NSW GOVERNMENT

Department of Planning, Industry and Environment

# State of the beaches 2020–2021

Illawarra region

## Beachwatch

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Front cover: Surf Beach Kiama (Beachwatch/DPIE)

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ISBN 978-1-922672-15-5
EES 2021/0267
July 2021

# Contents

Recreational water quality has been monitored in the Illawarra region since 1996 by Sydney Water, and by Wollongong City Council and Kiama Municipal Council under the Department of Planning, Industry and Environment's Beachwatch Partnership Program. This report summarises the performance of 21 swimming sites in the Illawarra region of New South Wales, providing a long-term assessment of how suitable a site is for swimming. Monitored sites include ocean beaches and a designated swimming site in Lake Illawarra.

In 2020–2021, 100% of swimming sites in the Illawarra region were graded as Good or Very Good. These sites were suitable for swimming for most or almost all of the time. This is an excellent result, similar in performance to previous years, and despite some wet months.

# Illawarra region summary 2020–2021

## Beach monitoring in NSW

Austinmer Beach
Photo: Beachwatch/EES, DPIE

The water quality of beaches and other swimming locations is monitored under the NSW Government's Beachwatch programs to provide the community with accurate information on the cleanliness of the water and to enable individuals to make informed decisions about where and when to swim. Routine assessment also measures the impact of pollution sources, enables the effectiveness of stormwater and wastewater management practices to be assessed and highlights areas where further work is needed.

Swimming sites in New South Wales are graded as Very Good, Good, Fair, Poor or Very Poor in accordance with the National Health and Medical Research Council's 2008 *Guidelines for Managing Risks in Recreational Waters*. These Beach Suitability Grades provide a long-term assessment of how suitable a beach is for swimming. The grades are determined from the most recent 100 water quality results (two to four years' worth of data depending on the sampling frequency) and a risk assessment of potential pollution sources.

See the section on **Quality assurance** in the Statewide Summary for results of the quality assurance program.

Recreational water quality has been monitored in the Illawarra region by Sydney Water since 1996, and Wollongong City Council and Kiama Municipal Council since 2011.

A **quality assurance** program ensures the information collected and reported by Beachwatch and its partners is accurate and reliable.

## Rainfall impacts

During 2020–2021, 21 swimming sites were monitored including ocean beaches and a designated swimming site in Lake Illawarra.

Rainfall is the major driver of pollution to recreational waters, generating stormwater runoff and triggering untreated discharges from the wastewater treatment and transport systems. Changes in rainfall patterns are reflected in beach water quality over time due to variation in the frequency and extent of stormwater and wastewater inputs.

The Beach Suitability Grades for 2020–2021 are based on water quality data collected over the last two to four years. Rainfall over this period has been diverse:

- 2017–2018: prolonged dry weather periods broken by heavy rain at times
- 2018–2019: extended dry weather conditions except for isolated wet months
- 2019–2020: long dry periods, with some isolated wet weather events and a very wet February
- 2020–2021: variable rainfall with some wet months.

See the section on **How to read this report** on page 41 for an explanation of the graphs, tables and Beach Suitability Grades.

Winter rainfall in the Illawarra region was average to above average. There were several isolated wet weather events with very heavy rain falling over several days from 26–28 July and 8–10 August 2020. Bellambi had its highest July daily rainfall on record with 110 mm on 27 July.

Rainfall during spring 2020 was below average for the season; however, severe storms brought heavy rain to the Illawarra coast in late October 2020.

Summer and early autumn were wet with average to above average rainfall recorded in December 2020, and January and March 2021.

Notably, very heavy rain fell in mid-March with Kiama and Port Kembla recording three-day rain totals on 21–23 March of 136 mm and 119 mm, respectively. Many coastal areas were impacted by flooding triggered by the heavy rainfall. Beachwatch issued an extreme wet weather and flooding alert on the Illawarra daily beach pollution forecast during March 2021, advising stormwater pollution and floodwaters may be impacting swimming sites for an extended period, with lifeguard reports of floating debris and discoloured water continuing after the rain had ceased.

Rainfall totals for April 2021 were well below the long-term monthly average.

## Algal blooms

Marine algal bloom present in the water
Photo: Chad Weston/NPWS, DPIE

Water NSW reported a suspected cyanobacteria bloom at Kendalls Beach in Kiama in November 2020. Marine algae advisories were issued on the Water NSW website.

The appearance of **marine algae** is sometimes mistaken for **sewage contamination** or **oil slicks**, due to a strong odour and red or brown discolouration in the water caused by the blooms.

As a precaution, direct contact with algae should be avoided as it can cause skin and eye irritations. The marine algal blooms dissipated with changes in tide and wind conditions.

Beachwatch issues daily **beach pollution forecasts** to enable beach goers to make informed decisions about where and when to swim.

Pollution forecasts for the Illawarra beaches can be accessed via the Beachwatch website, email subscription, Twitter and Facebook.

## Health risks

Contamination of recreational waters with faecal material from animal and human sources can pose significant health problems to beach users owing to the presence of pathogens (disease-causing micro-organisms) in the faecal material. The most common groups of pathogens found in recreational waters are bacteria, protozoans and viruses.

Exposure to contaminated water can cause gastroenteritis, with symptoms including vomiting, diarrhoea, stomach-ache, nausea, headache and fever. Eye, ear, skin and upper respiratory tract infections can also be contracted when pathogens come into contact with small breaks and tears in the skin or ruptures of the delicate membranes in the ear or nose.

Certain groups of users may be more vulnerable to microbial infection than others. Children, the elderly, people with compromised immune systems, tourists, and people from culturally and linguistically diverse backgrounds are generally most at risk.

**Beach Suitability Grades for Illawarra region**

| Swimming site | Site type | Beach Suitability Grade | Change |
|---|---|---|---|
| **Wollongong City Council** | | | |
| Stanwell Park Beach | Ocean beach | VG | ● |
| Coledale Beach | Ocean beach | G | ↓ |
| Austinmer Beach | Ocean beach | VG | ● |
| Thirroul Beach | Ocean beach | G | ● |
| Bulli Beach | Ocean beach | G | ● |
| Woonona Beach | Ocean beach | VG | ● |
| Bellambi Beach | Ocean beach | G | ● |
| Corrimal Beach | Ocean beach | G | ● |
| North Wollongong Beach | Ocean beach | G | ● |
| Wollongong City Beach | Ocean beach | VG | ● |
| Coniston Beach | Ocean beach | VG | ● |
| Fishermans Beach | Ocean beach | VG | ● |
| Port Kembla Beach | Ocean beach | G | ● |
| **Shellharbour City Council** | | | |
| Entrance Lagoon Beach | Lake/Lagoon | G | ● |
| Warilla Beach | Ocean beach | VG | ● |
| Shellharbour Beach | Ocean beach | VG | ● |
| **Kiama Municipal Council** | | | |
| Boyds Jones Beach | Ocean beach | G | ↓ |
| Bombo Beach | Ocean beach | VG | ● |
| Surf Beach Kiama | Ocean beach | G | ● |
| Werri Beach | Ocean beach | G | ↓ |
| Seven Mile Beach (Gerroa) | Ocean beach | VG | ● |

| Beach Suitability Grade | | | | | Change | | |
|---|---|---|---|---|---|---|---|
| VG | G | F | P | VP | ↑ | ● | ↓ |
| Very Good | Good | Fair | Poor | Very Poor | Improved | Stable | Declined |

# Wollongong City Council

**100%**
**swimming sites graded Good or Very Good**

## Overall results

All 13 swimming sites were graded as Very Good or Good in 2020–2021. Excellent results have also been recorded in previous years.

Percentage of sites graded as Very Good or Good:

- 2020–2021: 100%
- 2019–2020: 100%
- 2018–2019: 100%
- 2017–2018: 100%.

See the section on **How to read this report** on page 41 for an explanation of the graphs, tables and Beach Suitability Grades.

Eleven locations were monitored by Sydney Water. Samples were collected every sixth day throughout the year at nine locations, and two locations were monitored every sixth day between October and April.

Two locations were monitored by Wollongong City Council. Samples were collected every sixth day (excluding weekends) between October and April and sampling and laboratory analysis was fully funded by the council.

### Best beaches

Stanwell Park Beach, Austinmer Beach, Woonona Beach, Wollongong City Beach, Coniston Beach and Fishermans Beach.

These sites had excellent water quality and were suitable for swimming almost all of the time.

Ocean beaches were the only site type monitored in the Wollongong region.

As a general precaution swimming should be avoided during and for at least one day after heavy rain at ocean beaches, or if there are signs of stormwater pollution such as discoloured water or floating debris.


**Site types in Wollongong City Council**

## Ocean beaches


**Beach Suitability Grades for Wollongong City Council ocean beaches**

All 13 ocean beaches continued to be graded as Very Good or Good in 2020–2021.

Stanwell Park Beach, Austinmer Beach, Woonona Beach, Wollongong City Beach, Coniston Beach and Fishermans Beach were graded as Very Good. Water quality at these beaches has been of a very high standard for many years and is suitable for swimming almost all of the time.

Seven beaches were graded as Good: Coledale Beach, Thirroul Beach, Bulli Beach, Bellambi Beach, Corrimal Beach, North Wollongong Beach and Port Kembla Beach. Coledale Beach was downgraded to Good from Very Good in 2019–2020, due to a slight decline in microbial water quality. Water quality at these sites was frequently suitable for swimming during dry weather conditions. Elevated enterococci levels were occasionally recorded following rainfall, and generally increased with increasing rainfall. Many of these sites have several, or more significant, potential sources of pollution such as stormwater or upstream sources discharged from creeks or lagoons. Discharges from storm sewage treatment plants (SSTPs) at Bellambi and Port Kembla may also affect the water quality at nearby beaches Bellambi, Corrimal and Port Kembla following heavy rainfall.

It is recommended that swimming be avoided at these beaches during and for up to one day following rainfall, or if there are signs of pollution such as discoloured water, flowing drains or floating debris.

# Management


Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

A **Coastal Management Program** (CMP) outlines a long-term strategy for managing the coast, in line with the *Coastal Management Act 2016*.

The NSW Government provides guidance and funding through the Coastal and Estuary Grants Program for local councils to prepare and implement CMPs.

Under the previous *Coastal Protection Act 1979*, councils developed a **Coastal Zone Management Plan** (CZMP) to address coastal issues. Councils can continue to implement priority actions from certified CZMPs with funding assistance from the NSW Government's Coastal and Estuary Grants Program until 2021.

## Wollongong City Council

The Lake Illawarra Coastal Management Program (CMP) has been prepared in partnership by Wollongong City Council, Shellharbour City Council and the Department of Planning, Industry and Environment (DPIE), with funding provided under the NSW Government's Coastal and Estuary Grants Program. The CMP has been adopted by both councils and was certified by the NSW Government in November 2020. It outlines the strategic aims for managing Lake Illawarra and includes prioritised actions for managing specific threats to estuary health. In recognition of land-use pressures and threats, and in response to the values held by the community, water quality is a key consideration within the CMP. Water quality management actions within the CMP relate to stormwater infrastructure improvements, restoring and maintaining riparian corridors and coastal wetlands, strategic land-use planning, and water quality monitoring.

Wollongong City Council has previously installed several stormwater quality improvement devices and is continuing to maintain these. This includes devices in waterways that drain to the patrolled beaches in the Wollongong local government area. Council is planning to install a device at Port Kembla Beach and design a new device for installation at Belmore Basin, located between Wollongong City and North Wollongong patrolled beaches.

The No Butts Trail project, a community education project about cigarette butt litter, was implemented along the coastline from Stanwell Tops to Windang in early 2021, supported by the NSW Environment Protection Authority's Waste Less Recycle More initiative.

As part of an ongoing program with Corrective Services NSW, council undertakes weekly litter collection along the foreshore, beaches and creeks, as well as collection after coastal storms. Material collected includes plastics, cans, paper, polystyrene and large litter items.

Riparian work is continuing along Hargraves Creek, Stanwell Creek, Whartons Creek, Slacky Creek, Collins Creek, Bellambi Creek, Bellambi Lagoon, Towradgi Creek and Fairy Creek, aimed at improving water quality and overall catchment health.

