

# Bathing Beach Recreational Water Quality

State of the Environment

Annual Report

2019-2020

Technical Report 2020-82



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## Executive summary

This report provides an assessment of microbial water quality at 12 coastal bathing beach sites in the Taranaki region, based on summer monitoring of faecal indicator bacteria conducted by the Council between November 2019 and March 2020. The report focusses on enterococci results, as this indicator is considered by health authorities to provide the closest correlation with risks of health effects in New Zealand coastal waters. Results have been assessed for compliance with microbiological water quality guidelines prepared by the Ministry for the Environment (MfE) and the Ministry of Health (MfE, 2003).

Eleven samples were collected at every monitored beach under dry weather conditions for State of the Environment Monitoring (SEM) purposes, except when it was unsafe to do so. This was two less than normal due to the COVID pandemic and associated lockdown restrictions. At eight of the ten coastal sites monitored every year, an extra eight samples were collected to satisfy MfE requirements for the number of seasonal samples to be used for grading purposes and to provide more timely results during the holiday periods. Follow up samples were often collected following instances where enterococci counts exceeded 140 cfu/100 ml.

Microbiological water quality results were regularly reported on the Taranaki Regional Council website ([www.trc.govt.nz](http://www.trc.govt.nz)) and there was timely liaison with territorial local authorities and the Health Protection Unit of the Taranaki District Health Board throughout the summer bathing season of 2019-2020.

The normal mode of monitoring is deemed the 'Surveillance' mode. Additional monitoring is considered if a sample exceeds the 'Alert' mode (140 cfu/100 ml). The 'Action' mode guideline is reached when enterococci counts in two consecutive samples exceed 280 enterococci cfu/100 ml, and requires public notification by health authorities.

During the 2019-2020 summer season, 196 routine samples were collected across 12 sites; of which 94.9% remained within Surveillance mode ( $\leq 140$  cfu/100 ml), and 5.1% (ten samples) reached Alert mode ( $> 140$  cfu/100 ml). Nine out of the ten samples that reached Alert mode were collected during three surveys that were carried out shortly after rainfall. There were no Action mode events during the year under review. No anomalous or persistent water quality issues were identified during the season.

Based on all routine sample results, Opunake Beach, Oakura Beach (at the camp ground) and Fitzroy Beach had the highest water quality (median enterococci counts ranging from 1 - 4 cfu/100 ml). Oakura Beach (at the surf club), Back Beach and Onaero Beach had the lowest water quality (median enterococci counts ranging from 18 – 28 cfu/100 ml). The key difference between these sites is their proximity to potential sources of faecal contamination such as rivers, streams and stormwater outlets. The stream and river mouths that occur near Oakura Beach (at the surf club), Back Beach and Onaero Beach can potentially have a significant influence on coastal water quality, particularly after heavy rainfall.

Mann-Kendall tests were performed on the SEM samples in order to assess long-term trends in microbiological water quality. One site, Fitzroy Beach, showed a significant decrease in median enterococci counts (improving quality) over the 25 years it has been monitored, indicating an overall improvement in microbiological water quality. Slight decreases in median enterococci counts were found at another seven sites, although these trends were not statistically significant. Similarly, trend analyses found slight increasing trends in median enterococci counts at two sites that were not statistically significant. Overall, based on SEM samples, recreational water quality across the region was generally comparable with previous years.

Through the Council's Long Term Plan (LTP), the Council's target in respect of the microbiological state of coastal bathing sites is that there is maintenance or increase in the number of annual monitoring sites from the 2003-2004 summer that are compliant with the contact recreational guidelines (MfE, 2003). In the 2003-2004 summer, seven of the nine coastal bathing sites were compliant with the guidelines (Action levels). No sites exceeded this guideline in the season under review. The LTP target was therefore met.

Continuation of the Bathing Beach Recreational Water Quality Programme in the 2020-2021 year is recommended.

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# 1 Introduction

## 1.1 General

The Resource Management Act 1991 (RMA) established new requirements for local authorities to undertake environmental monitoring. Section 35 of the RMA requires local authorities to monitor, among other matters, the state of the environment of their region or district, to the extent that is appropriate to enable them to effectively carry out their functions under the Act.

To this effect, the Taranaki Regional Council ('the Council') has established a state of the environment monitoring (SEM) programme for the region. This programme is outlined in the Council's 'State of the Environment Monitoring Procedures Document', which was prepared in 1997. The monitoring programme is based on the significant resource management issues that were identified in the Council's Regional Policy Statement for Taranaki (1994).

The SEM programme is made up of a number of individual monitoring activities, many of which are undertaken and managed on an annual basis (from 1 July to 30 June). For these annual monitoring activities, summary reports are produced following the end of each monitoring year (i.e., after 30 June). Where possible, individual consent monitoring programmes have been integrated within the SEM programme to save duplication of effort and minimise costs. The purpose of annual SEM reports is to summarise regional environmental monitoring activity results for the year, and provide an interpretation of these results, together with an update of trends in the data.

Annual SEM reports act as 'building blocks' towards the preparation of the regional state of the environment report every five years. The Council's first, or baseline, state of the environment report was prepared in 1996 (TRC, 1996b), summarising the region's progress in improving environmental quality in Taranaki over the past two decades. The second report (for the period 1995-2000) was published in 2003 (TRC, 2003). Data spanning the ten year period 1995 to 2005 have been used in the preparation of a trend report (TRC, 2006). The third State of the Environment report (for the period 1995 to 2007) was published (TRC, 2009a) and included trend reporting, and the fourth report (for the 1995 to 2014 period) has been published (TRC, 2015a). The provision of appropriate computer software statistical procedures allows regular reporting on trends in the environmental quality over time, in relation to Council's ongoing monitoring activities, now that there has been an accumulation of a comprehensive dataset of sufficient duration to permit a meaningful analysis of trends (i.e. minimum of 10 years).

This report summarises the results for the sites surveyed in the Bathing Beach Recreational Water Quality SEM programme over the 2019-2020 monitoring year, the 25<sup>th</sup> year of the programme.

## 1.2 Background

In coastal waters, faecal indicator bacteria (enterococci, *E. coli* and faecal coliforms) can be monitored to assess contamination from human or animal excreta. Levels of these faecal indicators are of particular interest where the coast is used for recreational activities due to the potential health risks associated.

The Taranaki Regional Council has monitored faecal indicator bacteria at bathing beaches along the Taranaki coast since 1979, with systematic surveys undertaken from 1987. A more comprehensive annual bathing beach monitoring programme has been implemented from the 1995-1996 summer as an on-going component of the SEM programme for the Taranaki region.

The Bathing Beach Recreational Water Quality programme has three objectives:

- to characterise the bacteriological quality of principal recreation waters in the Taranaki area, and more specifically to determine their suitability for contact recreation;

- to identify changes in contact recreational water quality over time. Therefore the detection of trends is an important component in programme design;
- to assess compliance with recreational water quality guidelines.

*[Note: Contact recreation concerns water-based activities involving a high probability of accidental water ingestion. This mainly applies to bathing, but may also include other high-contact water sports e.g. jet-skiing, surfing, kayaking]*

## 2 Standards and guidelines

### 2.1 Microbiological water quality guidelines

Guidelines for microbiological water quality of marine recreational areas have been prepared by the Ministry for the Environment in conjunction with the Ministry of Health (MfE, 2003). The guidelines use a combination of a qualitative risk grading of the catchment, together with direct measurements of appropriate faecal indicators to assess the suitability of a site for recreation (see Section 3.2).

In addition, 'Alert' and 'Action' guideline levels are used for surveillance throughout the bathing season. These guideline levels are summarized in Table 1 and are based on keeping illness risk associated with recreational water use to less than approximately 2%. Levels are based on enterococci counts as these bacteria are the preferred indicators for marine waters. Research has shown that enterococci are the indicator most closely correlated with health effects in New Zealand marine waters, in common with general findings overseas (New Zealand Marine Bathing Study).

Table 1 Surveillance, Alert and Action levels for marine waters (2003)

	Mode		
	Surveillance	Alert	Action
Enterococci (cfu/100ml)	No single sample > 140	Single sample > 140	Two consecutive single samples > 280
Recommended procedure	<ul style="list-style-type: none"> <li>Continue routine monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Increase sample to daily ('Follow up sampling')</li> <li>Undertake sanitary survey</li> <li>Identify sources of contamination</li> <li>Consult CAC to assist in identifying possible source</li> </ul>	<ul style="list-style-type: none"> <li>Increase sample to daily</li> <li>Undertake sanitary survey</li> <li>Identify sources of contamination</li> <li>Consult CAC to assist in identifying possible source</li> <li>Erect warning signs</li> <li>Inform the public through the media that a public health problem exists</li> </ul>

CAC = Catchment Assessment Checklist

It should be noted that in 'Alert' mode, the beach is still considered suitable for swimming, but monitoring becomes more focused.

Over the 2019-2020 summer season, warning signage was erected in response to one sample reaching 280 cfu/100 ml, rather than two consecutive samples. Also, daily follow up sampling was often not practicable or appropriate (see Section 3.1.3 for more information on follow up sampling).

### 2.2 Suitability for recreational grading (SFRG) of sites

The guidelines (MfE, 2003) provide for the grading of recreational water bodies based on two components:

- The Microbiological Assessment Category (MAC): this is established on the basis of five years' enterococci data for a particular site, providing a quantitative measurement of the actual water quality over time. Sites are assigned MAC categories ranging from A to D, with definitions provided in Table 2. For the Taranaki region, the Taranaki Regional Council provides the Ministry for the Environment with these data collected as part of the annual bathing beach monitoring programme.
- The Sanitary Inspection Category (SIC): generates a measure of the deemed susceptibility of a water body to faecal contamination. A site is allocated a category of either Very High, High, Moderate, Low or Very Low, which is determined using the SIC flow chart. Information used in the flow chart comes

from the Catchment Assessment Checklist (CAC) which provides qualitative risk information on the catchment. Detailed information about SIC, including the SIC flow chart and the CAC can be found in the 2003 Microbiological Water Quality Guidelines (MfE, 2003).

The SIC is combined with the MAC to determine a Suitability for Recreation Grade (SFRG) for each site (Table 2). The SFRG therefore describes the general condition of a site based on both qualitative risk grading of the catchment and the quantitative measurement of faecal indicators. A grade is established on the basis of the most recent five years' data and recalculation of a grade is typically performed annually.

**Table 2 Microbiological Assessment Categories**

MAC	MAC definitions for marine waters
A	Sample 95 percentile $\leq$ 40 enterococci/100 ml
B	Sample 95 percentile 41 - 200 enterococci/100 ml
C	Sample 95 percentile 201 - 500 enterococci/100 ml
D	Sample 95 percentile $>$ 500 enterococci/100 ml

SFRGs, as defined and interpreted by the Ministry for the Environment, are:

- Very good: considered satisfactory for swimming at all times.
- Good: satisfactory for swimming most of the time. Exceptions may include following rainfall.
- Fair: generally satisfactory for swimming, though there are many potential sources of faecal material. Caution should be taken during periods of high rainfall, and swimming avoided if water is discoloured.
- Poor: generally unsuitable for swimming, as indicated by historical results. Swimming should be avoided, particularly by the very young, the very old and those with compromised immunity.
- Very poor: avoid swimming.

Of the 18 total coastal sites monitored by the Council, 17 had sufficient data available to calculate SFRG grades for the period spanning November 2014 to April 2019. Of these 17 sites, 10 were graded 'good', 6 were graded 'fair' and 1 was graded 'poor'. None of the beaches graded 'very poor'. As 16 of the 18 beaches were assigned a SIC of 'moderate' it was not possible for any of these beaches to obtain a 'very good' SFRG grading regardless of the actual enterococci results used to calculate MAC. This was mainly related to either the agricultural nature of the catchment areas or the presence of nearby streams and rivers which heavily influenced the SIC assessment results.

It must be emphasized that the SFRG grade provides a conservative/precautionary guideline intended for assessing the suitability of beaches for contact recreation from a public health perspective. The grade is of limited use for assessing the state of the environment, as it includes the SIC: a static assessment based on qualitative information. Instead, the remainder of this report will focus on presenting and interpreting actual faecal indicator data collected during routine monitoring. This quantitative information enables the assessment of general trends in coastal water quality, and can be used to measure how well management practices and policies are working, and whether environmental outcomes are being achieved.

It should be noted that the Ministry itself states that the SFRG *'reflects a precautionary approach to managing public health risks and does not represent an accurate picture of water quality in the catchment. ... The grades reflect a precautionary approach to managing health risk and are not designed to represent health risks on a particular day. They tend to reflect the poorest water quality measured at a site rather than the*



average water quality. A site may be graded as poor but still be suitable for swimming much of the time. The indicator does not replace the site-specific information available on council websites<sup>1</sup>

Note: The grades presented in Table 3 take into account all routine sampling results; comprising SEM and extended monitoring results (see Section 3).

**Table 3 Suitability for recreation grade for the period November 2014 to April 2019**

Site	Sanitary Inspection Category	MAC			SFRG Grade	%of all inspection in compliance
		95%ile	No of samples	Category		
Wai-iti	Moderate 13	664.0	26	D	Poor	96%
Urenui	Moderate 13	186.6	22	B	Good	95%
Onaero (SC)	Moderate 13	309.0	108	C	Fair	94%
Onaero Settlement	Low 14	114.0	20	B	Good	100%
Waitara (East)	Moderate 13	241.0	93	C	Fair	95%
Waitara (West)	Moderate 13	180.0	83	B	Good	97%
Bell Block	Moderate 3	Insufficient data (triennial)				
Fitzroy	Moderate 3	100.0	110	B	Good	97%
East End	Moderate 3	135.0	65	B	Good	98%
Ngamotu	Moderate 3	269.0	110	C	Fair	95%
Back Beach	Low 14	406.0	26	C	Fair	92%
Oakura (SC)	Moderate 13	213.5	109	C	Fair	96%
Oakura (CG)	Moderate 13	78.0	65	B	Good	100%
Opunake	Moderate 3	28.1	109	A	Good	100%
Ohawe	Moderate 13	267.5	95	C	Fair	95%
Patea	Moderate 13	40.0	26	A	Good	100%
Waverley	Moderate 13	27.4	26	A	Good	100%
Waiinu	Moderate 13	41.6	26	B	Good	100%

13 = River - agricultural activities/birds/feral animal

14 = River - focal points of discharge

3 = Urban stormwater

<sup>1</sup> Suitability for swimming: Indicator update July 2013: INFO 690, Ministry for the Environment

## 3 Monitoring methodology

### 3.1 Programme design

The Council's Bathing Beach Recreational Water Quality programme consists of two primary components: State of the Environment monitoring and extended (MfE) monitoring.

The SEM component involves ten annual sampling sites and nine rotational sites (Figure 1). The rotational sites are sampled on a three year rotation, with Year 2 beaches sampled during the 2019-2020 monitoring programme (Table 4). Thirteen samples are collected per site for the SEM component.

The extended monitoring component has been included in order to meet requirements of the revised guidelines for microbiological water quality of marine recreational areas (MfE, 2003). Since the 2016-2017 bathing season, additional samples are collected at eight SEM sites as part of this extended (MfE) monitoring (Figure 1). Approximately ten samples are collected during the extended monitoring regime.

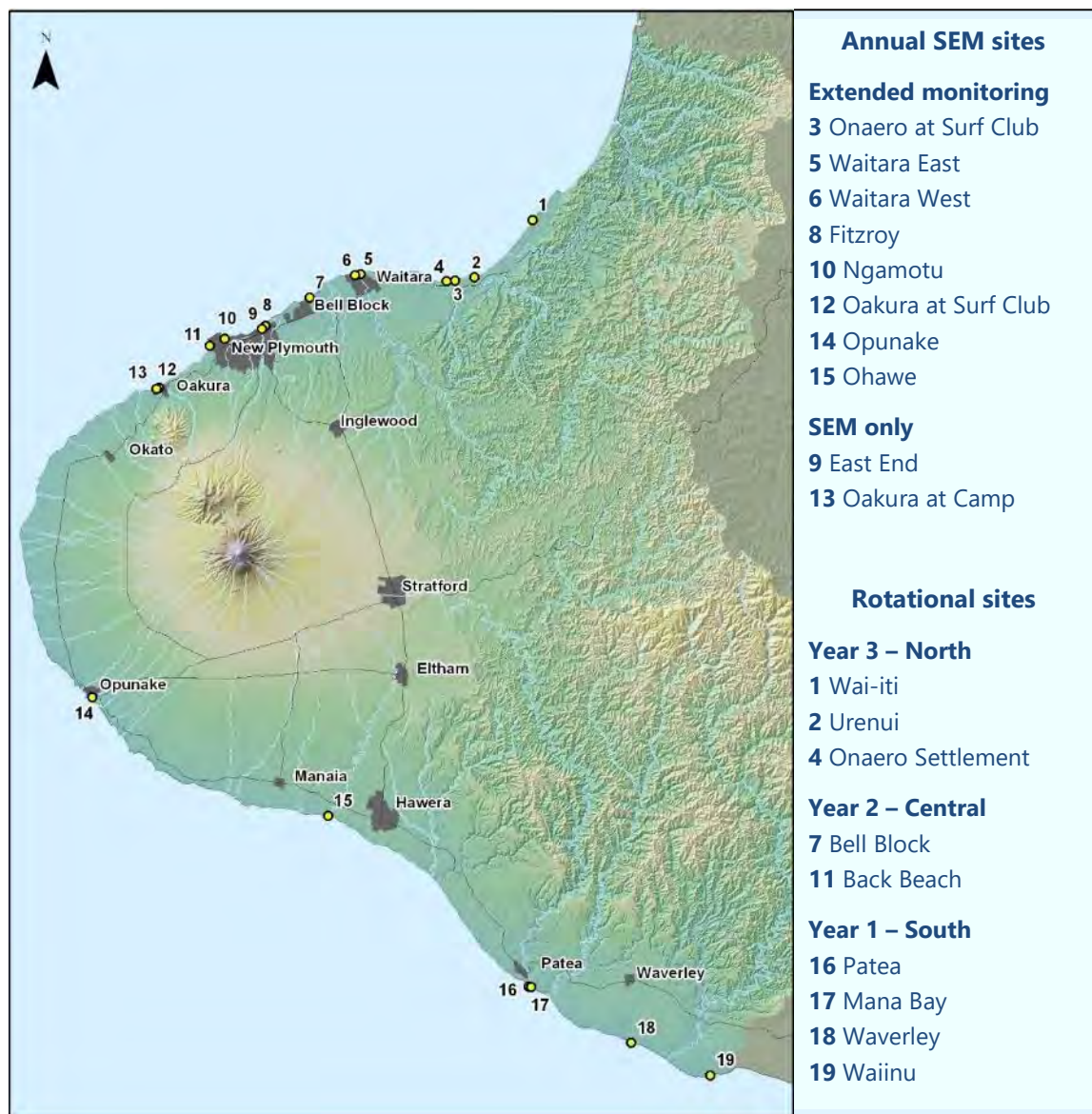


Figure 1 Bathing beach monitoring sites

The 12 sites that were sampled during the 2019-2020 bathing season are specified in Table 4.

Table 4 Beach sites sampled during the 2019-2020 bathing season

Beach	Location	GPS	Site code
Onaero	Opposite surf lifesaving club	2628254-6244898	SEA900085
Waitara	East Beach	1706602-5683915	SEA901033
Waitara	West Beach	1705951-5683802	SEA901037
Bell Block	West of Mangati Stream	2609210-6242224	SEA902001
Fitzroy	Opposite surf lifesaving club	2605036-6239351	SEA902025
East End	Opposite surf lifesaving club	2604605-6239000	SEA902035
Ngamotu	Centre of beach	2600022-6237765	SEA902062
Back Beach	To the north of the Herekawe Stream	2598198-6236896	SEA902070
Oakura	Opposite surf lifesaving club, south of Wairau Stream	2591974-6231726	SEA903030
Oakura	Opposite motorcamp, south of Waimoku Stream	2591700-6231600	SEA903032
Opunake	Centre of beach	2583775-6193800	SEA904090
Ohawe	Adjacent to boat ramp, east of Waingongoro River	2612688-6179169	SEA906010

The purpose of each monitoring component, and their respective sampling protocols, are discussed in sections 3.1.1 and 3.1.2.

### 3.1.1 State of the Environment monitoring

The monitoring network is designed to assess coastal water quality in terms of its suitability for contact recreation. As such, the network targets the main bathing times and avoids, as far as possible, the localized influence of diffuse sources (i.e. streams and rivers) on adjacent coastal water quality. For these reasons the following criteria have been adopted for this SEM protocol:

Sample collection, field measurements, transport and analyses were undertaken according to documented Taranaki Regional Council procedures. It was intended that on average, four samples would be collected from each of the sites in each month when hydrological flow conditions permitted, within two hours of high tide. SEM sampling was performed only under dry weather flow conditions (i.e. not within three days of a fresh) to ensure, as far as practicable, consistent environmental factors. Bathing water samples were taken between the hours of 0900 and 1800 hours (NZDT) to reflect the most likely period for swimming. Where necessary, a 2 m sampling pole was used for bacteriological sample collection immediately beneath the water surface and at a minimum of knee depth at the sites.

In the 2019-2020 summer period, only 11 of the 13 SEM surveys were undertaken; due to the COVID-19 Level 4 restrictions that were implemented on 25 March 2020.

### 3.1.2 Extended (MfE) monitoring

The revised guidelines for microbiological water quality of marine recreational areas (MfE, 2003) envisaged weekly surveillance monitoring during the 5-month recreational period, with a minimum of 20 sampling dates, regardless of weather conditions or state of the tide. This number of samples each season is regarded as providing the most robust dataset for site categorisation purposes. In the 2002-2003 summer period, following consultation with the territorial local authorities and the Taranaki District Health Board, TRC added seven sampling dates to the SEM protocol at five of the most popular marine recreational sites (Onaero,

Fitzroy, Ngamotu, Oakura and Opunake beaches). These seven sampling dates were systematically selected (one per week) in weeks not sampled by the SEM programme. Sampling was undertaken regardless of prior weather conditions or tides but adhering to all other SEM programme protocols.

In the 2016-2017 summer period, monitoring frequency was increased to at least weekly between December and February at eight of the most popular coastal recreational sites (Onaero, Waitara West, Waitara East, Fitzroy, Ngamotu, Oakura Surf Club, Opunake and Ohawe Beaches), to align fully with the MfE guidelines and the reporting protocols for the Land, Air, Water Aotearoa (LAWA) website. When possible, the SEM protocol of dry weather monitoring was followed. In weeks when weather or tide did not meet the SEM protocol, sampling occurred no later than Thursday to allow public posting of results before the weekend.

In the 2019-2020 summer period, an additional eight samples were collected at the eight sites listed above, following the extended monitoring protocol. In the discussion that follows, these samples are described as 'extended' or 'MfE' samples.

### 3.1.3 Follow up monitoring

As recommended by the national guidelines (MfE, 2003), a follow up sample may be collected when a routine monitoring sample reaches 'Alert' mode (see Section 2.1). Follow up samples can be useful in determining the source of a high enterococci count, the longevity of the event, and for updating the site's suitability for bathing. These samples are generally collected as soon as reasonably practicable in the days following the high result, though a follow up may be deemed inappropriate under certain circumstances. For example, if wet weather ensues, a follow up sample may not be collected due to contamination from nearby freshwater inputs masking the source in question. In some instances, when routine surveys are scheduled within close succession, the subsequent survey may substitute a dedicated follow up survey.

## 3.2 Analysis

### 3.2.1 Sample analysis

Historically, samples were analysed for enterococci, *E. coli*, faecal coliforms and conductivity. *E. coli* and faecal coliform numbers were obtained using the mTEC agar method #9213-d, Standard Methods for the Examination of Waters and Wastewaters (APHA, 2005). Enterococci were quantified using the EPA modified method #1600 on mEI agar (EPA, 1986).

In the 2017-2018 summer period, it was decided to stop analysing for *E. coli* and faecal coliforms, in order to optimise the efficiency of the laboratory; given the increase in overall sampling intensity in recent years. *E. coli* and faecal coliforms are inferior indicators of faecal contamination in marine waters, when compared with enterococci (see Section 3.1). Follow up enterococci samples were quantified using the Enterolert (IDEXX) Quanti-Tray system (see Section 3.1 for an explanation of when follow up samples are required).

The 2018-2019 summer marked the first bathing season following the closure of the Council laboratory. Instead, all samples were sent to Hill Laboratories for analysis. Enterococci were quantified using a membrane filtration method (APHA, 9230 C (modified) 23<sup>rd</sup> ed. 2017) during routine sampling and using the Enterolert method (APHA, 9230 D 23<sup>rd</sup> ed. 2017) for follow up sampling. Specific conductivity was also measured at the laboratory using a conductivity meter (APHA, 2510 B 23<sup>rd</sup> ed. 2017).

At each of the sites the following additional information was recorded: time, water temperature, weather condition, wind condition, surf condition, colour/appearance of water, and number of bathers and other users.

Once verified, all results were posted on the Taranaki Regional Council website ([www.trc.govt.nz](http://www.trc.govt.nz)) and the Land Air Water Aotearoa website ([www.lawa.org.nz](http://www.lawa.org.nz)).

### 3.2.2 Data analysis

The enterococci boxplots presented in this report are produced using R statistical software and the NADA package to work with non-detects and censored data. As such, censored data is redistributed using a robust linear regression on order statistics (ROS) model to redistribute any censored measurements to a value below the censor limit. Any statistics presented in the boxplots that lie below the maximum censor limit should not be directly interpreted. In the majority of cases, the maximum censor limit is 1 cfu/100 ml, and no statistics (e.g. medians, lower quartiles) below this threshold are meaningful. Using this method ensures that reported statistics at or above the censor limit are robust, and not biased by censored data, as would occur if, for example, censored data was simply halved and then included in analysis.

A simple figure explaining the statistics presented in the boxplots is given in Appendix IV.

Long term trend analysis is only carried out with the results from samples collected within the SEM schedule of the complete programme, in order to determine the trends of recreational water quality around Taranaki under dry weather conditions (i.e. samples collected under reproducible conditions). For sites with sufficient data ( $\geq 10$  years), non-parametric trend analysis was performed using annual median enterococci data. For each site, a LOWESS (Logically Weighted Scatterplot) line (tension 0.4) was fitted to a temporal scatter plot of the enterococci median data. Statistical significance of the trend was tested using a Mann-Kendall test. The sign (+/-) of the Kendall tau value was used to assess whether the trend was positive or negative and the significance of the trend was determined using the p value ( $p < 0.05 = \text{significant}$ ).

When multiple correlations are undertaken, there is a chance that some will be found to be significant purely by chance. In order to deal with this potential problem, the Benjamini-Hochberg False Discovery Rate (FDR) method was applied to the results of the Mann-Kendall test. Further justification for this statistical approach can be found in Stark and Fowles (2006).

## 4 Results

During the 2019-2020 bathing season, sampling was generally confined to weekdays, with no statutory holidays included. For these reasons, recreational usage of the waters at the time was generally less intensive, often with no apparent usage at the time of sampling. However, all sites are known to be regularly utilized for bathing and other contact recreational activities, particularly at weekends, dependent on suitable weather conditions.

Whenever possible, no sampling for SEM purposes was undertaken within three days following significant river freshes. However, it is recognised that water conditions at the time of sampling was occasionally affected by localized rainfall and elevated river flows. The extended ('MfE') monitoring was preferentially, but not exclusively, undertaken during fine weather. Given these sampling criteria, the results presented here generally reflect coastal water quality under fine weather conditions (that is, conditions where bathing would be typically most popular).

All results (SEM, MfE and follow up monitoring), from the 2019-2020 bathing season are presented and discussed on a site by site basis in this report. The statistical analyses do not include follow-up sampling results, as they're collected in response to particular events (resulting in high enterococci counts) and are therefore not random, and potentially not representative of typical bathing conditions.

Supplementary data and observations are presented in Appendices I and II.

## 4.1 Onaero Beach (Surf Club)

Onaero Beach (Photo 1), located in North Taranaki, is a relatively popular bathing beach, particularly over the Christmas holiday period. The Onaero River drains to the southern end of the beach, making a significant contribution to bacteria counts following rainfall events.



