



Government of **Western Australia**  
Department of **Health**

# Application of the NHMRC Guidelines for Managing Risks in Recreational Water within Western Australia



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## Introduction

Swimming in polluted recreational water is a well-recognised cause of illness including gastroenteritis, acute febrile respiratory illness, skin, ear and eye irritation/infection. This can result in a significant burden of disease and economic loss to the community.

In order to reduce the likelihood of recreational water-borne illness in a community, it is important that ongoing monitoring and up-to-date public information, about health risks in recreational waterways is available.

To enable up-to-date public information, a microbiological water quality monitoring program is administered by the Department of Health, Western Australia (WA Health) and undertaken primarily by local government authorities (LGA's) to assess the health risks of many popular recreational and other significant environmental water sites through-out Western Australia.

## National Recreational Water Guidelines

The National Health and Medical Research Council (NHMRC), 2008, [Guidelines for Managing Risks in Recreational Water](#) (NHMRC Guidelines) [1], help manage health risks from environmental (coastal, estuarine and freshwater) recreational water in Australia.

The NHMRC Guidelines provide a method for communicating long-term evidence-based information to the public, about bacterial risks in popular recreational waters, rather than relying upon a one sample pass or fail approach. A risk-management framework is used to provide grading's to popular swimming beaches or water bodies. The aim is to provide the public with simple statements, about the level of risk from a recreational area.

**Note:** WA Health fundamentally adopts the NHMRC Guidelines approach, but of necessity has modified certain aspects e.g. reduced minimum number of samples collected, due to the vast geographical extent and inability for many local governments to resource and undertake intensive microbial monitoring programs.

### Why use 'beach' grades?

Grading is an effective way of providing the public with general information about bacterial water quality at a given swimming beach or water body area. This enables the public to be aware of potential bacterial health risks, and to make a more informed decision about undertaking direct water contact recreation e.g. swimming, diving, water-skiing etc.

### What do the Guidelines involve?

To manage public health risks in recreational water, Chapter 5, of the NHMRC Guidelines [1] highlights several factors that are herewith mentioned including:

- Microbial monitoring programs
- Microbial assessment categories (MACs)
- Sanitary inspection categories
- Beach grades
- Follow-up sampling
- Public communication
- Future monitoring

# 1. Microbial Monitoring Program

## 1.1. Deciding where to monitor

A health-based monitoring program needs to be practical, but it should not put a strain on resources. It should be maintained for the long term and target recreational water body sites that potentially present a greater risk to public health.

It is generally not feasible to sample every recreational water body or site. A monitoring program should concentrate on popular recreational beaches or sites that are commonly used for whole of body contact activities such as swimming. This is particularly important for popular beaches or sites that may have or are known to have variable water quality.

Factors that increase potential use and/or promote the area as a popular recreational location e.g. sandy beach access and built facilities e.g. BBQ facilities, shaded shelters, toilet blocks etc., should be considered when determining whether to monitor a site.

It is not generally cost-effective to monitor beaches/water bodies that are rarely used for recreational activities. If monitoring is considered necessary at such sites, monitoring may be reduced to a small number of samples collected at less frequent intervals.

## 1.2. When should monitoring occur?

The monitoring program should concentrate on times when most people are using the water for whole of body contact activities. For the Perth metropolitan, Peel, South West, Great Southern, Goldfields-Esperance, and Wheatbelt regions, and the Mid-West and Gascoyne region areas south of the -26° latitude (~ Denham), the sampling season (predominant swim use period) is between November to May for environmental/ recreational waters.

Monitoring during late autumn, winter and early spring in waterways South of the -26° latitude is generally not necessary, unless for example responding to a pollution event, or undertaking rainfall impact investigations. Most people do not swim during cooler and wetter months.

Winter weather patterns South of the -26° latitude, tend to produce frequent and sometimes heavy rainfall, which introduces pollutants including bacteria into waterways. This can make waterways unsuitable for swimming and other whole of body contact recreational activities.

For locations north of the -26° latitude (including the Kimberley, Pilbara and Gascoyne regions), monitoring may be undertaken at any time of the year, but this will primarily depend upon water body use and locally relevant factors e.g. weather and resources.

## 1.3. Number of recommended samples

The NHMRC Guidelines [1] recommend at least 20 samples be collected, during a monitoring period/season and repeated for 5 consecutive years (i.e. 100 samples over 5 years). A final [microbial assessment category](#) (MAC) can then be assigned.

The NHMRC Guidelines also recommend that most samples are collected during peak use periods e.g. summer, school holidays etc. During these times, samples as circumstance or opportunity permits could be collected more frequently e.g. weekly.

## 1.4. WA Health revised number of samples

Alternatively, WA Health requests a minimum of **13 samples per season** are collected from each recreational water 'program' sampling site. This minimum number of samples per season, is essential to ensure that **65 samples over 5 consecutive years** is collected, and that the assigned MAC maintains similar statistical confidence as if 100 samples were collected.



In practice, 13 samples per season, equates to approximately 1 sample per fortnight and may be more manageable for LGA's who struggle to balance time, resources and responsibilities.

**Note:** More frequent sampling during peak use periods if possible is encouraged. Consideration may be given to share sampling between agencies, community groups or other entities.

## 1.5. Which indicators are analysed?

### 1.5.1. Enterococci

*Enterococci* are a group of bacteria commonly associated with the intestinal tract of warm-blooded animals and humans. They can be used to indicate potential sewage contamination.

Although not all enterococci species cause disease, they still are a useful indicator of disease-causing microorganisms found in the gut of humans and animals, including bacteria, viruses and protozoa. "*The WHO advocates the use of enterococci as the single preferred faecal indicator*" [1].

Enterococci are favoured over other faecal indicators, as they have a greater survival rate in highly saline ocean water and are therefore a more reliable indicator of faecal contamination. "*Enterococci are good predictors of GI illnesses in marine and fresh recreational waters*" [2].

*Enterococci* monitoring results are used to generate the [MAC](#).

### 1.5.2. Escherichia coli

The WA Health recommends *Escherichia coli* (*E. coli*) is also analysed in water samples of fresh to estuarine water origin e.g. lakes, reservoirs, rivers etc.

*"E. coli is relatively straightforward and inexpensive to measure. It can survive for up to four to six weeks in freshwater and is a definite indication of recent faecal contamination. While it is not possible to know whether E. coli are of human, animal or avian origin, all of these species can act as carriers of micro-organisms that can cause human disease. The chances of E.coli multiplying in water are very small, except under some specific tropical and sub-tropical conditions, so the number detected can be interpreted quantitatively."*[3]

Unfortunately, the survival rate of *E. coli* in saline water is relatively short-lived and prone to rapid die-off in increasingly saline water concentration.

*E. coli* analysis in fresh to estuarine water environments is useful to highlight more recent faecal contamination and to provide additional comparative context to *Enterococci* results.