## Sydney Water

To reduce the incidence of wet weather sewage overflows in beach catchments from Austinmer to Port Kembla, Sydney

Water increased the capacity of pipes and pumps and included storage tanks. Sydney Water has also inspected, cleaned and repaired those sewer mains in beach catchments from Austinmer to Port Kembla that have a high likelihood of discharging sewage to waterways if they become blocked. When significant tree root intrusion to the public sewer from the private sewer was identified, property owners were asked to remedy the problem.

Fishermans Beach
Photo: Beachwatch/EES, DPIE


**Sampling sites and Beach Suitability Grades in Wollongong City Council**

# Stanwell Park Beach

**Beach grade:** VG


See ‘How to read this report’ for key to map.

The beach is 700 metres long and is backed by dunes and a reserve. Lifeguards patrol the beach from September to April.

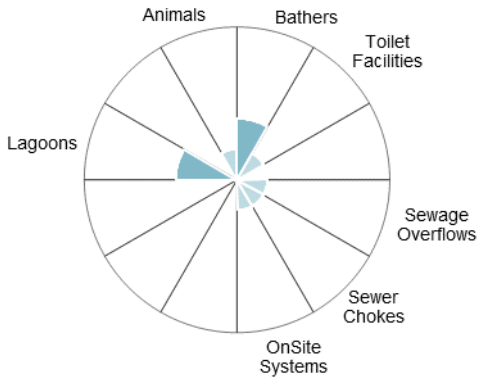
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 5 mm or more of rain.

The site has been monitored since 2011.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Nov 2016 to Apr 2021 | 98% | 100 | Stable |

## Sanitary inspection: Low

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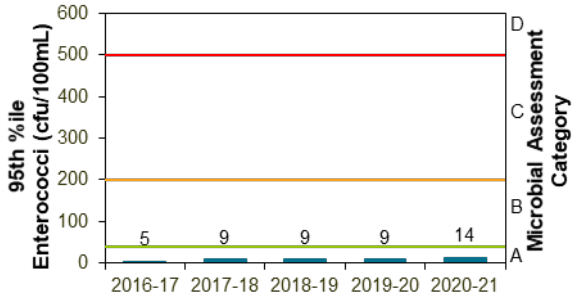


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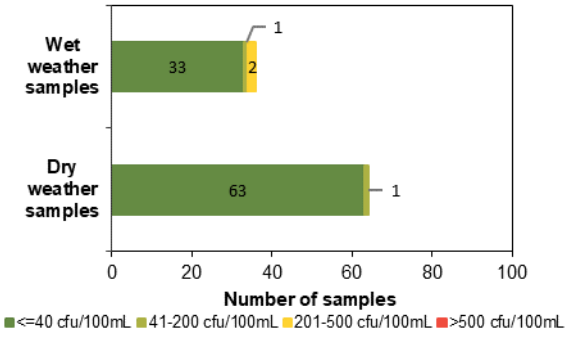


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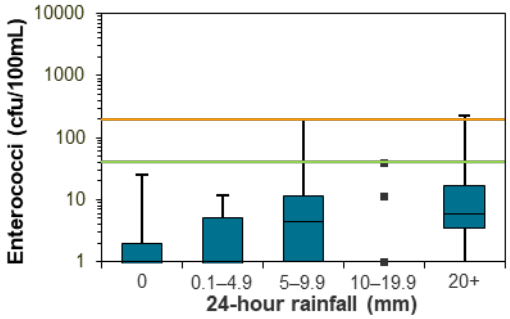


# Coledale Beach

**Beach grade:** G


See 'How to read this report' for key to map.

Coledale Beach is 300 metres long and is backed by a small grass reserve and campsite. Lifeguards patrol the beach from September to April.

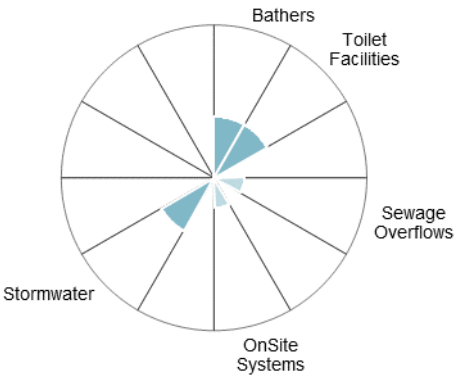
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after 5 mm or more of rain and often after 20 mm or more.

The site has been monitored since 2011.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Dec 2016 to Apr 2021 | 98% | 100 | Declined |

## Sanitary inspection: Low

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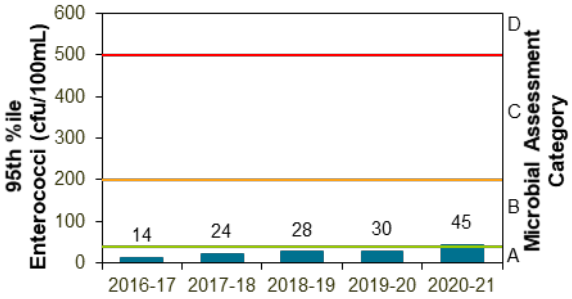
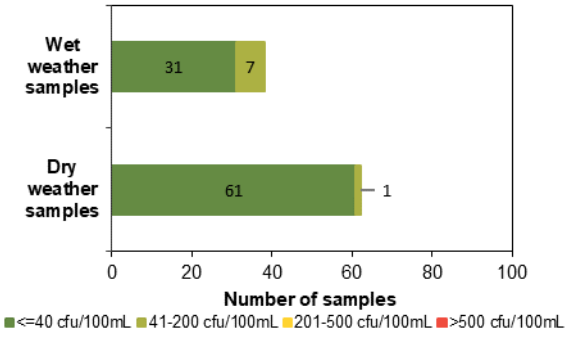
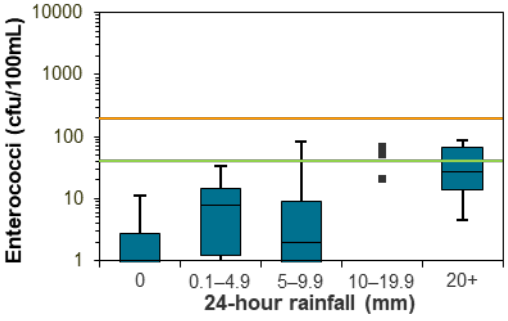



## Dry and wet weather water quality




## Water quality in response to rainfall



# Austinmer Beach

**Beach grade:** VG


See 'How to read this report' for key to map.

Austinmer is a small beach with ocean baths on the southern rock platform. Lifeguards patrol the beach from September to April.

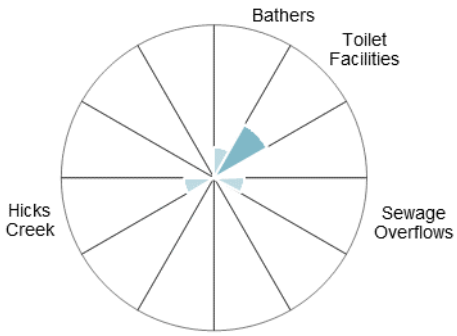
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20 mm or more of rain.

The site has been monitored since 2006.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Nov 2018 to Apr 2021 | 100% | 100 | Stable |

## Sanitary inspection: Low

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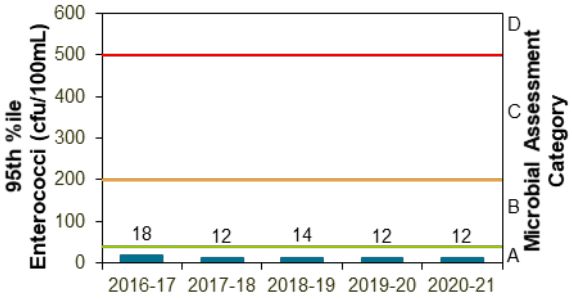
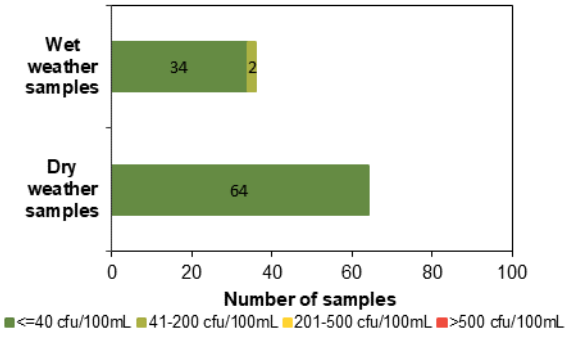
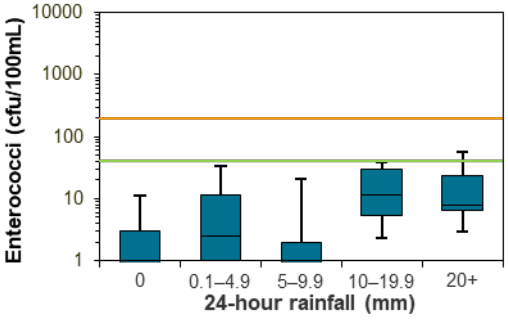



## Dry and wet weather water quality




## Water quality in response to rainfall



# Thirroul Beach

**Beach grade:** G


See 'How to read this report' for key to map.

Thirroul Beach is one kilometre long and backed by a grassed reserve. Lifeguards patrol the beach from September to April.

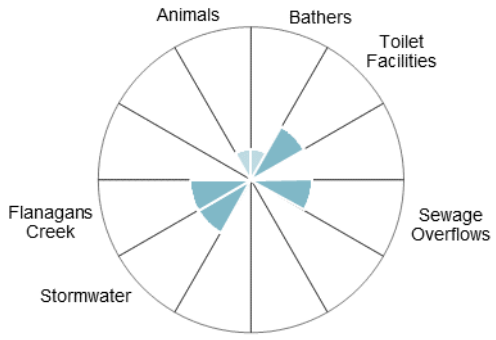
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, from several potential sources of faecal contamination including stormwater and Flanagans Creek.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to rainfall.

The site has been monitored since 2006.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Nov 2018 to Apr 2021 | 98% | 100 | Stable |

## Sanitary inspection: Moderate

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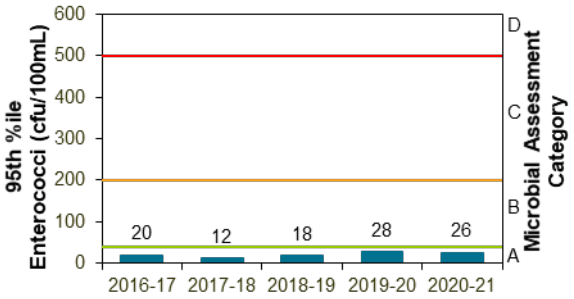


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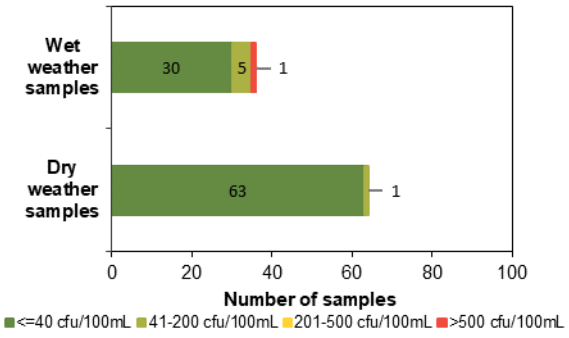
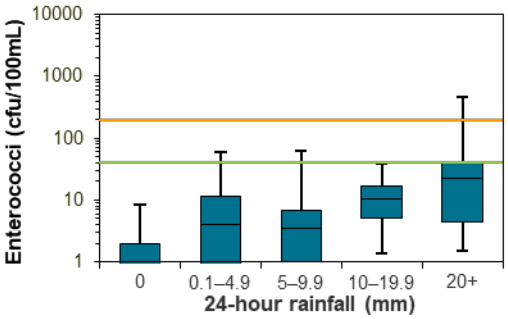



## Water quality in response to rainfall



# Bulli Beach

**Beach grade:** G


See ‘How to read this report’ for key to map.