Photo 1 Onaero Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 2. A total of 19 samples were collected at this site across the summer. There were 11 SEM samples collected, as well as eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

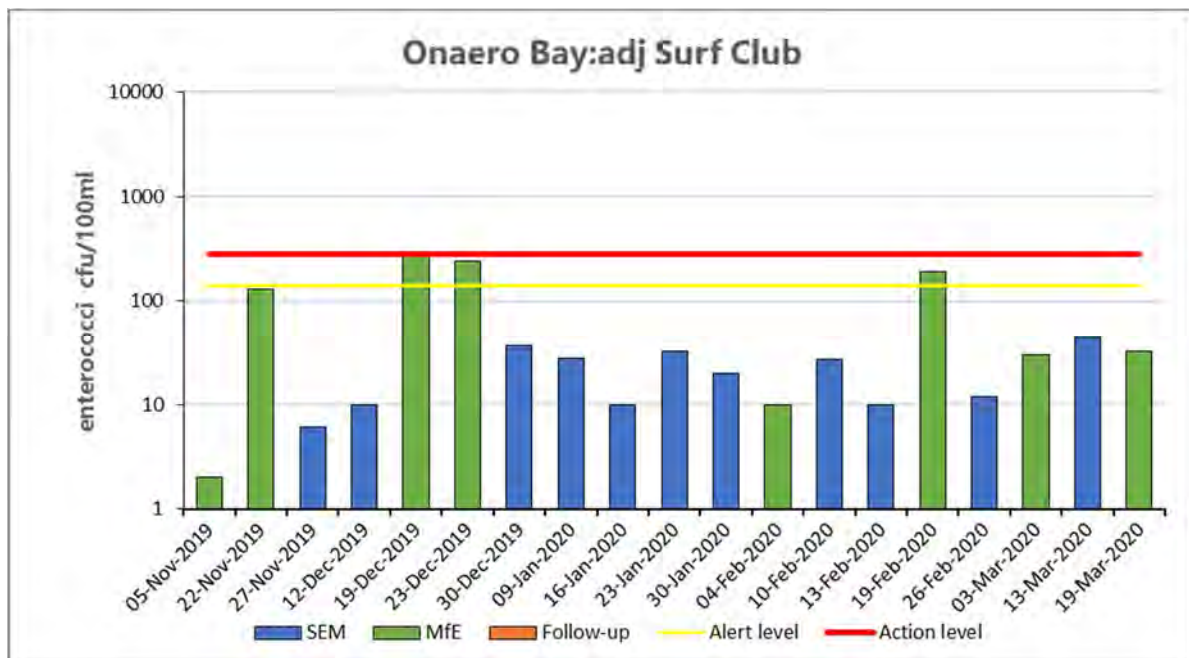


Figure 2 Enterococci results for Onaero Beach at the Surf Club

The monitoring data is summarized in Table 5.

Table 5 Statistical summary for Onaero Beach (at the Surf Club)

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	41,600	52,300	49,400
	Enterococci	cfu/100 ml	11	6	44	20
	Temperature	$^\circ\text{C}$	11	14.9	21.0	18.9
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	4,460	52,300	47,800
	Enterococci	cfu/100 ml	19	2	280	28
	Temperature	$^\circ\text{C}$	19	14.9	23.4	18.9

#### 4.1.1 Comparison with guidelines

Enterococci counts from Onaero Beach at the Surf Club over the 2019-2020 summer are summarized against the guidelines in Table 6. 'Alert' mode was reached following three MfE surveys carried out on 19 December 2019, 23 December 2019, and 19 February 2020 (280, 240, and 190 cfu/100 ml, respectively). The conductivity results associated with the three samples were indicative of varying degrees of freshwater influence from the adjacent Onaero River mouth (Appendix I). Considerable rainfall occurred prior to the first exceedance on 19 December (46 mm in 72 hours; Appendix I). The remaining 16 samples collected over the summer were within 'Surveillance' mode.

Table 6 Performance against guidelines at Onaero Beach (at the Surf Club)

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	3 [16%]	0 [0]

#### 4.1.2 Comparison with previous summer surveys

Summary statistics for the SEM enterococci data collected at Onaero Beach over 21 summers are presented in Figure 3. The distribution of results from the 2019-2020 summer period were relatively high compared with previous summers, recording the second highest median count to date (20 cfu/100 ml, Figure 3, Table 5).



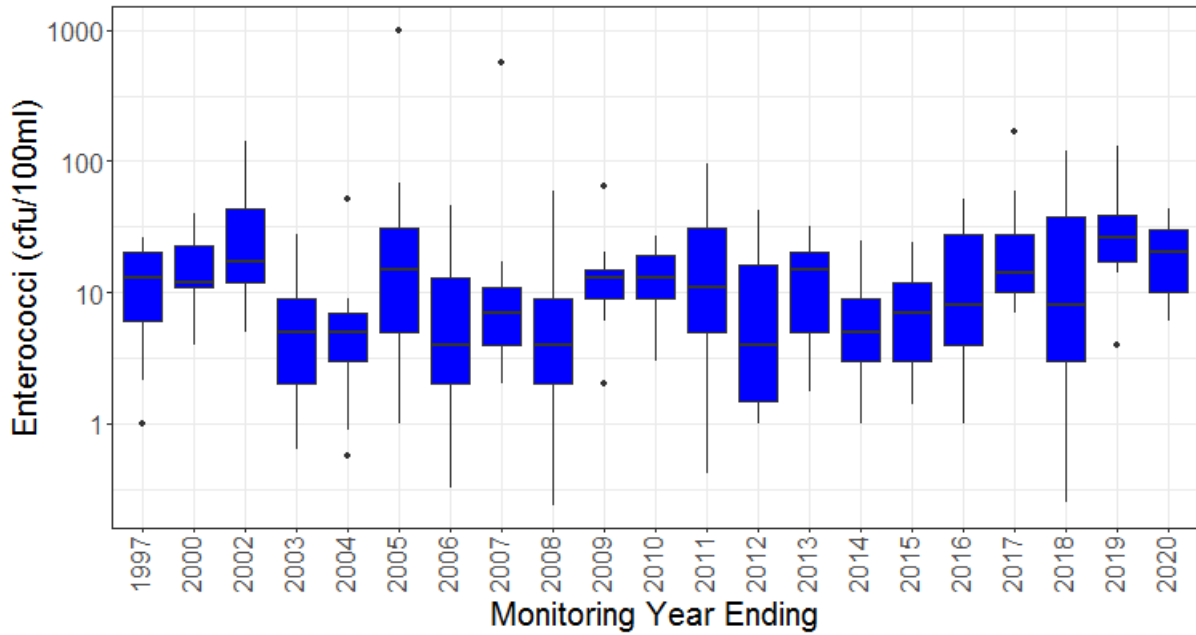


Figure 3 Box and whisker plots of enterococci for all summer SEM surveys at Onaero Beach

#### 4.1.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 21 summer seasons (Figure 4) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

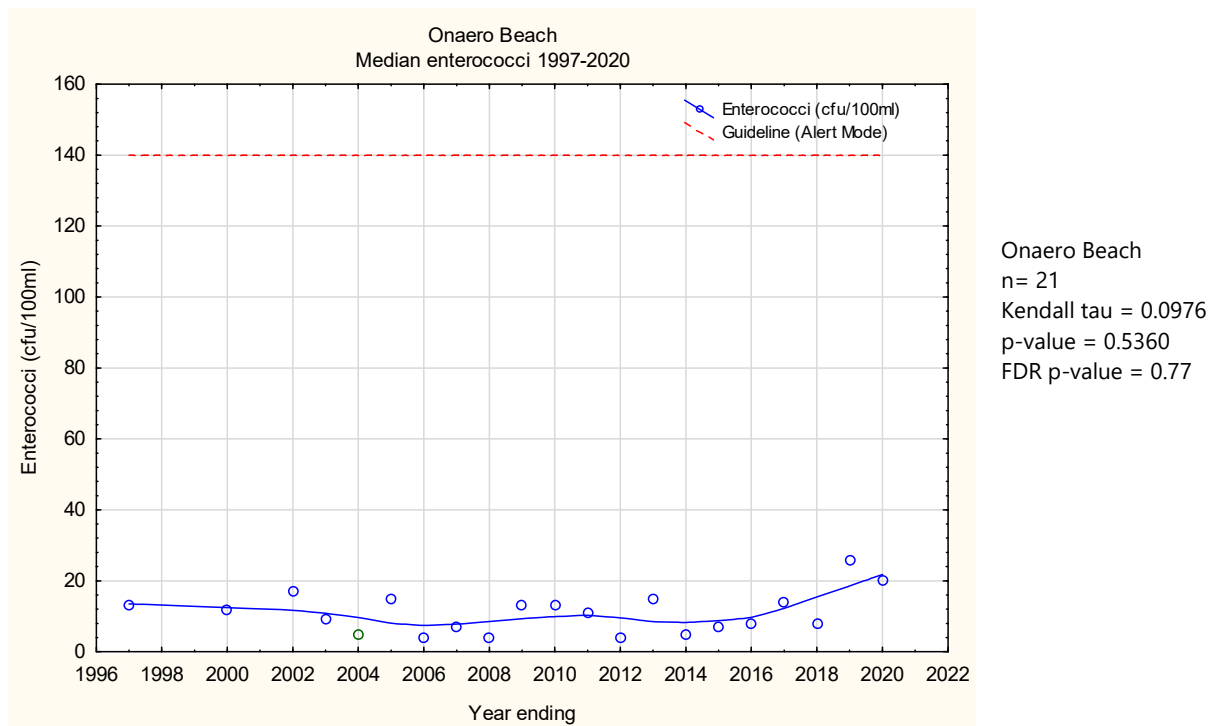


Figure 4 LOWESS trend analysis of median enterococci data at Onaero Beach

Over the 21 seasons monitored, there was a positive trend (i.e. an increase) in median enterococci counts (Kendall tau = 0.0976) that was not significant at the 5% level ( $p = 0.536$ ).

## 4.2 Waitara East Beach

Waitara East Beach is located to the east of the Waitara River mouth (Photo 2). Results at this site are influenced by the Waitara River which drains a large agricultural catchment and often contains high levels of bacteria.

Prior to October 2014, municipal wastewater from the Waitara township was discharged through the Waitara Marine Outfall approximately 1.8 km out to sea. Since October 2014, New Plymouth District Council (NPDC) has pumped municipal wastewater from the Waitara township to the New Plymouth Wastewater Treatment Plant and sewage is no longer discharged through the Waitara Marine Outfall during normal operation of the wastewater system.



Photo 2 Waitara East Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 5. There were 11 SEM samples collected, as well as eight MfE samples (19 in total). All sample results and field observations are presented in Appendices I and II, respectively.

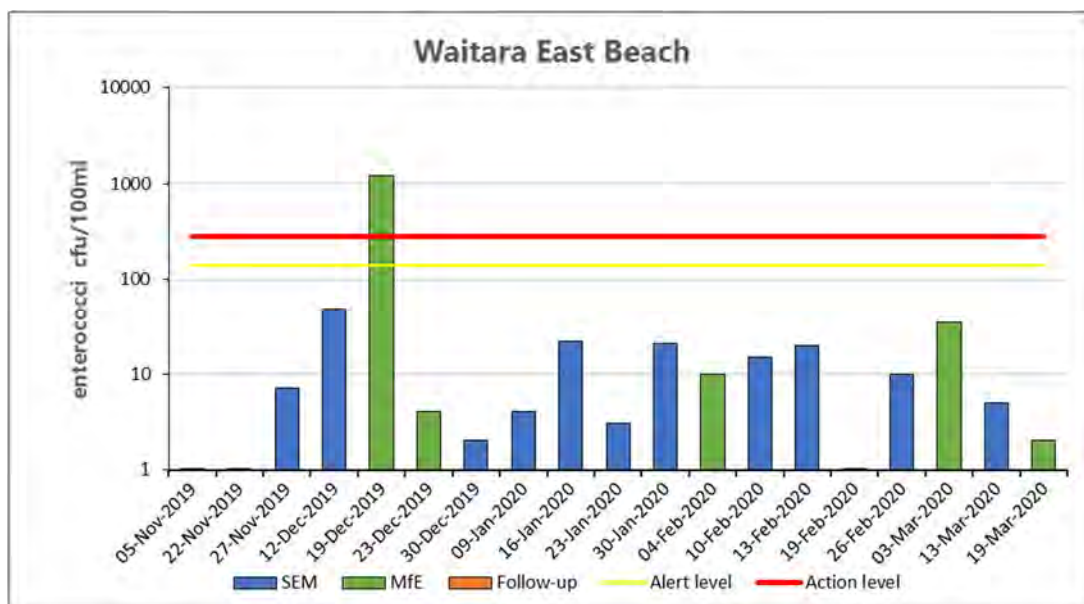


Figure 5 Enterococci results (presented on a logarithmic scale) for Waitara East Beach

The monitoring data is summarized in Table 7.

Table 7 Statistical summary for Waitara East Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	µS/cm@25°C	11	46,300	52,700	50,800
	Enterococci	cfu/100 ml	11	2	49	10
	Temperature	°C	11	15.2	21.6	19.6
MfE & SEM samples	Specific conductivity	µS/cm@25°C	19	6,830	52,700	49,800
	Enterococci	cfu/100 ml	19	<1	1,200	7
	Temperature	°C	19	15.2	23.3	19.6

#### 4.2.1 Comparison with guidelines

Enterococci counts from Waitara East over the 2019-2020 summer are summarized against the guidelines in Table 8. 'Alert' mode was reached once following an MfE survey due to an elevated count (1,200 cfu/100 ml on 19 December 2019). There had been considerable rainfall preceding the survey and the associated conductivity result was indicative of a significant freshwater influence (Appendix I). A dead rotting cow was also discovered just above the high tide line when this sample was collected. The remaining 18 samples were within 'Surveillance' mode.

Table 8 Performance against guidelines at Waitara East Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0%]	0 [0]
SEM & MfE samples	1 [5%]	0 [0]

#### 4.2.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Waitara East Beach over 25 summers are presented in Figure 6. The results from the 2019-2020 summer period were comparable with previous summers. When compared with results from previous years the 2019-2020 median count (10 cfu/100 ml; Table 7) is typical for this site.

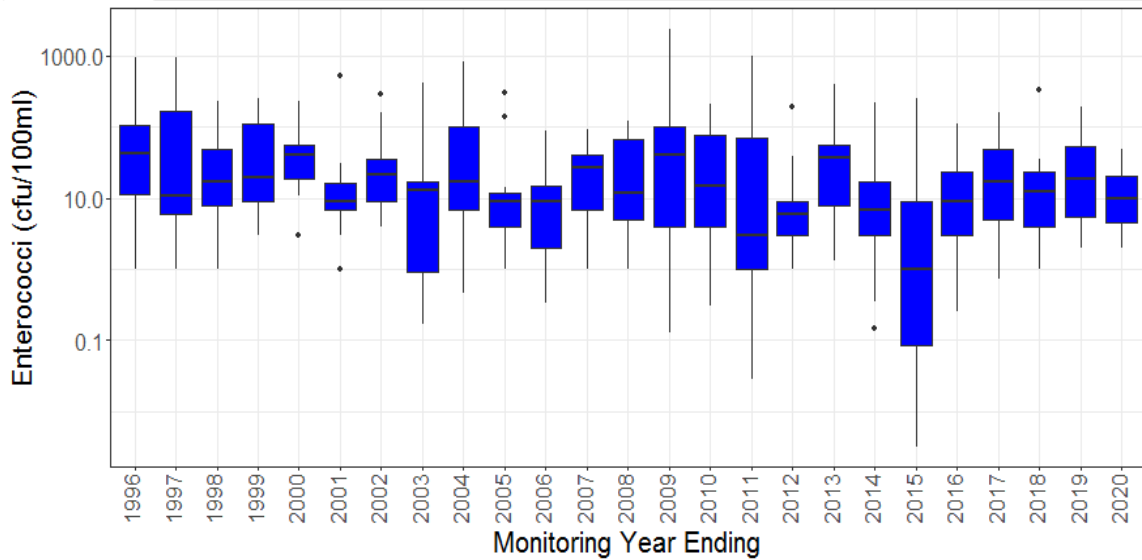


Figure 6 Box and whisker plots of enterococci for all summer SEM surveys at Waitara East Beach

#### 4.2.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 7) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

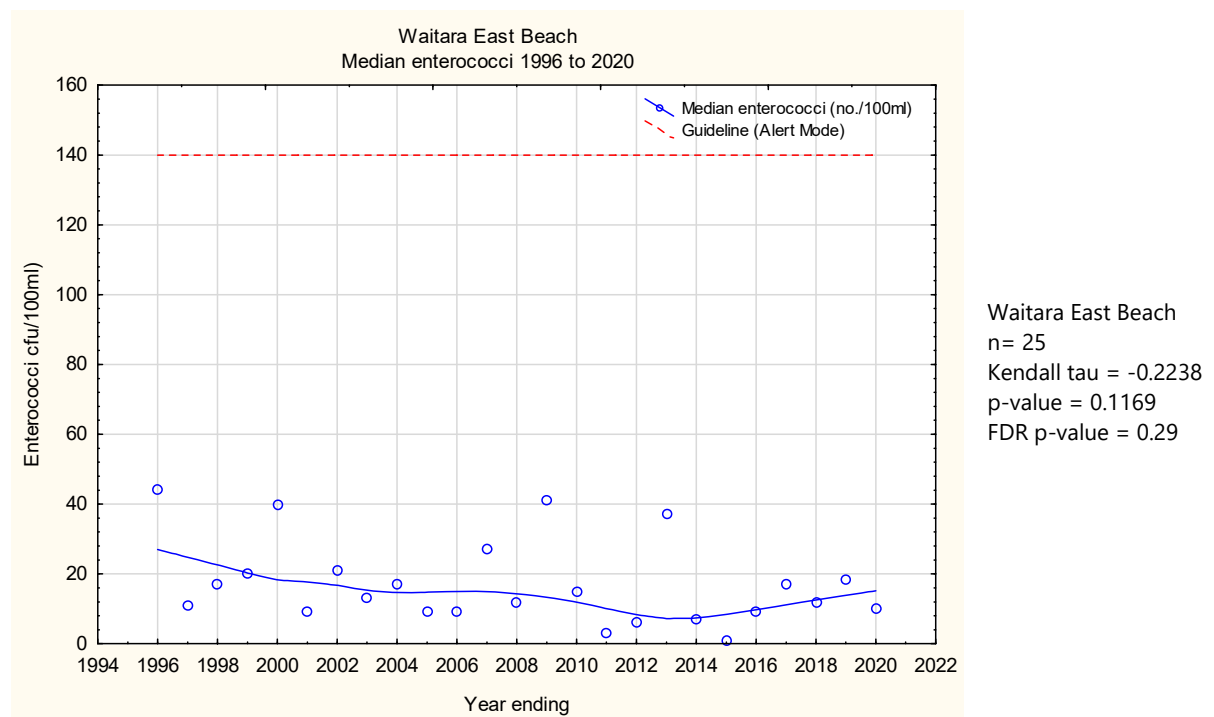


Figure 7 LOWESS trend analysis of median enterococci data at Waitara East Beach

Over 25 seasons, there was a negative trend (i.e. a decrease) in median enterococci counts (Kendall tau = -0.224) that was not significant at the 5% level ( $p = 0.117$ ).

### 4.3 Waitara West Beach

Waitara West Beach is located to the west of the Waitara River mouth (Photo 3). As with Waitara East Beach, the results at this site can be influenced by the Waitara River.

Since October 2014, municipal wastewater from the Waitara Township has been directed to the New Plymouth Wastewater Treatment Plant and is no longer discharged through the Waitara Marine Outfall during normal operation of the wastewater system.



Photo 3 Waitara West Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 8. A total of 19 samples were collected at this site across the summer, including 11 SEM samples and eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

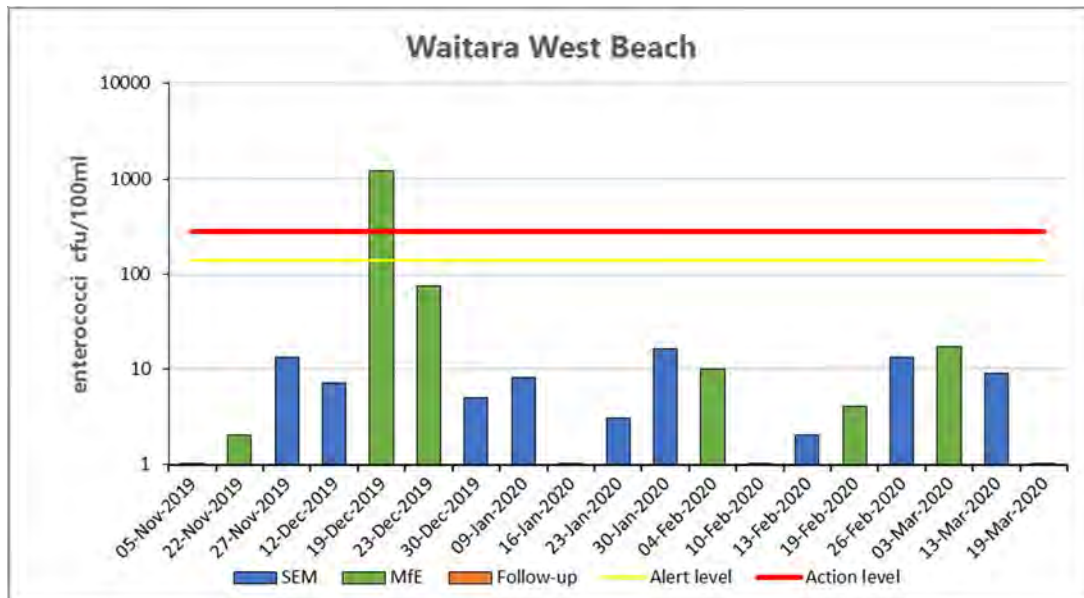


Figure 8 Enterococci results (presented on a logarithmic scale) for Waitara West Beach

The monitoring data is summarized in Table 9.

Table 9 Statistical summary for Waitara West Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	µS/cm@25°C	11	40,200	52,900	51,600
	Enterococci	cfu/100 ml	11	1	16	7
	Temperature	°C	11	15.4	22.7	19.6
SEM & MfE samples	Specific conductivity	µS/cm@25°C	19	18,110	52,900	50,700
	Enterococci	cfu/100 ml	19	<1	1,200	7
	Temperature	°C	19	15.4	23.8	19.1

### 4.3.1 Comparison with guidelines

Enterococci counts from Waitara West over the 2019-2020 summer are summarized against the guidelines in Table 10. 'Alert' mode was prompted once following a high count from an SEM sample on 19 December 2019 (1,200 cfu/100 ml). This high result was likely influenced by the preceding rainfall that affected the water quality at a number of monitoring sites on 19 December (Appendix I). The 18 remaining samples were within 'Surveillance' mode limits.

Table 10 Performance against guidelines at Waitara West Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	1 [5%]	0 [0]

### 4.3.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Waitara East Beach over 25 summers are presented in Figure 9. The distribution of counts from the 2019-2020 summer period was lower than previous summers. The median count (7 cfu/100 ml) is below the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 9).

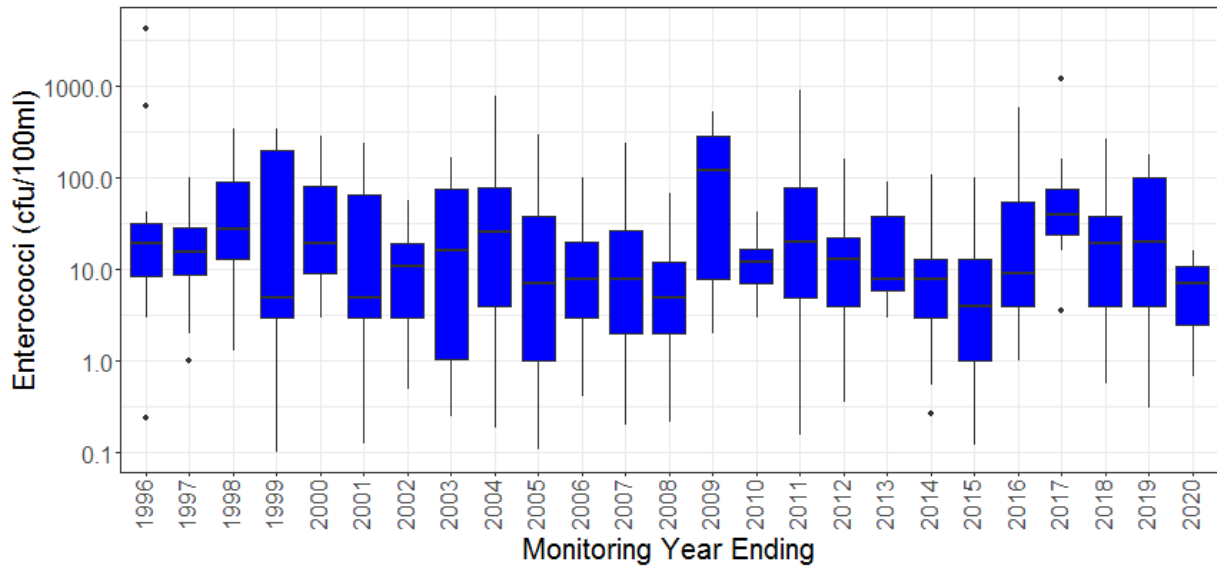


Figure 9 Box and whisker plots of enterococci for all summer SEM surveys at Waitara West Beach

### 4.3.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 10) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

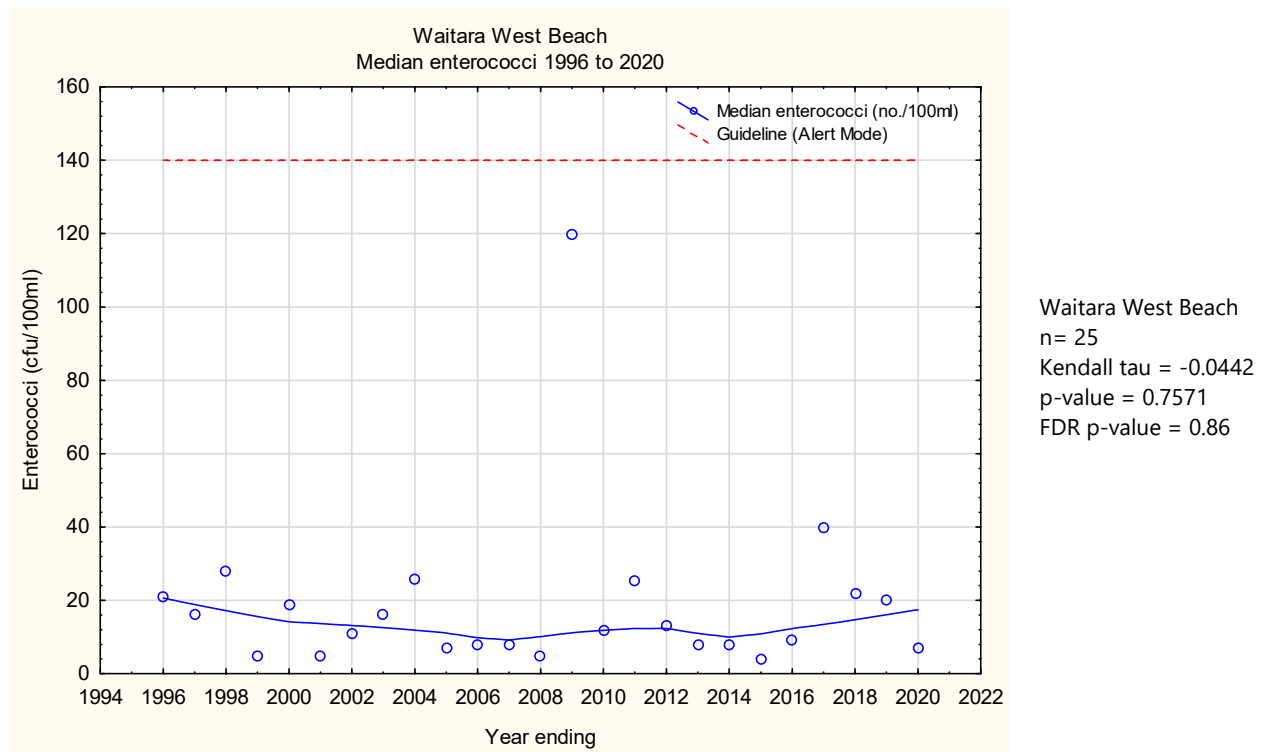


Figure 10 LOWESS trend analysis of median enterococci data at Waitara West Beach

Over 25 seasons, there was a negative trend (i.e. a decrease) in median enterococci counts (Kendall tau = -0.044) that was not significant at the 5% level (p = 0.757).