In the absence of any national *E. coli* guidelines values for recreational water, a comparative guideline reference source for *E. coli* in fresh waters may be the New Zealand – [Ministry for the Environment, 2003, Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas](#) [4] and/or the [United States - Environmental Protection Authority, 2012, Recreational Water Quality Criteria](#) [2].

### 1.5.3. Thermophilic amoebae / *Naegleria*

Warm freshwater: lakes, reservoirs, or stagnant low-flow water bodies, may provide ideal growing conditions for '*Naegleria fowleri*', a single-celled organism (amoeba), responsible for the rare but usually fatal disease 'primary amoebic meningoencephalitis' (or PAM).

When water samples are collected for bacteriological analysis, a separate amoeba water sample should be collected from any warm freshwater body sites that are utilised for primary contact recreation e.g. swimming, skiing etc.

The laboratory analysis most often undertaken by PathWest Waters (PWW) laboratory will determine whether any ‘thermophilic amoebae’ and/or ‘thermophilic Naegleria’ (a subset of thermophilic amoebae) is detected. If thermophilic *Naegleria* is detected, PWW will undertake further speciation testing and notify WA Health if ‘*Naegleria fowleri*’ is confirmed.

Further information regarding PAM is available at: [Amoebic meningitis \(healthywa.wa.gov.au\)](http://healthywa.wa.gov.au).

## 2. Microbial Assessment Category (MAC)

### 2.1. What is a Microbial Assessment Category (MAC)?

The first part to classifying a recreational water site is to assign a microbial assessment category (MAC) for that sampling location. The MAC is expressed in terms of the 95th percentile of numbers of enterococci per 100ml.

Each microbial assessment category: A (highest quality), B, C or D (lowest quality), represents a different level of health risk to a water user, based upon the exposure conditions of key epidemiological studies for healthy adult bathers. The values have been determined using a known relationship between bacterial density in water and illness rates, and the distribution of bacterial levels at a swimming site.

Table 1 (below) summarises different MAC with the estimated probability of a water user experiencing gastrointestinal illness (GII) or acute febrile respiratory illness (AFRI) when swimming at a site.

**Table 1: Microbial assessment categories [1]**

Category	95 <sup>th</sup> percentile (enterococci)	Basis of derivation	Estimation of probability
A	≤ 40 /100mL	No illness seen in most epidemiological studies	GII risk: <1% AFRI risk: <0.3%
B	41-200 /100mL	200/100mL is above the illness threshold in most epidemiological studies	GII risk: 1-5% AFRI risk: 0.3-1.9%
C	201-500 /100mL	Substantial ↑ in risk of adverse effects where dose-response data available	GII risk: 5-10% AFRI risk: 1.9-3.9%
D	>500 /100mL	Significant risk of high levels of illness transmission	GII risk: >10% AFRI risk: >3.9%

### 2.2. How is the 95th percentile calculated?

Several methods for calculating the 95th percentile are detailed in the NHMRC Guidelines [1]. The method utilised by each regulatory authority is based on data availability, statistical considerations and local resources.

WA Health utilises an automated enterococci tester spreadsheet titled EnteroTester, to calculate 95th percentile results. This method standardises (as closely as possible) 95th percentile results to reflect the infection risks shown in Table 1. The EnteroTester can be downloaded from the WA Health corporate website: [Environmental waters publications \(health.wa.gov.au\)](http://environmentalwaterspublications.health.wa.gov.au).

The paper titled '[Estimating 95<sup>th</sup> percentiles from microbial sampling: A novel approach to standardising their application to recreational waters](#)' [5], further describes the process for calculating 95<sup>th</sup> percentiles.

**Note:** *There is an error in section 3.1.6 of the text of this paper, which refers to four quartic polynomial regression equations, but cites only one of them.*

### **2.3. How many enterococci values are needed to calculate the 95th percentile?**

In order to calculate the 95th percentile with reliable statistical confidence, a data set of 100 samples collected within a 5-year period is preferable. Alternatively, a minimum of 65 samples collected over the same monitoring period is required to produce 95<sup>th</sup> percentiles with an acceptable, though slightly lower level of statistical confidence.

**Note:** The more samples available will improve the accuracy of the 95th percentile estimate.

### **2.4. Required samples for provisional and final classifications**

Until such time as 65 samples over a 5 consecutive year period for each site is obtained, only a provisional MAC can be assigned to that sampling site. Monitoring programs therefore require the collection of a minimum of 13 samples for each sampling site per season for 5 consecutive years for a final MAC to be assigned.

Utilising the Enterotester, a provisional classification can be assigned with as few as 8 sample results, but the generated 95<sup>th</sup> percentile result will be statistically unreliable. Alternatively, a minimum of 20 sample results is better to generate a 95<sup>th</sup> percentile provisional classification.

A provisional classification is usually assigned after the first or second season of sampling, and/or as a result of a sanitary inspection undertaken at the site. This provisional classification will be updated annually, until there is enough information to confirm a final classification.

### **2.5. Are both dry and wet weather monitoring results included?**

Many recreational waters sites experience 'good' water quality during dry summer periods. However, during heavy summer rainfall events and the days following heavy rainfall, certain sites (e.g. sites with stormwater drains and/or influenced by downstream rainfall flow) may experience elevated bacterial levels.

Both dry and wet weather sampling results are included in the 95th percentile calculations. Wet weather results can only be excluded from the dataset, if:

- management interventions have been implemented to prevent people from accessing recreational water, and/or;
- stormwater drains are redirected to prevent flushing into recreational waters during rainfall events, and/or;
- The public is warned of the potential health risks from engaging in primary contact recreational water activities during or following rainfall events. This may incorporate erecting warning signs ([permanent](#) or [temporary](#)) with a clear message of the potential health risk during or following heavy rainfall (>10mm) events.

**Note:** It is recommended that warning signs are accompanied by website communication, and if necessary, a media statement to reinforce the potential health risk.

Even though most people do not swim during or immediately after heavy rainfall events, the MAC is designed to account for, the long-term range of bacterial water quality results, including elevated bacterial water samples experienced during or following heavy summer rainfall events.



## 3. Sanitary Inspection Category (SIC)

### 3.1. What is a Sanitary Inspection Category?

The second part to classifying a recreational water body site is to assign a sanitary inspection category (SIC) for each site. The SIC is a risk classification of the waters' susceptibility to faecal pollution. There are five SICs which include: 'Very Low', 'Low', 'Moderate', 'High' or 'Very High'.

### 3.2. What is a Sanitary Inspection Report?

A sanitary inspection report (SIR) should be completed for each site. This involves identifying and risk-assessing all faecal contamination sources which may affect the site's water quality, such as stormwater drains, rainfall run-off, birds and animals, sewage outfalls, septic tanks, boating activities etc.