Bulli beach is at the northern end of a 900 metre long beach. The beach is patrolled from September to April.

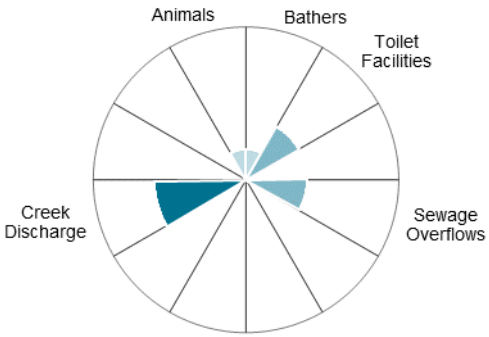
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination, including discharge from Whartons Creek.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after 5 mm or more of rain, and often after 20 mm or more.

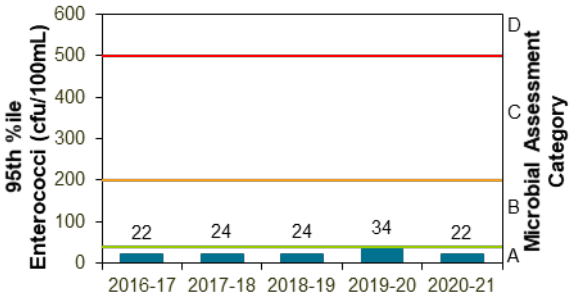
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

## Sanitary inspection: Moderate




## Microbial Assessment Category: A

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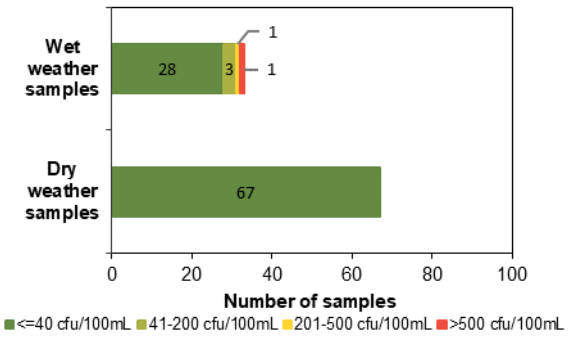
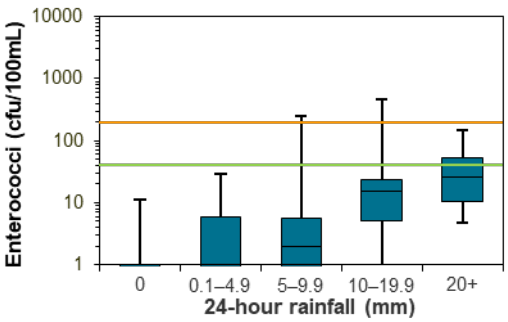
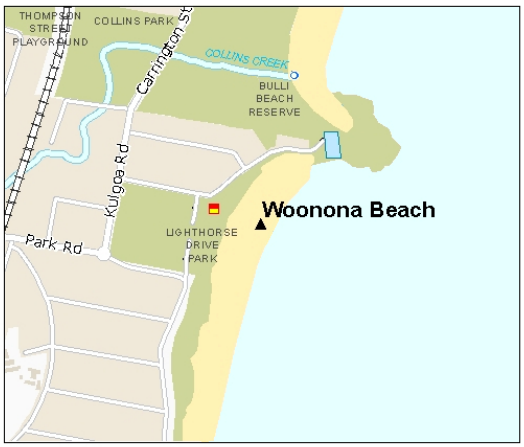



## Water quality in response to rainfall



# Woonona Beach

**Beach grade:** VG




See 'How to read this report' for key to map.

Woonona Beach is at the northern end of a two kilometre stretch of beach. Lifeguards patrol the beach from September to April.

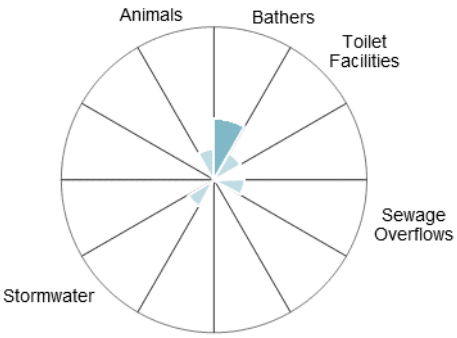
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, often exceeding the safe swimming limit in response to 20 mm or more of rain.

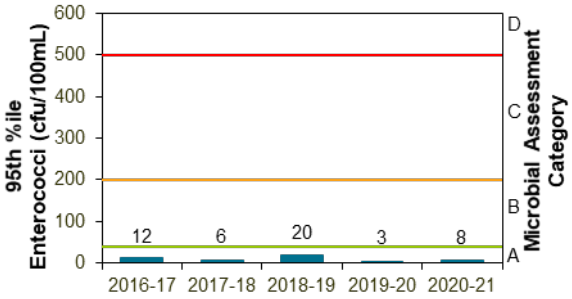
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

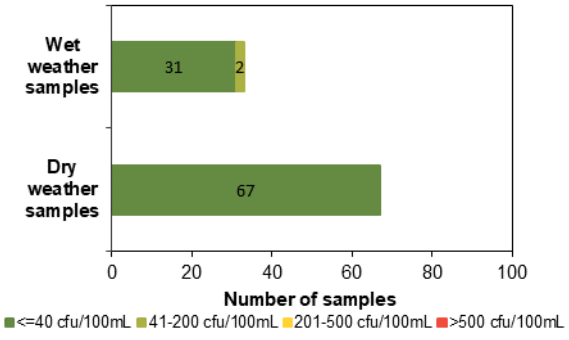
## Sanitary inspection: Low



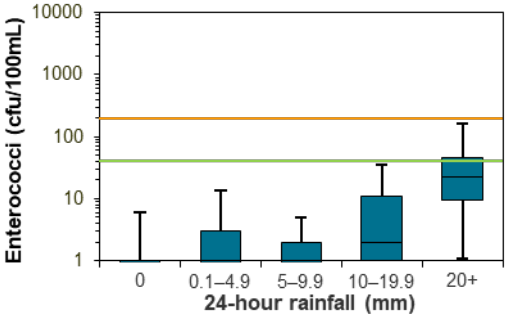

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Bellambi Beach

**Beach grade:** G


See 'How to read this report' for key to map.

Bellambi Beach is at the southern end of a two kilometre stretch of beach. Lifeguards patrol the beach from September to April.

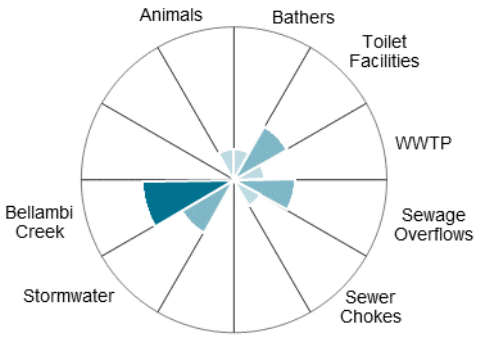
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination, including discharge from Bellambi Gully.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and often after 5 mm or more.

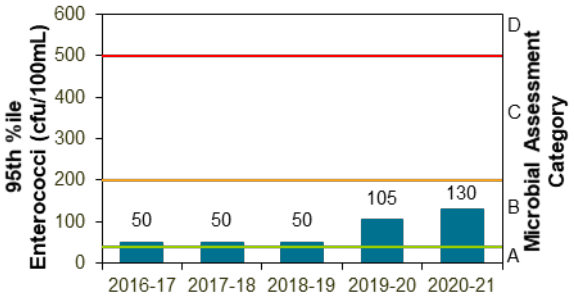
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 97% | 100 | Stable |

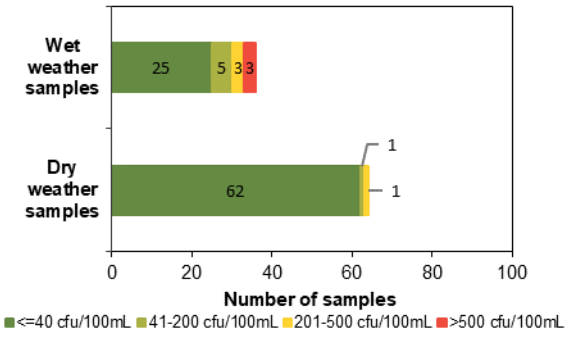
## Sanitary inspection: Moderate



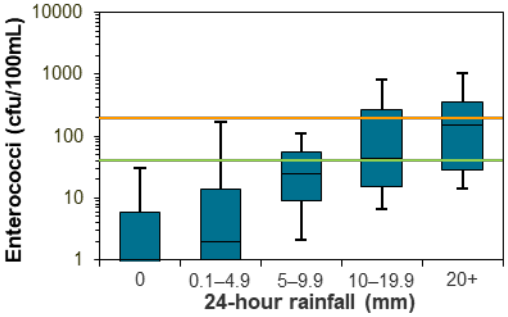

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# Corrimal Beach

**Beach grade:** G


See 'How to read this report' for key to map.

The beach is 1.4 kilometres long and is backed by a reserve and caravan park. Lifeguards patrol the beach from September to April.

The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination, including Towradgi Creek.

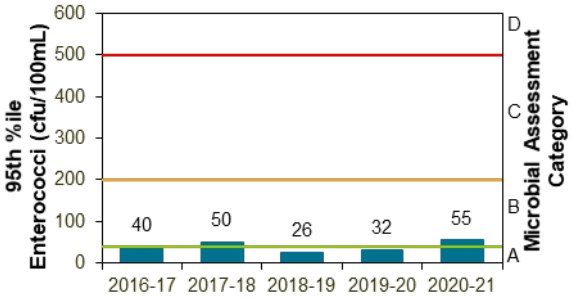
Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to light rain, and often after 5 mm or more.

The site has been monitored since 1996.

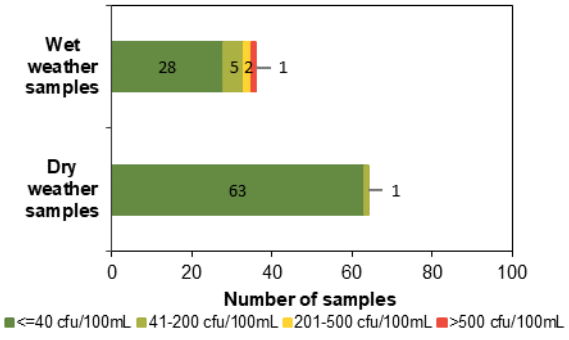
| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 98% | 100 | Stable |

## Sanitary inspection: Moderate

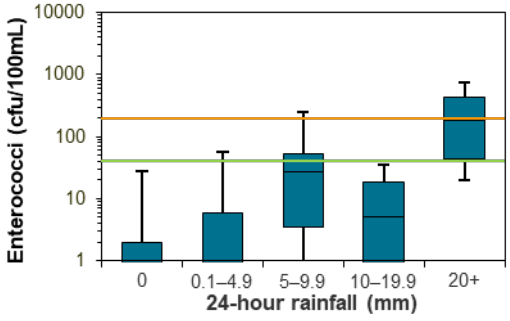

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# North Wollongong Beach

**Beach grade:** G


See 'How to read this report' for key to map.

North Wollongong Beach is 500 metres long and is backed by steep bluffs, a reserve and a picnic area. Lifeguards patrol the beach all year round.

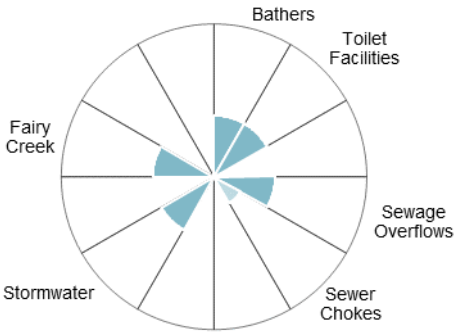
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after heavy rain, with several potential sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, often exceeding the safe swimming limit after 20 mm or more of rain.