## 4.4 Bell Block

Bell Block Beach (Photo 4) is a moderately popular summer bathing beach located north east of New Plymouth. The Mangati Stream enters the beach in the vicinity of the sample site. This stream drains through a highly modified/industrial catchment, which after rain, may impact significantly on faecal indicator bacteria counts in the receiving waters.



Photo 4 Bell Block Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 11. A total of 11 SEM samples were collected over the season. All sample results and field observations are presented in Appendices I and II, respectively.

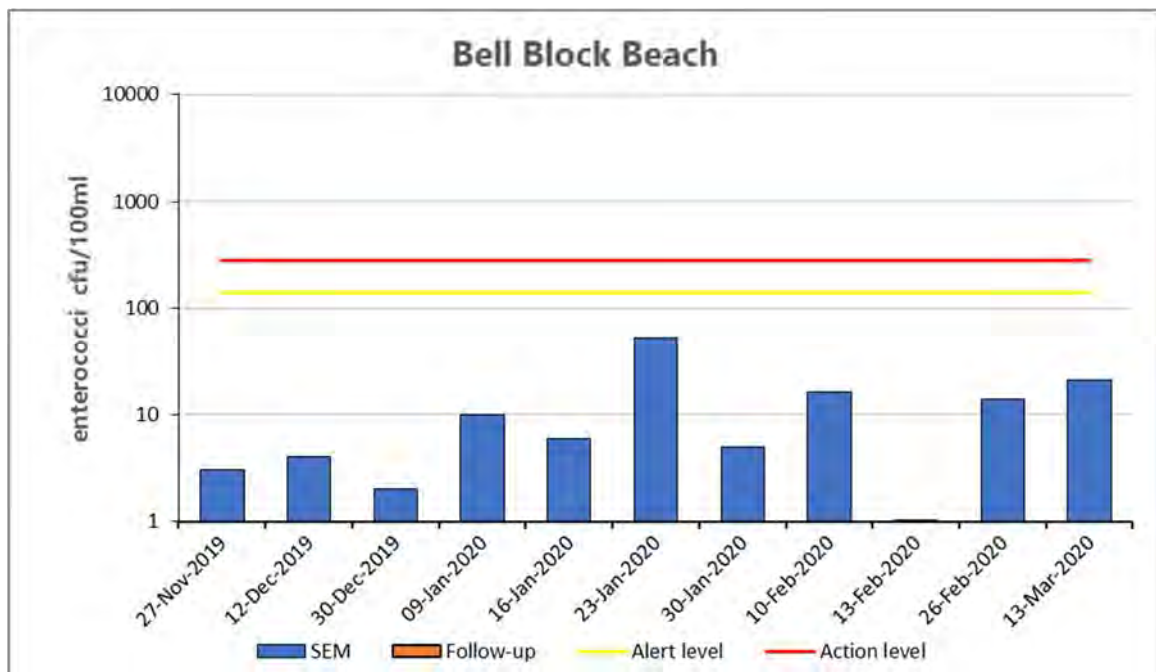


Figure 11 Enterococci results (presented on a logarithmic scale) for Bell Block Beach

The monitoring results are summarized in Table 11.



Table 11 Statistical summary for Bell Block Beach

Parameter	Units	Number of samples	Minimum	Maximum	Median
Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	50,500	52,600	51,800
Enterococci	cfu/100 ml	11	1	53	6
Temperature	$^\circ\text{C}$	11	15.7	21.8	19.2

#### 4.4.1 Comparison with guidelines

Enterococci counts from Bell Block Beach over the 2019-2020 summer are summarised against the guidelines in Table 12. All 11 samples remained within the 'Surveillance' limits.

Table 12 Performance against guidelines at Bell Block Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]

#### 4.4.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Bell Block over 10 summers are presented in Figure 12. The distribution of results from the 2019-2020 summer period remained low but comparable with previous summers. The 2019-2020 median count (6 cfu/100 ml) is the third lowest summer median recorded at this site.

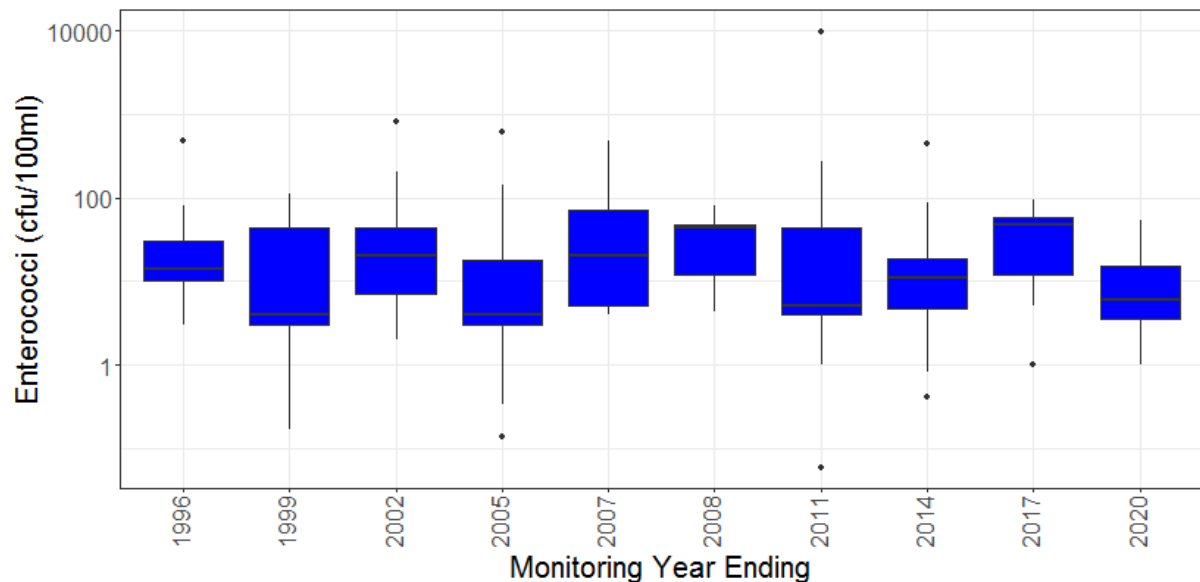


Figure 12 Box and whisker plots of enterococci for all summer SEM surveys at Bell Block

#### 4.4.3 Long-term trend analysis

Long term trend analysis was not performed with data from this site as there were an insufficient number of samples (only triennial data available).

## 4.5 Fitzroy Beach

Fitzroy Beach is situated in New Plymouth and is one of the most popular bathing beaches in Taranaki. It is also a very popular surfing beach due to its central location and high quality waves (Photo 5).

The mouth of the Waiwhakaiho River enters the sea at the eastern end of the beach, approximately 800 m from the sample site, which can contribute significant amounts of freshwater during floods. Draining from a highly modified catchment with agricultural, industrial and residential areas, this river can have a significant impact on bacteriological water quality following heavy rainfall. The river typically has a high level of contamination from birdlife.



Photo 5 Fitzroy Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 13. A total of 19 samples were collected, comprising 11 SEM samples, eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

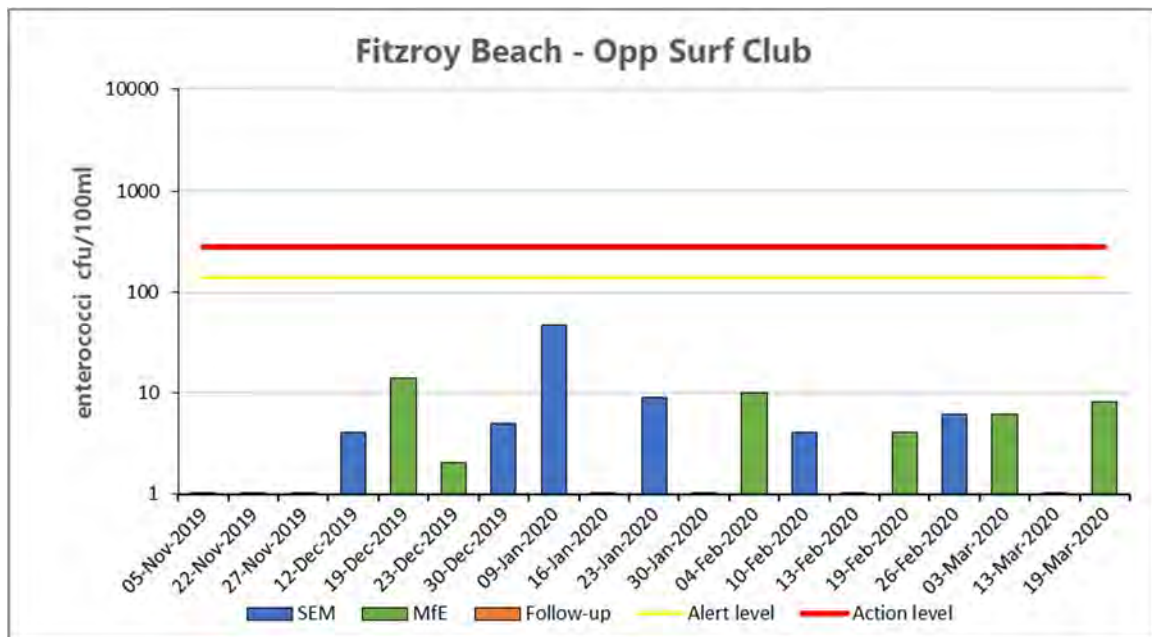


Figure 13 Enterococci results for Fitzroy Beach

The monitoring data is summarized in Table 13.

Table 13 Statistical summary for Fitzroy Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	49,900	52,700	51,700
	Enterococci	cfu/100 ml	11	<1	47	4
	Temperature	$^\circ\text{C}$	11	14.8	20.8	19.2
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	49,000	52,700	51,700
	Enterococci	cfu/100 ml	19	<1	47	4
	Temperature	$^\circ\text{C}$	19	14.8	22.0	19.0

#### 4.5.1 Comparison with guidelines

Enterococci counts from Fitzroy Beach over the 2019-2020 summer are summarized against the guidelines in Table 14. All 19 samples taken during the 2019-2020 summer bathing season were within the 'Surveillance' limits.

Table 14 Performance against guidelines at Fitzroy Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	0 [0]	0 [0]

#### 4.5.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Fitzroy Beach over 25 summers are presented in Figure 14. The distribution of results from the 2019-2020 summer period was comparable with recent years. The median count (4 cfu/100 ml) was equal to the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 14).

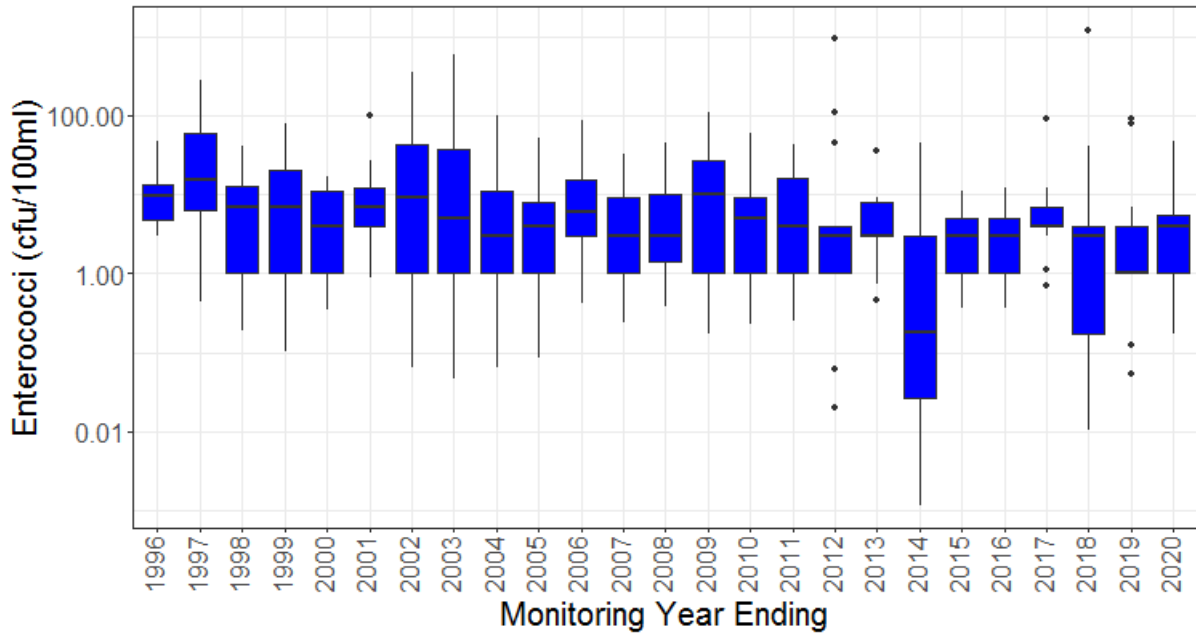


Figure 14 Box and whisker plots of enterococci for all summer SEM surveys at Fitzroy Beach

#### 4.5.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 15) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

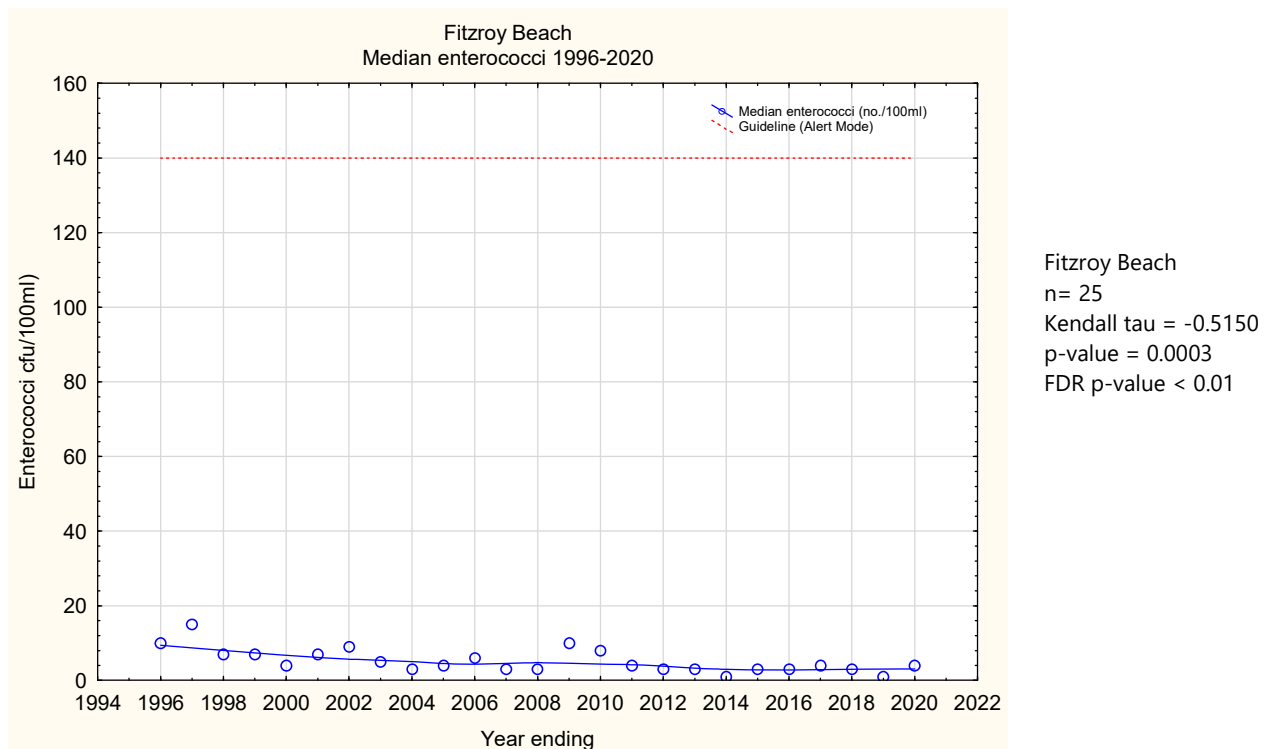


Figure 15 LOWESS trend analysis of median enterococci data at Fitzroy Beach

Over the 25 seasons monitored, there was a decrease in median enterococci counts (Kendall tau = -0.515). This negative trend was significant using the Mann-Kendall test ( $p = 0.0003$ ) and after FDR application ( $p < 0.01$ ).

## 4.6 East End Beach

East End Beach is situated approximately 500 m south-west of Fitzroy Beach in New Plymouth (Photo 6). This beach is popular with summer bathers and has its own Surf Life-saving Club. The Te Henui Stream enters the sea approximately 200 m to the south-west of the sample site, which can result in high freshwater inputs during significant rainfall events.



Photo 6 East End Beach

All data for this site, from the 2019-2020 summer period, is presented in Figure 16. A total of 11 SEM samples were collected over the season. All sample results and field observations are presented in Appendices I and II, respectively.

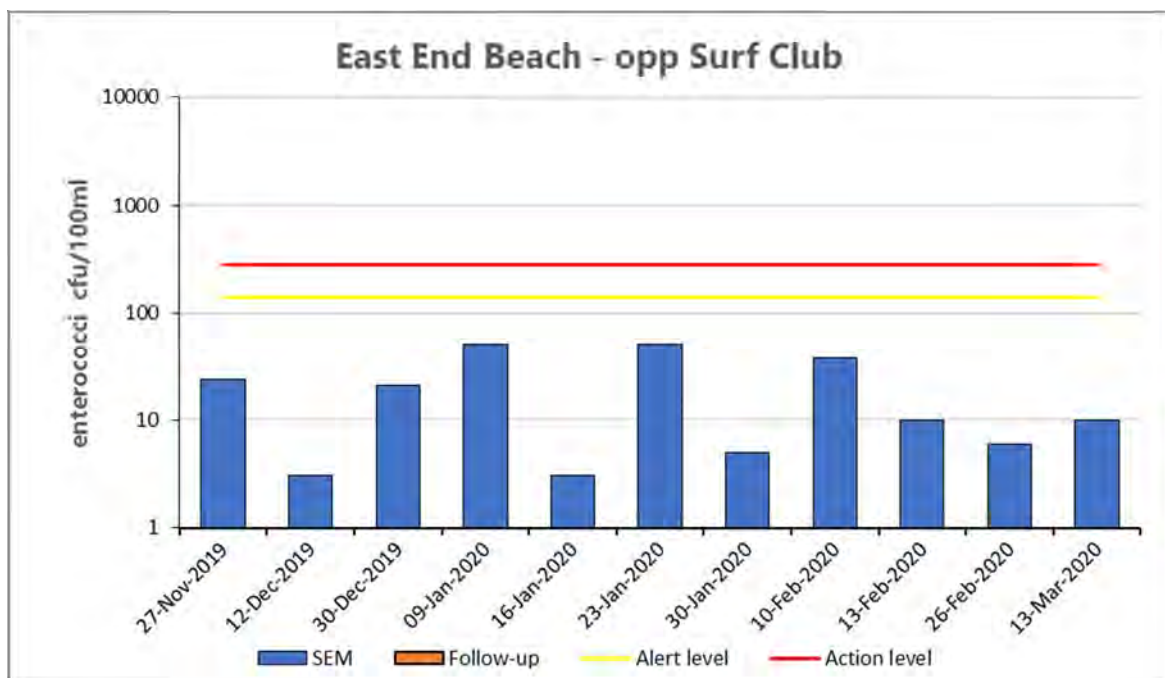


Figure 16 Enterococci results for East End Beach

The monitoring results are summarized in Table 15.

Table 15 Statistical summary for East End Beach

Parameter	Units	Number of samples	Minimum	Maximum	Median
Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	47,700	52,400	51,200
Enterococci	cfu/100 ml	11	3	52	10
Temperature	$^\circ\text{C}$	11	15.2	20.5	18.7

#### 4.6.1 Comparison with guidelines

Enterococci counts from East End Beach over the 2019-2020 summer are summarized against the guidelines in Table 16. All 11 samples remained within the 'Surveillance' limits.

Table 16 Performance against guidelines at East End Beach

Monitoring regime	Number of exceedances of enterococci guidelines	
	ALERT Single sample $>140/100$ ml	ACTION Two consecutive single samples $>280/100$ ml
SEM samples	0 [0]	0 [0]

#### 4.6.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at East End Beach over 17 summers are presented in Figure 17. The distribution of results from the 2019-2020 summer period was comparable with previous summers. The median count (10 cfu/100 ml; Table 15) was equal to the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 17).

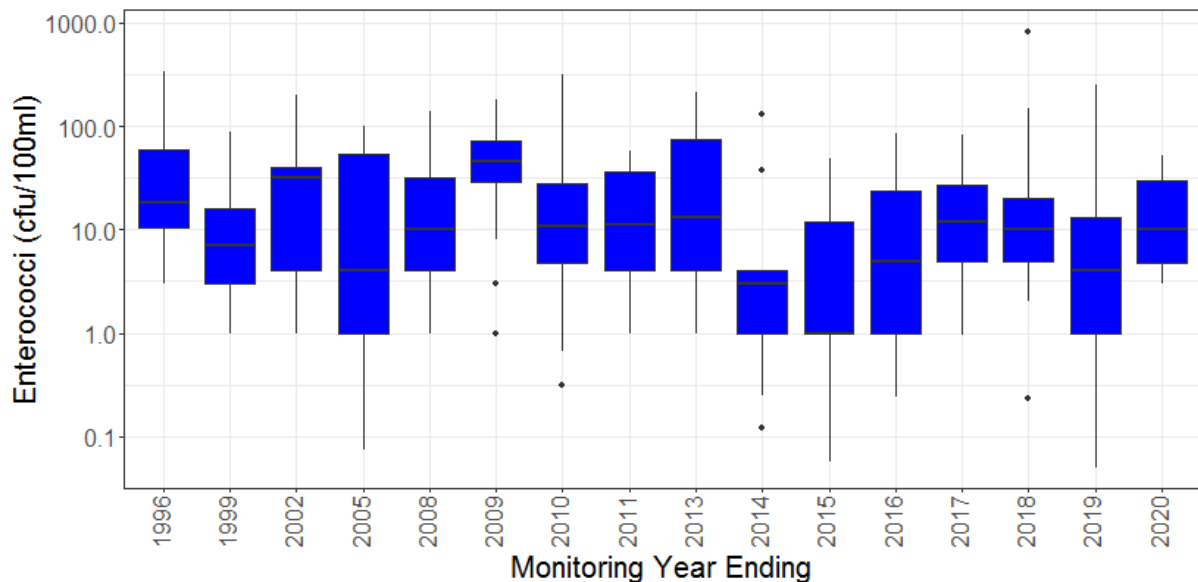


Figure 17 Box and whisker plots of enterococci for all summer SEM surveys at East End Beach

### 4.6.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 17 summer seasons (Figure 18) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

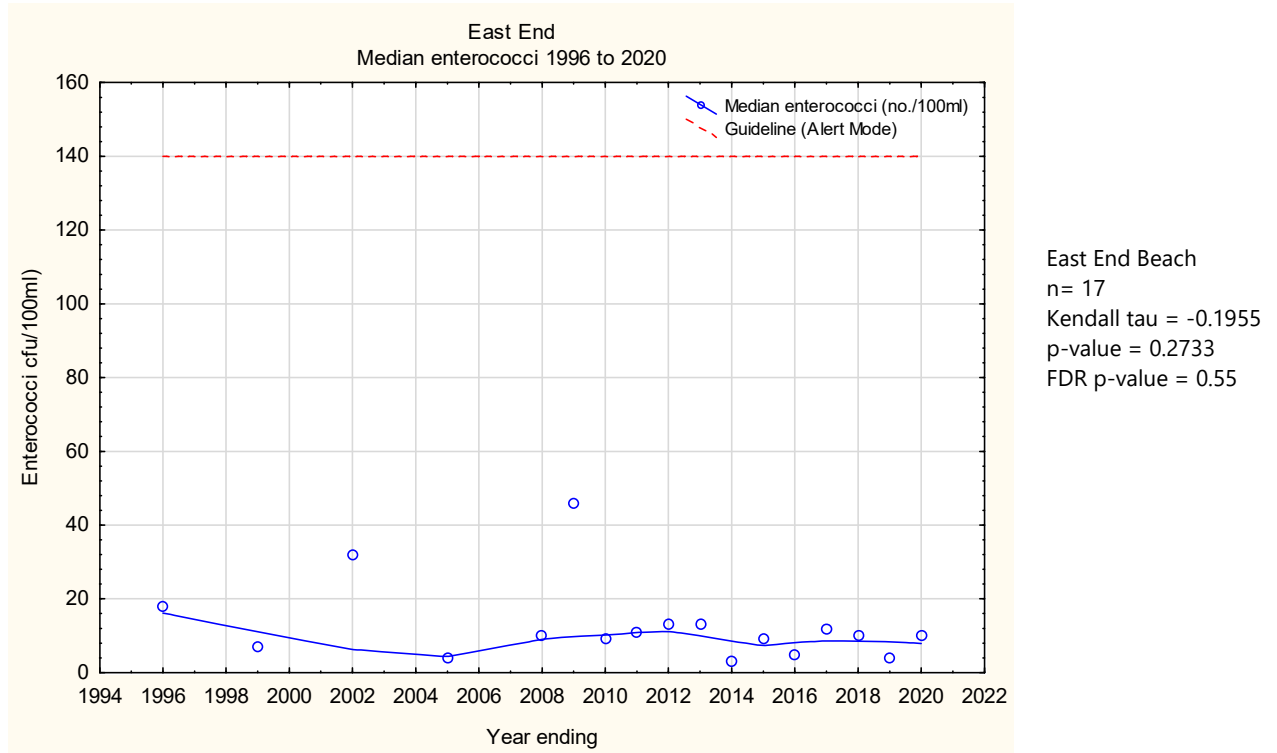


Figure 18 LOWESS trend analysis of median enterococci data at East End Beach

Over the 17 seasons monitored, there was a decreasing trend in median enterococci counts (Kendall tau = -0.196) that was not significant at the 5% level ( $p = 0.273$ ).

## 4.7 Ngamotu Beach

Ngamotu Beach (Photo 7) is situated within Port Taranaki, in close proximity to boat traffic and Port activities. It receives urban stormwater and a piped stream. Due to its sheltered location, situated between two breakwaters, this beach is very popular with young families and school groups and is often used for sports events.



Photo 7 Ngamotu Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 19. A total of 19 samples were collected at this site across the summer, including 11 SEM samples and eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

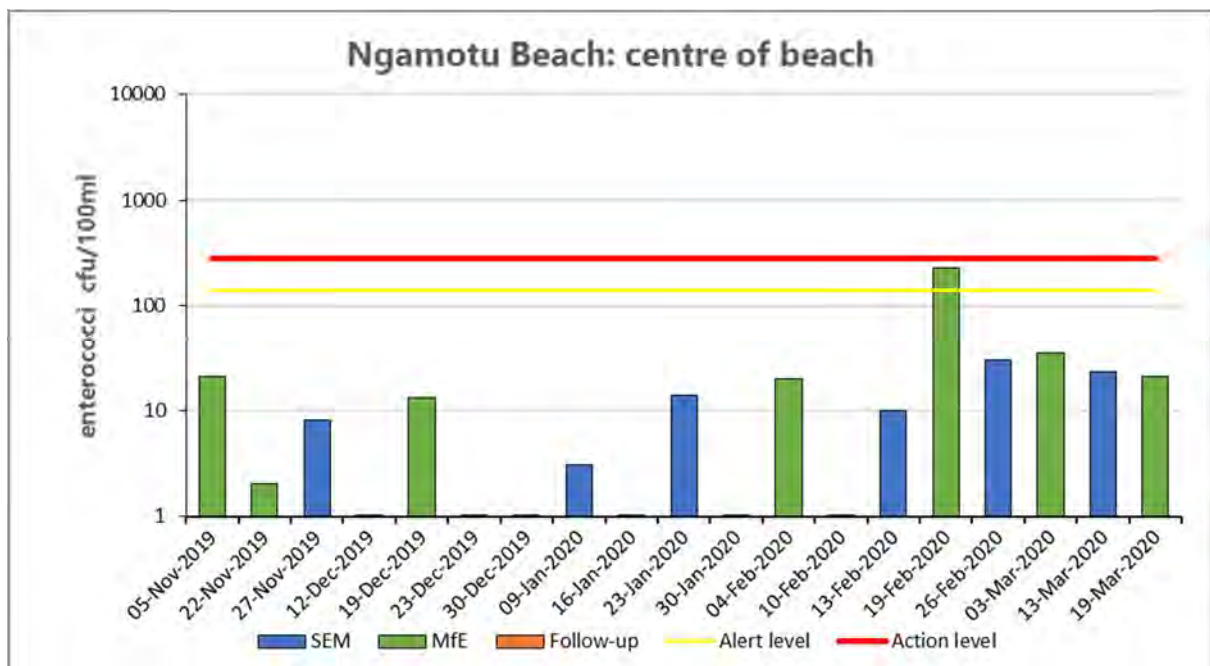


Figure 19 Enterococci results (presented on a logarithmic scale) for Ngamotu Beach

The monitoring results are summarised in Table 17.