An SIR is undertaken to better understand the site's potential for and susceptibility to faecal pollution, and water quality impacts that may arise at different times or under certain conditions.

Local knowledge is important when completing the SIR. Discussions with the water body manager (WBM) and/or local or state authorities can assist to identify and understand faecal and other pollutant sources.

The SIR places greater emphasis on identifying human faecal pollution sources entering a site. Due to the species barrier from humans to animals, the range of human pathogens in animal excreta is less than human excreta, thus representing a less significant risk to human health.

The SIR endeavours to follow a science and evidence-based approach to assigning the SIC. However, there still is subjectivity associated with assigning a SIC, and it may be necessary to substantiate e.g. through further sampling individual risk criteria that make up the final SIC.

An example of substantiating individual risk criteria may include undertaking additional monitoring from stormwater drains and/or at the sampling site, during or after heavy rainfall events, to confirm stormwater drain and rainfall run-off risk ratings at the site.

**Note:** A copy of the SIR template is located on the DoH Public Health website:  
[http://ww2.health.wa.gov.au/Articles/A\\_E/Environmental-waters-publications%20](http://ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications%20).

### 3.3. How are pollutant sources assigned into the Sanitary Inspection Category?

Different pollutant sources can represent different levels of risk to a water user. The final SIC is a summation of all recognised faecal pollutant sources as outlined in the SIR. Once the risk assessment for each pollutant source is completed, the summary (see [Table 2](#)) is used to combine the risk ratings for each pollutant source and to assign an overall SIC.

**Table 2: Sanitary inspection category risk summary**

SOURCE (Part B)	Risk Classification (Use the highest risk classification identified for each Section under Part B, If not present write N/A)	SOURCE (Part B)	Risk Classification (Use the highest risk classification identified for each Section under Part B)
1. Bather Density	Low	6. Riverine discharge	N/A
2. Bather Toilet Facilities	Very Low	7. Boats	Low
3. Discharge of Wastewater (highest ranked risk)	Low	8. Animals 8.1 & 8.2 (highest ranked risk) 8.3 wet weather only	Low N/A
4. Stormwater discharge Dry weather Wet weather	Low Moderate	9. Other faecal sources	N/A
5. Rainfall runoff	Moderate		

**Dry Weather Sanitary Inspection Category (SIC)**

List the highest ranked risk classification identified from the above table from **Part B Sections 1, 2, 3, 4 (dry weather only), 6, 7, 8 and 9**. Exclude Part B Section 4 and 8.3 where the source only presents a risk during wet weather.

**Dry Weather Sanitary Inspection Category:** Low

**Wet Weather Sanitary Inspection Category (SIC)**

List the highest ranked risk classification identified from the above table from **Part B Sections 4 (wet weather), 5, 8.3 (wet weather only) and 9**.

**Wet Weather Sanitary Inspection Category:** Moderate

**3.4. How is the Sanitary Inspection Category assigned?**

To assign the overall SIC, the SIR for the monitoring location must be completed. The overall SIC is the highest risk level for all potential faecal pollutant sources as determined by the SIR.

For example, in [Table 2](#), the highest ranked source: **Moderate** becomes the overall SIC, unless management interventions are applied to prevent/restrict/minimise access to the recreational site during wet weather events.

A management intervention may include the erection of [permanent](#) or [temporary](#) warning signs, to advise the public of the potential risk of entering the water body during or immediately after wet weather events.

### 3.5. How often should the sanitary inspection report be reviewed?

The initial SIR is the most comprehensive. Thereafter the SIR should be reviewed annually, usually prior to the start of the sampling season.

An annual SIR review is necessary, to identify any site changes, including new or changed arrangements for pollutant sources that may impact upon water quality. If action has been undertaken to remove a pollutant source, this also needs to be updated as part of the SIR review.

If no changes are noted as part of the review, then an updated SIR is not required.

## 4. Assigning Beach Grades

### 4.1. How does WA Health assign a beach grade?

Once the MAC and SIC have been determined for each site an overall site classification or beach grade can be assigned. [Table 3](#) can be used to assign a beach grade to a sampling location.

**Table 3: Classification matrix for faecal pollution of recreational water environments [1]**

		Microbial Assessment Category (95 <sup>th</sup> percentiles – intestinal enterococci/100mL)				Exceptional Circumstances <sup>c</sup>
		A ≤ 40	B 41-200	C 201-500	D > 500	
Sanitary Inspection Category (Susceptibility to faecal influence)	Very Low	Very Good	Very Good	F/up <sup>b</sup>	F/up <sup>b</sup>	ACTION
	Low	Very Good	Good	F/up <sup>b</sup>	F/up <sup>b</sup>	
	Moderate	Good	Good	Poor	Poor	
	High	Good <sup>a</sup>	Fair <sup>a</sup>	Poor	Very Poor	
	Very High	F/up <sup>a</sup>	Fair <sup>a</sup>	Poor	Very Poor	
Exceptional Circumstances <sup>c</sup>		ACTION				

- a** Indicates possible discontinuous/sporadic contamination (often driven by results such as rainfall). This is mostly associated with the presence of sewage – contaminated stormwater. These results should be investigated further, and initial follow-up should include verification of the sanitary inspection category and ensuring that samples include ‘event’ periods.
- b** Implies non-sewage sources of faecal indicators (e.g. livestock), which need to be verified.
- c** Exceptional circumstances are known periods of higher risk such as during an outbreak involving a human or other pathogen that may be waterborne (e.g. avian botulism – where outbreaks of avian botulism occur,

swimming or other aquatic recreational activities should not be permitted), or the rupture of a sewer in a recreational water catchment area etc. Under such circumstances the classification matrix may not fairly represent risk/safety.

- \* In certain circumstances there may be a risk of transmission of pathogens associated with more severe health effects through recreational water use. The human health risk depends on specific (often local) circumstances. Public health authorities should be engaged in the identification and interpretation of such conditions.

## 4.2. What do the different beach grades mean?

Each grade has been defined below:

- **Very Good:** Bacterial water quality is almost always considered safe for swimming. Water sampling results are consistently very good, and there are very few or low risk faecal contamination sources at this location.
- **Good:** Bacterial water quality is considered safe for swimming most of the time. Water sampling results are good on most occasions, and there are few or low risk faecal contamination sources at this location.

Standard warnings apply e.g. avoid swimming after heavy rainfall (>10mm): for up to 3 days in fresh to estuarine waters and for 1 day in ocean/marine waters.

- **Fair:** Bacterial water quality is variable at this location. Water quality is at times considered safe for swimming; however elevated bacterial levels may also make this site unsuitable for swimming.

Elevated bacterial levels are mostly due to animal pollutant sources e.g. bird faeces, and stormwater drain contaminants flushing into the water following rainfall.

