
Paraparaumu Beach @ Nathan Ave	Moderate	Moderate	C (343)	B (185)	Fair	Good
Paraparaumu Beach @ Maclean Pk	Moderate	Moderate	C (248)	B (187)	Fair	Good

Bathing site	SIC grade		MAC grade		SFRG	
	2001/02–2005/06	2006/07–2010/11	2001/02–2005/06	2006/07–2010/11	2001/02–2005/06	2006/07–2010/11
Paraparaumu Beach @ Toru Rd	Moderate	Moderate	C (333)	B (168)	Fair	Good
Paraparaumu Beach @ Wharemauku Rd	Moderate	Moderate	C (238)	B (162)	Fair	Good
Raumati Beach @ Tainui St	Moderate	Moderate	C (259)	B (118)	Fair	Good
Raumati Beach @ Marine Gardens	Moderate	Moderate	C (238)	C (268)	Fair	Fair
Raumati Beach @ Aotea Rd	Low/Mod	Moderate	B (138)	B (144)	Good	Good
Raumati Beach @ Hydes Rd	Moderate	Moderate	C (246)	B (110)	Fair	Good
Paekakariki Beach @ Whareroa Rd	Low	Low	B (113)	B (72)	Good	Good
Paekakariki Beach @ Surf Club	Low	Low	B (67)	B (64)	Good	Good
Paekakariki Beach @ Memorial Hall	Low	Low	B (68)	A (40)	Good	Very good
Porirua						
Pukerua Bay	Low	Moderate	B (113)	C (321)	Good	Fair
Karehana Bay @ Cluny Rd	Moderate	Moderate	B (188)	C (297)	Good	Fair
Plimmerton Beach @ Bath St	Moderate	Moderate	D (502)	C (317)	Poor	Fair
Plimmerton Beach @ Queens Ave	Moderate	Moderate	C (204)	C (206)	Fair	Fair[1]
South Beach @ Plimmerton	Moderate	Moderate	D (811)	D (692)	Poor	Poor
Pauatahanui Inlet @ Water Ski Club	Moderate	Moderate	C (344)	C (283)	Fair	Fair
Pauatahanui Inlet @ Motukaraka Pt	Moderate	Moderate	B (191)	C (215)	Good	Fair
Pauatahanui Inlet @ Browns Bay	Moderate	Moderate	D (632)	D (555)	Poor[2]	Poor
Pauatahanui Inlet @ Paremata Bridge	Moderate	Moderate	-	B (124)	-	Good[3]
Paremata Beach @ Pascoe Ave	Moderate	Moderate	C (490)	B (199)	Fair	Good[1]
Porirua Harbour @ Rowing Club	Moderate	Moderate	D (918)	D (1,340)	Poor	Poor
Titahi Bay @ Bay Drive	Moderate	Moderate	D (962)	C (370)	Poor	Fair
Titahi Bay @ Toms Rd	Moderate	Moderate	C (309)	C (328)	Fair	Fair
Titahi Bay @ South Beach Access Rd	Moderate	Moderate	C (361)	D (598)	Fair	Poor
Onehunga Bay	Moderate	Low	D (563)	B (70)	Poor	Good
Wellington city						
Aotea Lagoon	Moderate	Moderate	B (115)	B (184)	Good	Good
Oriental Bay @ Freyberg Beach	Moderate	Moderate	B (169)	B (59)	Good	Good
Oriental Bay @ Wishing Well	Moderate	Moderate	C (413)	B (200)	Fair	Good
Oriental Bay @ Band Rotunda	Moderate	Moderate	C (285)	B (123)	Fair	Good
Balaena Bay	Low	Low	B (42)	A (32)	Good	Very good
Kio Bay	Low	Moderate	B (126)	B (120)	Good	Good[1]
Hataitai Beach	Moderate	Moderate	C (232)	B (49)	Fair	Good
Shark Bay	Low	Moderate	B (68)	B (71)	Good	Good
Mahanga Bay	Low	Low	B (191)	B (54)	Good	Good
Scorching Bay	Low	Low	B (58)	A (32)	Good	Very good
Worser Bay	Low	Moderate	B (46)	B (41)	Good	Good
Seatoun Beach @ Wharf	Low/Mod	Moderate	B (110)	B (63)	Good	Good
Seatoun Beach @ Inglis St	Low/Mod	Moderate	B (95)	B (78)	Good	Good
Breaker Bay	Very Low	Low	B (80)	A (8)	Very good	Very good
Lyall Bay @ Tirangi Rd	Moderate	Moderate	B (182)	B (131)	Good	Good
Lyall Bay @ Onepu Rd	Moderate	Moderate	B (85)	A (39)	Good	Good[4]
Lyall Bay @ Queens Drive	Moderate	Moderate	B (78)	A (32)	Good	Good[4]
Princess Bay	Low	Low	A (37)	A (4)	Very good	Very good
Island Bay @ Surf Club	Moderate	Moderate	B (153)	C (271)	Good	Fair
Island Bay @ Reef St Recreation Grd	Moderate	Moderate	B (172)	B (148)	Good	Good
Island Bay @ Derwent St	Moderate	Moderate	–	A (29)	–	Good[4]
Owhiro Bay	Moderate	Moderate	C (232)	D (618)	Fair	Poor
Hutt						
Petone Beach @ Water Ski Club	Moderate	Moderate	C (283)	C (219)	Fair	Fair
Petone Beach @ Sydney St	Moderate	Moderate	C (375)	C (466)	Fair	Fair
Petone Beach @ Settlers Museum	Moderate	Moderate	B (158)	C (265)	Good	Fair
Petone Beach @ Kiosk	Moderate	Moderate	B (124)	C (204)	Good	Fair

Bathing site	SIC grade		MAC grade		SFRG	
	2001/02–2005/06	2006/07–2010/11	2001/02–2005/06	2006/07–2010/11	2001/02–2005/06	2006/07–2010/11
Sorrento Bay	Low	Low	B (102)	B (110)	Good	Good
Lowry Bay @ Cheviot Rd	Low	Moderate	C (283)	C (210)	Fair	Fair
York Bay	Low	Low	B (89)	B (137)	Good	Good
Days Bay @ Wellesley College	Low	Moderate	B (85)	C (248)	Good	Fair
Days Bay @ Wharf	Low	Moderate	B (140)	C (220)	Good	Fair
Days Bay @ Moana Rd	Low	Moderate	B (122)	B (175)	Good	Good
Rona Bay @ N end of Cliff Bishop Pk	Low/Mod	Moderate	C (342)	C (219)	Fair	Fair
Rona Bay @ Wharf	Low/Mod	Moderate	C (215)	C (272)	Fair	Fair
Robinson Bay @ HW Shortt Rec Grd	Low	Moderate	C (235)	D (693)	Fair	Poor
Robinson Bay @ Nikau St	Low	Moderate	B (172)	B (103)	Good	Good
Camp Bay	Very Low	Low	B (122)	B (62)	Very good	Good
Wairarapa						
Castlepoint Beach @ Castlepoint Strm	Moderate	Moderate	C (233)	B (150)	Fair	Good
Castlepoint Beach @ Smelly Creek	Moderate	Low	B (163)	A (39)	Good	Very good
Riversdale Beach @ Lagoon Mouth	Moderate	Moderate	B (134)	B (72)	Good	Good
Riversdale Beach Between the Flags	Low	Low	B (90)	A (24)	Good	Very good
Riversdale Beach South	Very Low	Low	B (42)	A (12)	Very good	Very good

Water, air, earth and energy – elements in Greater Wellington's logo that combine to create and sustain life. Greater Wellington promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, cultural and social needs of the community

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