Table 17 Statistical summary for Ngamotu Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	51,100	52,800	52,300
	Enterococci	cfu/100 ml	11	1	30	3
	Temperature	$^\circ\text{C}$	11	14.7	21.4	19.0
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	49,800	52,800	52,300
	Enterococci	cfu/100 ml	19	1	230	10
	Temperature	$^\circ\text{C}$	19	14.7	21.7	19.0

#### 4.7.1 Comparison with guidelines

Enterococci counts from Ngamotu Beach over the 2019-2020 summer are summarised against the guidelines in Table 18. 'Alert' mode was prompted once following a high count from an SEM sample on 19 February 2020 (1,200 cfu/100 ml). This high result was likely associated with preceding rainfall (approximately 8 mm in 24 hours; Appendix I). At the time this sample was collected, a large number of gulls were present on the beach which may have also had a localized effect on water quality (Appendix II). The 18 remaining samples were within 'Surveillance' mode limits.

Table 18 Performance against guidelines at Ngamotu Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	1 [5%]	0 [0]

#### 4.7.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Ngamotu Beach over 25 summers is presented in Figure 20. The distribution of counts recorded over the 2019-2020 summer was relatively low compared with previous years. The 2019-2020 median count (3 cfu/100 ml) is the lowest annual median from all surveys carried out at this site to date.

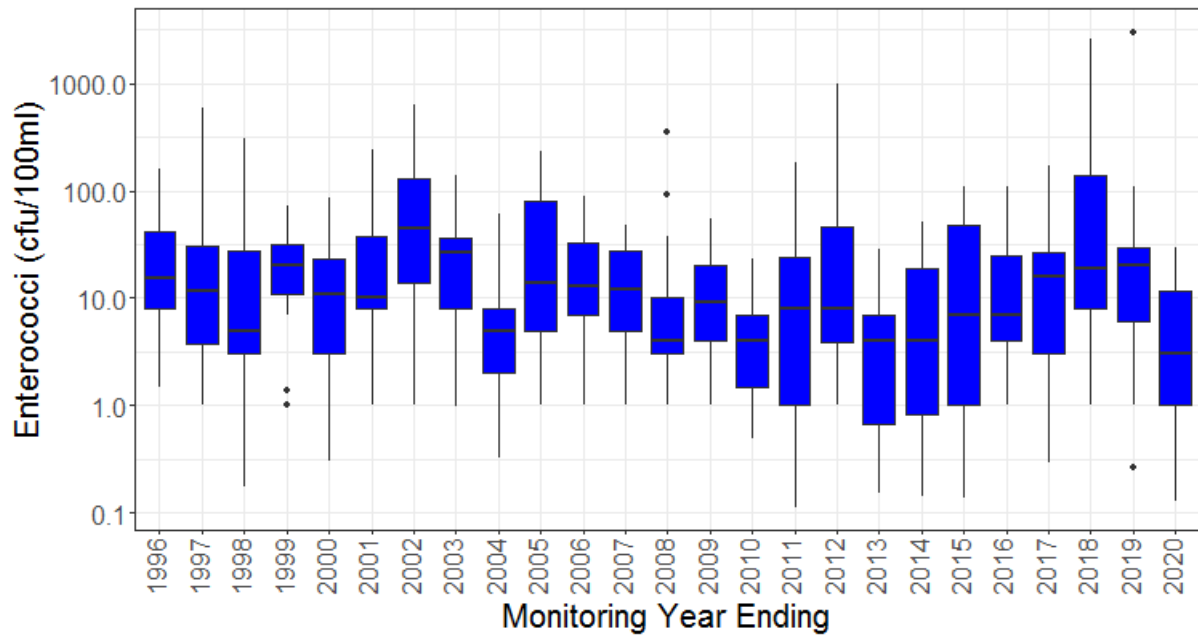


Figure 20 Box and whisker plots of enterococci for all summer SEM surveys at Ngamotu Beach

#### 4.7.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 21) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

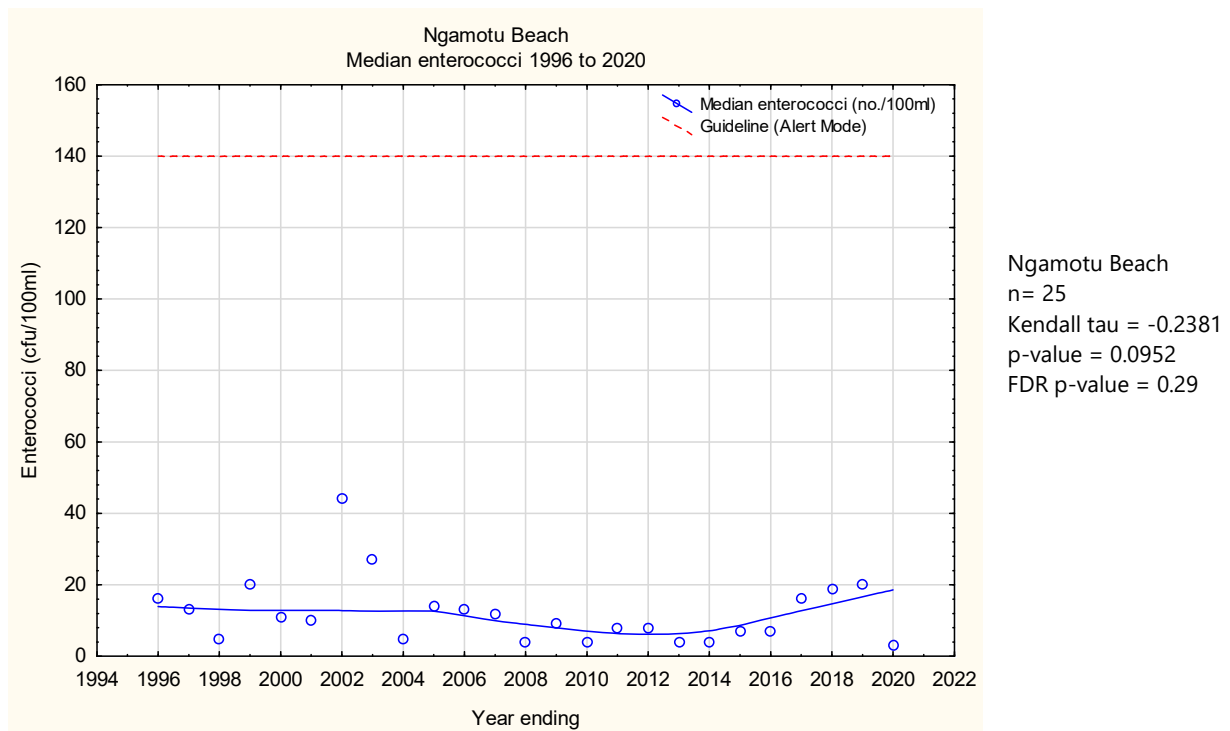


Figure 21 LOWESS trend analysis of median enterococci data at Ngamotu Beach

Over the 25 seasons monitored, there was a decreasing trend in median enterococci counts (Kendall tau = -0.238) that was not significant at the 5% level ( $p = 0.095$ ).

## 4.8 Back Beach

Back Beach (Photo 7) is situated to the west of New Plymouth. It is a very well used beach for swimming over the summer months and popular with surfers year-round. The Herekawe Stream enters the beach approximately 50 m from the sampling site.



Photo 8 Back Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 22. A total of 11 SEM samples and one follow up sample were collected over the season. All sample results and field observations are presented in Appendices I and II, respectively.

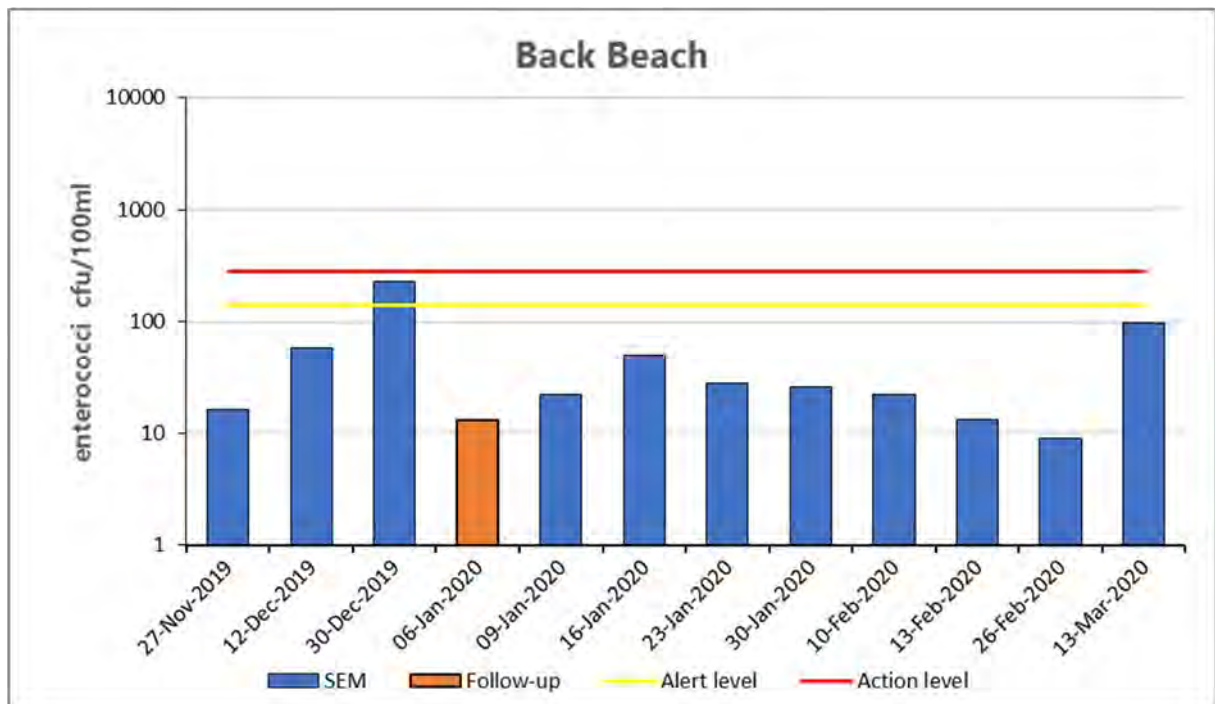


Figure 22 Enterococci results (presented on a logarithmic scale) for Back Beach

The monitoring results are summarized in Table 17.

Table 19 Statistical summary for Back Beach

Parameter	Units	Number of samples	Minimum	Maximum	Median
Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	49,200	52,100	51,200
Enterococci	cfu/100 ml	11	9	230	26
Temperature	$^\circ\text{C}$	11	14.3	20.3	18.1

#### 4.8.1 Comparison with guidelines

Enterococci counts from Back Beach over the 2019-2020 summer are summarised against the guidelines in Table 20. 'Alert' mode was reached on one occasion following an MfE survey carried out on 30 December 2019 (230 cfu/100 ml). Preceding rainfall may have influenced this high result (approximately 5 mm in 24 hours), however, excreta from dogs and gulls could be another explanation; given their regular presence at this site (Appendix I, Appendix II). The remaining eight samples were within the 'Surveillance' limits.

Table 20 Performance against guidelines at Back Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	1 [9%]	0 [0]

#### 4.8.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Back Beach over 10 summers are presented in Figure 23. The results from the 2019-2020 summer period were comparable with previous summers. The 2019-2020 median count (26 cfu/100 ml) was just below the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 23).

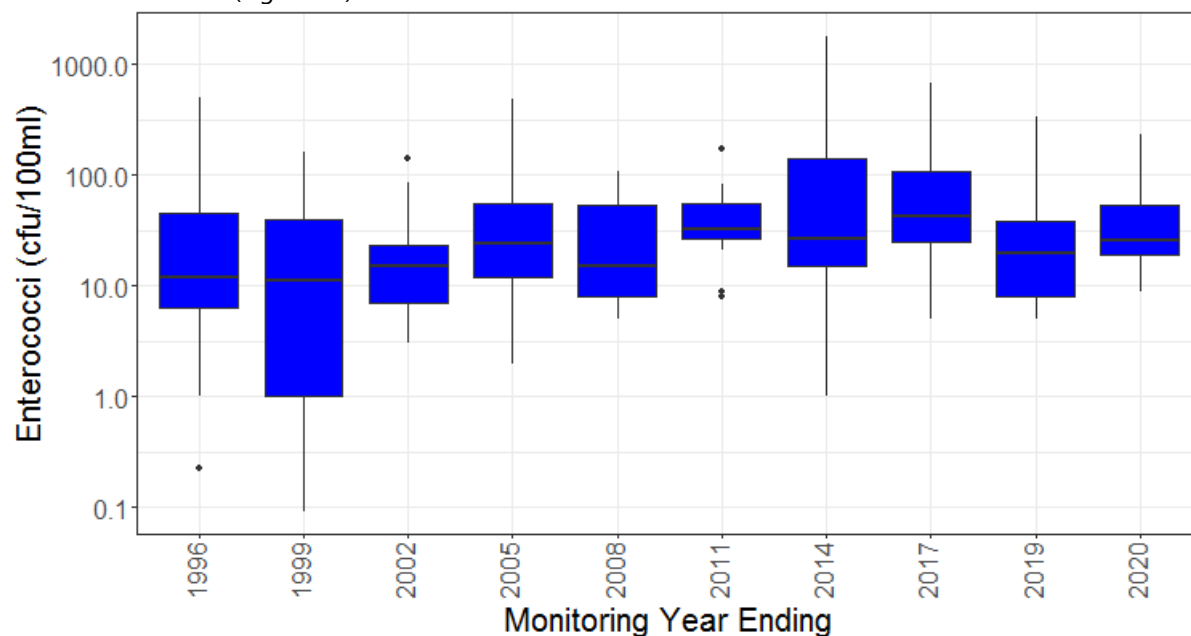


Figure 23 Box and whisker plots of enterococci for all summer SEM surveys at Back Beach

#### 4.8.3 Long-term trend analysis

Long term trend analysis was not performed with data from this site as there were an insufficient number of samples (only triennial data available).

## 4.9 Oakura Beach (Surf Club)

Oakura Beach (Photo 9) is popular with beach bathers during summer, and frequented by surfers all year-round. Two small lowland streams (Waimoku and Wairau) enter the beach on either side of the site, and as a consequence concentrations of faecal indicator bacteria can increase significantly during periods of high rainfall.



Photo 9 Oakura Beach at Surf Club

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 24. This beach was sampled on 20 occasions throughout the summer. There was 11 SEM samples, eight MfE samples and one follow up sample collected. All sample results and field observations are presented in Appendices I and II, respectively.

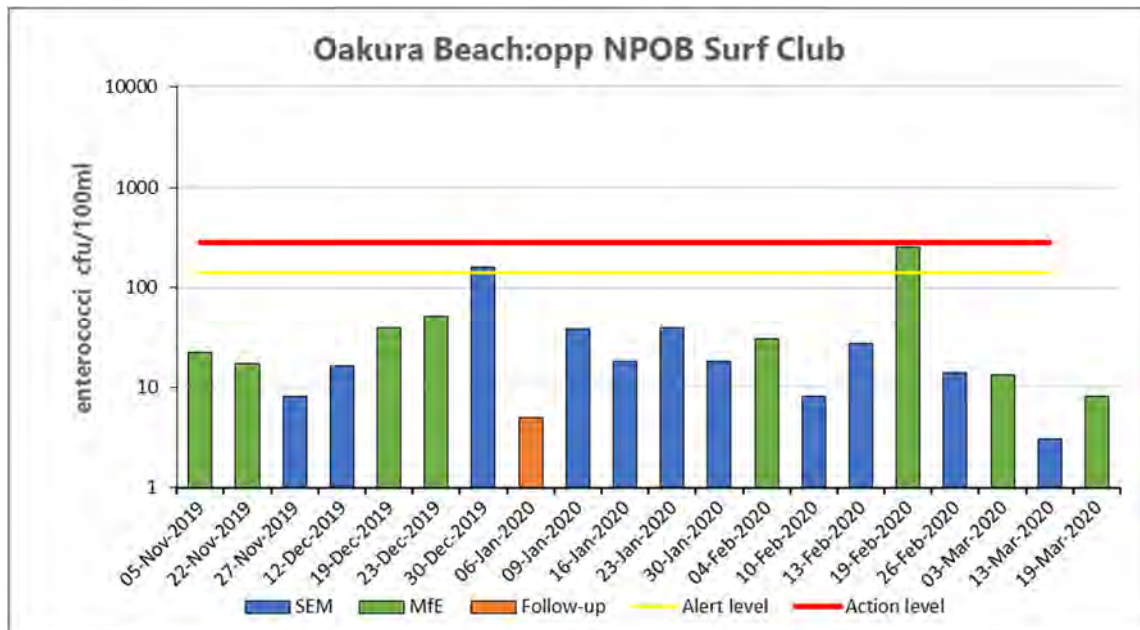


Figure 24 Enterococci results (presented on a logarithmic scale) for the Surf Club at Oakura Beach

The monitoring results are summarised in Table 21.

Table 21 Statistical summary for Oakura Beach (Surf Club)

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	48,800	52,500	51,600
	Enterococci	cfu/100 ml	11	3	160	18
	Temperature	$^\circ\text{C}$	11	14.2	20.7	17.3
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	48,800	52,500	51,400
	Enterococci	cfu/100 ml	19	3	250	18
	Temperature	$^\circ\text{C}$	19	14.2	20.7	17.5

#### 4.9.1 Comparison with guidelines

Enterococci counts from the Surf Club at Oakura Beach over the 2019-2020 summer are summarised against the guidelines in Table 22. 'Alert' mode was reached twice following MfE surveys on 30 December 2019 and 19 February 2020 (160 and 250 cfu/100 ml, respectively). Both of these sampling surveys were preceded by rain (5 and 8 mm in 24 hours, respectively), which may have led to the temporary decline in water quality at this site (Appendix I). The 17 remaining results were within 'Surveillance' limits.

Table 22 Performance against guidelines at Oakura Beach (Surf Club)

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	2 [11%]	0 [0]

#### 4.9.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected from Oakura Beach at the Surf Club over 25 summers are presented in Figure 25. The distribution of results from the 2019-2020 summer period were comparable with previous summers. The median count (18 cfu/100 ml) was one unit above the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 25).

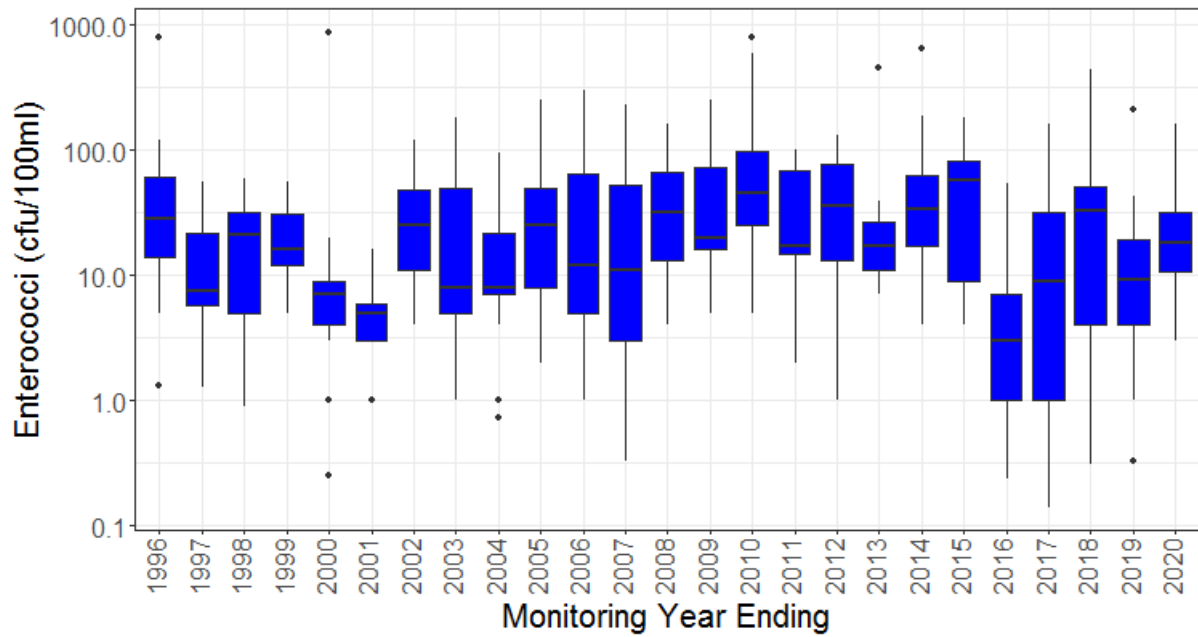


Figure 25 Box and whisker plots of enterococci for all summer SEM surveys at Oakura Beach at the Surf Club

#### 4.9.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 26) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

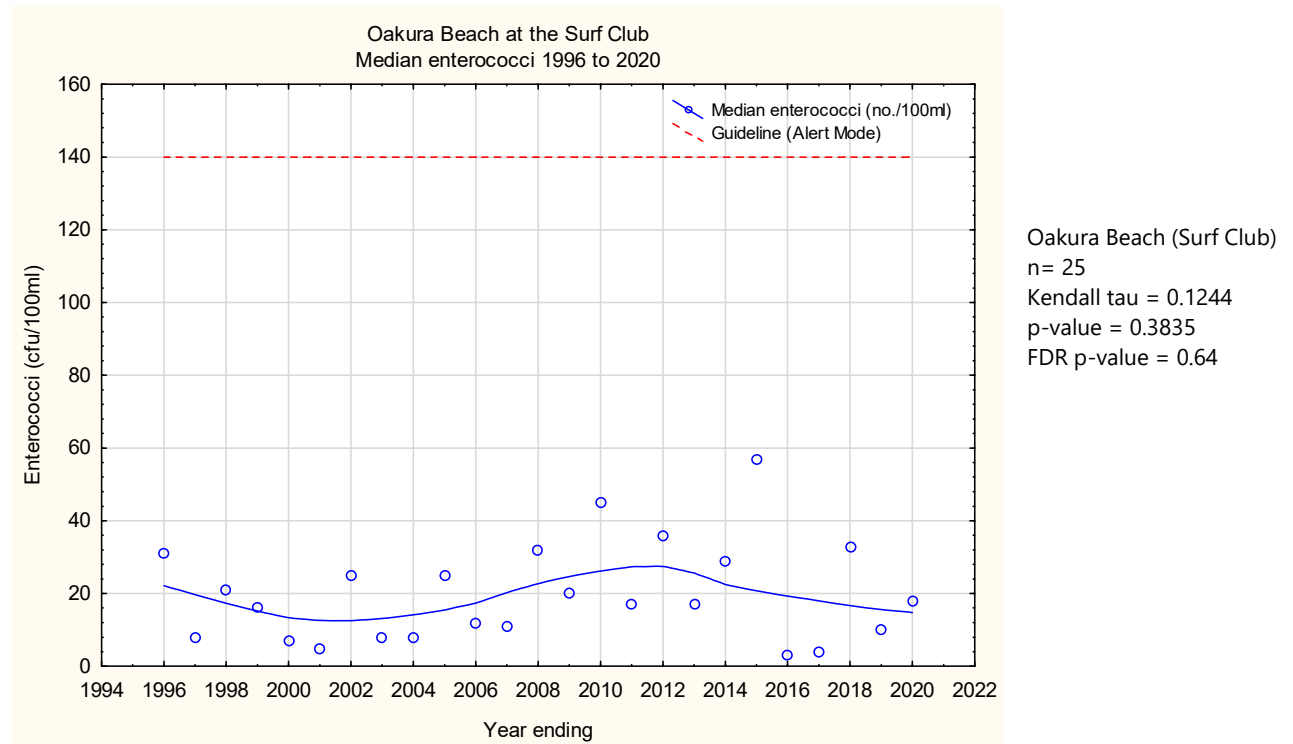


Figure 26 LOWESS trend analysis of median enterococci data at Oakura Beach (Surf Club)

Over the 25 seasons monitored, there was a positive trend (i.e. an increase) in median enterococci counts (Kendall tau = 0.124) that was not significant at the 5% level ( $p = 0.383$ ).

## 4.10 Oakura Beach (campground)

This site, situated at the west end of Oakura Beach in front of the campground, is a popular site with bathers and surfers (Photo 10).



Photo 10 Oakura Beach, opposite the campground

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 27. A total of 11 SEM samples were collected over the season. All sample results and field observations are presented in Appendices I and II, respectively.

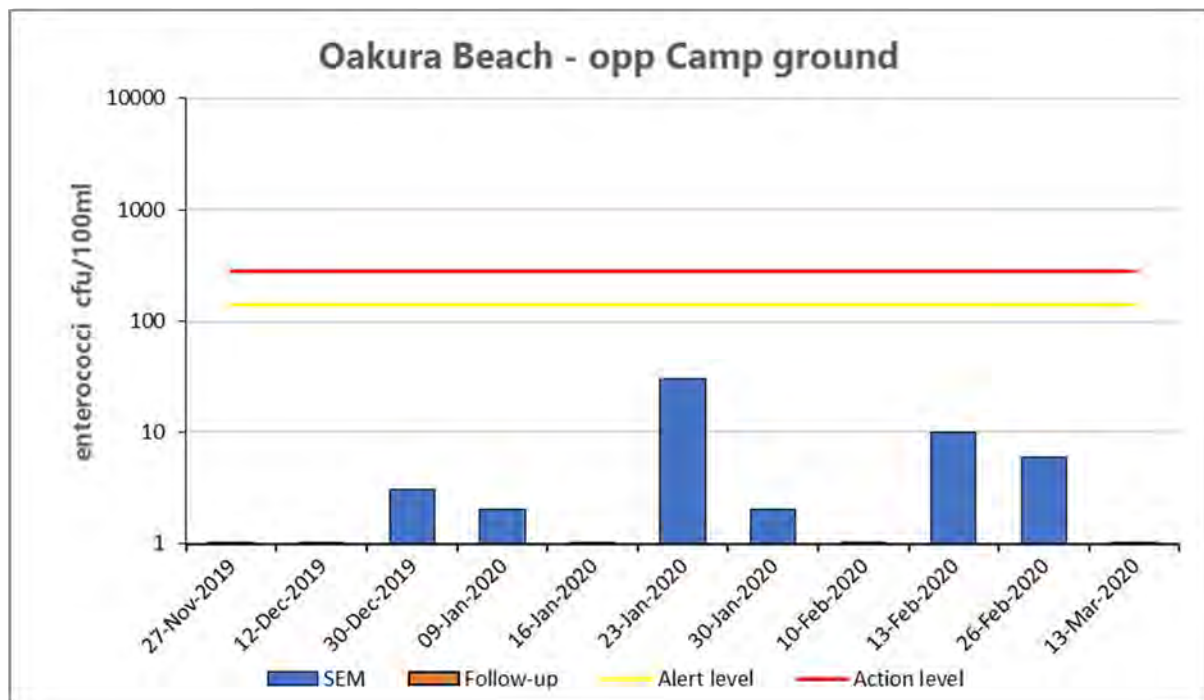


Figure 27 Enterococci results (presented on a logarithmic scale) for Oakura Beach at the campground

The monitoring results are summarised in Table 23.