Swimming should be avoided during, and for several days following heavy rainfall (>10mm); and if the water is discoloured, murky or has visual pollution.

- **Poor:** Bacterial water quality is often unsatisfactory for swimming. Elevated bacterial levels occur during and following rainfall events, and/or as a result of stormwater drain inflow, or due to animal pollutant sources e.g. bird faeces.

Other factors such as low dilution levels, tidal movement, sheltered water environments and wind direction may enable bacteria to survive longer in these waters.

There may be a greater risk of illness, if you ingest the water, particularly by the very young, and those who are elderly or who have **compromised immunity**. Swimming or putting your head under water should be avoided.

- **Very Poor:** Bacterial water quality is unsatisfactory most of the time. Avoid swimming at this location, as there may be direct discharges of faecal material or other pollution sources.

Erect permanent warning signs at this site stating that **swimming is not recommended**.

## 5. Trigger Levels and Follow-up Sampling

### 5.1. 'Site specific' trigger levels

Apart from the 95<sup>th</sup> percentile result, the Enterotester worksheet produces two other statistical results (99<sup>th</sup> and 90<sup>th</sup> percentiles). These results are commonly referred to as the "one-off" and a "two-in-a-row" sample trigger levels. They are calculated from historical *Enterococci* data specific for each site. These results in effect become "site specific" trigger levels.

#### 5.1.1. One-off trigger level

The one-off trigger level is a calculation of the estimated 99<sup>th</sup> percentile. It indicates the likely highest sample result in a set of 100 samples i.e. a sampling result at or above this level should only be expected once in every 100 sampling events.

When an *Enterococci* sampling result is greater than or equal to the one-off trigger value, and the water sample result is elevated at a level that is of potential public health concern (Refer to the: [one-off generic trigger level](#)), re-sampling, and an investigation of the elevated sample result is recommended.

If the resample result is also elevated above the one-off generic trigger level, sampling and investigations should continue, to determine the potential cause for the elevated results. The public may also need to be notified, regarding the potential health risks associated with elevated bacterial water quality levels and advised that primary and/or secondary contact recreation is currently not recommended. The decision to issue a public health warning will depend upon several factors e.g. the sites popularity, frequency of use, environmental/weather conditions etc.

#### 5.1.2. Two-in-a-row trigger level

The two-in-a-row trigger level is a calculation of the estimated 90<sup>th</sup> percentile. It indicates the likely 90<sup>th</sup> highest sample result out of a set of 100 samples i.e. a sample result elevated at or above this level should only occur 10 times in every 100 sampling events.

Re-sampling should be undertaken, and an investigation commenced, if the *Enterococci* value exceeds both the two-in-a-row trigger level for two consecutive sampling events and any of the generic trigger levels. The potential cause for the elevated bacterial water quality results should try to be determined.

Depending upon the likely source of contamination e.g. wildlife, or human pollution etc., and the bacterial levels concerned, the public may be advised that the water body is currently unsuitable for recreational use.

**Note:** In some situations, particularly for ocean sites, the site-specific trigger levels although exceeded, may still be at a level that is acceptable for primary contact recreation i.e. within the very good to good MAC range. In these situations, the 'site specific' trigger levels are not as important from a management perspective.

### 5.2. Generic trigger levels

One of the fundamental purposes of Chapter 5 of the NHMRC Guidelines [1] is to assign a beach grade (health risk rating) to a recreational water body / site, based upon an assessment its long-term bacterial water quality. However, LGA's / WBM's are at times required to make decisions based upon short-term bacterial water quality levels, which may include erecting warning signs, closing water bodies and issuing media, public or stakeholder advice.



WA Health has developed and recommends two types of generic trigger levels for indicating short-term bacterial water quality for primary contact recreation. Like the [site specific trigger levels](#), the generic trigger levels, includes a one-off and a two-in-a-row sample trigger level.

### 5.2.1. Trigger levels for primary contact recreation

WA Health recommends the following short-term bacterial trigger levels where the long-term monitoring of the water body is normally satisfactory for primary contact recreation.

**Table 4: WA Health primary contact *Enterococci* trigger levels for recreational water**

Summary	Indicator	Value	Units
<ul style="list-style-type: none"> <li>A 'one-off' trigger level, where a single sample yields a result of 700 or more <i>Enterococci</i> per 100mL of water</li> </ul>	<i>Enterococci</i>	> 700	MPN/100mL
<ul style="list-style-type: none"> <li>A 'two-in-a-row' trigger level, where two consecutive samples yield results of 100 or more <i>Enterococci</i> per 100mL of water</li> </ul>	<i>Enterococci</i>	> 100	MPN/100mL

The intent is that LGA's/WBM's consider these trigger levels, in conjunction with any other relevant or available information in determining what management action may be necessary.

For example:

- Any predisposing factor or event that may potentially have increased the risk of faecal water contamination (Sampling site observations may be of assistance)
- Recent or forecast rainfall;
- Other pertinent weather or environmental conditions;
- Type and level of recreational water use/activity – including any upcoming events

It is not intended that this approach should necessarily result in the immediate closure of the water body for primary contact recreation. The trigger levels should however initiate:

- Consideration for the potential cause/reason for elevated bacterial levels,
- Repeat sampling, and;
- Site investigation (as appropriate).

**Example** - a new development at the site may have increased the susceptibility to faecal contamination through stormwater runoff increased bacterial levels at the sample site.

If an imminent or likely public health risk is identified, it may be necessary to issue a media statement/ public advisory that the water body site is currently experiencing elevated bacterial levels and is unsuitable for secondary and/or primary contact recreation. The issuing of a media statement/ public advisory will be subject to the abovementioned factors.

**Example (Ocean waters)** are highly saline and subject to strong winds, tides, wave action and high levels of dilution/flushing. Elevated *Enterococci* levels in ocean waters tend to dissipate and reduce quickly, unless there is a significant or ongoing pollution source.

The erection of warning signs at swimming beaches and the issue of a media statement is often not necessary, unless a current large-scale pollution event is identified or ongoing, or the effects from a recent pollution event are still clearly visible or evident.

**Example (Lake, River, Reservoir)** tend to be better sheltered from wind than an ocean environment and experience lower levels of dilution/flushing. Elevated *Enterococci* levels are more likely to pose a potential risk of illness. Management measures including erecting warning signs and issuing a media statement should be considered in these circumstances.

**Note:** If a wastewater overflow is identified the public should be notified as soon as possible.

### 5.2.2. Trigger level for secondary contact recreation

WA Health has also considered trigger levels for secondary contact recreation such as kayaking, rowing, wading etc. and in the absence of any NHMRC Guidelines, recommends trigger levels set ten times the trigger values for primary contact recreation (See Table 5 below).