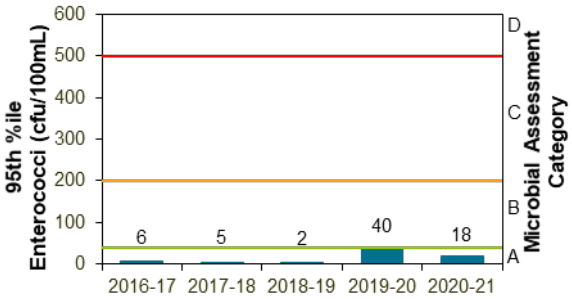
The site has been monitored since 1996, excluding 1997–1998.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 97% | 100 | Stable |

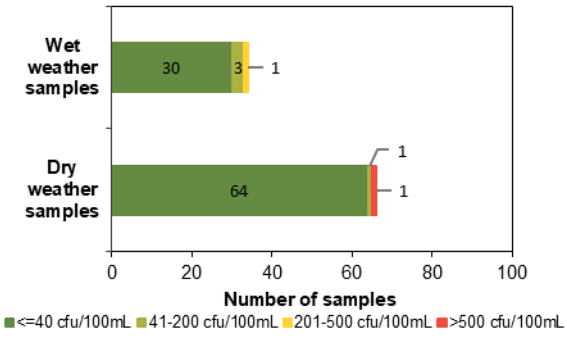
## Sanitary inspection: Moderate



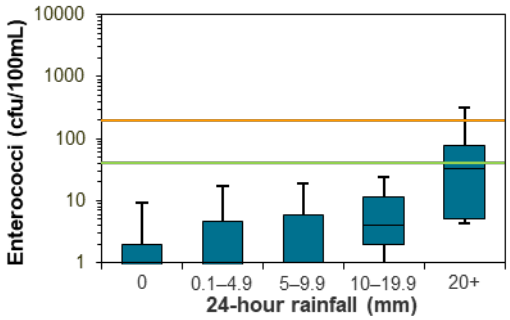

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Wollongong City Beach

**Beach grade:** VG


See 'How to read this report' for key to map.

Wollongong City Beach is at the northern end of a four kilometre stretch of beach. Lifeguards patrol the beach from September to April.

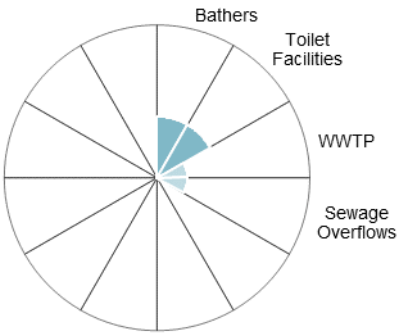
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 20 mm or more of rain.

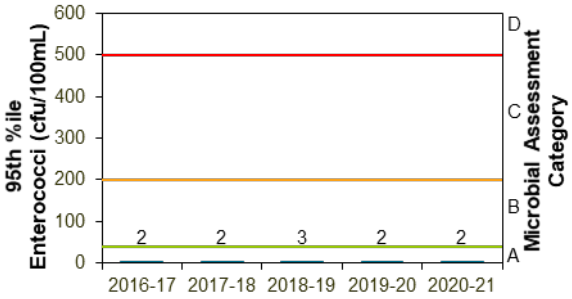
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

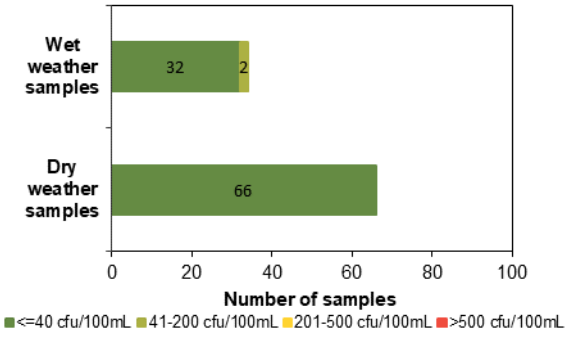
## Sanitary inspection: Low



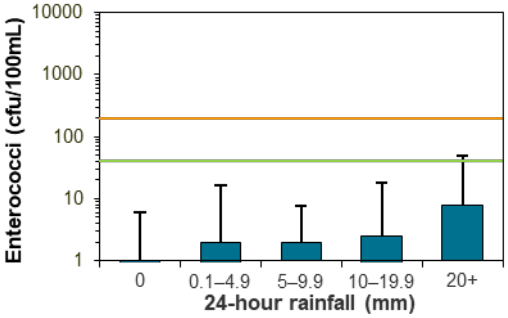

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Coniston Beach

**Beach grade:** VG


See ‘How to read this report’ for key to map.

Coniston Beach is in the middle of a four kilometre stretch of sand, to the north of Port Kembla, and backed by a golf course.

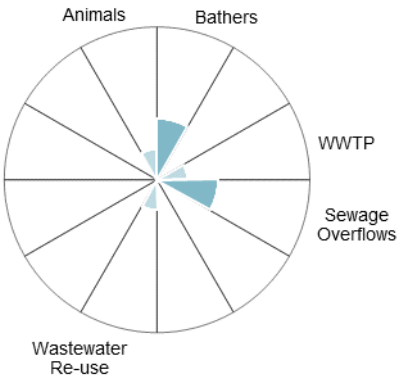
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20 mm or more of rain.

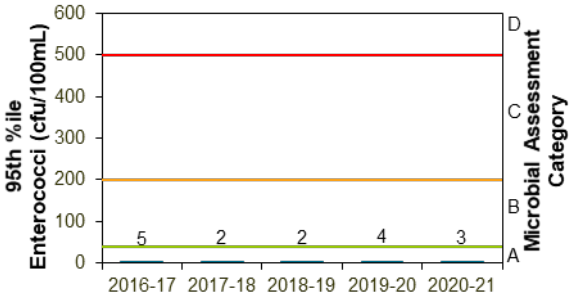
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

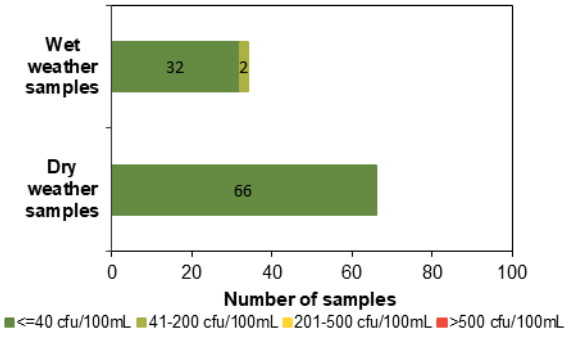
## Sanitary inspection: Low



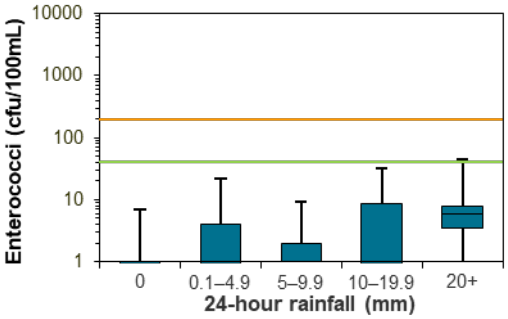

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Fishermans Beach

**Beach grade:** VG


Fishermans Beach is a small, north-east facing beach backed by high cliffs.

The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

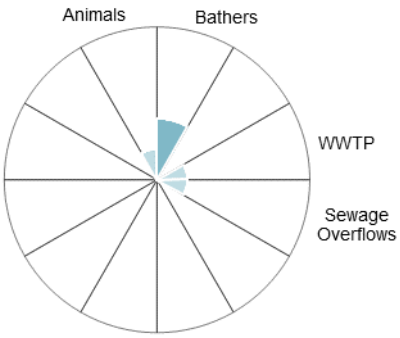
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 5 mm or more of rain.

The site has been monitored since 1996.

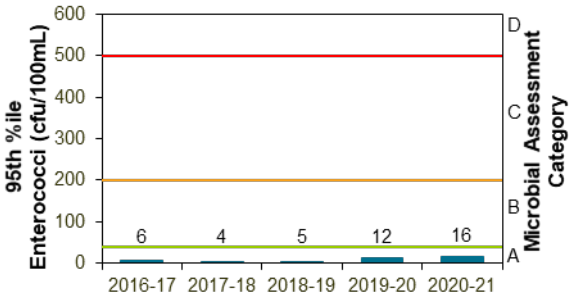
See ‘How to read this report’ for key to map.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

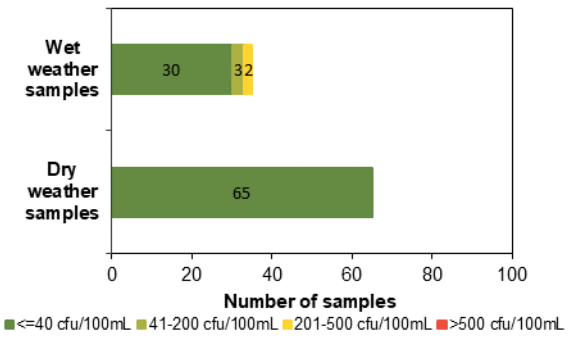
## Sanitary inspection: Low



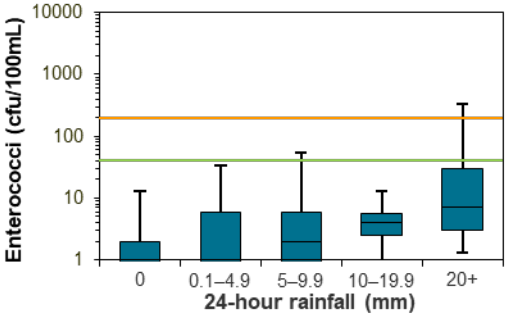

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Port Kembla Beach

**Beach grade:** G


See 'How to read this report' for key to map.

Port Kembla Beach is in the northern corner of a long stretch of beach. Lifeguards patrol the beach from September to April.

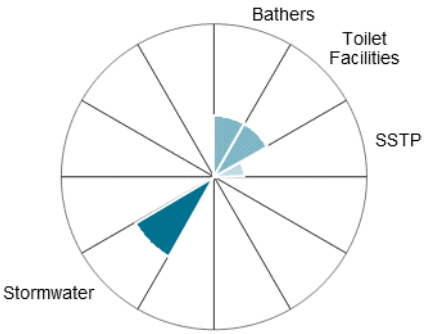
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after rain.

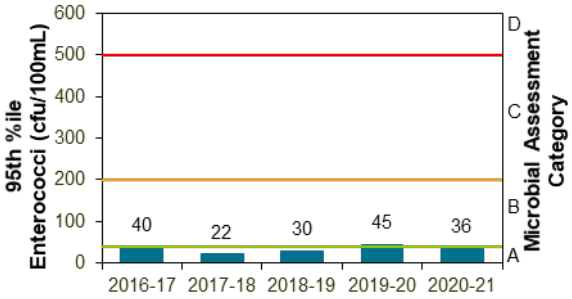
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 97% | 100 | Stable |

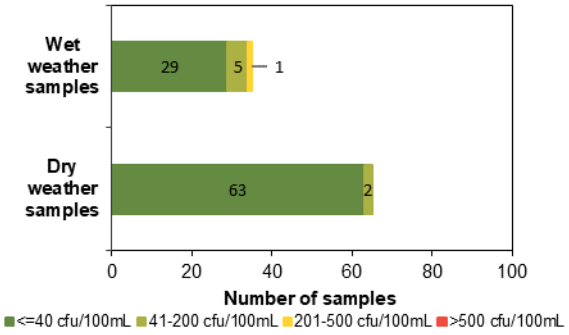
## Sanitary inspection: Moderate



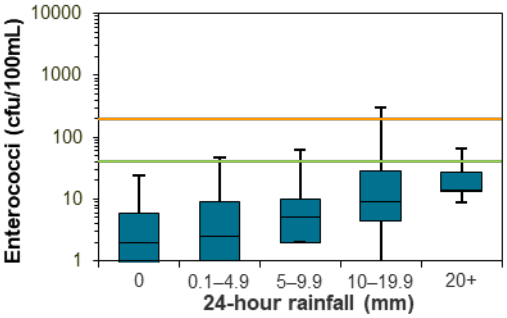

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Shellharbour City Council

**100%**
**swimming sites graded Good or Very Good**

Three swimming sites were monitored in the Shellharbour local government area.