Table 23 Statistical summary for Oakura Beach (campground)

Parameter	Units	Number of samples	Minimum	Maximum	Median
Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	51,300	53,000	52,300
Enterococci	cfu/100 ml	11	1	30	2
Temperature	$^\circ\text{C}$	11	14.2	21.1	17.3

#### 4.10.1 Comparison with guidelines

Enterococci counts from Oakura Beach at the campground over the 2019-2020 summer are summarised against the guidelines in Table 24. All 11 samples remained within the 'Surveillance' limits.

Table 24 Performance against guidelines at Oakura Beach (campground)

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample $>140/100$ ml	ACTION Two consecutive single samples $>280/100$ ml
SEM samples	0 [0]	0 [0]

#### 4.10.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Oakura Beach (at the campground) over 25 summers are presented in Figure 28. The distribution of results from the 2019-2020 summer period was low compared with previous summers. The 2019-2020 median count (2 cfu/100 ml) is one unit lower than the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 25).

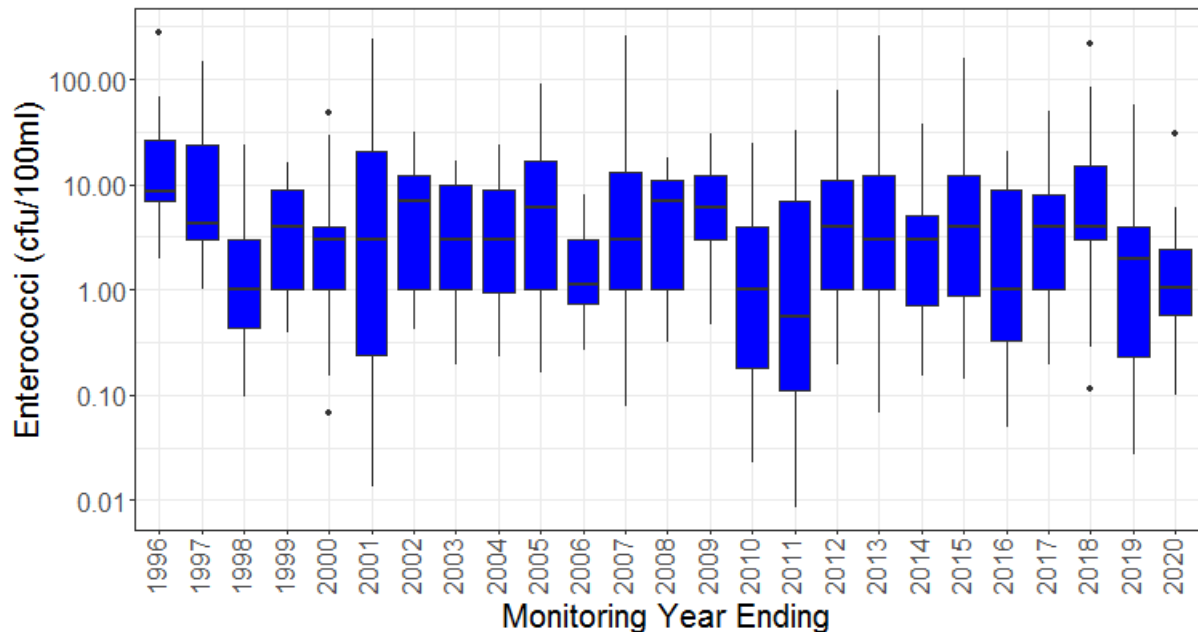


Figure 28 Box and whisker plots of enterococci for all summer SEM surveys at Oakura Beach opposite the campground

### 4.10.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 29) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

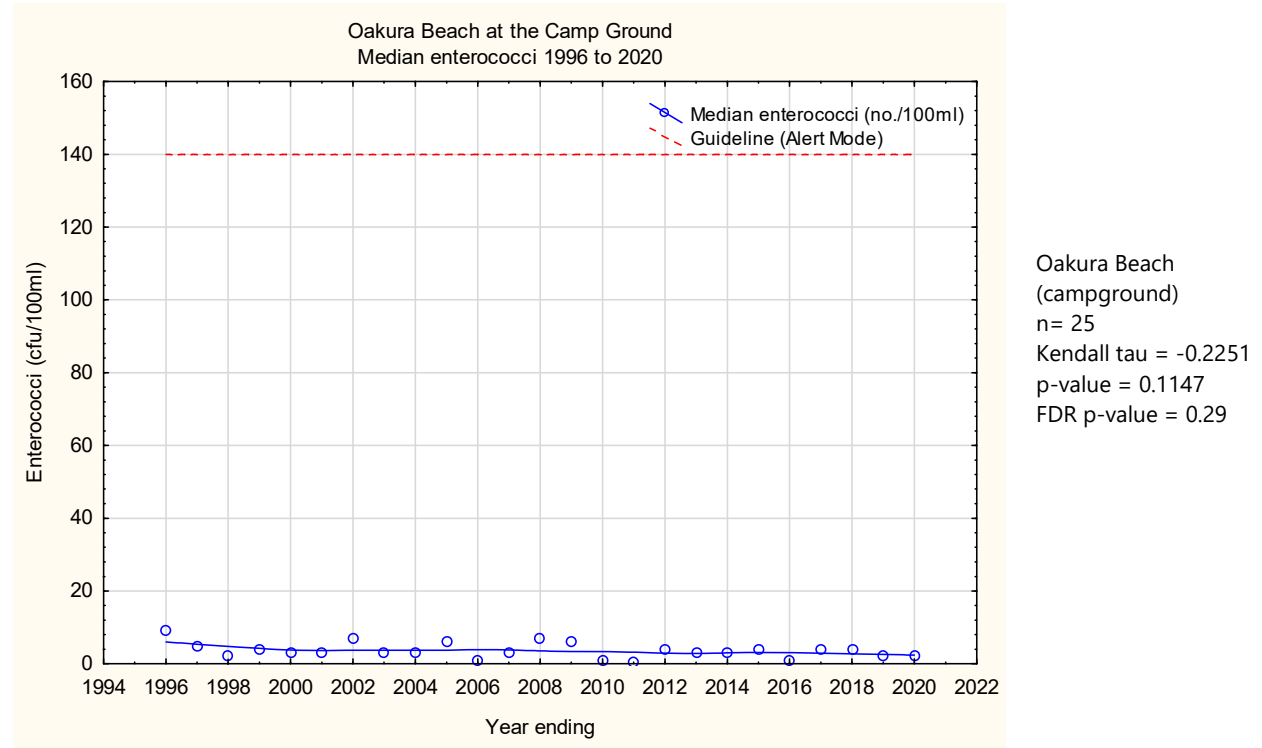


Figure 29 LOWESS trend analysis of median enterococci data at Oakura Beach (at the campground)

Over the 25 seasons monitored, there was a negative trend (i.e. a decrease) in median enterococci counts (Kendall tau = -0.225) that was not significant at the 5% level ( $p = 0.115$ ).

## 4.11 Opunake Beach

Opunake Beach (Photo 11) is a very popular swimming beach in South Taranaki. There are no large rivers in the vicinity. However, the outlet of a freshwater stream from the Opunake Power Station enters at the southern end of the beach.



Photo 11 Opunake Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 30. This beach was sampled on 19 occasions throughout the summer; comprising 11 SEM samples and eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

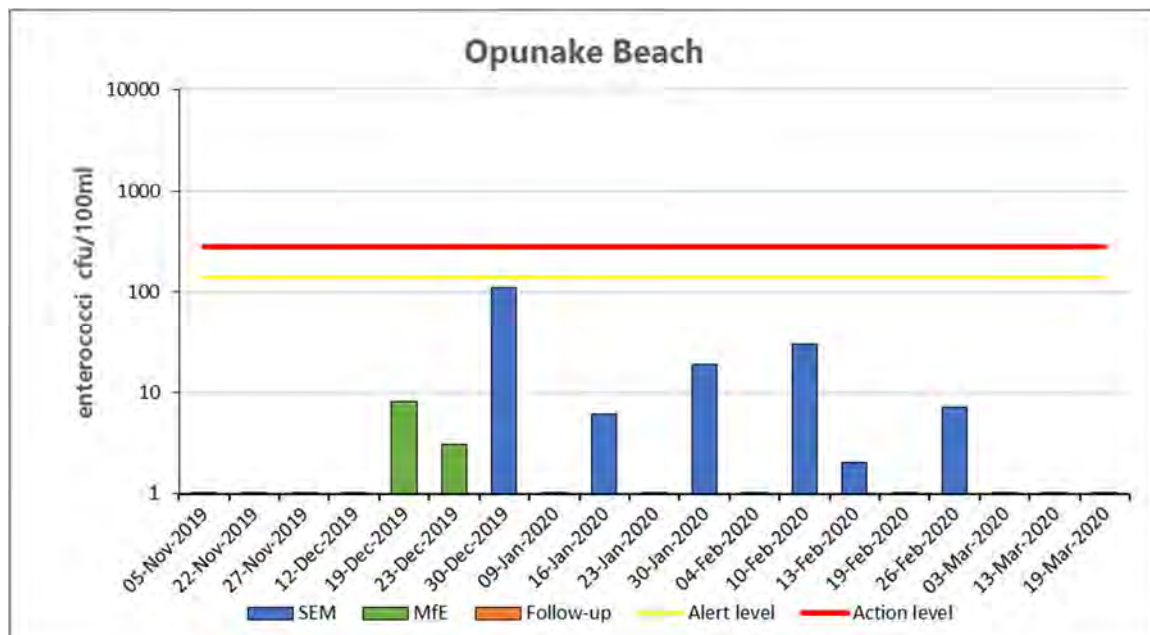


Figure 30 Enterococci results (presented on a logarithmic scale) for the Surf Club at Opunake Beach

The monitoring results are summarized in Table 25.

Table 25 Statistical summary for Opunake Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	51,100	53,000	52,200
	Enterococci	cfu/100 ml	11	<1	110	2
	Temperature	$^\circ\text{C}$	11	16.8	21.3	18.4
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	50,400	53,000	52,100
	Enterococci	cfu/100 ml	19	1	110	1
	Temperature	$^\circ\text{C}$	19	16.5	21.6	18.4

#### 4.11.1 Comparison with guidelines

Enterococci counts from Opunake Beach over the 2019-2020 summer are summarized against the guidelines in Table 26. All 19 samples were within the 'Surveillance' limits.

Table 26 Performance against guidelines at Opunake Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0]	0 [0]
SEM & MfE samples	0 [0]	0 [0]

#### 4.11.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Opunake Beach over 15 summers are presented in Figure 31. The distribution of results from the 2019-2020 summer period remained low, comparable with previous summers. The 2019-2020 median count (2 cfu/100 ml) is one unit above the 50<sup>th</sup> percentile of all previous annual medians recorded at this site (Figure 31).

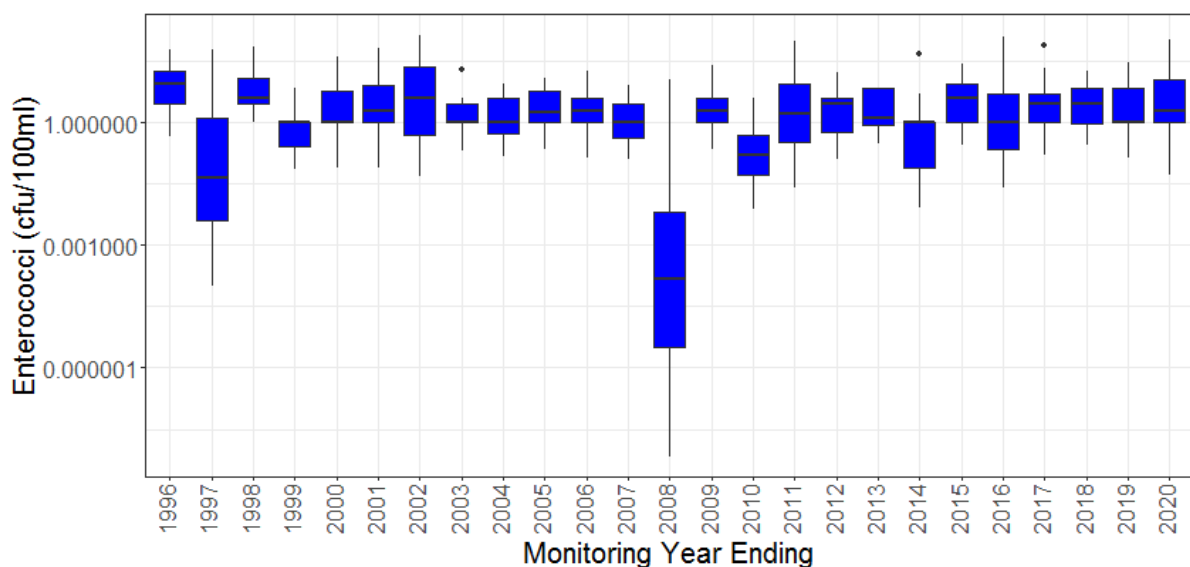


Figure 31 Box and whisker plots of enterococci for all summer SEM surveys at Opunake Beach

### 4.11.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 25 summer seasons (Figure 32) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

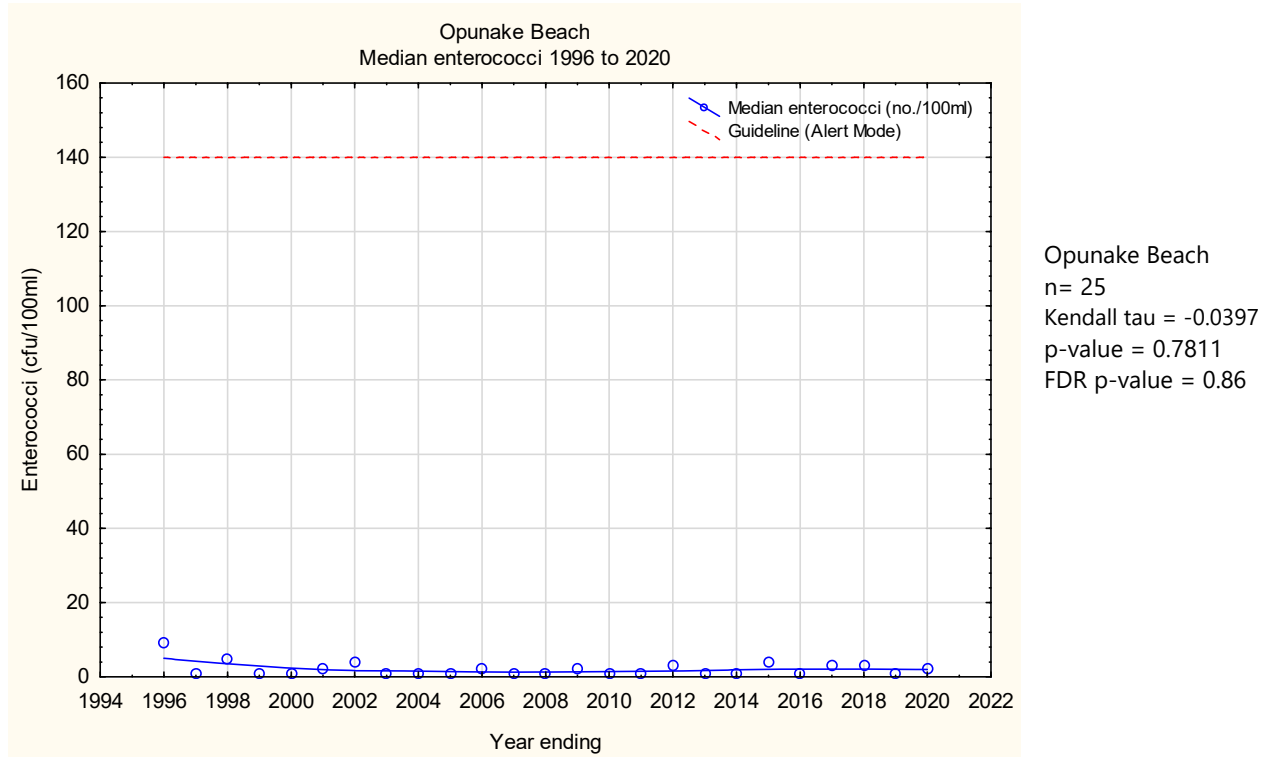


Figure 32 LOWESS trend analysis of median enterococci data at Opunake Beach

Over the 25 seasons monitored, there was a negative trend (i.e. a decrease) in median enterococci counts (Kendall tau = -0.040) that was not significant at the 5% level ( $p = 0.781$ ).

## 4.12 Ohawe Beach

Ohawe Beach (Photo 12) is located close to the large Waingongoro River in South Taranaki. The river catchment drains highly modified agricultural land.



Photo 12 Ohawe Beach

All enterococci data for this site, from the 2019-2020 summer period, is presented in Figure 33. This beach was sampled on 19 occasions throughout the summer; comprising 11 SEM samples and eight MfE samples. All sample results and field observations are presented in Appendices I and II, respectively.

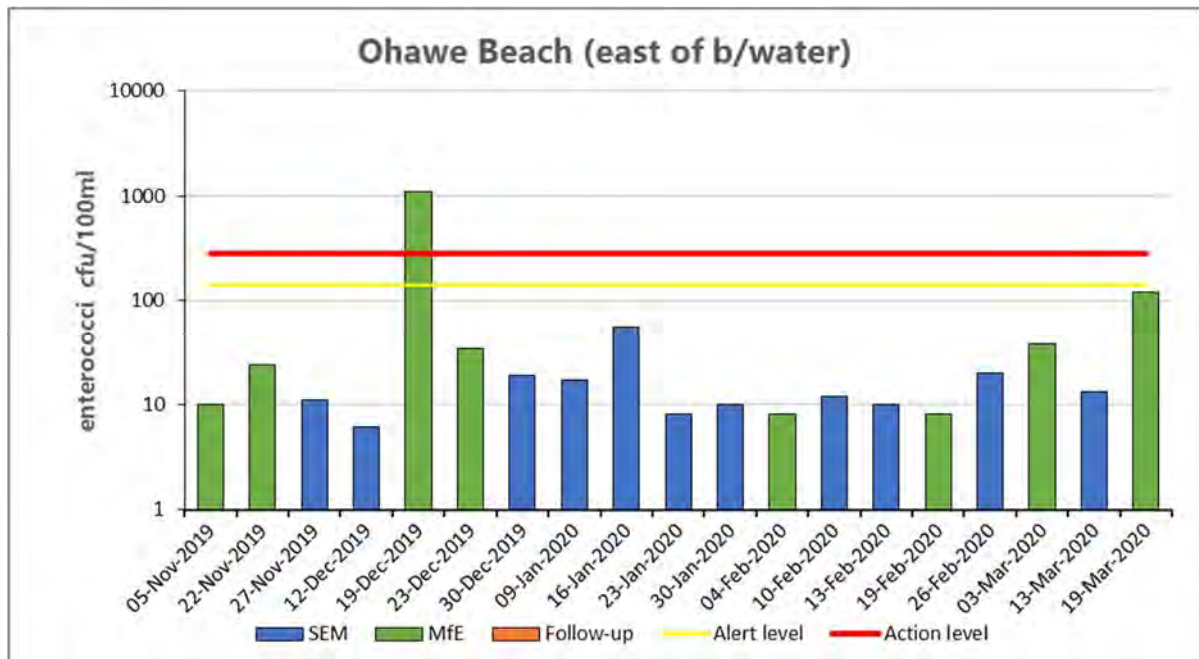


Figure 33 Enterococci results (presented on a logarithmic scale) for Ohawe Beach

The monitoring results are summarized in Table 27.

Table 27 Statistical summary for Ohawe Beach

	Parameter	Units	Number of samples	Minimum	Maximum	Median
SEM samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	11	43,200	51,400	49,500
	Enterococci	cfu/100 ml	11	6	56	12
	Temperature	$^\circ\text{C}$	11	17.1	21.3	19.2
SEM & MfE samples	Specific conductivity	$\mu\text{S}/\text{cm}@25^\circ\text{C}$	19	23,900	51,400	45,800
	Enterococci	cfu/100 ml	19	6	1,100	13
	Temperature	$^\circ\text{C}$	19	15.7	22.1	19.1

#### 4.12.1 Comparison with guidelines

Enterococci counts from Ohawe Beach over the 2019-2020 summer are summarized against the guidelines in Table 28. 'Alert' mode was prompted on one occasion following the survey on 19 December 2019 (1,100 cfu/100 ml). Considerable rainfall preceded this survey, and the sample conductivity was indicative of a much higher freshwater influence than usual (31 mm in 24 hours and 23,900  $\mu\text{S}/\text{cm}$ ; Appendix I). The remaining 18 routine samples remained within 'Surveillance' limits.

Table 28 Performance against guidelines at Ohawe Beach

Parameter	Number of exceedances of enterococci guidelines	
	ALERT Single sample >140/100 ml	ACTION Two consecutive single samples >280/100 ml
SEM samples	0 [0%]	0 [0]
SEM & MfE samples	1 [5%]	0 [0]

#### 4.12.2 Comparison with previous summer surveys

Summary statistics for SEM enterococci data collected at Ohawe Beach over 24 summers are presented in Figure 34. The distribution of results from the 2019-2020 summer period was relatively low compared with previous summers. The median count of 12 cfu/100 ml was the 5<sup>th</sup> lowest of the 24 summer surveys completed to date (Figure 34).

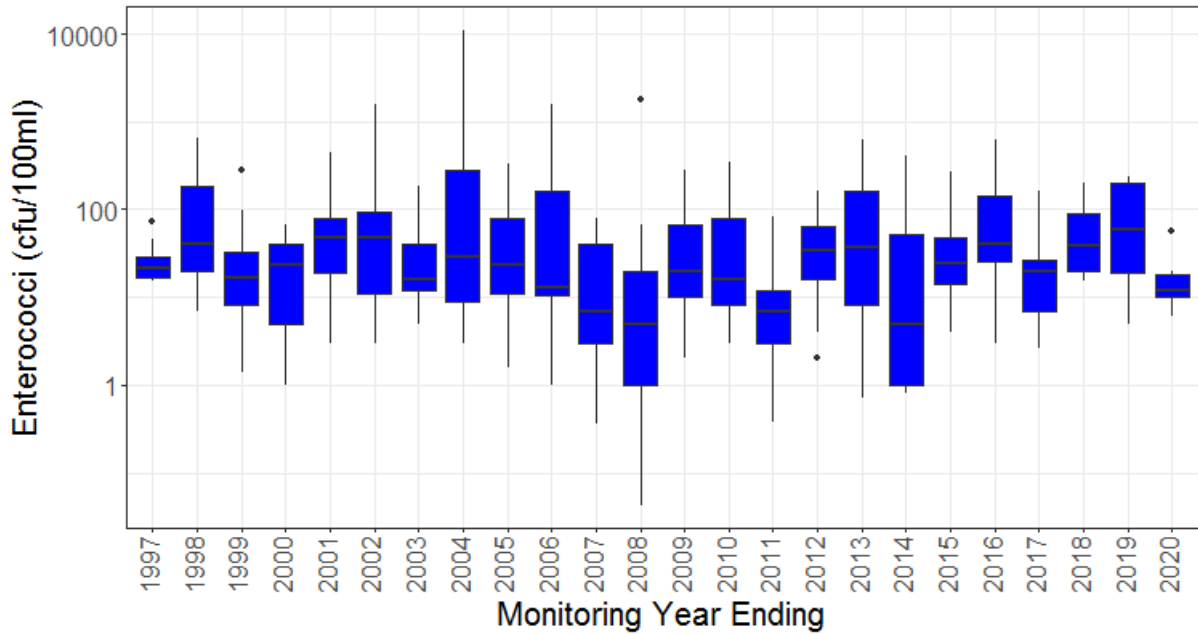


Figure 34 Box and whisker plots of enterococci for all summer SEM surveys at Ohawe Beach

### 4.12.3 Long-term trend analysis

Trend analysis was performed by applying a LOWESS fit (tension 0.4) to a time scatterplot of the median enterococci data for 24 summer seasons (Figure 35) and testing the significance of any trend using the Mann-Kendall test at the 5% level, followed by Benjamini-Hochberg False Discovery Rate (FDR) analysis.

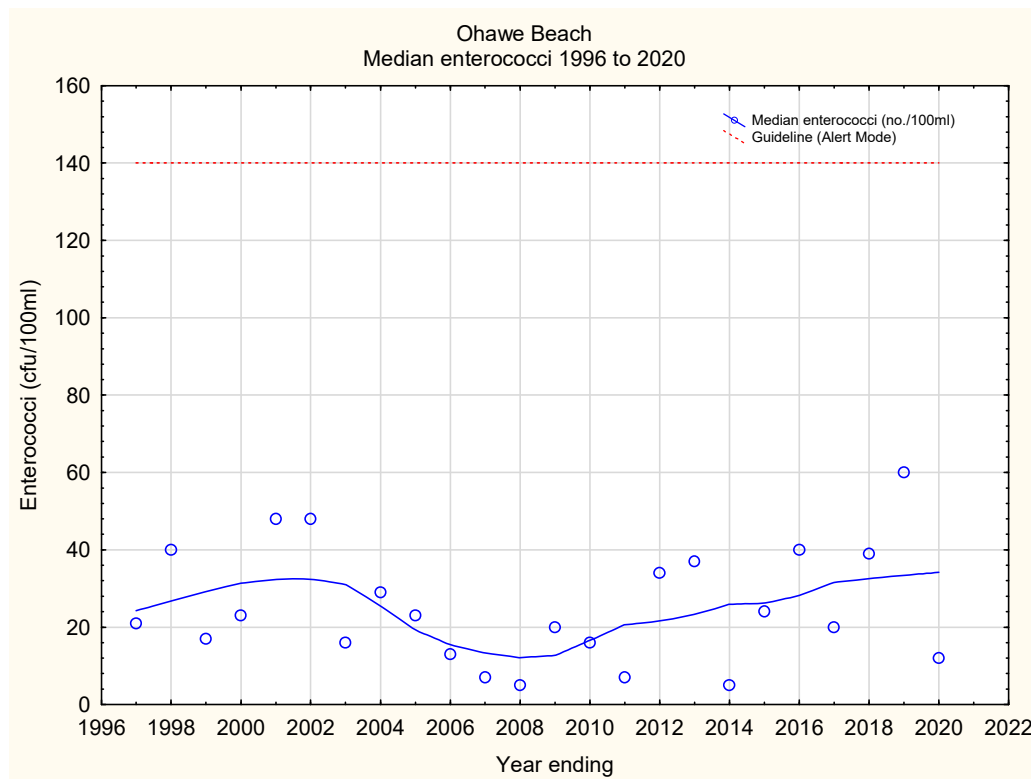


Figure 35 LOWESS trend analysis of median enterococci data at Ohawe Beach

Over the 24 seasons monitored, there was a decreasing trend in median enterococci counts (Kendall tau = -0.026) that was not significant at the 5% level (p = 0.860).



## 5 Discussion

### 5.1 Regional overview

Rainfall is a major factor influencing recreational water quality in the coastal environment, particularly at swimming beaches in close proximity to rivers, streams and stormwater outlets. During heavy rain, faecal contaminants run off the land and into waterways; ultimately discharging to the coast. During the summer bathing season (November 2019 to March 2020), rainfall totals across the region were generally lower than the historical average for that period (Figure 36). At coastal sites, rainfall totals were between 70 – 77% of the historic average in North Taranaki, 84 – 89% in Western Taranaki, and 94 – 113% in South Taranaki. This slightly drier than usual summer meant that the majority of sampling was able to be carried out during fine weather; as is the Council’s preferred sampling protocol. There were only three sampling surveys that were carried out following considerable rainfall (ranging from 4.6 to 31 mm in the preceding 24 hours). The majority of MfE guideline exceedances during 2019-2020 were from samples collected during those surveys (see Section 5.1). No anomalous or persistent water quality issues were discovered at any of the monitored sites during the summer bathing season.