**Table 5: WA Health secondary contact *Enterococci* trigger levels for recreational water**

Summary	Indicator	Value	Units
<ul style="list-style-type: none"> <li>A 'one-off' trigger level, where a single sample yields a result of 7000 or more <i>Enterococci</i> per 100mL of water</li> </ul>	<i>Enterococci</i>	> 7000	MPN/100mL
<ul style="list-style-type: none"> <li>A 'two-in-a-row' trigger level, where two consecutive samples yield results of 1000 or more <i>Enterococci</i> per 100mL of water</li> </ul>	<i>Enterococci</i>	> 1000	MPN/100mL

### 5.2.3. Two-in-a-row trigger level exceedance

Like the approach for the site specific two-in-a-row trigger level, the following can be considered and/or applied when the generic two-in-a-row trigger level is exceeded:

- Repeat sampling;
- Review sampling observations;

Consider:

- Potential sources of faecal pollution;
- Locally relevant factors;
- Environmental and weather conditions, and;
- Likelihood for water quality quickly returning to a level suitable for primary contact recreation.

The erection of warning signs and the issuing of an advisory, would generally not to be considered unless, repeat sampling (at least 2 to 3 consecutive samples) confirm elevated bacterial levels, indicative of potential faecal contamination or an ongoing pollution event.

### 5.2.4. Table of generic trigger levels

Table 6 below summarises both generic one-off and two-in-a-row trigger levels for both *Enterococci* and *E. coli*. Whilst in the absence of any formative national guideline for *E. coli*, on an interim basis, the DoH has proposed the following *E. coli* trigger levels for comparative purposes, to assist with decision making primarily for identified contamination related events e.g. heavy rainfall or wastewater overflow events.

**Table 6: WA Health short-term generic bacterial trigger levels for recreational waters**

Contact type	Recreation activity example	Contact exposure level	Indicator	'One sample' trigger level	'Two-in-a-row' trigger level
Primary Recreation	e.g. swimming, diving, water-skiing, surfing etc.	High	<i>Enterococci</i>	700 MPN/100mL <sup>#</sup>	100 MPN/100mL <sup>#</sup>
			<i>E. coli</i>	400 CFU/100mL <sup>+</sup>	150 CFU/100mL <sup>*</sup>
Secondary Recreation	e.g. wading, kayaking, fishing etc.	Medium	<i>Enterococci</i>	7000 MPN/100mL <sup>#</sup>	1000 MPN/100mL <sup>#</sup>
			<i>E. coli</i>	4000 CFU/100mL <sup>*</sup>	1000 CFU/100mL <sup>*</sup>

Table developed by Department of Health (WA Health) 2021

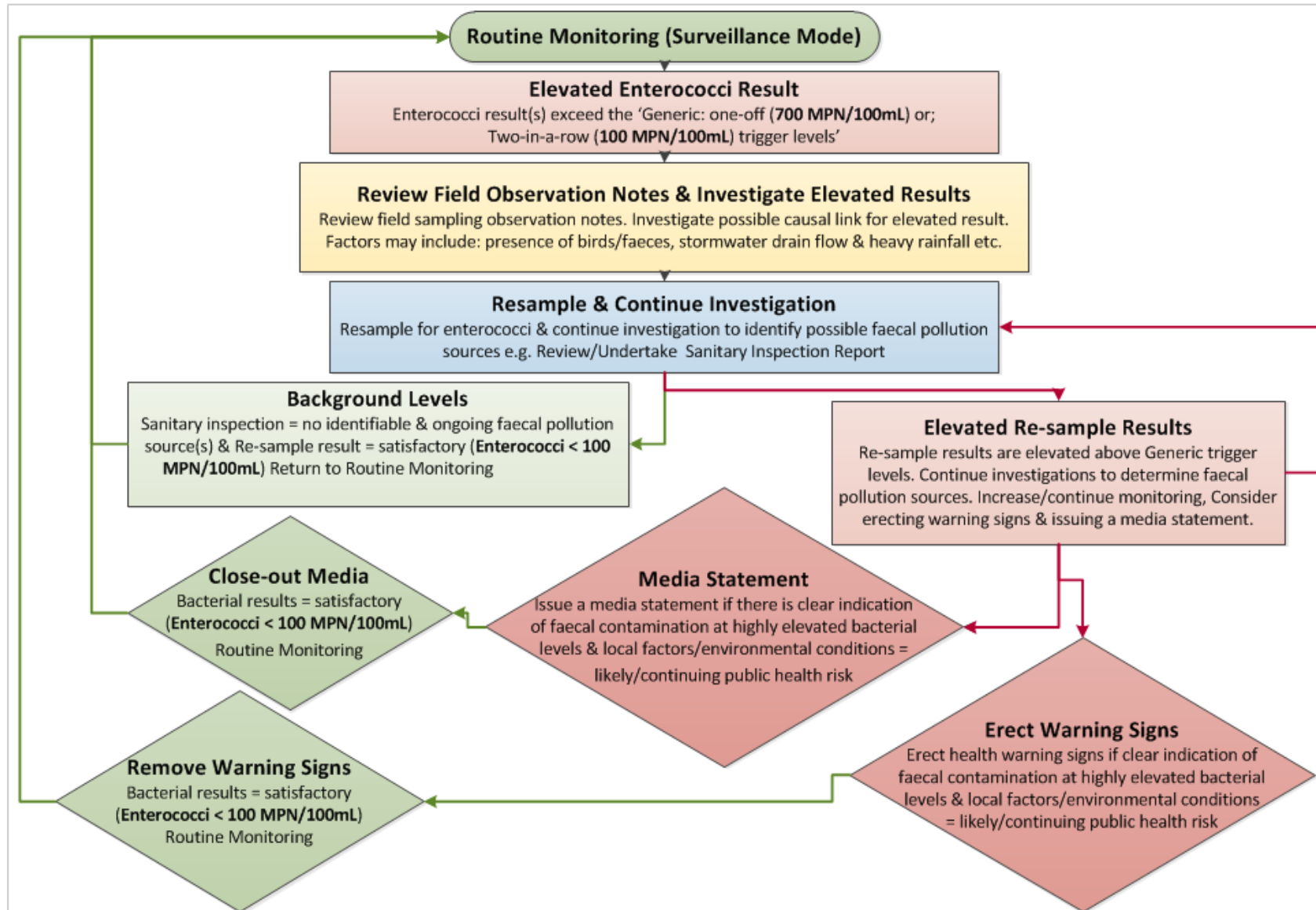
<sup>#</sup> Trigger levels developed by DoH in 2015 as a Ministerial condition for Champion Lakes Regatta Centre.

<sup>\*</sup> Not a formal guideline/trigger level – for comparative/reference purposes only. Utilising equivalent levels for faecal coliforms from the ANZECC, 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality [6].

<sup>+</sup> Not a formal guideline/trigger level – for comparative/reference purposes only. Utilising comparative levels for *E. coli* from the New Zealand, Ministry for the Environment, 2002, Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas [4].