All three locations were monitored by Sydney Water. Samples were collected every sixth day throughout the year.

## Overall results

All three swimming sites were graded as Very Good or Good in 2020–2021. This is an excellent result and consistent with previous years.

Percentage of sites graded as Very Good or Good:

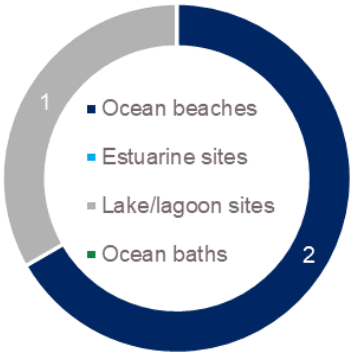
- 2020–2021: 100%
- 2019–2020: 100%
- 2018–2019: 100%
- 2017–2018: 100%.

See the section on **How to read this report** on page 41 for an explanation of the graphs, tables and Beach Suitability Grades.

### Best beaches

Warilla Beach and Shellharbour Beach.

These sites had excellent water quality and were suitable for swimming almost all of the time.




**Site types in Shellharbour City Council**

Swimming sites monitored in the Shellharbour region include ocean beaches and a lake/lagoon swimming site in Lake Illawarra, with each site type having a different response to rainfall-related impacts.

In general, lake/lagoon swimming sites do not perform as well as ocean beaches, due to lower levels of flushing increasing the time needed to disperse and dilute pollution inputs, taking longer to recover from stormwater events.

As a general precaution swimming should be avoided during and for at least one day after heavy rain at ocean beaches, and for up to three days in lake/lagoon areas, or if there are signs of stormwater pollution such as discoloured water or floating debris.

## Ocean beaches


**Beach Suitability Grades for Shellharbour City Council ocean beaches**

Warilla Beach and Shellharbour Beach were graded as Very Good in 2020–2021, consistent with results in previous years. These beaches had excellent water quality and were suitable for swimming almost all of the time.

## Lake/lagoon swimming sites


**Beach Suitability Grades for Shellharbour City Council lake/lagoon swimming sites**

Entrance Lagoon Beach continued to be graded as Good in 2020–2021, as in previous years. Water quality at this site was mostly suitable for swimming during dry weather conditions, with 81% of dry weather samples within the safe swimming limit when there had been no rain in the previous 24 hours. Elevated enterococci levels were recorded following rainfall, with levels often unsuitable for swimming after light rain. The swimming site is located within the entrance of Lake Illawarra and has lower levels of flushing. Due to this, the site can retain pollution inputs and take longer to recover from the impacts of stormwater. Water quality at this site may be impacted by contaminants discharged from Lake Illawarra, and stormwater during and following rainfall.

Swimming should be avoided during and for up to three days following rainfall, or if there are signs of pollution such as discoloured water, flowing drains or floating debris.


Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

# Management

## Shellharbour City Council

The Lake Illawarra Coastal Management Program (CMP), developed in partnership with Wollongong City Council, Shellharbour City Council and DPIE, was adopted by both councils and certified by the NSW Government in November 2020. The CMP outlines the strategic aims for managing Lake Illawarra and includes actions for managing specific threats to estuary health. In recognition of land-use pressures and threats, and in response to the values held by the community, water quality is a key consideration within the CMP. Water quality management actions within the CMP relate to stormwater infrastructure improvements, restoring and maintaining riparian corridors and coastal wetlands, strategic land-use planning, and water quality monitoring.

A **Coastal Management Program** (CMP) outlines a long-term strategy for managing the coast, in line with the *Coastal Management Act 2016*.

The NSW Government provides guidance and funding through the Coastal and Estuary Grants Program for local councils to prepare and implement CMPs.

Under the previous *Coastal Protection Act 1979*, councils developed a **Coastal Zone Management Plan** (CZMP) to address coastal issues. Councils can continue to implement priority actions from certified CZMPs with funding assistance from the NSW Government's Coastal and Estuary Grants Program until 2021.

Shellharbour City Council collaborated with the University of Wollongong, Wollongong City Council, Shoalhaven City Council, Kiama Municipal Council and Lendlease on the Smart Water Management Project. During 2020 water quality sensors were installed to monitor stormwater and gross pollutant traps within the waterways remotely. These devices will provide a live data stream of the quality of waterways without the need for staff to be in the field. The project demonstrates how smart technology can be used to enhance the natural environment, community liveability and build resilient communities and urban infrastructure. The collaborating councils and the University of Wollongong have been in discussion on how to develop and enhance the project in the next stage.

Stormwater monitoring continued under council's existing stormwater management program and city-wide stormwater improvement program. Monitoring assists with assessing the environmental health of the city's major waterways, evaluating the effectiveness of stormwater treatment measures, and identifying any water quality concerns. The improvement program incorporates the delivery of engineered stormwater quality solutions, environmental rehabilitation projects, water monitoring of major waterways and community education.

Warilla Beach
Photo: Shellharbour City Council

During 2020 council participated in a project through the Illawarra Shoalhaven Joint Organisation (ISJO), Enabling Water Sensitive Communities. This project has been funded by DPIE and Local Government NSW's Increasing Resilience to Climate Change program. The project objectives are to improve water management in local development planning and deliver resilient water infrastructure to meet future demands. Project outcomes will include a new regional policy for water sensitive urban design to be embedded by ISJO's four member councils across the Illawarra–Shoalhaven region.

Additionally, Shellharbour Council and Wollongong Council in conjunction with DPIE are near completion on the development of a risk-based framework for the Lake Illawarra catchment. This framework will identify a range of stormwater treatment processes to achieve the new stormwater management targets and reflect contemporary best practices for integrated water cycle management and develop guidelines on how they can be applied to urban developments in Lake Illawarra.

## Sydney Water

Sydney Water has inspected, cleaned and repaired sewer mains that have a high likelihood of discharging sewage to Shellharbour Beach if they become blocked. When significant tree root intrusion to the public sewer from the private sewer was identified, property owners were asked to remedy the problem.


**Sampling sites and Beach Suitability Grades in Shellharbour City Council**

# Entrance Lagoon Beach

**Beach grade:** G


See 'How to read this report' for key to map.

Entrance Lagoon Beach is on the southern shore of the entrance to Lake Illawarra and is partly enclosed by a rock breakwater.

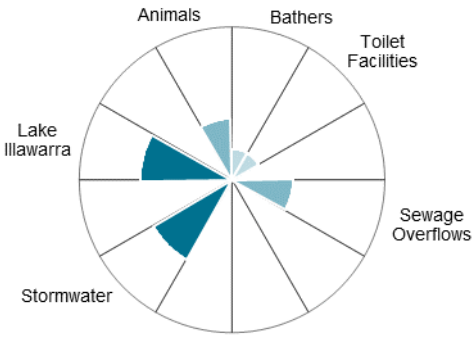
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater and upstream sources in Lake Illawarra.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to no rain and often after rainfall.

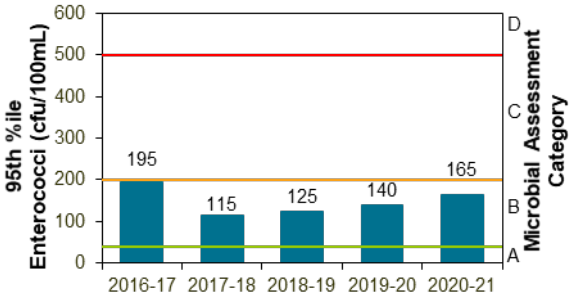
The site has been monitored since 2007.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Lake/Lagoon | Sep 2019 to Apr 2021 | 81% | 100 | Stable |

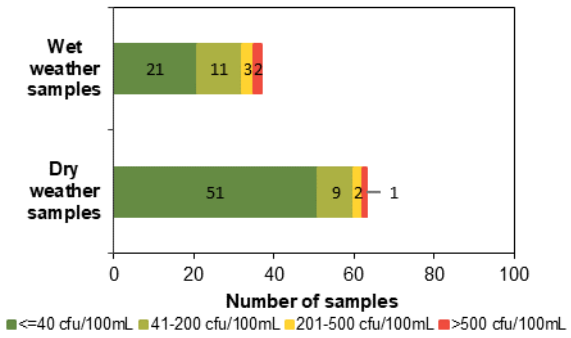
## Sanitary inspection: Moderate



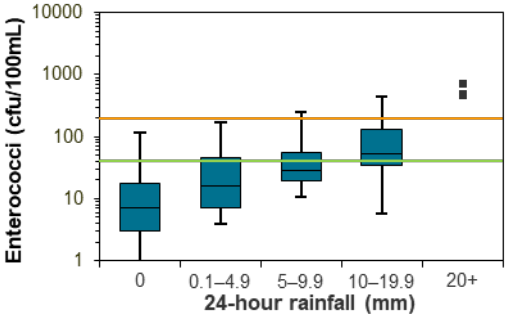

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# Warilla Beach

**Beach grade:** VG


See ‘How to read this report’ for key to map.

Warilla beach is almost two kilometres long, protected by prominent headlands. Lifeguards patrol the beach from September to April.

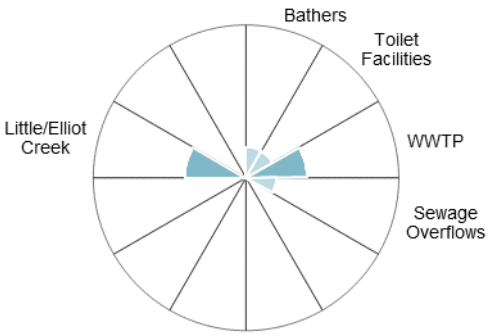
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after rainfall.

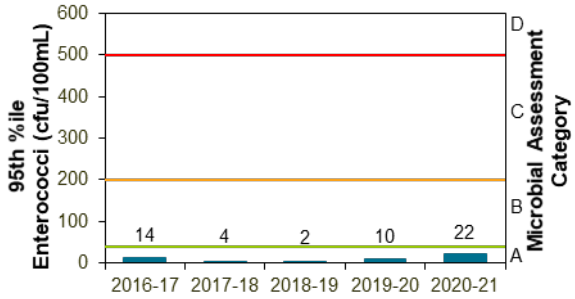
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

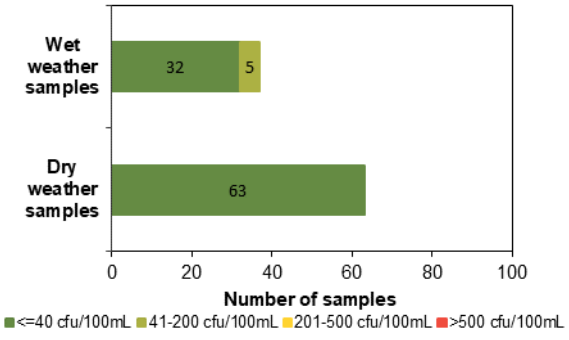
## Sanitary inspection: Low



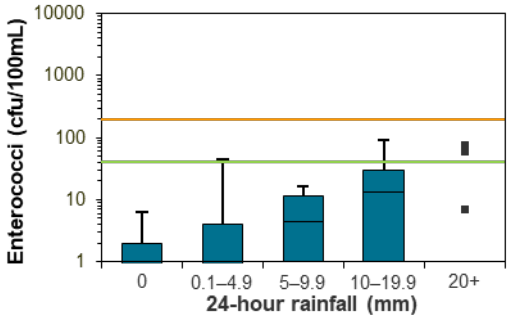

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Shellharbour Beach

**Beach grade:** VG


See 'How to read this report' for key to map.

Shellharbour Beach is at the southern end of a small, east facing beach. Lifeguards patrol the beach from October to April.