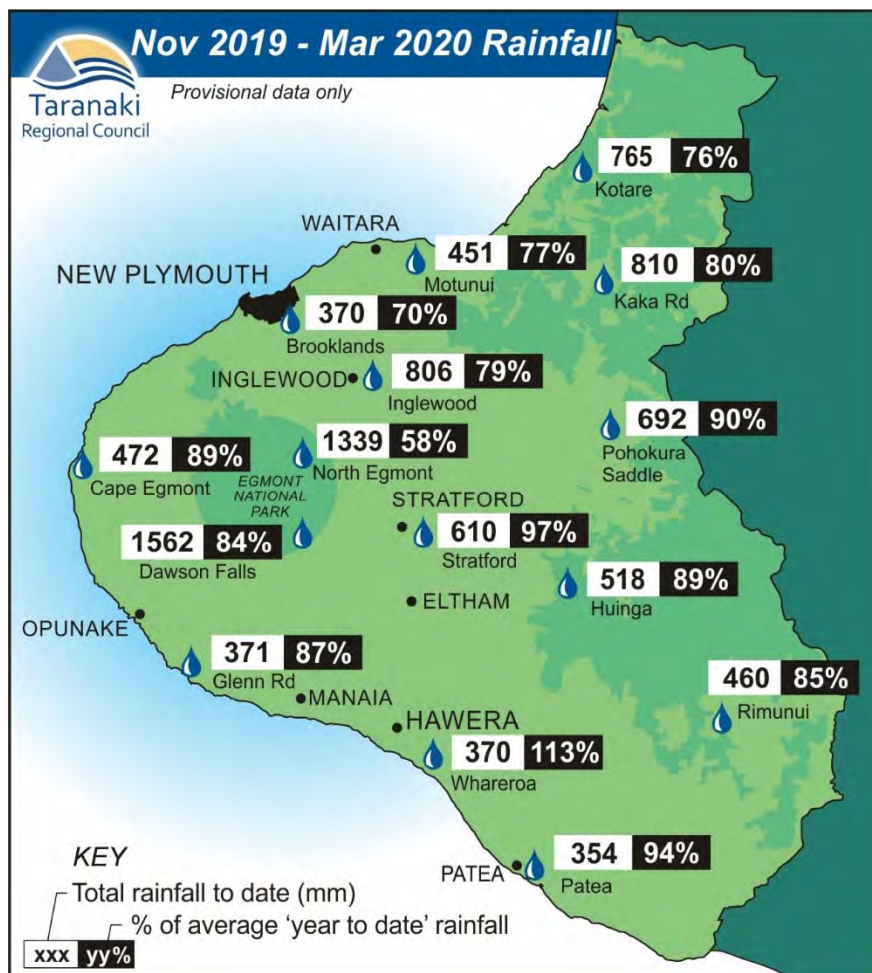


Figure 36 Average rainfall data for Taranaki, 1 November 2019 to 31 March 2020

The 2019-2020 recreational water quality monitoring programme was truncated due to the COVID-19 pandemic and associated lockdown restrictions. This meant that only 11 of the usual 13 SEM samples were collected, with the last samples being collected on 19 March. However, with the lockdown restrictions also preventing people from bathing at the coast, ongoing recreational water quality monitoring at this time was not necessary.

## 5.2 Guidelines and grades

A summary of results for all bathing beach sites monitored over the 2019-2020 summer period is presented in Table 29, in ascending order of median count. In this table, the performance of each site is summarised in terms of the MfE Guidelines and the Suitability for Recreation Grades (2015/16 - 2019/20), based on routine samples collected over the summer (SEM and MfE monitoring).

Table 29 Summary of bathing beach performance against relevant guidelines and grades

Beach	Median	Number of samples	Number of samples reaching Alert mode [% of samples]	Number of samples reaching Action mode [% of samples]	Suitability for Recreation Grade (SFRG)
Opunake Beach	1	19	0 [0%]	0 [0%]	Good
Oakura Beach (camp ground)	2	11	0 [0%]	0 [0%]	Good
Fitzroy Beach	4	19	0 [0%]	0 [0%]	Good
Bell Block	6	11	0 [0%]	0 [0%]	Good
Waitara West Beach	7	19	1 [5%]	0 [0%]	Good
Waitara East Beach	7	19	1 [5%]	0 [0%]	Fair
East End Beach	10	11	0 [0%]	0 [0%]	Good
Ngamotu Beach	10	19	1 [5%]	0 [0%]	Fair
Ohawe Beach	13	19	1 [5%]	0 [0%]	Fair
Oakura Beach (surf club)	18	19	2 [11%]	0 [0%]	Fair
Back Beach	26	11	1 [9%]	0 [0%]	Fair
Onaero Beach (surf club)	28	19	3 [16%]	0 [0%]	Fair

During the 2019-2020 summer period, 196 routine samples were collected across 12 sites. Of those, 186 samples (94.9%) remained in Surveillance mode ( $\leq 140$  cfu/100 ml) and 10 samples (5.1%) reached Alert mode ( $> 140$  cfu/100 ml). No samples exceeded the Action mode threshold ( $2x > 280$  cfu/100 ml). Each time that the Alert mode threshold was exceeded, the next sample result was back in the Surveillance mode category; indicating that there were no persistent faecal pollution issues at these sites during the 2019-2020 summer season. The proportion of samples within the Surveillance mode category was higher than in the previous bathing season (91.8% of routine samples were within Surveillance mode in 2018-2019).

The ten samples that reached Alert mode in 2019-2020 were collected across four surveys. Recent rainfall preceded three of those survey dates, including a considerable rainfall event prior to 19 December. Low sample conductivity results were also associated with seven of the Alert mode exceedances, providing evidence of freshwater influence.

There were two sites in 2019-2020 that differed markedly from 2018-2019 with regards to their performance against the MfE guidelines. In 2018-2019, Ngamotu Beach recorded three guideline exceedances (including two Action mode exceedances) and a median enterococci count of 20 cfu/100 ml. In 2019-2020, there was only one guideline exceedance and the median enterococci count was 10 cfu/100 ml. This improvement is at least in part due to the resolution of a pollution issue that was discovered in March 2019 (see the previous monitoring report for further information). At Ohawe Beach, there were six guideline

exceedances and a median enterococci count of 45 cfu/100 ml recorded in 2018-2019. In 2019-2020 there was just one guideline exceedance and a median count of 13 cfu/100 ml.

Sites that were monitored during the 2019-2020 summer were also assigned a Suitability for Recreation Grade (SFRG), which reflects a qualitative risk grading of the catchment in addition to quantitative enterococci results since the 2015-2016 summer (see Section 3.2). Half of the sites (6/12) were graded 'good' and the other half were graded 'fair'. No sites were graded 'poor' or 'very poor'. These grades are similar to those following the 2018-2019 bathing season, where 8/14 sites were graded 'good' and 6/14 were grade 'fair'. None of the annually monitored sites changed grades between monitoring seasons (the decrease in the number of 'good' sites is because three of the 'good' sites in 2018-2019 were rotational sites that were not monitored in 2019-2020). Bell Block Beach was the only rotational site monitored in 2019-2020. Complete SFRG results are presented in Appendix III.

### 5.3 State of the Environment samples

The bathing beach results from SEM surveys over the 2019-2020 summer period are presented in Figure 37, and also summarised in Table 30 in ascending order of median enterococci count. Table 30 also includes the median enterococci count from all surveys<sup>2</sup> and long-term trend analysis statistics for each site.

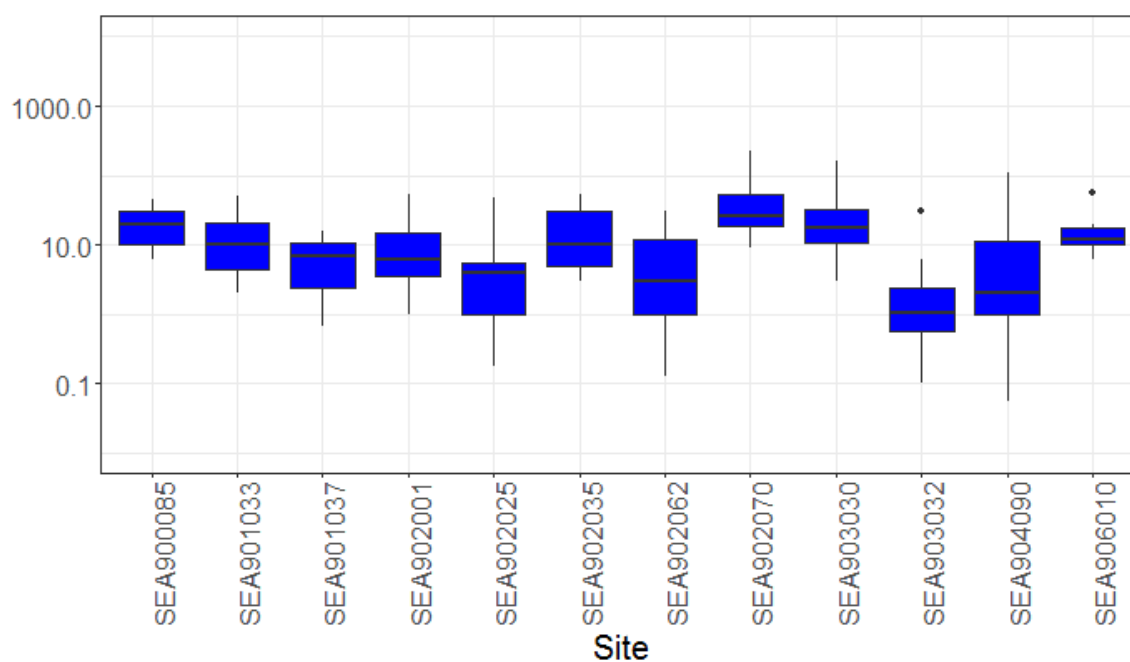


Figure 37 Box and whisker plots of all SEM enterococci data at all sites during the 2019-2020 season presented on a logarithmic scale (see Table 4 for site codes)

Table 30 Summary of SEM enterococci results, including overall medians and trend analysis statistics

Beach	Median enterococci count			Long term trend analysis		
	2019-2020 summer survey	All summer surveys	no. of surveys	Kendall tau	Mann-Kendall p- value	False Discovery Rate p-value
Opunake Beach	2	1	25	-0.040	0.781	0.86
Oakura Beach (camp ground)	2	3	25	-0.225	0.115	0.29

<sup>2</sup> For each site, calculated as the median of all summer survey median enterococci counts

Beach	Median enterococci count			Long term trend analysis		
	2019-2020 summer survey	All summer surveys	no. of surveys	Kendall tau	Mann-Kendall p- value	False Discovery Rate p-value
Ngamotu Beach	3	10	25	-0.238	0.095	0.29
Fitzroy Beach	4	4	25	-0.515	<0.001	<0.01
Bell Block	6	12.5	10	Insufficient data (triennial)		
Waitara West Beach	7	12	25	-0.044	0.757	0.86
Waitara East Beach	10	13	25	-0.224	0.117	0.29
East End Beach	10	10	17	-0.196	0.273	0.55
Ohawe Beach	12	22	24	-0.026	0.860	0.86
Oakura Beach (surf club)	18	17	25	0.124	0.384	0.64
Onaero Beach (surf club)	20	11	21	0.098	0.536	0.77
Back Beach	26	22	10	Insufficient data (triennial)		

From all of the 2019-2020 SEM results, Opunake Beach and Oakura Beach (at the camp ground) shared the lowest median enterococci count (2 cfu/100 ml; Table 30). As demonstrated by their comparably low overall (long-term) median counts, recreational water quality at these sites has typically been high. This is likely attributed to their distance from potential contaminant sources such as streams and stormwater outlets.

The median enterococci count for 2019-2020 was the highest at Back Beach, followed closely by Onaero Beach and Oakura Beach at the surf club (26, 20, and 18 cfu/100 ml, respectively; Table 30). At the Back Beach monitoring site, the adjacent Herekawe Stream mouth is a likely factor influencing water quality; particularly following rainfall. However, the gulls and dogs that were regularly observed near this monitoring site may also be generating a localised source of contamination (Appendix II). The primary factors influencing water quality at the Onaero and Oakura surf club monitoring sites are most likely the adjacent stream mouths. This influence is particularly evident at Onaero where the freshwater input can often be identified through low sample conductivity results (Appendix I). At Oakura, recreational water quality in the adjacent Waimoku Stream has been monitored intermittently for a number of years; the results of which have shown there to be relatively high counts of faecal indicator bacteria in the stream (TRC, 2019b). During summer, this stream is known to meander east along the beach until the mouth is positioned in front of the surf club; in close proximity to the sampling site.

At eight sites, median enterococci counts from the 2019-2020 survey were lower than or equal to their respective overall medians (Table 30). As discussed previously regarding all of the monitoring data (including MfE samples), the biggest differences were seen at Ohawe and Ngamotu Beach (differences of 10 and 7 cfu/100 ml, respectively). Out of the ten sites with sufficient data, long-term trend monitoring also showed slight decreasing trends at eight (i.e. decreases in enterococci counts). However, these decreasing trends were only statistically significant (at the 5% level) at one site; Fitzroy Beach (Kendall tau = -0.515, Mann-Kendall p value <0.001; Table 30). This significant trend reflects an improvement in water quality that may be attributed in part or in whole due to work undertaken by NPDC as part of the Stormwater Upgrade Project at Fitzroy. As a result of this project there is now less flow of stormwater to the stormwater infiltration galleries located in the Fitzroy Beach car park.

At four sites, median enterococci counts in the 2019-2020 survey were higher than their respective overall medians (Table 30). These differences were negligible at Opunake Beach, Oakura at the surf club and Back

Beach; indicating that the 2019-2020 results were still comparable with previous results. The largest difference was seen at Onaero beach at the Surf Club, where the 2019-2020 median was nearly double the overall median (although this was only a difference of 9 cfu/100 ml, and was a decrease from the 2018-2019 median; Figure 4). Two sites, Oakura and Onaero at the surf clubs, demonstrated slightly increasing long-term trends (i.e. increases in enterococci counts). However, neither of these trends were statistically significant.

## 5.4 Conclusion

During the 2019-2020 summer season, 196 routine samples were collected across 12 sites; of which 94.9% remained within Surveillance mode ( $\leq 140$  cfu/100 ml). The majority of guideline exceedances were from samples collected shortly after rainfall. No anomalous or persistent water quality issues were identified during the season.

Based on SEM samples, recreational water quality was generally comparable with historical results. At eight sites, median enterococci counts from the 2019-2020 survey were lower than or equal to their respective overall medians. This statistic was higher than the historical equivalent at the remaining four sites. One site, Fitzroy Beach, continued to demonstrate a significant negative trend in median enterococci counts (improving quality) based on 25 years of monitoring data.

Many of the popular beach sites monitored in Taranaki happen to be located close to stream or river mouths which can act as a source of contamination during heavy rainfall. The majority of these rivers and streams drain catchments with intensive agricultural land use, including dairying. Microbial source tracking has revealed that in addition to ruminants, birds (wildfowl and gulls) can also act as a key source of contamination in Taranaki freshwater and downstream environments (TRC 2017, Photo 13). In order to minimize potential health and safety risks, the Council recommends reducing coastal recreational activities in the vicinity of stream mouths for up to three days following heavy rainfall.



Photo 13 Black-backed gulls at the mouth of the Waiwhakaiho River

## 6 Recommendations

As a result of the 2019-2020 bathing beach recreational water quality survey it is recommended:

1. THAT the 2020-2021 summer survey be performed at 12 sites continuing with the existing sampling protocol (sites monitored annually, plus Year 3 sites).
2. THAT the 2020-2021 summer survey also includes weekly 'MfE samples' at eight sites (Onaero, Waitara West, Waitara East, Fitzroy, Ngamotu, Oakura Surf Club, Opunake and Ohawe) between December and February in accordance with MfE, 2003 guidelines to provide up to date public information on beach conditions throughout the holiday periods.
3. THAT follow-up sampling be performed as deemed necessary by Council staff.
4. THAT public reporting of results be performed as appropriate during the season, and in an annual report upon completion of the season's programme.

## Glossary of common terms and abbreviations

The following abbreviations and terms are used within this report:

Action mode	Two consecutive single samples greater than 280 enterococci cfu/100ml
Alert mode	Single sample greater than 140 enterococci cfu/100ml
Bacteriological faecal indicators	Micro-organisms selected as indicators of faecal contamination
Bathers	Those who enter the water, and either partially or fully immerse themselves
Bathing season	The bathing season generally extends between 1 November and 31 March
Beach	The shore or any access point to the sea
cfu	Colony forming units. A measure of the concentration of bacteria usually expressed as per 100 ml sample
Specific conductivity	Conductivity, an indication of the level of dissolved salts in a sample, measured at 25°C and expressed in microsiemens/centimetre ( $\mu\text{S}/\text{cm}$ )
Contact recreation	Recreation activities that bring people physically in contact with water, involving a risk of involuntary ingestion or inhalation of water
<i>E.coli</i>	<i>Escherichia coli</i> , member of the Enterobacteriaceae, an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
Enterococci	Members of the Streptococcus group of bacteria characterised as faecal in origin. Enterococci provide an indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre of sample
Faecal coliform	An indicator of the possible presence of faecal material and pathological micro-organisms. Usually expressed as colony forming units per 100 millilitre sample
False Discovery Rate (FDR)	The expected proportion of true hypothesis rejected out of the total number of rejections
Follow-up sample	Second sample taken to confirm an initial high result; usually within 24-72 hours depending on accessibility/sample turnaround time, etc.
Median	Central value when values are arranged in order of magnitude
Microbiological Assessment Category (MAC)	A measurement of water quality over time as provided by historical (five years) microbiological results – A, B, C or D
RMA	Resource Management Act 1991 and subsequent amendments
Sanitary Inspection Category (SIC)	A measure of the susceptibility of a water body to faecal contamination – Very High, High, Moderate, Low or Very Low
Suitability for Recreation Grade (SFRG)	A combination of Sanitary Inspection Category (SIC) and Microbiological Assessment Category (MAC), describes the general hypothetical condition of a site in the absence of specific monitoring data, based on both risk and past indicator bacteria counts
Temp	Temperature, measured in °C (degrees Celsius)

Water quality            The bacteriological condition of a water body as it relates to human health, measured using indicator bacteria

For further information on analytical methods, contact a Science Services Manager.



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## Appendix I

Complete marine recreational water quality results  
for 2019-2020 summer season



Onaero Beach (Surf Club)

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	10:00	43500	2	17.7	16:11	2.7	0.0	0.0
MFE	22/11/2019	10:15	35300	130	17.5	18:01	3.2	0.0	7.8
SEM	27/11/2019	09:20	51200	6	18.7	09:56	3.6	0.0	0.0
SEM	12/12/2019	10:00	51500	10	21	09:40	3.4	0.0	0.0
MFE	19/12/2019	11:30	25400	280	18.6	15:22	3.2	3.6	46.4
MFE	23/12/2019	12:30	4460	240	20.5	07:13	3.2	0.0	0.0
SEM	30/12/2019	12:20	41600	37	17.4	12:20	3.3	3.8	6.4
SEM	09/01/2020	08:10	47100	28	14.9	08:37	3.2	0.0	0.8
SEM	16/01/2020	12:00	47000	10	18	14:00	3.4	0.0	12.8
SEM	23/01/2020	08:00	47200	32	18.9	08:46	3.2	0.0	0.0
SEM	30/01/2020	11:55	49400	20	20.8	13:06	3.2	0.0	1.8
MFE	04/02/2020	12:35	51300	< 10	23.4	17:25	2.7	0.0	0.0
SEM	10/02/2020	08:50	51200	27	17.8	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:50	52300	10	19.7	12:49	3.7	0.0	0.0
MFE	19/02/2020	14:30	37800	190	22	06:39	2.9	1.0	1.4
SEM	26/02/2020	10:45	51400	12	20.9	11:27	3.4	0.0	0.0
MFE	03/03/2020	09:10	48200	30	21	15:33	2.7	0.0	0.2
SEM	13/03/2020	10:45	47800	44	20.1	12:27	3.7	0.0	0.6
MFE	19/03/2020	09:45	49300	32	18.9	06:18	2.8	0.2	0.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Motonui

Waitara East Beach

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	10:35	45000	< 1	18.1	16:11	2.7	0.0	0.0
MFE	22/11/2019	10:50	43900	< 1	18.6	18:01	3.2	0.0	7.8
SEM	27/11/2019	10:35	46300	7	20.1	09:56	3.6	0.0	0.0
SEM	12/12/2019	09:40	50300	49	21.1	09:40	3.4	0.0	0.0
MFE	19/12/2019	11:00	6830	1200	18.6	15:22	3.2	4.8	46.4
MFE	23/12/2019	11:40	43500	4	21.1	07:13	3.2	0.0	0.0
SEM	30/12/2019	11:50	48400	2	17.6	12:20	3.3	3.8	6.4
SEM	09/01/2020	09:25	50800	4	15.2	08:37	3.2	0.0	0.8
SEM	16/01/2020	13:00	50900	22	18.1	14:00	3.4	0.0	10.8
SEM	23/01/2020	08:45	49800	3	19	08:46	3.2	0.0	0.0
SEM	30/01/2020	13:15	52100	21	20.7	13:06	3.2	0.0	1.8
MFE	04/02/2020	12:00	38300	< 10	23.3	17:25	2.7	0.0	0.0
SEM	10/02/2020	09:50	52700	15	17.6	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:30	51000	20	19.6	12:49	3.7	0.0	0.0
MFE	19/02/2020	10:30	49400	< 1	21.9	06:39	2.9	1.4	1.4
SEM	26/02/2020	12:05	50100	10	21.6	11:27	3.4	0.0	0.0
MFE	03/03/2020	10:30	49200	35	23.3	15:33	2.7	0.0	0.0
SEM	13/03/2020	12:00	52300	5	20.2	12:27	3.7	0.0	0.0
MFE	19/03/2020	10:15	50500	2	19	06:18	2.8	0.2	0.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Motonui



Waitara West Beach

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	11:00	42700	< 1	17.5	16:11	2.7	0.0	0.0
MFE	22/11/2019	12:00	48300	2	18.7	18:01	3.2	0.0	7.8
SEM	27/11/2019	11:05	40200	13	20.1	09:56	3.6	0.0	0.0
SEM	12/12/2019	09:00	51200	7	19.8	09:40	3.4	0.0	0.0
MFE	19/12/2019	10:43	18110	1200	18.3	15:22	3.2	5.6	46.4
MFE	23/12/2019	11:00	29900	76	18.6	07:13	3.2	0.0	3.8
SEM	30/12/2019	11:10	50700	5	18.7	12:20	3.3	3.8	6.4
SEM	09/01/2020	09:55	52100	8	15.4	08:37	3.2	0.0	0.8
SEM	16/01/2020	13:20	51500	< 1	17.6	14:00	3.4	0.0	10.0
SEM	23/01/2020	09:15	51600	3	19.6	08:46	3.2	0.0	0.0
SEM	30/01/2020	13:50	51700	16	21.9	13:06	3.2	0.0	1.8
MFE	04/02/2020	12:10	50400	< 10	23.8	17:25	2.7	0.0	0.0
SEM	10/02/2020	10:20	52500	1	18.1	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:00	52100	2	19.1	12:49	3.7	0.0	0.0
MFE	19/02/2020	10:10	47100	4	21.8	06:39	2.9	1.4	1.4
SEM	26/02/2020	12:40	46500	13	22.7	11:27	3.4	0.0	0.0
MFE	03/03/2020	10:55	48700	17	21.3	15:33	2.7	0.0	0.0
SEM	13/03/2020	12:35	52900	9	20.9	12:27	3.7	0.0	0.0
MFE	19/03/2020	10:35	52700	< 1	18.9	06:18	2.8	0.2	0.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Motonui

Bell Block Beach

Programme	Date	Time (NZST)	Conductivity ( $\mu\text{S/cm}$ )	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
SEM	27/11/2019	11:35	50500	3	21	09:56	3.6	0.0	0.0
SEM	12/12/2019	08:30	51100	4	19.2	09:40	3.4	0.0	0.0
SEM	30/12/2019	13:30	51800	2	17.6	12:20	3.3	3.2	4.6
SEM	09/01/2020	10:22	52400	10	15.7	08:37	3.2	0.0	0.6
SEM	16/01/2020	14:00	51800	6	17.8	14:00	3.4	0.0	4.8
SEM	23/01/2020	09:40	52000	53	19.6	08:46	3.2	0.0	0.0
SEM	30/01/2020	14:20	51500	5	21.8	13:06	3.2	0.2	2.8
SEM	10/02/2020	10:50	52600	16	18	10:31	3.8	0.0	0.0
SEM	13/02/2020	11:25	52300	1	19.1	12:49	3.7	0.0	0.0
SEM	26/02/2020	13:15	51900	14	21.8	11:27	3.4	0.0	0.0
SEM	13/03/2020	13:05	51800	21	20.2	12:27	3.7	0.2	0.4

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Mangati (SH3)

Fitzroy Beach

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	12:00	51300	< 1	17.2	16:11	2.7	0.0	0.0
MFE	22/11/2019	11:45	51400	< 1	17.7	18:01	3.2	0.0	1.6
SEM	27/11/2019	10:30	50200	1	18.2	09:56	3.6	0.0	0.0
SEM	12/12/2019	10:49	51700	4	20.8	09:40	3.4	0.0	0.2
MFE	19/12/2019	09:30	49000	14	18.5	15:22	3.2	3.4	39.0
MFE	23/12/2019	09:45	50600	2	19	07:13	3.2	0.0	9.4
SEM	30/12/2019	12:20	49900	5	17.3	12:20	3.3	4.6	6.4
SEM	09/01/2020	09:36	50700	47	14.8	08:37	3.2	0.0	0.4
SEM	16/01/2020	13:50	51900	1	17.9	14:00	3.4	0.0	4.6
SEM	23/01/2020	09:40	51300	9	19.2	08:46	3.2	0.0	0.0
SEM	30/01/2020	11:25	52000	1	19.7	13:06	3.2	0.8	3.8
MFE	04/02/2020	11:15	51900	< 10	20.9	17:25	2.7	0.0	0.0
SEM	10/02/2020	10:45	52400	4	17.2	10:31	3.8	0.0	0.0
SEM	13/02/2020	13:05	51300	1	19.9	12:49	3.7	0.0	0.0
MFE	19/02/2020	09:30	52100	4	20.8	06:39	2.9	7.8	10.4
SEM	26/02/2020	09:45	52500	6	19.5	11:27	3.4	0.0	0.0
MFE	03/03/2020	11:45	51800	6	22	15:33	2.7	0.0	0.2
SEM	13/03/2020	11:07	52700	< 1	19.3	12:27	3.7	0.0	1.0
MFE	19/03/2020	11:40	52000	8	17.6	06:18	2.8	0.0	1.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo

East End Beach

Programme	Date	Time (NZST)	Conductivity ( $\mu\text{S/cm}$ )	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
SEM	27/11/2019	10:20	49800	24	18	09:56	3.6	0.0	0.0
SEM	12/12/2019	10:42	51900	3	20.5	09:40	3.4	0.0	0.2
SEM	30/12/2019	12:10	48100	21	17.4	12:20	3.3	4.6	6.4
SEM	09/01/2020	09:25	47700	52	15.2	08:37	3.2	0.0	0.4
SEM	16/01/2020	13:35	50500	3	18	14:00	3.4	0.0	4.6
SEM	23/01/2020	09:55	49800	51	19.5	08:46	3.2	0.0	0.0
SEM	30/01/2020	11:35	51400	5	20.2	13:06	3.2	0.8	3.8
SEM	10/02/2020	10:40	52400	38	17.5	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:55	51200	< 10	19.8	12:49	3.7	0.0	0.0
SEM	26/02/2020	10:00	52200	6	19.8	11:27	3.4	0.0	0.0
SEM	13/03/2020	11:20	52400	10	19.5	12:27	3.7	0.0	1.0

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo

Ngamotu Beach

Programme	Date	Time (NZST)	Conductivity ( $\mu\text{S/cm}$ )	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	12:30	49800	21	19	16:11	2.7	0.0	0.0
MFE	22/11/2019	10:50	52400	2	17.2	18:01	3.2	0.0	1.6
SEM	27/11/2019	09:45	51100	8	19	09:56	3.6	0.0	0.0
SEM	12/12/2019	10:11	51400	1	20.2	09:40	3.4	0.0	0.2
MFE	19/12/2019	09:10	52200	13	16.8	15:22	3.2	3.4	39.0
MFE	23/12/2019	09:10	51400	1	18.5	07:13	3.2	0.0	10.0
SEM	30/12/2019	11:20	52300	< 1	16.6	12:20	3.3	4.6	6.4
SEM	09/01/2020	08:51	51900	3	14.7	08:37	3.2	0.0	0.4
SEM	16/01/2020	12:55	51900	< 1	18.2	14:00	3.4	0.0	5.4
SEM	23/01/2020	09:25	52700	14	18.7	08:46	3.2	0.0	0.0
SEM	30/01/2020	12:18	52800	1	19.3	13:06	3.2	0.8	3.8
MFE	04/02/2020	10:35	52300	20	21	17:25	2.7	0.0	0.0
SEM	10/02/2020	11:30	52400	1	18.1	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:10	52300	10	19.2	12:49	3.7	0.0	0.0
MFE	19/02/2020	09:15	52500	230	21.5	06:39	2.9	7.8	10.4
SEM	26/02/2020	10:50	52800	30	20.3	11:27	3.4	0.0	0.0
MFE	03/03/2020	12:50	52200	35	21.7	15:33	2.7	0.0	0.2
SEM	13/03/2020	12:20	51900	23	21.4	12:27	3.7	0.0	1.0
MFE	19/03/2020	12:05	52600	21	18.4	06:18	2.8	0.0	1.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo

Back Beach

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
SEM	27/11/2019	09:30	50900	16	17.3	09:56	3.6	0.0	0.0
SEM	12/12/2019	09:45	51300	58	19.4	09:40	3.4	0.0	0.2
SEM	30/12/2019	11:00	49200	230	16.4	12:20	3.3	4.6	6.4
Follow Up	06/01/2020	08:10	50700	13	14.9	18:15	2.8	1.0	1.2
SEM	09/01/2020	08:41	51700	22	14.3	08:37	3.2	0.0	0.4
SEM	16/01/2020	12:40	50100	50	17.2	14:00	3.4	0.0	5.6
SEM	23/01/2020	09:10	51200	28	18.1	08:46	3.2	0.0	0.0
SEM	30/01/2020	12:30	51400	26	19.9	13:06	3.2	0.6	3.8
SEM	10/02/2020	11:50	50600	22	17.1	10:31	3.8	0.0	0.0
SEM	13/02/2020	12:00	52100	13	18.9	12:49	3.7	0.0	0.0
SEM	26/02/2020	11:00	52100	9	19.5	11:27	3.4	0.0	0.0
SEM	13/03/2020	12:45	50500	98	20.3	12:27	3.7	0.0	1.0

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo

Oakura Beach (Surf Club)

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	12:55	50200	22	16.7	16:11	2.7	0.0	0.0
MFE	22/11/2019	10:15	50900	17	16.4	18:01	3.2	0.0	1.6
SEM	27/11/2019	08:50	51600	8	17.2	09:56	3.6	0.0	0.0
SEM	12/12/2019	09:25	50300	16	18.7	09:40	3.4	0.0	0.2
MFE	19/12/2019	08:45	50200	39	16.1	15:22	3.2	3.4	39.0
MFE	23/12/2019	08:40	50800	51	17.7	07:13	3.2	0.0	10.0
SEM	30/12/2019	10:40	48800	160	16	12:20	3.3	4.6	6.4
Follow Up	06/01/2020	07:46	52100	5	14.8	18:15	2.8	1.0	1.2
SEM	09/01/2020	08:14	51400	38	14.2	08:37	3.2	0.0	0.4
SEM	16/01/2020	12:20	50600	18	17.3	14:00	3.4	0.0	6.4
SEM	23/01/2020	08:33	50700	39	17.1	08:46	3.2	0.0	0.0
SEM	30/01/2020	13:35	51600	18	19.8	13:06	3.2	0.2	3.8
MFE	04/02/2020	10:10	52300	30	19.7	17:25	2.7	0.0	0.0
SEM	10/02/2020	09:00	51900	8	15.3	10:31	3.8	0.0	0.0
SEM	13/02/2020	11:15	52500	27	18.4	12:49	3.7	0.0	0.0
MFE	19/02/2020	08:45	51200	250	19.9	06:39	2.9	8.2	10.4
SEM	26/02/2020	12:05	51900	14	19.8	11:27	3.4	0.0	0.0
MFE	03/03/2020	13:15	52400	13	20.3	15:33	2.7	0.0	0.2
SEM	13/03/2020	13:20	52400	3	20.7	12:27	3.7	0.0	1.0
MFE	19/03/2020	12:30	51900	8	18.6	06:18	2.8	0.0	1.2

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo

Oakura Beach (Camp ground)

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
SEM	27/11/2019	08:35	52100	< 1	17.2	09:56	3.6	0.0	0.0
SEM	12/12/2019	09:00	51300	1	18.7	09:40	3.4	0.0	0.2
SEM	30/12/2019	10:25	51800	3	16	12:20	3.3	4.6	6.4
SEM	09/01/2020	07:57	52300	2	14.2	08:37	3.2	0.0	0.4
SEM	16/01/2020	12:10	52000	< 1	17.3	14:00	3.4	0.0	6.4
SEM	23/01/2020	08:50	52600	30	17.3	08:46	3.2	0.0	0.0
SEM	30/01/2020	13:15	52100	2	20.3	13:06	3.2	0.2	3.8
SEM	10/02/2020	08:40	52600	1	15.2	10:31	3.8	0.0	0.0
SEM	13/02/2020	11:00	53000	< 10	18.2	12:49	3.7	0.0	0.0
SEM	26/02/2020	12:15	52400	6	19.9	11:27	3.4	0.0	0.0
SEM	13/03/2020	13:40	52700	< 1	21.1	12:27	3.7	0.0	1.0

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Brooklands Zoo



Opunake Beach

Programme	Date	Time (NZST)	Conductivity (µS/cm)	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	10:35	51500	< 1	16.5	16:11	2.7	0.0	0.0
MFE	22/11/2019	11:30	51500	1	17.3	18:01	3.2	0.0	7.0
SEM	27/11/2019	10:10	51700	1	17.3	09:56	3.6	0.0	0.0
SEM	12/12/2019	10:05	51700	1	18.9	09:40	3.4	0.0	0.0
MFE	19/12/2019	10:10	50400	8	18.8	15:22	3.2	10.0	58.5
MFE	23/12/2019	09:30	51200	3	18.1	07:13	3.2	0.0	3.0
SEM	30/12/2019	12:25	51100	110	19.2	12:20	3.3	1.0	3.5
SEM	09/01/2020	10:45	52100	1	16.8	08:37	3.2	0.0	0.0
SEM	16/01/2020	14:00	51600	6	17.2	14:00	3.4	0.0	0.5
SEM	23/01/2020	11:00	52700	< 1	18.1	08:46	3.2	0.0	0.0
SEM	30/01/2020	13:15	52200	19	21.3	13:06	3.2	3.5	6.0
MFE	04/02/2020	11:25	52700	< 1	21.6	17:25	2.7	0.0	0.0
SEM	10/02/2020	10:55	52300	30	19.2	10:31	3.8	0.0	0.0
SEM	13/02/2020	13:20	52400	2	20.3	12:49	3.7	0.0	0.0
MFE	19/02/2020	12:45	52300	< 1	21.6	06:39	2.9	4.5	5.5
SEM	26/02/2020	12:00	53000	7	18.4	11:27	3.4	0.0	0.0
MFE	03/03/2020	11:40	52500	< 1	19.6	15:33	2.7	0.0	0.0
SEM	13/03/2020	13:30	52600	< 1	18.4	12:27	3.7	0.0	4.0
MFE	19/03/2020	09:30	52100	< 1	17.7	06:18	2.8	1.5	1.5

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Eltham Road

Ohawe Beach

Programme	Date	Time (NZST)	Conductivity ( $\mu\text{S/cm}$ )	Enterococci (cfu/100mL)	Temperature (deg.C)	High Tide	HT height (m)	24hr RF (mm)	72hr RF (mm)
MFE	05/11/2019	09:15	25600	10	16.7	16:11	2.7	0.0	0.0
MFE	22/11/2019	10:00	30400	24	16.3	18:01	3.2	0.0	3.0
SEM	27/11/2019	09:00	47100	11	18.4	09:56	3.6	0.0	0.0
SEM	12/12/2019	08:55	47200	6	19.4	09:40	3.4	0.0	0.0
MFE	19/12/2019	09:00	23900	1100	15.7	15:22	3.2	31.0	97.0
Follow Up	23/12/2019	08:10	34600	34	17.8	07:13	3.2	0.0	12.0
SEM	30/12/2019	11:20	43200	19	19.1	12:20	3.3	1.5	5.0
SEM	09/01/2020	09:10	45500	17	17.1	08:37	3.2	0.0	0.0
SEM	16/01/2020	12:45	51400	56	18.6	14:00	3.4	0.0	1.0
SEM	23/01/2020	09:10	50100	8	19.2	08:46	3.2	0.0	0.0
SEM	30/01/2020	11:55	45800	10	21.3	13:06	3.2	0.0	0.0
MFE	04/02/2020	10:10	41300	8	22.1	17:25	2.7	0.0	0.0
SEM	10/02/2020	09:25	50600	12	19.5	10:31	3.8	0.5	5.0
SEM	13/02/2020	12:20	49600	10	21.1	12:49	3.7	0.0	0.0
MFE	19/02/2020	11:25	47300	8	20.7	06:39	2.9	4.0	6.0
SEM	26/02/2020	10:37	49800	20	20	11:27	3.4	0.0	0.0
MFE	03/03/2020	10:15	37000	38	20.1	15:33	2.7	0.0	0.0
SEM	13/03/2020	11:40	49500	13	18.6	12:27	3.7	0.0	3.5
MFE	19/03/2020	10:45	42600	120	17.2	06:18	2.8	0.0	0.0

Tide data from Port Taranaki

Rainfall data from TRC rain gauge at Glenn Road

## Appendix II

Field observations from 2019-2020 summer  
surveys



Site: TASMAN SEA (Onaero Bay: adj Surf Club) (Site code: SEA900085)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	3/8 (scattered)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	1/0	13 seagulls at river mouth
22 Nov 2019	MFE	Fine	3/8 (scattered)	Onshore	4 (small waves)	Clear, turquoise/green	0	Sampled further east than usual as river shifted
27 Nov 2019	SEM	Fine, breeze	2/8 (few)	Onshore	2 (small wavelets)	Clear, green/blue	0/0	
12 Dec 2019	SEM	Fine, light to moderate breeze	0/8 (fine)	Offshore	1 (ripples with appearance of scales)	Slightly turbid, brown/green	0/0	2 sparrows
19 Dec 2019	MFE	Fine	3/8 (scattered)	Onshore	2 (small wavelets)	Turbid, brown/blue	0/0	
23 Dec 2019	MFE	Overcast, hot	7/8 (broken)		1 (ripples with appearance of scales)	Turbid, dark green/brown	12 (4 fishing)/1	Gulls on other side of river
30 Dec 2019	SEM	Fine, rain overnight prior to sampling.	3/8 (scattered)	Onshore	3 (large wavelets)	Slightly turbid, green/tan	2 (one fishing, one in ute)/0	Moderate westerly wind. Campground packed. Waves breaking right onshore
09 Jan 2020	SEM	Fine, light westerly breeze	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly Turbid, green/grey	0/0	A few campers in camp ground
16 Jan 2020	SEM	Fine	0/8 (fine)	Offshore	1 (ripples with appearance of scales)	Turbid, brown/green	6/4	
23 Jan 2020	SEM	Fine	2/8 (few)	Onshore	1 (ripples with appearance of scales)	Turbid, green/brown	4 (2 fishing)/0	

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
30 Jan 2020	SEM	Fine, breezy	0/8 (fine)	Onshore	3 (large wavelets)	Turbid, blue/brown	4 (fishing)/0	1 dead gull
04 Feb 2020	MFE	Fine	6/8 (broken)	Onshore		Clear, grey	0/0	4 black backed gulls
10 Feb 2020	SEM	Fine	1/8 (few)		1 (ripples with appearance of scales)	Slightly turbid, dark green/blue	2 fishermen/0	
13 Feb 2020	SEM	Partly cloudy, very minimal breeze	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue/green	1/0	
19 Feb 2020	MFE	Fine	4/8 (scattered)	Onshore	2 (small wavelets)	Clear, blue	1 walking/2 swimming	25 gulls. Many blue bottles on the beach
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	3 (large wavelets)	Clear, turquoise/green	0/1 kayaker	
03 Mar 2020	MFE	Overcast, medium breeze	7/8 (broken)	Onshore	2 (small wavelets)	Clear, blue/grey	0/0	Approximately 70 gulls
13 Mar 2020	SEM	Fine, calm	0/8 (fine)	Onshore	2 (small wavelets)	Slightly turbid, blue/grey	0/0	
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, dull blue/green	0/0	1 gull at stream mouth

Site: TASMAN SEA (Waitara East Beach) (Site code: SEA901033)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	4/8 (scattered)	Onshore	2 (small wavelets)	Clear, blue/green	2/1 in boat	15 gulls approximately 25m east of sampling site
22 Nov 2019	MFE	Fine, strong wind	2/8 (few)	Upshore	4 (small waves)	Clear, green/grey	0	2 gulls, old rahui sign up
27 Nov 2019	SEM	Fine, some wind	6/8 (broken)	Onshore	2 (small wavelets)	Turbid, grey/green	0/0	NPDC warning sign set to green
12 Dec 2019	SEM	Fine	0/8 (fine)	Offshore	1 (ripples with appearance of scales)	Slightly turbid, brown/green	0/0	NPDC warning sign set to green
19 Dec 2019	MFE	Fine breeze	4/8 (scattered)	Upshore	2 (small wavelets)	Turbid, brown	0/0	NPDC warning sign set to green, one dead rotting cow
23 Dec 2019	MFE	Overcast, hot	6/8 (broken)	Downshore	1 (ripples with appearance of scales)	Turbid, green/brown	0/0	NPDC warning sign set to green, 8 gulls
30 Dec 2019	SEM	Fine, rain overnight prior to sampling.	3/8 (scattered)	Onshore	3 (large wavelets)	Clear, green	0/0	NPDC warning sign set to red
09 Jan 2020	SEM	Fine, light to moderate wind	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Turbid, green/grey	0/0	NPDC warning sign set to red
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	2 (small wavelets)	Slightly turbid, green	2 fishing/1 jet skiing	NPDC warning sign set to red
23 Jan 2020	SEM	Fine, windy	7/8 (broken)	Upshore	1 (ripples with appearance of scales)	Turbid, green/grey	0/0	NPDC warning sign set to red, fishing at rivermouth
30 Jan 2020	SEM	Fine, strong breeze	0/8 (fine)	Upshore	3 (large wavelets)	Turbid, blue/brown	0/0	NPDC warning sign set to green

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
04 Feb 2020	MFE	Fine	4/8 (scattered)	Downshore	1 (ripples with appearance of scales)	Turbid, brown	0/0	
10 Feb 2020	SEM	Fine, light breeze	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, green/grey	2/0	NPDC warning sign set to green
13 Feb 2020	SEM	Mostly cloudy, minimal breeze	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Turbid, grey	0/0	NPDC warning sign set to green
19 Feb 2020	MFE	Fine	4/8 (scattered)	Onshore	2 (small wavelets)	Clear, green/aqua	0/0	NPDC warning sign set to green, 32 gulls
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	3 (large wavelets)	Slightly turbid, green/grey	0/2 (1 kayaker, 1 surfer)	NPDC warning sign set to green
03 Mar 2020	MFE	Fine, slight breeze	2/8 (few)	Onshore	2 (small wavelets)	Clear, green/blue	1 walking/0	NPDC warning sign set to green
13 Mar 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Turbid, blue/grey	0/0	NPDC warning sign set to green
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Upshore	1 (ripples with appearance of scales)	Clear, dull green	0/0	NPDC warning sign set to green, 10 gulls 50m east, and 5 gulls 50m west



Site: TASMAN SEA (Waitara West Beach) (Site code: SEA901037)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	6/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue/brown	2/0	Seagulls 75m away, 1 horse, 1 dog
22 Nov 2019	MFE	Fine, strong wind	2/8 (few)	Upshore	3 (large wavelets)	Slightly turbid, grey/brown	0/0	1 gull
27 Nov 2019	SEM	Fine	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Turbid, grey/green	3 (2 walkers, 1 flying kite)/0	NPDC warning sign set to green at entrance, orange at river mouth, 1 bird flying over
12 Dec 2019	SEM	Fine, light breeze	0/8 (fine)	Downshore	1 (ripples with appearance of scales)	Turbid, brown/green	1 dog walker/0	NPDC warning sign set to green at entrance, orange at river mouth
19 Dec 2019	MFE	Fine	4/8 (scattered)	Upshore	2 (small wavelets)	Turbid, brown	0/5 (2 kite surfing, 3 wind surfing)	NPDC warning sign set to green at entrance, orange at river mouth
23 Dec 2019	MFE	Light breeze	6/8 (broken)	Downshore	1 (ripples with appearance of scales)	Turbid, green/brown	0/0	NPDC warning sign set to green at entrance, orange at river mouth
30 Dec 2019	SEM	Fine, rain overnight prior to sampling, moderate westerly wind	2/8 (few)	Onshore	3 (large wavelets)	Turbid, tan/black	0/0	NPDC warning sign set to red at entrance and river mouth, 1 gull, lots of burnt driftwood near sampling site.
09 Jan 2020	SEM	Fine, moderate NW wind	5/8 (broken)	Upshore	2 (small wavelets)	Turbid, green/grey	1 walker/0	NPDC warning sign set to red at entrance and river mouth
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	2 (small wavelets)	Turbid, green/brown	0/0	NPDC warning sign set to red at entrance and river mouth, sizeable fire has occurred on the shore

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
23 Jan 2020	SEM	Fine, windy	7/8 (broken)	Upshore	1 (ripples with appearance of scales)	Turbid, grey/green	2 (walking dogs)/0	NPDC warning sign set to red at entrance and river mouth
30 Jan 2020	SEM	Fine, breezy	0/8 (fine)	Upshore	2 (small wavelets)	Turbid, brown	4 (walking)/0	NPDC warning sign set to green at entrance and river mouth
04 Feb 2020	MFE	Cloudy	4/8 (scattered)	Downshore	1 (ripples with appearance of scales)	Clear, blue	0/0	NPDC warning sign set to green at entrance and river mouth, 7 black backed gulls
10 Feb 2020	SEM	Fine, slight breeze	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Turbid, grey/brown	4 (2 fishers)/0	NPDC warning sign set to green at entrance and river mouth, 17 seagulls
13 Feb 2020	SEM	Overcast, marginal breeze	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Turbid, grey/green	2 fishers/0	NPDC warning sign set to green at entrance and river mouth, 1 gull
19 Feb 2020	MFE	Fine	4/8 (scattered)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, green/brown	1 fishing 1 dog walking/0	NPDC warning sign set to green at entrance and river mouth, 3 gulls, <i>Ulva</i> sp. on beach
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	3 (large wavelets)	Clear, turquoise/green/grey	0/0	NPDC warning sign set to green at entrance and river mouth
03 Mar 2020	MFE	Fine, medium breeze	1/8 (few)	Downshore	2 (small wavelets)	Slightly turbid, blue/grey	1 flying kite/0	NPDC warning sign set to red at entrance and river mouth
13 Mar 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, green/blue	3/0	NPDC warning sign set to red at entrance and river mouth

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Upshore	1 (ripples with appearance of scales)	Turbid, grey/green	0/0	NPDC warning sign set to red at entrance and river mouth

Site: TASMAN SEA (Bell Block Beach) (Site code: SEA902001)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
27 Nov 2019	SEM	Fine	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, grey/blue	1 walker/0	NPDC warning sign set to red
12 Dec 2019	SEM	Fine, light breeze	0/8 (fine)	Downshore	1 (ripples with appearance of scales)	Slightly turbid, brown/green	1 person sitting, 2 dog walkers/0	NPDC warning sign set to red
30 Dec 2019	SEM	Fine, rain overnight prior to sampling, moderate westerly wind	2/8 (few)	Onshore	3 (large wavelets)	Turbid, tan/green	5 (four sitting in cars, one dog walker)/0	NPDC warning sign set to red, 1 seagull
09 Jan 2020	SEM	Fine, moderate NW wind	5/8 (broken)	Upshore	1 (ripples with appearance of scales)	Turbid, green/grey	2 in carpark/0	NPDC warning sign set to red, 3 seagulls in the carpark, lots of seaweed in water just onshore
16 Jan 2020	SEM	Sunny	0/8 (fine)	Upshore	2 (small wavelets)	Turbid, green/tan	3(1 fishing)/0	NPDC warning sign set to red
23 Jan 2020	SEM	Fine, slight breeze	3/8 (scattered)	Upshore	1 (ripples with appearance of scales)	Turbid, grey/blue	2 walking 2 sitting/0	NPDC warning sign set to red
30 Jan 2020	SEM	Fine, breezy	1/8 (few)	Upshore	2 (small wavelets)	Turbid, brown	1/2	
10 Feb 2020	SEM	Fine, slight breeze	1/8 (few)	Upshore	1 (ripples with appearance of scales)	Slightly turbid, green/grey	2/0	NPDC warning sign set to red, 3 to 4 small birds
13 Feb 2020	SEM	Fine, no wind	7/8 (broken)		1 (ripples with appearance of scales)	Turbid, grey/green	0/0	NPDC warning sign set to red
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	3 (large wavelets)	Slightly turbid, green/brown	0/0	NPDC warning sign set to red

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
13 Mar 2020	SEM	Fine	0/8 (fine)	Upshore	2 (small wavelets)	Turbid, green/blue	0/0	NPDC warning sign set to red

Site: TASMAN SEA (Fitzroy Beach - Opp Surf Club) (Site code: SEA902025)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	6/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	8/12	1 dog, 5 gulls
22 Nov 2019	MFE	Fine, strong breeze	1/8 (few)	Upshore	3 (large wavelets)	Slightly turbid, green/brown	2 walking dogs, 1 walking, 1 kite surfing/0	
27 Nov 2019	SEM	Fine	2/8 (few)	Onshore	2 (small wavelets)	Clear, blue/green	17/7 (surfing and swimming)	1 dog
12 Dec 2019	SEM	Fine	1/8 (few)	Downshore	1 (ripples with appearance of scales)	Slightly turbid, green	26/21	3 gulls
19 Dec 2019	MFE	Fine	5/8 (broken)	Upshore	2 (small wavelets)	Turbid, brown/green	4/2 swimming	2 dogs
23 Dec 2019	MFE	Fine, light breeze	4/8 (scattered)	Downshore	1 (ripples with appearance of scales)	Turbid, brown/green	36/11 surfers, 7 swimming, 2 rowing	2 dogs, many people walking along the beach, mainly families on the beach
30 Dec 2019	SEM	Fine, windy	3/8 (scattered)	Upshore	2 (small wavelets)	Slightly turbid, blue/green	20/14 surfing, 6 swim	
09 Jan 2020	SEM	Fine, windy	5/8 (broken)	Onshore	2 (small wavelets)	Slightly turbid, green	2/9 surfing	1 dog
16 Jan 2020	SEM	Fine	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	30+/21	
23 Jan 2020	SEM	Fine	3/8 (scattered)	Onshore	2 (small wavelets)	Clear, blue	8 walking/10 (surfing and swimming)	
30 Jan 2020	SEM	Fine, strong breeze	1/8 (few)	Upshore	3 (large wavelets)	Slightly turbid, green	14/10	1 dog

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
04 Feb 2020	MFE	Fine	4/8 (scattered)	Downshore	2 (small wavelets)	Clear, blue	6/0	
10 Feb 2020	SEM	Fine	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	12/4 surfing	1 dog , 2 seagulls
13 Feb 2020	SEM	Fine, cloudy	4/8 (scattered)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	7/4	4 seagulls
19 Feb 2020	MFE	Fine	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	18/9	Lots of blue bottles on beach
26 Feb 2020	SEM	Fine	1/8 (few)	Onshore	0 (sea like a mirror)	Slightly turbid, blue/green	15/3 swimmers, 17 surfers, 1 paddle boarder	1 gull
03 Mar 2020	MFE	Fine, light breeze	8/8 (overcast)	Downshore	2 (small wavelets)	Clear, grey	8 walking/5 surfing and boogie boarding	
13 Mar 2020	SEM	Sunny, breeze	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Turbid, blue/green	30/21 surfers	1 Dog on beach
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Upshore	3 (large wavelets)	Clear, grey/blue	6/0	

Site: TASMAN SEA (East End Beach - opp Surf Club) (Site code: SEA902035)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
27 Nov 2019	SEM	Fine	2/8 (few)	Onshore	2 (small wavelets)	Clear, blue/green	2 walking/ watching/3 surf lifesavers	
12 Dec 2019	SEM	Fine	1/8 (few)	Offshore	1 (ripples with appearance of scales)	Slightly turbid, green	1/3 swim	
30 Dec 2019	SEM	Fine, windy	3/8 (scattered)	Upshore	1 (ripples with appearance of scales)	Clear, blue/green	5/0	
09 Jan 2020	SEM	Fine, windy	4/8 (scattered)	Upshore	2 (small wavelets)	Slightly turbid, green	2/0	
16 Jan 2020	SEM	Fine	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	30+/12	
23 Jan 2020	SEM	Fine	4/8 (scattered)	Onshore	2 (small wavelets)	Turbid, green/tan	3 walking/0	Dog poop on beach
30 Jan 2020	SEM	Strong breeze	1/8 (few)	Upshore	3 (large wavelets)	Clear, green/blue	3/0	
10 Feb 2020	SEM	Fine	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	2/0	
13 Feb 2020	SEM	Fine, cloudy	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	2/2	
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	0 (sea like a mirror)	Slightly turbid, blue/green	nil/20+ in kayak class, 4 surfers	2 dogs
13 Mar 2020	SEM	Sunny, light breeze	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue/green	3/0	



Site: TASMAN SEA (Ngamotu Beach: centre of beach) (Site code: SEA902062)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue/green	2/0	31 gulls
22 Nov 2019	MFE	Fine, breeze	1/8 (few)	Upshore	2 (small wavelets)	Slightly turbid, blue	2 sunbathing, 4 walking/6	17 seagulls
27 Nov 2019	SEM	Fine	4/8 (scattered)	Onshore	2 (small wavelets)	Slightly turbid, blue/green	4/0	14 seagulls
12 Dec 2019	SEM	Fine	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	4/1 swimming	24 gulls
19 Dec 2019	MFE	Fine	5/8 (broken)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, brown/green	11 kids/26 sailing, 12 rowing	11 seagulls
23 Dec 2019	MFE	Fine, slight breeze	3/8 (scattered)	Upshore	0 (sea like a mirror)	Slightly turbid, grey	6 people/5 rowing	1 bird
30 Dec 2019	SEM	Fine, breezy	1/8 (few)	Upshore	0 (sea like a mirror)	Clear, blue	8/15 dragon boat, 6 triathlon practice	
09 Jan 2020	SEM	Light rain	7/8 (broken)	Upshore	1 (ripples with appearance of scales)	Clear, green	4/1	40+ gulls
16 Jan 2020	SEM	Fine	0/8 (fine)	Upshore	1 (ripples with appearance of scales)	Clear, blue/green	30+/18	
23 Jan 2020	SEM	Fine, calm	3/8 (scattered)		1 (ripples with appearance of scales)	Clear, blue/green	1 walking/0	60+ seagulls
30 Jan 2020	SEM	Fine	1/8 (few)	Upshore	1 (ripples with appearance of scales)	Clear, blue	10/5 boat	2 seagulls

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
04 Feb 2020	MFE	Fine	4/8 (scattered)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue	3/0	
10 Feb 2020	SEM	Fine	1/8 (few)	Onshore	1 (ripples with appearance of scales)	Clear, blue	50 kids/0	85+ seagulls, 15 seagulls
13 Feb 2020	SEM	Fine, cloudy	6/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	100+ school trip/7 paddling	70+ seagulls
19 Feb 2020	MFE	Fine	6/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	22/0	80+ gulls, large amount of <i>Ulva</i> sp. on shore and in the surf
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	0 (sea like a mirror)	Slightly turbid, blue	Approximately 100 (School group in and out of water)/4 waka ama crews	50+ seagulls
03 Mar 2020	MFE	Overcast, slight breeze	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Turbid, grey	Approximately 30 in a school group/approximately 10 (2 open water swimming, 8 in shallows)	Approximately 100 gulls
13 Mar 2020	SEM	Sunny, breeze	0/8 (fine)	Upshore	1 (ripples with appearance of scales)	Slightly turbid, blue	15 people/60 swimming (school group) 1 jetski	Approximately 50 gulls, <i>Ulva</i> sp. washed inshore + free floating in wave zone
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Upshore	1 (ripples with appearance of scales)	Slightly turbid, dull green/blue	3 kids playing on beach/0	Seagull colony about 100m away