A flowchart for responding to elevated *Enterococci* results is outlined in Figure 1.

Figure 1: Flow chart for responding to elevated *Enterococci* results



## 6. Public Communication

### 6.1. How can this information be presented to the public?

It is important to advise the general public of the potential health risks that a water body may pose. There are several practical options to communicate water quality information to the public which may include some of the following methods:

- Internet (Public health and local government websites)
- Social media
- Press releases (media statements)
- Health warning signs
- Fact sheets and brochures
- Maps
- Email alerts
- Apps for electronic devices
- Public forums and community action groups

### 6.2. Beach grades for Western Australia – environmental waters website

The public health - environmental waters beach grades website: [Beach grades for Western Australia \(health.wa.gov.au\)](http://Beach%20grades%20for%20Western%20Australia%20(health.wa.gov.au)) was first created to provide Western Australian recreational water users with information about prevailing bacterial water quality at popular swimming beaches along Perth's coastline, the Swan and Canning Rivers and Rottnest and Garden Island's. Bacterial water quality classifications (beach grades) are now also available for many areas of Western Australia's regional coastline and inland waterways.

### 6.3. Traffic light classifications

For ease of understanding, the bacterial water quality health risk that a water body site may pose, is generally indicated using traffic light colours green, amber or red on maps for popular recreational beaches.

The colour green refers to sites with good bacterial water quality, which is suitable for swimming. The colour red indicates recreational sites with poor bacterial water quality which are generally not suitable for swimming and amber represents variable bacterial water quality.

The traffic light classifications are based upon and take into consideration both the [MAC](#) and [SIC](#) (as available) and provide either a [provisional](#) or [final](#) classification.



#### 6.3.1. Provisional classification

A provisional classification implies that there are gaps in the available information, which may occur as a result of any of the following:

- Less than 65 samples have been collected over a 5 consecutive year period;
- A sanitary inspection has not been undertaken, and/or a default SIC has been assigned, based upon an assigned risk level representative of the type of water body, or;
- A SIC has been assigned, but some aspects of the SIC risk criteria require verification e.g. rainfall samples are required to confirm the impact of rainfall on water quality at the site.




A provisional classification is displayed in either of the following formats:



	<p>‘Single colour icon’ e.g. green, amber, or red with a ‘P’ symbol in the middle.</p>
	<p>‘Two-toned paddle colour icon’: one colour left, and the other colour right.</p>

### 6.3.1.1. Single colour icon

The ‘**single colour icon**’ with a ‘P’ symbol in the middle, implies that either, or both the [MAC](#) and [SIC](#), are at a provisional classification stage but are at the same risk colour level.

	<p><b>Good:</b> Based upon <u>incomplete information available to date</u>, bacterial water quality appears to be safe for swimming most of the time. Water quality results to date have been good on most occasions and there are few potential faecal contamination sources identified.</p> <p>Standard warnings apply e.g. avoid swimming after heavy rainfall (&gt;10mm) for up to 3 days in fresh to estuarine waters, and for 1 day in ocean/marine waters.</p>
	<p><b>Fair:</b> Based upon <u>incomplete information available to date</u>, bacterial water quality appears to be variable at this location. Water quality results at times appear to be safe for swimming; however elevated bacterial levels can also make this site unsuitable for swimming.</p> <p>Elevated bacterial levels are likely due to animal pollutant sources e.g. bird faeces, and from contaminants flushing into the water following rainfall.</p> <p>Swimming should be avoided during and for several days following heavy rainfall (&gt;10mm) and if the water is discoloured, murky, has visual pollution or smells unpleasant.</p>
	<p><b>Poor:</b> Based upon <u>incomplete information available to date</u>, bacterial water quality often appears to be unsatisfactory for swimming.</p> <p>Elevated bacterial levels occur during and following rainfall events, and/or as a result of stormwater drain inflow, or due to animal pollutant sources e.g. birds etc. Other factors such as low dilution, tidal movement and wind direction may enable bacteria to survive longer in these waters.</p> <p>There may be a greater risk of illness if you ingest the water, particularly for the very young, the elderly and those with compromised immunity. Swimming or putting your head under water should be avoided.</p>

### 6.3.1.2. Two-toned paddle colour icon

The ‘**two-toned paddle colour icon**’ relates directly to the [MAC](#) and [SIC](#), either or both of which are at the provisional classification stage. The colour on the left represents the MAC and the colour on the right represents the SIC.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be safe for swimming most of the time.

Standard warnings apply avoid swimming after heavy rainfall (>10mm) for up to 3 days in fresh to estuarine waters, and for 1 day in ocean/marine waters.

**SIC:** Based upon incomplete information available to date, elevated bacterial levels are likely to be due to animal pollutant sources e.g. bird faeces, and from contaminants flushing into the water following rainfall.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be safe for swimming most of the time.

Standard warnings apply avoid swimming after heavy rainfall (>10mm) for up to 3 days in fresh to estuarine waters, and for 1 day in ocean/marine waters.

**SIC:** Verification of the SIC is required. SIC may over emphasise the actual risk.

Elevated bacterial levels may occur during and following rainfall events, and/or as a result of stormwater drain inflow, or due to animal pollutant sources e.g. birds. Other factors such as low dilution, tidal movement and wind direction may enable bacteria to survive longer in these waters.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be variable at this location. Water quality results at times appear to be safe for swimming; however elevated bacterial levels can also make this site unsuitable for swimming.

Swimming should be avoided for during and for several days following heavy rainfall (>10mm) and if the water is discoloured, murky, has visual pollution or smells unpleasant.

**SIC:** Verification of SIC is required, as few potential faecal contamination sources have been identified; but bacterial water quality results to date have been variable.

Elevated bacterial levels are likely from animal pollutant sources (e.g. bird faeces) and contaminants flushing into the water following rainfall.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be variable at this location. Water quality results at times appear to be safe for swimming; however elevated bacterial levels can also make this site unsuitable for swimming.

Swimming should be avoided during and for several days following heavy rainfall (>10mm) and if the water is discoloured, murky, has visual pollution or smells unpleasant.

**SIC:** Based upon incomplete information available to date, elevated bacterial levels may occur during and following rainfall events, as a result of stormwater inflow, or due to animal pollutant sources e.g. birds. Other factors such as low dilution, tidal movement and wind direction may enable bacteria to survive longer in these waters.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be unsatisfactory for swimming.

There may be a greater risk of illness if you ingest the water, particularly for the very young, the elderly and those who are immuno-compromised.

Avoid swimming or putting your head under water. Permanent warning signs stating “*Swimming is not recommended*” should be considered at this site.

**SIC:** Verification of SIC is required, as few potential faecal contamination sources have been identified; but bacterial water quality results to date have generally been unsatisfactory for swimming.