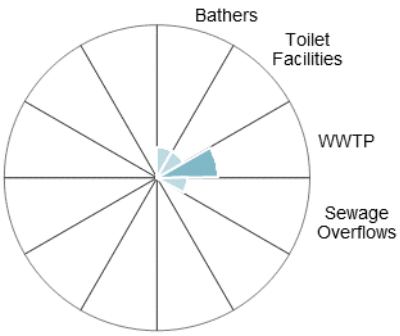
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few significant sources of faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 10 mm or more of rain.

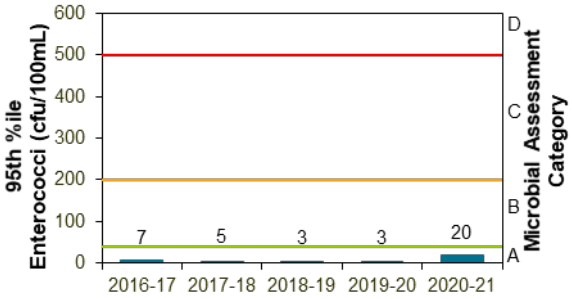
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

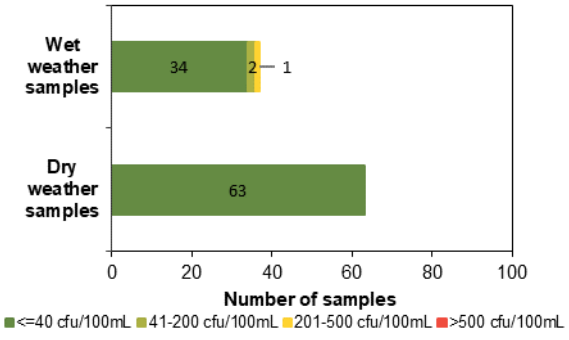
## Sanitary inspection: Low



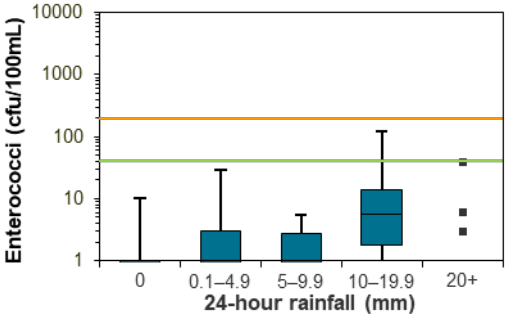

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Kiama Municipal Council

**100%**
**swimming sites graded Good or Very Good**

Five swimming sites were monitored in the Kiama local government area.

Four locations were monitored by Sydney Water with samples collected every sixth day. Three of these locations were monitored throughout the year. One location was monitored between October and April.

One location was monitored by Kiama Municipal Council. Samples were collected weekly between October and April and sampling and laboratory analysis was fully funded by the council.


**Site types in Kiama Municipal Council**

## Overall results

All five swimming sites were graded as Very Good or Good in 2020–2021. This is an excellent result and consistent with previous years.

Percentage of sites graded as Very Good or Good:

- 2020–2021: 100%
- 2019–2020: 100%
- 2018–2019: 100%
- 2017–2018: 100%.

See the section on **How to read this report** on page 41 for an explanation of the graphs, tables and Beach Suitability Grades.

### Best beaches

Bombo Beach and Seven Mile Beach (Gerroa).

These sites had excellent water quality and were suitable for swimming almost all of the time.

Ocean beaches were the only site type monitored in the Kiama region.

As a general precaution swimming should be avoided during and for at least one day after heavy rain at ocean beaches, or if there are signs of stormwater pollution such as discoloured water or floating debris.

## Ocean beaches


**Beach Suitability Grades for Kiama Municipal Council ocean beaches**

All five ocean beaches were graded as Very Good or Good in 2020–2021.

Bombo Beach and Seven Mile Beach (Gerroa) were graded as Very Good, a similar result to previous years. Water quality at these sites was suitable for swimming almost all of the time.

Boyds Jones Beach, Surf Beach Kiama and Werri Beach were graded as Good in 2020–2021. Water quality at these beaches is frequently suitable for swimming during dry weather conditions, with between 94% and 98% of dry weather samples within the safe swimming limit. Elevated enterococci levels were recorded following rainfall, with levels occasionally unsuitable for swimming after light rain at Boyds Jones Beach and Surf Beach Kiama, and moderate to heavy rain at Werri Beach.

It is recommended to avoid swimming during and for at least one day following rainfall or if there are signs of stormwater pollution such as discoloured water and floating debris.


Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

# Management

## Kiama Municipal Council

Kiama Municipal Council is continuing the development of a CMP for the open coast of the local government area, with funding and technical assistance from the NSW Government's Coastal and Estuary Grants Program. Development of the CMP includes coordination and consultation with state agencies to identify coastal hazards and risks and their potential for impact on assets, infrastructure and environmental values of the Kiama coast, including potential impacts associated with sea level rise. The CMP will then look at developing management actions to deal with these risks.

Council also coordinates the implementation of Coastal Zone Management Plans (CZMPs) for the Minnamurra and Crooked River estuaries. Part of this is working with other agencies and stakeholders to improve riparian management and quality of runoff from land, which impacts the creeks, rivers and open coast waters. During 2020–2021, council received funding under the NSW Government's Coastal and Estuary Grants Program to complete a three-year weed control program and rehabilitation of endangered ecological communities on Baileys Island, Gerroa. Council has also sought and accepted grant funding under the NSW Government's Coast and Estuary Grants Program for a bank stabilisation project at Blue Angle Creek, which will commence in 2021–2022. These are both priority actions within the Crooked River CZMP. Work is also being finalised on a wetland weed control program in Minnamurra River, which is due to finish in May 2021.

Council maintains stormwater filtration units in the Black Beach and Surf Beach catchment and around the townships of Minnamurra, Gerringong, Gerroa and Jamberoo, which prevent gross pollutants, sediments, oil and grease entering the waterways and beaches.

Council undertakes a scheduled program of inspections for all the onsite sewage management facilities in the local government area. Systems are risk rated and inspected annually for high risk systems and every four years for low risk systems. Most onsite sewage management facilities are on rural land in the upper catchments.

Council responds to and investigates stormwater pollution complaints and takes action under the *Protection of the Environment Operations Act 1997*, *Local Government Act 1993* or other means, depending on the issue. Many reported issues relate to erosion and sediment controls for development sites, pollutants in stormwater drains and

A **Coastal Management Program** (CMP) outlines a long-term strategy for managing the coast, in line with the *Coastal Management Act 2016*.

The NSW Government provides guidance and funding through the Coastal and Estuary Grants Program for local councils to prepare and implement CMPs.

Under the previous *Coastal Protection Act 1979*, councils developed a **Coastal Zone Management Plan** (CZMP) to address coastal issues. Councils can continue to implement priority actions from certified CZMPs with funding assistance from the NSW Government's Coastal and Estuary Grants Program until 2021.

Surf Beach, Kiama
Photo: Beachwatch/EES, DPIE

concerns raised by the public relating to activities that could pollute the stormwater system and associated coastal waters.

Council is continuing to undertake monitoring of surface and groundwater at its rehabilitated landfill sites at Minnamurra and Gerroa, as required by the site Environment Protection Licences. The ongoing monitoring aims to identify trends in groundwater and surface water ammonia concentrations over time and take appropriate management actions to minimise and avoid harm to the environment.


**Sampling sites and Beach Suitability Grades in Kiama Municipal Council**

# Boyds Jones Beach

**Beach grade:** G


See ‘How to read this report’ for key to map.

Boyds Jones Beach is one kilometre long, east facing and backed by dunes. Lifeguards patrol the beach from October to April.

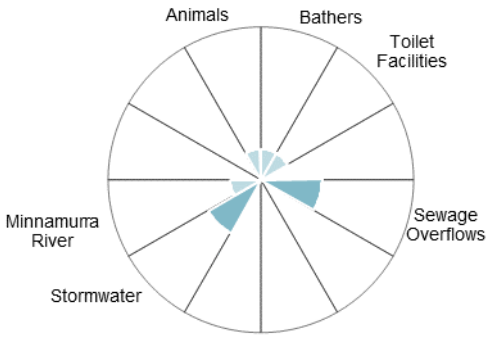
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain and regularly after 10 mm or more.

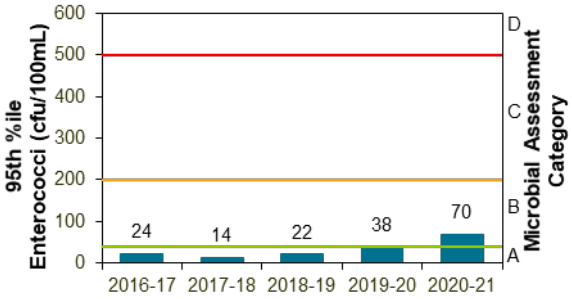
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 95% | 100 | Declined |

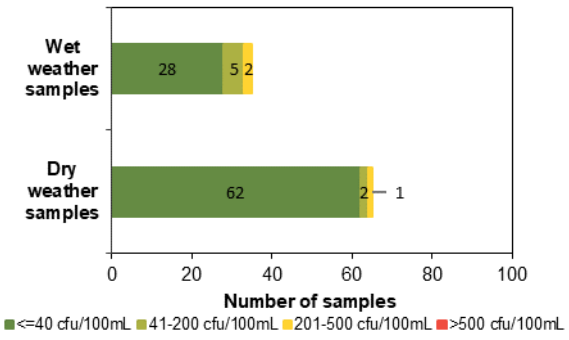
## Sanitary inspection: Low



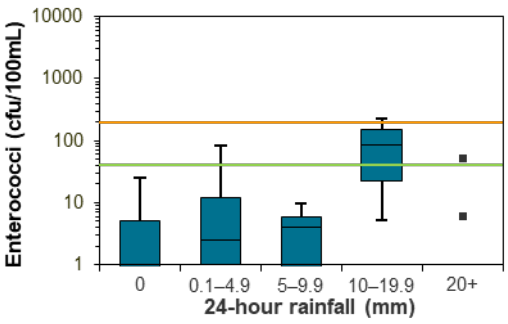

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# Bombo Beach

**Beach grade:** VG


See ‘How to read this report’ for key to map.

Bombo Beach is backed by a narrow reserve, railway and freeway. Lifeguards patrol the beach over the summer school holidays.

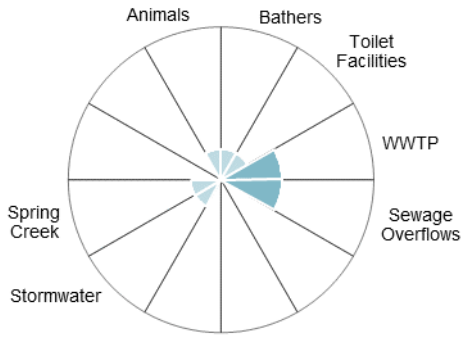
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

Enterococci levels increased slightly with increasing rainfall, but generally remained below the safe swimming limit across all rainfall categories.

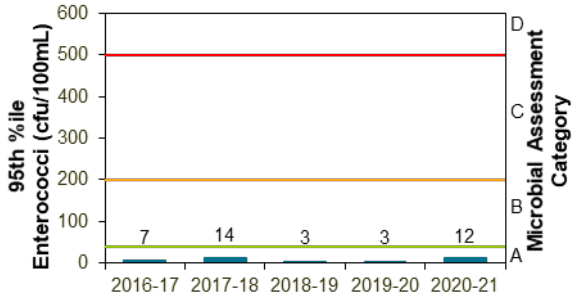
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 100% | 100 | Stable |

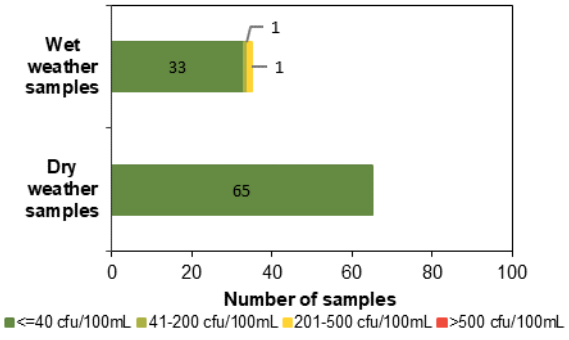
## Sanitary inspection: Low



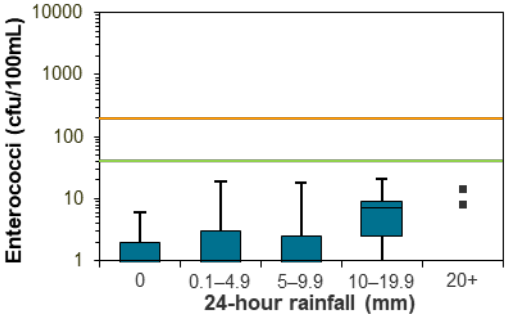

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# Surf Beach Kiama

**Beach grade:** G


See ‘How to read this report’ for key to map.