Site: TASMAN SEA (Back Beach) (Site code: SEA902070)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
27 Nov 2019	SEM	Fine	2/8 (few)	Onshore	2 (small wavelets)	Clear, green/blue	4/2 surfing, 1 kayaking	4 seagulls
12 Dec 2019	SEM	Fine	0/8 (fine)	Onshore	2 (small wavelets)	Slightly turbid, blue/green	13 sitting/12 surfing,	9 dogs
30 Dec 2019	SEM	Slight breeze	1/8 (few)	Onshore	2 (small wavelets)	Slightly turbid, green/blue	3 walking/5 surfing	3 dogs
06 Jan 2020	FOLLOW UP	Fine, breezy	3/8 (scattered)	Onshore	2 (small wavelets)	Turbid, green/blue	2/0	1 dog, 7 gulls
09 Jan 2020	SEM	Fine	7/8 (broken)	Onshore	2 (small wavelets)	Slightly turbid, green	0/4	2 gulls
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	6/22 surfing, 8 swimming	1 dog
23 Jan 2020	SEM	Fine, calm	2/8 (few)		1 (ripples with appearance of scales)	Clear, blue	8/6 swim, 4 surfers	5 dogs, 4 seagulls
30 Jan 2020	SEM	Fine, strong breeze	1/8 (few)	Onshore	3 (large wavelets)	Clear, blue/green	4/3	5 seagulls
10 Feb 2020	SEM	Fine	1/8 (few)	Onshore	3 (large wavelets)	Clear, blue	8/0	5 seagulls
13 Feb 2020	SEM	Fine, cloudy	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	0/8 surfing	2 seagulls
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	0 (sea like a mirror)	Slightly turbid, blue	3 on beach, 3 in stream/12 surfers	8 gulls at stream mouth
13 Mar 2020	SEM	Sunny, light breeze	0/8 (fine)		1 (ripples with appearance of scales)	Slightly turbid, blue	4/6 surfers, 2 swimmers	3 gulls

Site: TASMAN SEA (Oakura Beach: opp NPOB Surf Clb ) (Site code: SEA903030)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine	1/8 (few)	Downshore	1 (ripples with appearance of scales)	Clear, blue	7/2	10 gulls
22 Nov 2019	MFE	Fine, strong breeze	3/8 (scattered)	Onshore	3 (large wavelets)	Clear, green/brown	0/0	
27 Nov 2019	SEM	Fine	3/8 (scattered)	Downshore	2 (small wavelets)	Clear, green/blue	0/3 surfing	
12 Dec 2019	SEM	Fine, calm	1/8 (few)		1 (ripples with appearance of scales)	Clear, blue/green	5 wading/1 paddle boarding	
19 Dec 2019	MFE	Fine, breeze	6/8 (broken)	Upshore	1 (ripples with appearance of scales)	Turbid, green/brown	0/0	
23 Dec 2019	MFE	Windy	3/8 (scattered)	Upshore	1 (ripples with appearance of scales)	Slightly turbid, light brown/green	2 walking/0	Families playing beach games further up the beach
30 Dec 2019	SEM	Fine, windy	4/8 (scattered)	Upshore	2 (small wavelets)	Turbid, grey	10/1 paddle board, 3 surfing, 4 swim	
06 Jan 2020	FOLLOW UP	Fine, breezy	2/8 (few)	Upshore	1 (ripples with appearance of scales)	Turbid, green/brown	4/0	
09 Jan 2020	SEM	Fine, no rain	5/8 (broken)	Upshore	1 (ripples with appearance of scales)	Slightly turbid, green	0/2	
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	25+/13	
23 Jan 2020	SEM	Fine	2/8 (few)	Onshore	2 (small wavelets)	Clear, green/blue	5 walkers/0	1 dog

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
30 Jan 2020	SEM	Fine, strong breeze	2/8 (few)	Upshore	2 (small wavelets)	Slightly turbid, blue/green	5/2	3 seagulls
04 Feb 2020	MFE	Fine	5/8 (broken)	Downshore	1 (ripples with appearance of scales)	Clear, grey	3/0	
10 Feb 2020	SEM	Fine	3/8 (scattered)	Onshore	1 (ripples with appearance of scales)	Clear, blue	0/0	6 gulls
13 Feb 2020	SEM	Fine, cloudy	6/8 (broken)	Upshore	1 (ripples with appearance of scales)	Clear, blue	0/0	8 seagulls
19 Feb 2020	MFE	Fine	8/8 (overcast)	Onshore	1 (ripples with appearance of scales)	Clear, blue	1 runner/0	4 gulls
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	0 (sea like a mirror)	Slightly turbid, blue	7/1 surfer	Wairau enters approximately 150m upshore, Waimoku enters approximately 10m downshore
03 Mar 2020	MFE	Fine, moderate breeze	8/8 (overcast)	Downshore	2 (small wavelets)	Turbid, grey	3 walking/2 swimming	Approximately 30 gulls, stream mouth approximately 5m from sampling point
13 Mar 2020	SEM	Sunny, breeze	0/8 (fine)	Upshore	1 (ripples with appearance of scales)	Turbid, blue	21/4 swimming	3 gulls , Waimoku Stream 10m upshore of sampling point

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
19 Mar 2020	MFE	Overcast	8/8 (overcast)	Upshore	2 (small wavelets)	Clear, dull green/blue	0/1 surfer	50 gulls approximately 50m west, Waimoku Stream now entering sea directly in front of surf club (on sample site). Samples collected approximately 15 m west of site, directly in front of beach access.

Site: TASMAN SEA (Oakura Beach - opp Camp ground) (Site code: SEA903032)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
27 Nov 2019	SEM	Fine	2/8 (few)	Downshore	2 (small wavelets)	Clear, green/blue	1 running, 2 walking/3	
12 Dec 2019	SEM	Fine, no wind	1/8 (few)		1 (ripples with appearance of scales)	Clear, blue/green	2 walking/1 swimmer	
30 Dec 2019	SEM	Fine, windy	4/8 (scattered)	Upshore	2 (small wavelets)	Turbid, brown/blue	16/0	
09 Jan 2020	SEM	Fine, slight overcast	4/8 (scattered)	Downshore	1 (ripples with appearance of scales)	Turbid, green	9/0	7 seagulls
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Clear, green/blue	3/4	
23 Jan 2020	SEM	Fine	2/8 (few)	Upshore	2 (small wavelets)	Clear, blue	7/0	
30 Jan 2020	SEM	Fine, strong breeze	1/8 (few)	Upshore	2 (small wavelets)	Slightly turbid, green/blue	0/0	
10 Feb 2020	SEM	Fine	7/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue	0/0	2 seagulls
13 Feb 2020	SEM	Fine, cloudy	7/8 (broken)	Upshore	1 (ripples with appearance of scales)	Clear, blue/grey	0/0	
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	0 (sea like a mirror)	Slightly turbid, blue	1 fishing, 2 walking/0	2 seagulls
13 Mar 2020	SEM	Sunny, breeze	0/8 (fine)	Upshore	2 (small wavelets)	Slightly turbid, blue/green	3/0	18 seagulls

Site: TASMAN SEA (Opunake Beach ) (Site code: SEA904090)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine, strong breeze	2/8 (few)	Onshore	2 (small wavelets)	Clear, blue	1/0	5 seagulls
22 Nov 2019	MFE	fine, light breeze	1/8 (few)	Onshore	3 (large wavelets)	Slightly turbid, green	2 walking/2	
27 Nov 2019	SEM	Fine, Moderate Breeze	1/8 (few)	Onshore	3 (large wavelets)	Clear, blue	2 walking/6 boogie boarders, 3 surfers	2 Dogs
12 Dec 2019	SEM	Fine, Moderate Breeze	0/8 (fine)	Onshore	5 (moderate waves)	Clear, green	5/2 swimmers	
19 Dec 2019	MFE	fine	7/8 (broken)	Onshore	2 (small wavelets)	Clear, blue	10/0	
23 Dec 2019	MFE	Fine, Light Breeze	3/8 (scattered)	Onshore	2 (small wavelets)	Clear, turquoise/blue	1 Lifeguard, 2 cyclists, 5 sitting/2 swimmers	
30 Dec 2019	SEM	Overcast, fine, strong breeze	8/8 (overcast)	Onshore	2 (small wavelets)	Slightly turbid, blue	40/28 surfers, 2 swimmers	
09 Jan 2020	SEM	Fine, Moderate Breeze	7/8 (broken)	Onshore	3 (large wavelets)	Clear, turquoise/blue	30(sitting, walking)/12 (swimming, surfing)	15 seagulls
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	4 (small waves)	Slightly turbid, green	20/15 swimmers	
23 Jan 2020	SEM	Fine, Light Breeze	0/8 (fine)	Onshore	0 (sea like a mirror)	Clear, blue	25+ (sitting, walking)/7 swimming	
30 Jan 2020	SEM	fine	0/8 (fine)	Onshore	2 (small wavelets)	Clear, blue	15/10 swimmers	2 seagulls
04 Feb 2020	MFE	Fine	1/8 (few)	Onshore	2 (small wavelets)	Clear, blue	0/5 Swimmers	30 Seagulls



Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
10 Feb 2020	SEM	Fine, Partly Cloudy, Moderate Breeze	2/8 (few)	Onshore	3 (large wavelets)	Clear, blue	6 /10 Surfers	100+ seagulls
13 Feb 2020	SEM	Fine, mod wind	2/8 (few)	Onshore	3 (large wavelets)	Clear, blue	12 (playing, walking)/2 surfing	1 dog, 20 seagulls
19 Feb 2020	MFE	Fine	2/8 (few)	Onshore	1 (ripples with appearance of scales)	Clear, blue/green	70+ (sitting, walking, playing)/30 swimming	25 seagulls, Americana car rally was on at the beach
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Clear, blue	20+ /15 (swimmers, surfers)	10 seagulls
03 Mar 2020	MFE	Fine, light breeze	7/8 (broken)	Upshore	2 (small wavelets)	Clear, blue	0/0	20 seagulls, 2 people in cars at beach
13 Mar 2020	SEM	Fine, breezy	0/8 (fine)	Onshore	3 (large wavelets)	Clear, blue	0/1 surfer	5 people in cars at beach
19 Mar 2020	MFE	Fine, cold, mod-strong wind	8/8 (overcast)	Onshore	3 (large wavelets)	Clear, blue	0/0	1 person in car at beach

Site: TASMAN SEA (Ohawe Beach (east of b/water). ) (Site code: SEA906010)

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
05 Nov 2019	MFE	Fine, some cloud, light breeze	6/8 (broken)	Onshore	1 (ripples with appearance of scales)	Clear, blue/grey	1 fisher/0	
22 Nov 2019	MFE	Fine	3/8 (scattered)	Onshore	5 (moderate waves)	Slightly turbid, green/brown	2/0	3 Dogs
27 Nov 2019	SEM	Fine, light breeze	0/8 (fine)	Onshore	1 (ripples with appearance of scales)	Slightly turbid, blue/grey	0/1	2 Dogs
12 Dec 2019	SEM	Fine, moderate breeze	1/8 (few)	Onshore	3 (large wavelets)	Turbid, brown	3 People/0	3 dogs
19 Dec 2019	MFE	Fine	1/8 (few)	Onshore	4 (small waves)	Turbid, brown	0/0	5 Seagulls
23 Dec 2019	MFE	Fine, no wind	2/8 (few)	Onshore	2 (small wavelets)	Turbid, brown	6 walking/0	
30 Dec 2019	SEM	Overcast, fine, strong wind	7/8 (broken)	Downshore	3 (large wavelets)	Slightly turbid, grey/blue	1 walking/0	1 dog
09 Jan 2020	SEM	Fine, moderate breeze	6/8 (broken)	Onshore	5 (moderate waves)	Slightly turbid, slight brown	10 People Fishing/0	
16 Jan 2020	SEM	Fine	0/8 (fine)	Onshore	6 (large waves)	Turbid, grey	0/0	
23 Jan 2020	SEM	Fine, light breeze	1/8 (few)	Downshore	0 (sea like a mirror)	Turbid, blue/green	0/0	
30 Jan 2020	SEM	Fine	0/8 (fine)	Downshore	2 (small wavelets)	Slightly turbid, green	3 walkers/0	
04 Feb 2020	MFE	Fine	1/8 (few)	Offshore	2 (small wavelets)	Slightly turbid, green	5 people, 2 motorbikes/0	
10 Feb 2020	SEM	Fine, partly cloudy, light breeze	6/8 (broken)	Downshore	2 (small wavelets)	Slightly turbid, green/grey	0/0	

Collected date	Programme	Weather (general)	Cloud cover	Wind direction	Wind strength (Beaufort Scale)	Water appearance	Users (on beach / in water)	Miscellaneous (animals and other observations)
13 Feb 2020	SEM	Fine, strong breeze	2/8 (few)	Downshore	4 (small waves)	Turbid, brown/grey	6 on beach relaxing/0	
19 Feb 2020	MFE	Fine	0/8 (fine)	Onshore	2 (small wavelets)	Clear, dark green	1 person walking 1 dog/0	
26 Feb 2020	SEM	Fine	0/8 (fine)	Onshore	2 (small wavelets)	Slightly turbid, brown/green	5 people, 1 dog/0	2 seagulls
03 Mar 2020	MFE	Fine, moderate breeze	4/8 (scattered)	Offshore	2 (small wavelets)	Clear, blue	2 walking, 2 fishing, 1 dog/0	
13 Mar 2020	SEM	Fine, moderate breeze	0/8 (fine)	Onshore	3 (large wavelets)	Turbid, brown-green	0/0	1 seagull
19 Mar 2020	MFE	Fine, strong breeze	7/8 (broken)	Downshore	3 (large wavelets)	Slightly turbid, grey/brown	2 walking/0	2 seagulls, 9 cars in carpark



## Appendix III

### SFRG Assessments 2015-2020



Site	Sanitary Inspection Category	MAC			SFRG Grade	%of all inspection in compliance
		95%ile	No of samples	Category		
Wai-iti	Moderate 13	ID	ID	ID	ID	ID
Urenui	Moderate 13	ID	ID	ID	ID	ID
Onaero (SC)	Moderate 13	318.5	107	C	Fair	94%
Onaero Settlement	Low 14	ID	ID	ID	ID	ID
Waitara (East)	Moderate 13	272.5	99	C	Fair	94%
Waitara (West)	Moderate 13	184.5	89	B	Good	96%
Bell Block	Moderate 3	85.3	24	B	Good	100%
Fitzroy	Moderate 3	102.0	109	B	Good	97%
East End	Moderate 3	137.0	63	B	Good	98%
Ngamotu	Moderate 3	279.5	109	C	Fair	95%
Back Beach	Low 14	312.0	37	C	Fair	94%
Oakura (SC)	Moderate 13	253.0	108	C	Fair	96%
Oakura (CG)	Moderate 13	64.3	63	B	Good	100%
Opunake	Moderate 3	34.9	108	A	Good*	100%
Ohawe	Moderate 13	291.5	101	C	Fair	95%
Patea	Moderate 13	40.0	26	A	Good*	100%
Waverley	Moderate 13	27.4	26	A	Good*	100%
Waiinu	Moderate 13	41.6	26	B	Good	100%

\* Irreconcilable Followup

ID Insufficient data

## Back Beach

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Back Beach

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	11	26.0	1	0	100 %
2018	13	20.0	2	1	92 %
2017	0	0.0	0	0	0 %
2016	13	43.0	2	1	92 %
2015	0	0.0	0	0	0 %
Total	37	30.0	5	2	94 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results  
MAC category: C      95%ile (/100 mL): 312.0  
Interim Result?: Interim Data Set (< 5 years, or < 100 samples used)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: C  
Interim Assessment?: Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results  
SIC Assessment: Low  
Primary SIC Impact: 14: River - focal points of drainage

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results  
Site name: Back Beach  
SFRG Assessment: Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Bell Block

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Bell Block

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	11	6.0	0	0	100 %
2018	0	0.0	0	0	0 %
2017	0	0.0	0	0	0 %
2016	13	48.0	0	0	100 %
2015	0	0.0	0	0	0 %
Total	24	14.5	0	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results  
MAC category: B      95%ile (/100 mL): 85.3  
Interim Result?: Interim Data Set (< 5 years, or < 100 samples used)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: B  
Interim Assessment?: Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 3: Urban stormwater

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results  
Site name: Bell Block  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".



## East End

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: East End

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	11	10.0	0	0	100 %
2018	13	4.0	1	0	100 %
2017	13	10.0	1	1	92 %
2016	13	12.0	0	0	100 %
2015	13	5.0	0	0	100 %
Total	63	8.0	2	1	98 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: B 95%ile (/100 mL) 137.0  
Interim Result?: Interim Data Set (< 5 years, or < 100 samples used)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: B  
Interim Assessment?: Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 3: Urban stormwater

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG  
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results  
Site name: East End  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File  
 Print the column labels to the file "ColumnLabelsMarine.txt".

OK

## Fitzroy

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: Fitzroy

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	4.0	0	0	100 %
2018	21	2.0	0	1	95 %
2017	24	3.0	1	1	95 %
2016	24	4.0	0	0	100 %
2015	21	3.0	0	1	95 %
Total	109	4.0	1	3	97 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: B 95%ile (/100 mL) 102.0  
Interim Result?: Complete Data Set (5 years with at least 100 samples)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: B  
Interim Assessment?: Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 3: Urban stormwater

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG  
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results  
Site name: Fitzroy  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File  
 Print the column labels to the file "ColumnLabelsMarine.txt".

OK

## Ngamotu

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Ngamotu

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	10.0	1	0	100 %
2018	21	20.0	0	3	85 %
2017	24	19.0	3	1	95 %
2016	24	8.5	3	0	100 %
2015	21	9.0	0	1	95 %
Total	109	14.0	7	5	95 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results

MAC category	C	95%ile (/100 mL)	279.5
Interim Result?	Complete Data Set (5 years with at least 100 samples)		

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results

MAC Assessment	C
Interim Assessment?	Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results

SIC Assessment	Moderate
Primary SIC Impact	3: Urban stormwater

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results

Site name	Ngamotu
SFRG Assessment	Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Oakura (Camp Ground)

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Oakura (camp ground)

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	11	2.0	0	0	100 %
2018	13	2.0	0	0	100 %
2017	13	4.0	1	0	100 %
2016	13	4.0	0	0	100 %
2015	13	1.0	0	0	100 %
Total	63	3.0	1	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results

MAC category	B	95%ile (/100 mL)	64.3
Interim Result?	Interim Data Set (< 5 years, or < 100 samples used)		

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results

MAC Assessment	B
Interim Assessment?	Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results

SIC Assessment	Moderate
Primary SIC Impact	13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results

Site name	Oakura (camp ground)
SFRG Assessment	Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Oakura (Surf Club)

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Oakura (surf club)

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	18.0	2	0	100 %
2018	20	14.0	1	1	95 %
2017	24	44.5	3	1	95 %
2016	24	19.5	2	1	95 %
2015	21	4.0	0	1	95 %
Total	108	15.0	8	4	96 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results  
MAC category: C      95%ile (/100 mL): 253.0  
Interim Result?: Complete Data Set (5 years with at least 100 samples)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

Marine Suitability for Recreational Grade

MAC Assessment Results  
MAC Assessment: C  
Interim Assessment?: Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results  
Site name: Oakura (surf club)  
SFRG Assessment: Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Ohawe

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Ohawe

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	13.0	0	1	94 %
2018	21	45.0	6	0	100 %
2017	24	41.5	1	2	91 %
2016	24	18.0	1	0	100 %
2015	13	40.0	1	2	84 %
Total	101	26.0	9	5	95 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results  
MAC category: C      95%ile (/100 mL): 291.5  
Interim Result?: Complete Data Set (5 years with at least 100 samples)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

Marine Suitability for Recreational Grade

MAC Assessment Results  
MAC Assessment: C  
Interim Assessment?: Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results  
Site name: Ohawe  
SFRG Assessment: Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Onaero Settlement

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: Onaero settlement

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
0	0				0 %
0	0				0 %
0	0				0 %
0	0				0 %
0	0				0 %
Total	0				0 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: 95%ile (/100 mL)  
Interim Result?

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

Insufficient Data  
Unable to complete due to insufficient data (a minimum set of 20 data points is required)  
OK

## Onaero Surf Club

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: Onaero (surf club)

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	28.0	3	0	100 %
2018	20	29.5	0	2	90 %
2017	24	13.0	3	0	100 %
2016	24	28.0	3	2	91 %
2015	20	9.0	0	2	90 %
Total	107	27.0	9	6	94 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: C 95%ile (/100 mL) 318.5  
Interim Result?: Complete Data Set (5 years with at least 100 samples)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

Marine Suitability for Recreational Grade

MAC Assessment Results  
MAC Assessment: C  
Interim Assessment?: Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG  
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results  
Site name: Onaero (surf club)  
SFRG Assessment: Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File  
 Print the column labels to the file "ColumnLabelsMarine.txt".

OK

Opunake \*

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: Opunake

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	1.0	0	0	100 %
2018	21	1.0	0	0	100 %
2017	24	3.0	1	0	100 %
2016	24	3.0	0	0	100 %
2015	20	1.0	0	0	100 %
Total	108	1.0	1	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: A      95%ile (/100 mL): 34.9  
Interim Result?: Complete Data Set (5 years with at least 100 samples)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: A  
Interim Assessment?: Complete Data Set (5 years with at least 100 samples)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 3: Urban stormwater

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG  
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results  
Site name: Opunake  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File  
 Print the column labels to the file "ColumnLabelsMarine.txt".

OK

Patea\*

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: PateaBeach

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2018	13	4.0	0	0	100 %
2017	0	0.0	0	0	0 %
2016	0	0.0	0	0	0 %
2015	13	4.0	0	0	100 %
2014	0	0.0	0	0	0 %
Total	26	4.0	0	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results  
MAC category: A      95%ile (/100 mL): 40.0  
Interim Result?: Interim Data Set (< 5 years, or < 100 samples used)

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

**Marine Suitability for Recreational Grade**

MAC Assessment Results  
MAC Assessment: A  
Interim Assessment?: Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG  
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results  
Site name: PateaBeach  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File  
 Print the column labels to the file "ColumnLabelsMarine.txt".

OK

## Urenui

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Import data

Site Name  
Name of site from the MAC file: PateaBeach

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2018	13	4.0	0	0	100 %
2017	0	0.0	0	0	0 %
2016	0	0.0	0	0	0 %
2015	13	4.0	0	0	100 %
2014	0	0.0	0	0	0 %
Total	26	4.0	0	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

Calculate MAC

MAC Results  
MAC category  
Interim Result?

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment

Save MAC Report

Insufficient Data  
Unable to complete due to insufficient data (a minimum set of 20 data points is required)

OK

OK

## Waiinu

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Import data

Site Name  
Name of site from the MAC file: Waiinu

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2018	13	10.0	0	0	100 %
2017	0	0.0	0	0	0 %
2016	0	0.0	0	0	0 %
2015	13	9.0	0	0	100 %
2014	0	0.0	0	0	0 %
Total	26	9.5	0	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

Calculate MAC

MAC Results  
MAC category  
Interim Result?

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment

Save MAC Report

MAC category: B  
95%ile (/100 mL): 41.6  
Interim Result?: Interim Data Set (< 5 years, or < 100 samples used)

OK

Marine Suitability for Recreational Grade

MAC Assessment Results  
MAC Assessment: B  
Interim Assessment?: Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results  
SIC Assessment: Moderate  
Primary SIC Impact: 13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment

Calculate SFRG

Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

Irreconcilable Followup

SFRG Assessment Results  
Site name: Waiinu  
SFRG Assessment: Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.

Save to a Database Format File

Print the column labels to the file "ColumnLabelsMarine.txt".

OK

## Waitara East

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Waitara East

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	5.0	0	1	94 %
2018	20	11.0	1	0	100 %
2017	23	14.0	0	2	91 %
2016	24	19.5	2	2	91 %
2015	13	9.0	0	0	100 %
Total	99	13.0	3	5	94 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results

MAC category	C	95%ile (/100 mL)	272.5
Interim Result?	Interim Data Set (< 5 years, or < 100 samples used)		

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results

MAC Assessment	C
Interim Assessment?	Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results

SIC Assessment	Moderate
Primary SIC Impact	13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results

Site name	Waitara East
SFRG Assessment	Fair

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

## Waitara West

**Marine MAC Assessment**

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set

Site Name  
Name of site from the MAC file: Waitara West

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2019	19	5.0	0	1	94 %
2018	21	10.0	1	0	100 %
2017	23	11.0	1	0	100 %
2016	13	40.0	1	1	92 %
2015	13	9.0	1	1	92 %
Total	89	11.0	4	3	96 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment

MAC Results

MAC category	B	95%ile (/100 mL)	184.5
Interim Result?	Interim Data Set (< 5 years, or < 100 samples used)		

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment.

**Marine Suitability for Recreational Grade**

MAC Assessment Results

MAC Assessment	B
Interim Assessment?	Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results

SIC Assessment	Moderate
Primary SIC Impact	13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment   
Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade

SFRG Assessment Results

Site name	Waitara West
SFRG Assessment	Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file.

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file.   
 Print the column labels to the file "ColumnLabelsMarine.txt".

# Waverley\*

Marine MAC Assessment

Import MAC Data  
Press "Import Data" to retrieve a new MAC data set Import data

Site Name  
Name of site from the MAC file: Waverley

MAC Data Summary

Sampling Season	Sample size	Median (E. coli / 100 mL)	Number of exceedances (Enterococci / 100 mL)		Days in Compliance (%days < 280 / year)
			140 to 280	>280	
2018	13	10.0	0	0	100 %
2017	0	0.0	0	0	0 %
2016	0	0.0	0	0	0 %
2015	13	8.0	0	0	100 %
2014	0	0.0	0	0	0 %
Total	26	8.5	0	0	100 %

Calculate MAC  
Press "Calculate MAC" to determine a MAC assessment Calculate MAC

MAC Results

MAC category	A	95%ile (/100 mL)	27.4
Interim Result?	Interim Data Set (< 5 years, or < 100 samples used)		

Save MAC Assessment  
Press "Save MAC Report" to save this MAC assessment. Save MAC Report

OK

Marine Suitability for Recreational Grade

MAC Assessment Results

MAC Assessment	A
Interim Assessment?	Interim Data Set (< 5 years, or < 100 samples used)

SIC Assessment Results

SIC Assessment	Moderate
Primary SIC Impact	13: River - agricultural activities/birds/feral animals

Calculate Marine SFRG  
Press "Calculate SFRG" to determine a SFRG assessment Calculate SFRG

Reassessment of the MAC and / or SIC is required or press "Irreconcilable Followup" to assign a conservative grade Irreconcilable Followup

SFRG Assessment Results

Site name	Waverley
SFRG Assessment	Good

Save this SFRG Assessment to a Single Summary File  
Press "Save as a Single Entry File" to save the SFRG, MAC, and SIC assessments and the MAC and SIC data in one file. Save as a Single Entry File

Save SFRG Assessment to a Multiple Summary File  
Press "Save to a Database Format File" to save summary data as one row in a comma-delimited file. Save to a Database Format File

Print the column labels to the file "ColumnLabelsMarine.txt".

OK

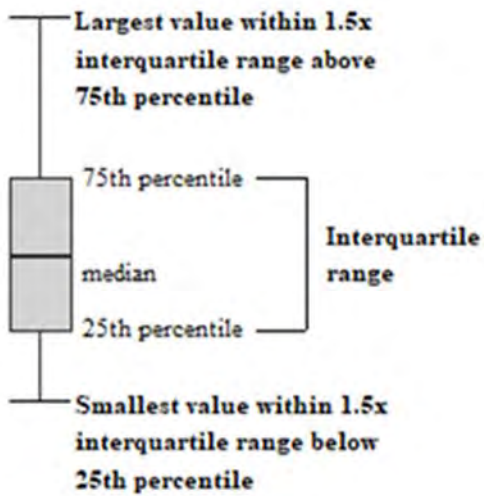


## Appendix IV

### How to Interpret a Boxplot



## HOW TO INTERPRET A BOXPLOT



- **Outlier**-Value is  $>1.5x$  and  $<3x$  the interquartile range beyond either end of the box