Elevated bacterial levels occur during and following rainfall events, as a result of stormwater drain inflow, or due to animal pollutant sources e.g. birds. Other factors such as low dilution, tidal movement and wind direction may enable bacteria to survive longer in these waters.



**MAC:** Based upon incomplete information available to date, bacterial water quality appears to be unsatisfactory for swimming.

There may be a greater risk of illness if you ingest the water, particularly by the very young, the elderly and those who are immuno-compromised.

Avoid swimming or putting your head under water. Permanent warning signs stating that “*Swimming is not recommended*” should be considered at this site.

**SIC:** Based upon incomplete information available to date, elevated bacterial levels appear mostly due to animal pollutant sources, stormwater inflow, and during and after rainfall events due to contaminants flushing into the water.

### 6.3.2. Final Classification

A final classification will be displayed as one colour, either: green, amber or red. This confirms that the MAC has been obtained with a minimum of 65 samples over 5 consecutive years, and individual faecal risk factors for the SIC have been verified.

Alternatively, management initiatives or activities relating to the SIC have been undertaken to address any potential risks that may not have been fully validated.



**Very Good:** Bacterial water quality is considered safe for swimming. Water sampling results are consistently very good, and there are very few or low risk faecal contamination sources at this location.

**Good:** Bacterial water quality is considered safe for swimming most of the time. Water sampling results are good on most occasions, and there are few or low risk faecal contamination sources at this location.

Standard warnings apply e.g. avoid swimming after heavy rainfall (>10mm) for up to 3 days in fresh to estuarine waters, and for 1 day in ocean/marine waters.

**Fair:** Bacterial water quality is variable at this location. Water quality is at times considered safe for swimming; however elevated bacterial levels can also make this site unsuitable for swimming.



Elevated bacterial levels are mostly due to animal pollutant sources e.g. bird faeces, and from contaminants flushing into the water following rainfall.

Swimming should be avoided during and for several days following heavy rainfall (>10mm) and if the water is discoloured, murky, has visual pollution or smells unpleasant.

**Poor:** Bacterial water quality is often unsatisfactory for swimming. Elevated bacterial levels occur during and following rainfall events, and/or as a result of stormwater drain inflow, or due to animal pollutant sources e.g. bird faeces etc.

Other factors such as low dilution, tidal movement and wind direction may enable bacteria to survive longer in these waters.

There may be a greater risk of illness if you ingest the water, particularly by the very young, the elderly and those who are immuno-compromised. Swimming or putting your head under water should be avoided.

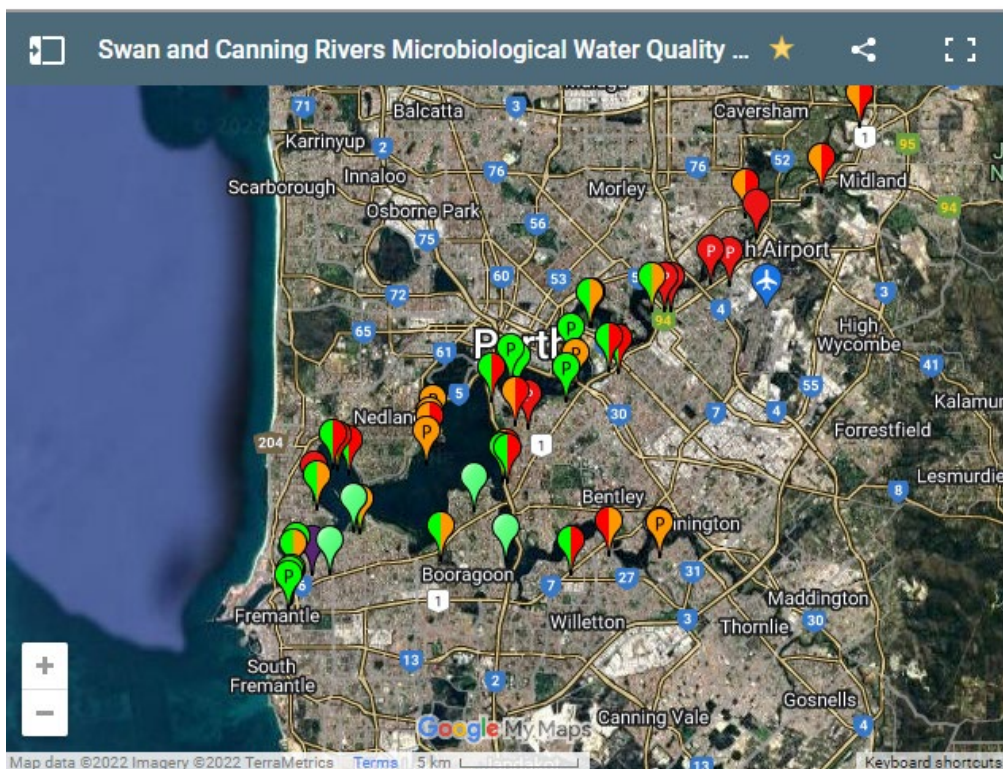
**Very Poor:** Bacterial water quality is unsatisfactory. Avoid swimming at this site, as there may be direct discharges of faecal material or other pollution sources.

Permanent warning signs should be erected at this site stating, "Swimming is not recommended".



**Note:** The following is an example of an inter-active beach grade map as displayed on the [Beach grades for Swan and Canning Rivers \(health.wa.gov.au\)](http://health.wa.gov.au) website.

**Figure 2: Example of beach grade mapping**





## 6.4. What do *Enterococci* guideline values mean to public health?

As mentioned previously, *Enterococci* are used to indicate the presence of enteric pathogens that live in the intestines and are shed in human and animal faeces. While it is not possible to know whether *Enterococci* are of human, animal or avian (bird) origin, all these species can act as carriers of micro-organisms that can cause human illness and disease.

Faecal pollution from human sources tends to present a greater risk to public health compared to faecal pollution from animal sources, due to fewer diseases being transmitted from animals to humans. However, there is still some risk from animal excreta, especially associated with faecal pollution from piggeries or cattle farms.

Defining the actual risk of faecal pollutant sources is extremely difficult. The human response to pathogens in water, person to person exposure and the pollutant risks it presents varies. The NHMRC Guidelines [1] are therefore based on a defined 'tolerable risk' rather than no risk at all.

*"Concentrations of E.coli and enterococci can be related to guideline levels to provide an indication of human health risk (in the form of likely numbers of illnesses per number of recreational events)." [3]*

**For most people, contact with water at acceptable guideline values will pose only a minimal increase in daily risk. However, water conforming to the guidelines may still pose a health risk to high-risk user groups such as the very young, the elderly and those who are immuno-compromised.**

## 6.5. When are health warning signs required?

### 6.5.1. Temporary signs

LGA's and WBM's should have several warning signs available, to enable timely response to a contamination event e.g. a wastewater overflow event or following heavy summer rainfall that may occur within a recreational water body and result in highly elevated bacterial water quality.