Surf Beach in Kiama is 250 metres long and backed by a park and surf club. Lifeguards patrol the beach from September to April.

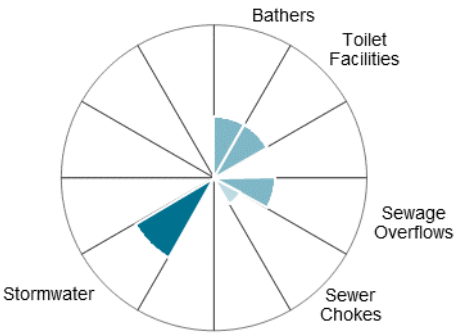
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and often after 5 mm or more.

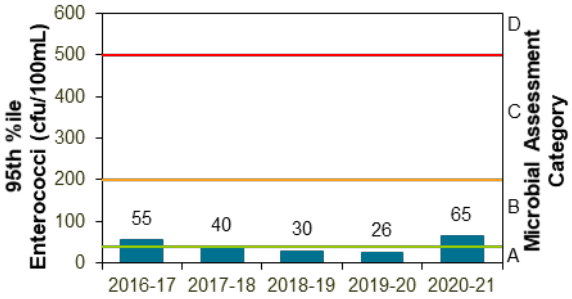
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Oct 2018 to Apr 2021 | 94% | 100 | Stable |

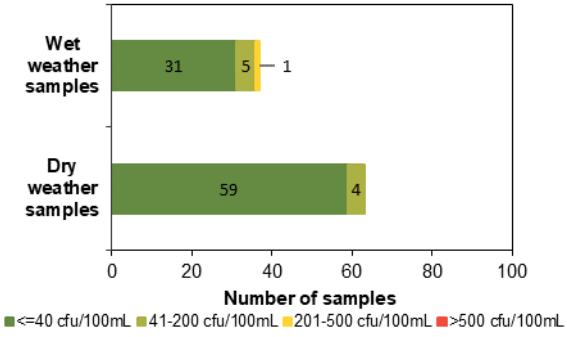
## Sanitary inspection: Moderate



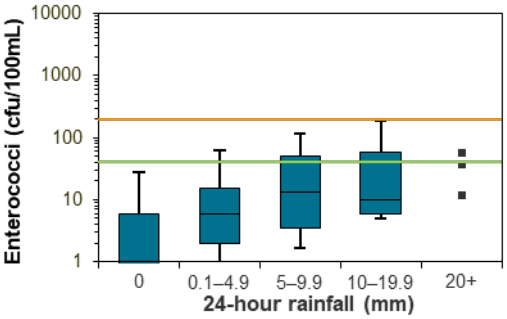

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# Werri Beach

**Beach grade:** G


See ‘How to read this report’ for key to map.

Werri Beach is 1.7 kilometres long with an ocean pool on the southern rock platform. It is patrolled over the summer school holidays.

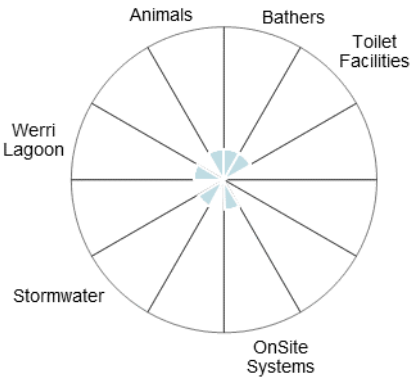
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after 10 mm or more of rain.

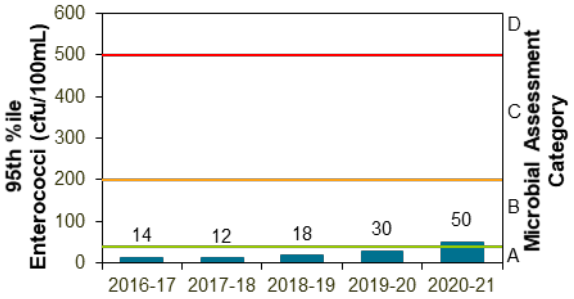
The site has been monitored since 1996.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Sep 2019 to Apr 2021 | 98% | 100 | Declined |

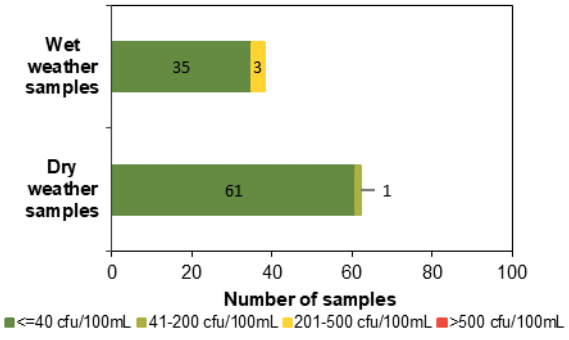
## Sanitary inspection: Low



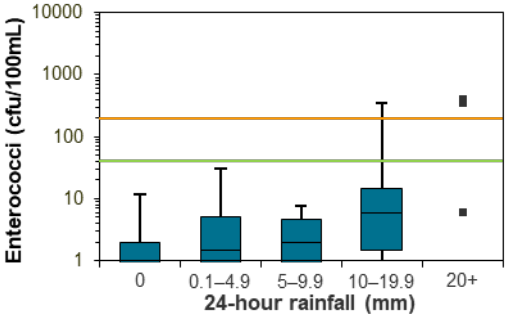

## Microbial Assessment Category: B




## Dry and wet weather water quality




## Water quality in response to rainfall



# Seven Mile Beach (Gerroa)

**Beach grade:** VG


See ‘How to read this report’ for key to map.

Seven Mile Beach at Gerroa is at the northern end of a long open beach. Lifeguards patrol during the summer school holidays.

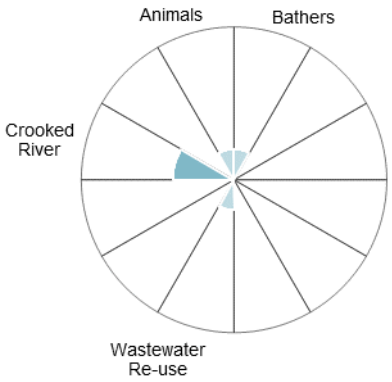
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 10 mm or more of rain.

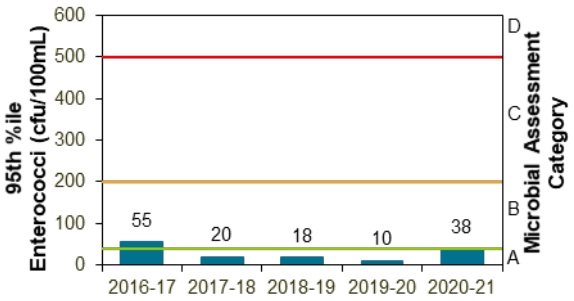
The site has been monitored since 2011.

| Site type | Assessment period | Dry weather samples suitable for swimming | Water samples | Beach grade status |
|---|---|---|---|---|
| Ocean beach | Oct 2018 to Apr 2021 | 100% | 100 | Stable |

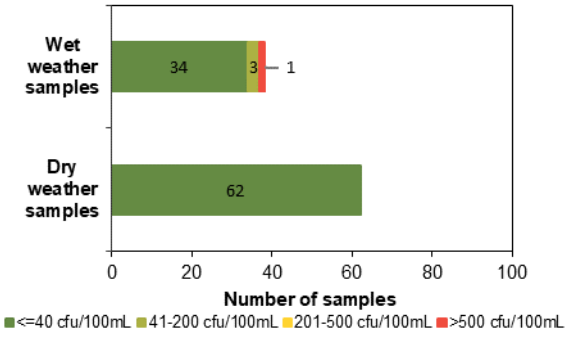
## Sanitary inspection: Low



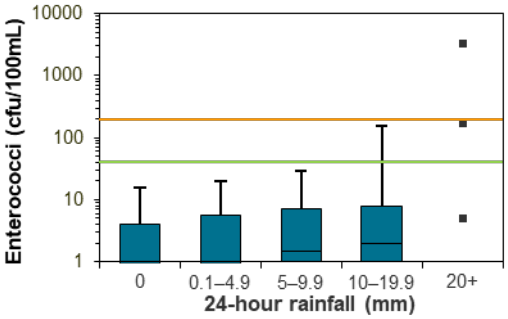

## Microbial Assessment Category: A




## Dry and wet weather water quality




## Water quality in response to rainfall



# How to read this report

## Beach Suitability Grades

Beach Suitability Grades provide an assessment of the suitability of a swimming location for recreation over time and are based on a combination of sanitary inspection (identification and rating of potential pollution sources at a beach) and microbial assessment (water quality measurements gathered over previous years). There are five grades ranging from Very Good to Very Poor:


### Very Good

Location has generally excellent microbial water quality and very few potential sources of faecal pollution. Water is considered suitable for swimming almost all of the time


### Good

Location has generally good microbial water quality and water is considered suitable for swimming most of the time. Swimming should be avoided during and for up to one day following heavy rain at ocean beaches and up to three days at estuarine sites




### Fair

Microbial water quality is generally suitable for swimming, but because of the presence of significant sources of faecal contamination, extra care should be taken to avoid swimming during and for up to three days following rainfall or if there are signs of pollution such as discoloured water or odour or debris in the water


### Poor

Location is susceptible to faecal pollution and microbial water quality is not always suitable for swimming. During dry weather conditions, ensure that the swimming location is free of signs of pollution, such as discoloured water, odour or debris in the water, and avoid swimming at all times during and for up to three days following rainfall


### Very Poor

Location is very susceptible to faecal pollution and microbial water quality may often be unsuitable for swimming. It is generally recommended to avoid swimming at these sites almost all of the time

Some of the Beach Suitability Grades in this report are **provisional**, as the information required for the analysis is incomplete due to limited bacterial data or limited information on potential pollution sources in a beach catchment.

## The guidelines

The National Health and Medical Research Council's Guidelines *for managing risks in recreational water*[1] were adopted for use in New South Wales in May 2009. These guidelines have been adopted in all Australian states and territories and are supported by guidance notes developed by the Department of Health Western Australia[2].

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[1]NHMRC 2008, *Guidelines for managing risks in recreational water*, National Health and Medical Research Council, Australian Government Publishing Service, Canberra, ACT.

[2]Department of Health, Western Australia 2007, *Microbial quality of recreational water guidance notes in support of chapter 5 of the National Health and Medical Research Council guidelines for managing risks in recreational water, 2006*, Department of Health, Western Australia and The University of Western Australia, October 2007, available at ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications, accessed on 27/05/21.

## Enterococci

**The national guidelines advocate the use of enterococci as the single preferred faecal indicator in marine waters.**

These bacteria are excreted in faeces and are rarely present in unpolluted waters. Enterococci have shown a clear dose–response relationship to disease outcomes in marine waters in the northern hemisphere. In accordance with the guidelines, Beachwatch tests for enterococci only. The enterococci density in water samples is analysed in the laboratory using method AS/NZS 4276.9:2007.

**AS/NZS 4276.9:2007**, *Water microbiology Method 9: Enterococci – Membrane filtration method (ISO 7899-2:2000, MOD)*, Standards Australia International Ltd, Sydney and Standards New Zealand, Wellington.