WA Health can provide a template of the standard health warning sign (Figure 2 below) for recreational waters in a PDF, jpg or png format. The sign template can be modified to add the relevant LGA/WBM logo and contact details in the bottom right corner of the sign.

**Figure 3: Standard health warning sign for recreational waters**





## 6.5.2. Permanent signs

Careful consideration is required when deciding if to install permanent caution or health advice signs at a monitoring site. Installation of permanent signs is normally recommended when the [final site classification](#) is Poor, or Very Poor, indicating frequent elevated bacterial water quality.

Permanent signs may also be appropriate for a monitoring site, to communicate key periods and/or events when bacterial water quality is most likely to be elevated e.g. during and following heavy rainfall. This assessment is often based upon historical sampling results and the [SIC](#).

Some examples of different types of permanent caution or health advice signs and statements are detailed below.

### 6.5.2.1. Rainfall / stormwater drain advisories / sign examples

- 'This waterway can be affected by high levels of bacteria at certain times; especially after rainfall. Avoid contact with the water during and after heavy rainfall.'
- 'This waterway may experience poor water quality during and after rainfall events. Avoid swimming during these times as ingestion of water may cause illness'
- After heavy rainfall (>10mm) high levels of bacteria from storm drains, enter our ocean. Avoid direct water contact for 24 hours after rainfall, especially near stormwater drains.

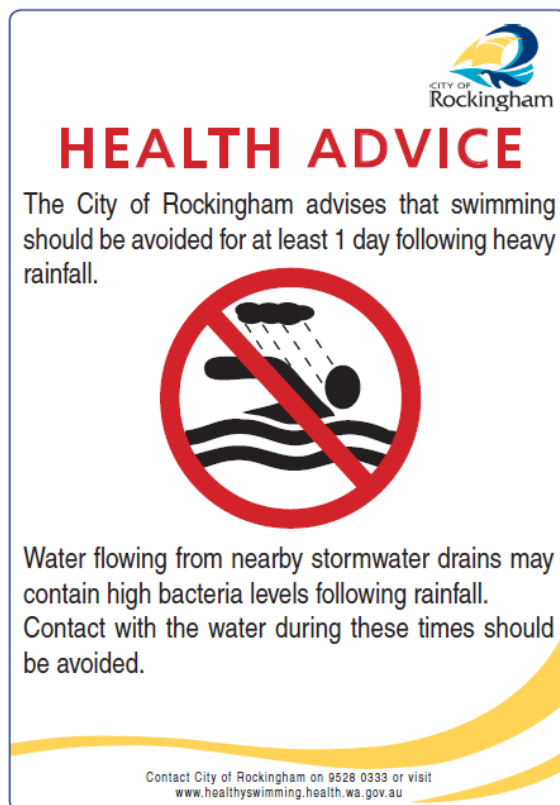
Figure 4: Rainfall stormwater drain sign example 1



Figure 5: Stormwater drain warning sign example 2



**Figure 6: Rainfall stormwater drain warning sign example 3**



**6.5.2.2. Elevated bacterial water quality advisory example**

“Health Warning: Bacterial levels in this water are often elevated. Avoid swallowing this water. Swimming or immersion is not recommended.”

**Figure 7: Elevated bacteria warning sign example 4**



**7. Future Monitoring**

After implementing a monitoring program and assigning a [final classification](#) ([MAC](#) and [SIC](#)) to a water body sampling site, microbial water sampling can potentially be reduced (to a minimum of 5 samples per season) for future years if the risk category identified is Very Low, Low or Very High. The NHMRC Guidelines [1] recommended monitoring schedule is outlined in [Table 7](#).

**Table 7: Recommended monitoring schedule [1]**

Risk category identified by sanitary inspection	Monitoring schedule	Frequency of sanitary inspection
Very low	Minimum of <b>5 samples per year</b> , at regular intervals during recording period.	Annual
Low	Minimum of <b>5 samples per year</b> at regular intervals during recording period.	Annual
Moderate	Annual low-level sampling. <b>20 samples at regular intervals</b> (e.g. 2 samples x 5 occasions during swimming season) Annual verification of management effectiveness. Additional sampling if abnormal results obtained.	Annual
High	Annual low-level sampling. <b>20 samples at regular intervals</b> (e.g. 2 samples x 5 occasions during swimming season) Annual verification of management effectiveness. Additional sampling if abnormal results obtained.	Annual
Very high	<b>Minimum of 5 samples</b> per year, but nil if closed to use. Permanent warning signs erected.	Annual

### 7.1. How can a site be reclassified once it is graded?

After a [final classification](#) ([MAC](#) and [SIC](#)) has been assigned to a recreational water body sampling site, and the water sampling frequency has been reduced in accordance with the recommended monitoring schedule (Table 7), the recreational site should not be re-classified based upon a reduced number of total sampling results in the following seasons.

For a recreational water site to be re-classified, the key risk factors that influence bacterial water quality at the site need to have changed or alternatively managed, reduced, removed etc., and combined with further monitoring to determine any long-term water quality trends or changes.

One example of managing a risk at a site to reduce the risk category could be a decision to erect permanent health warning signs to advise regarding the risk of elevated bacterial levels following heavy rainfall. This action/measure to manage the bacterial water quality risk, may enable the risk category for the site to be reduced from Moderate (amber traffic light) to Low i.e. Good (green traffic light) to be assigned.

## References

1. National Health and Medical Research Council, *Guidelines for Managing Risks in Recreational Water*. 2008: Canberra. p. 215.
2. Environmental Protection Agency, U.S., *Recreational Water Quality Criteria*, O.o.S.a.T. Health and Ecological Criteria Division, United States (U.S.) Environmental Protection Agency (EPA),, Editor. 2012. p. 63.
3. Ministry for the Environment, N.Z. *Microbiological water quality guidelines for recreational water - frequently asked questions*. 2009 8/10/2009 [cited 2017 15/03/2017]; Available from: <http://www.mfe.govt.nz/fresh-water/tools-and-guidelines/microbiological-guidelines-recreational-water>.
4. Ministry for the Environment, N.Z., *Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas*, M.f.t. Environment, Editor. 2003, Ministry for the Environment: Wellington, New Zealand. p. 159.
5. Lugg, R.S.W., A. Cook, and B. Devine, *Estimating 95th Percentiles from Microbial Sampling: A Novel Approach to Standardising their Application to Recreational Waters*, in *The Significance of Faecal Indicators in Water: A Global Perspective*. 2012, The Royal Society of Chemistry. p. 62-71.
6. Australian and New Zealand Environment and Conservation Council and and Agriculture and Resource Management Council of Australia and New Zealand, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* 2000: Canberra, ACT.

## More Information

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