Enterococci are measured in colony forming units per 100 mL of sample (cfu/100 mL).

Beach Suitability Grades are determined by using the following matrix:

| | | Microbial Assessment Category | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| Sanitary Inspection Category | Very Low | Very Good | Very Good | Follow Up | Follow Up |
| | Low | Very Good | Good | Follow Up | Follow Up |
| | Moderate | Good | Good | Poor | Poor |
| | High | Good | Fair | Poor | Very Poor |
| | Very High | Follow Up | Fair | Poor | Very Poor |

Using the Beach Suitability Grade classification matrix, sites assigned a moderate Sanitary Inspection Category can only be rated as Good or Poor, with no option of Fair grades. This can create the impression of a large change in water quality when in fact there need only be a slight increase in bacterial counts to push it over the threshold, with no significant increase in the risk to public health.

## Microbial Assessment Category (MAC)

There are four Microbial Assessment Categories (A to D) and these are determined from the 95th percentile of an enterococci dataset of at least 100 data points. Each MAC is associated with a risk of illness determined from epidemiological studies. The risks of illness shown below are not those associated with a single data point but are the overall risk of illness associated with an enterococci dataset with that 95th percentile[1].

**Risk of illness associated with Microbial Assessment Categories**

| Category | Enterococci (cfu/100 mL) | Illness risk* |
|---|---|---|
| A | ≤40 | GI illness risk: <1%<br>AFR illness risk: <0.3% |
| B | 41–200 | GI illness risk: 1–5%<br>AFR illness risk: 0.3–1.9% |
| C | 201–500 | GI illness risk: >5–10%<br>AFR illness risk: >1.9–3.9% |
| D | >500 | GI illness risk: >10%<br>AFR illness risk: >3.9% |

* GI = gastrointestinal illness; AFR = acute fever and rash

### Calculating the MAC

The 95th percentile is a useful statistic for summarising the distribution of enterococci data at a site. It embodies elements of both the location of the distribution (how high/low the enterococci counts are) and the scale of the distribution (how variable the enterococci counts are).

The 95th percentile values for each of the four Microbial Assessment Categories were determined by the World Health Organization using enterococci data collected from swimming locations across Europe. These values will represent different probabilities of illness if the distribution of enterococci data from swimming locations in New South Wales differs from the European distribution.

[1] Wyer MD, Kay D, Fleisher JM, Salmon RL, Jones F, Godfree AF, Jackson G and Rogers A 1999, An experimental health related classification for marine waters, *Water Research*, vol.33(3), pp.715–722.

In recognition of this issue, Dr Richard Lugg (Department of Health, Western Australia) has developed a Microsoft® Excel tool for calculating a modified 95th percentile that takes into account the distribution of data. This tool has been used to calculate the 95th percentile values presented in this report and has been adopted for use by other state governments in Australia.

The tool can be downloaded from the WA Government's Environmental waters publications webpage, under *Forms and templates* [accessed 27/05/21].

## Sanitary Inspection Category (SIC)

More information about the **sanitary inspection** process is available on the DPIE webpage:

Sanitary inspection of beaches

The aim of a sanitary inspection is to identify all sources of faecal contamination that could affect a swimming location and assess the risk to public health posed by these sources. It is an assessment of the likelihood of bacterial contamination from identified pollution sources and should, to some degree, correlate with the bacterial water quality results obtained from sampling.

The main sources of faecal contamination considered in the sanitary inspection are: bathers, toilet facilities, wastewater treatment plants (WWTPs), sewage overflows, sewer chokes, onsite systems, wastewater re-use, stormwater, river discharge, lagoons, boats and animals.

Rivers, lakes and estuaries themselves can be potential sources of faecal contamination to sites located in these waterbodies, with contaminated water from upstream or surrounding areas impacting water quality at the swimming location. This source is captured in river discharge or lagoon category, and shown as the waterbody in the sanitary inspection charts.

Through the sanitary inspection process, beaches are categorised to reflect the overall likelihood of faecal contamination. There are five categories: Very Low, Low, Moderate, High and Very High.

Stormwater at Coogee Beach
Photo: Beachwatch/EES, DPIE

Stormwater in urban areas often contains sewage from leakages, overflows or sewer chokes when the sewerage system fails.

Sewage overflows can occur in wet weather when the network has exceeded capacity due to rainwater entering the system. The mix of sewage and rainwater discharges from designated overflow points and drains to waterways, usually via the stormwater system. Overflows from the sewerage system can also occur in dry weather due to mechanical failure or power outage.

Sewer chokes occur due to blockages in the pipes usually due to tree roots, oil, grease or debris. This causes sewage to back up and escape via sewer inspection points, designed overflow structures or cracks in the pipes, then drain to waterways, usually via the stormwater system.

## Explanation of tables

Each region contains tables listing all monitored swimming sites including site type, beach grade and change in grade from the previous year.

The following symbols are used to show the change in beach grade from the previous year:

- Stable
- Improved
- Declined

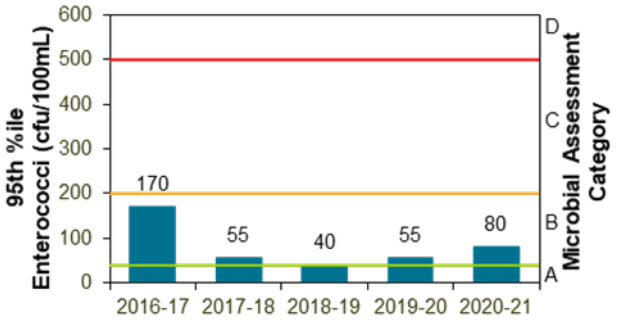
A provisional grade indicates the assessment is based on limited data collected during the assessment period and should not be compared to the beach grade from the previous year.

## Explanation of graphs, charts, and information bars on beach pages

### Microbial Assessment Category (MAC) chart

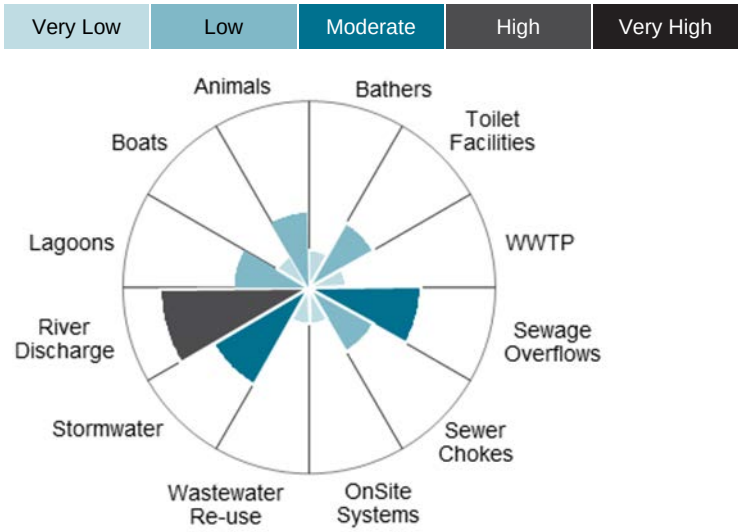
On each beach page, the MACs for the last five years are displayed on a simple bar chart. The MAC for the current year is based on enterococci data collected during the assessment period. The bars are labelled with the 95$^{th}$ percentile value for each year and the thresholds dividing the

A, B, C and D categories are marked in green, amber and red for reference.




## Sanitary Inspection Category (SIC) chart

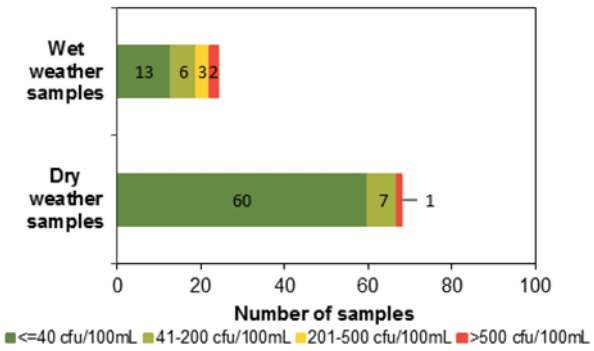
The results of the sanitary inspection for each swimming location are presented in a radar pie chart. The chart shows the likelihood that each identified pollution source will contribute to faecal contamination at a swimming site, as indicated by the size and colour of the segment, ranging from very low (lightest colour) to very high (darkest colour) as shown below. The sum of these contributions is the overall likelihood, or Sanitary Inspection Category.




## Wet and dry weather water quality chart

Enterococci levels in wet and dry weather conditions are presented for each swimming location as a bar graph. All data collected during the assessment period is included in the analysis. Dry weather is defined as no rainfall recorded in the previous 24 hours. Each bar is colour coded to show the number of enterococci results up to 40 cfu/100 mL, between 41 and 200 cfu/100 mL, between 201 and 500 cfu/100 mL and greater than 500 cfu/100 mL. These categories reflect the Microbial Assessment Category thresholds and are

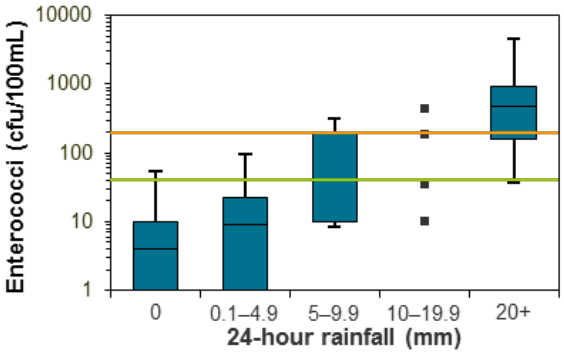
coloured on the graph as dark green, light green, amber and red respectively.



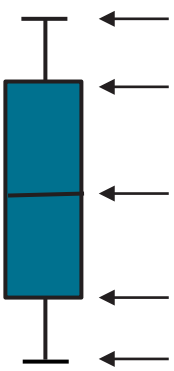

It is expected that swimming sites with lower levels of flushing will show some elevated bacterial results in dry weather samples (no rainfall in the previous 24 hours) due to the longer time needed to recover from a rainfall event. At some estuarine and lake/lagoon swimming locations the impacts of stormwater pollution on beach water quality may be detected up to three days after rainfall.

## Water quality in response to rainfall

Trends in enterococci levels in response to rainfall are shown using a box plot. For reference, enterococci levels of 40 cfu/100 mL and 200 cfu/100 mL are indicated with a green and orange line, respectively. The 40 cfu/100 mL level is referred to as the ‘safe swimming limit’. The enterococci data were obtained from the last five years of monitoring. Rainfall data were obtained from rain gauges situated close to the sample site and are 24-hour totals to 9am on the day of sampling. If there are fewer than five enterococci data points in a rainfall category, individual data points are presented instead of a box plot. At sites where many results are below the detection limit (1 cfu/100 mL), only the upper portion of the box plots will be visible.



Each part of the box plot represents a significant percentile value of the sample population:



95% of the samples lie below the top whisker

75% of the samples lie below the top of the box

half the samples are on each side of the middle line of the box (median or 50%ile)

25% of the samples lie below the bottom of the box

5% of the samples lie below the bottom whisker.

## Information bars

Information bars on each beach page provide a summary of details about the swimming site.

The **assessment period** shows the timeframe in which the water samples were collected. The NHMRC guidelines state beach grades should be determined from the most recent 100 water quality results collected within a five-year period. The assessment period varies between sites depending on sampling frequency.

Dry weather samples suitable for swimming (**dry weather swimmability**) shows the percentage of water samples with enterococci levels below 40 cfu/100 mL. Dry weather is defined as no rainfall in the previous 24 hours. Swimming sites with lower levels of flushing often have a lower percentage of dry weather samples within the safe swimming limit due to the impacts of rainfall detected up to three days after the event.

## Explanation of maps

A map of individual swimming locations is presented on each beach page. The scale of the maps is 1:10,000. Each map shows the location of the sampling site, land use and features such as surf lifesaving clubs. Potential pollution sources such as stormwater drains, sewage pumping stations, wastewater treatment plants, lagoons, rivers and creeks, are shown where accurate data is held.