



Department of Planning, Industry and Environment

# State of the beaches 2020-2021

Central Coast region

## Beachwatch



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Recreational water quality has been monitored in the Central Coast region since 2002 by Central Coast Council under the Department of Planning, Industry and Environment's Beachwatch Partnership Program. This report summarises the performance of 32 swimming sites on the Central Coast of New South Wales, providing a long-term assessment of how suitable a site is for swimming. Monitored sites included ocean beaches, ocean baths, estuarine areas in Brisbane Water, designated swimming areas in Lake Macquarie, Lake Munmorah and Tuggerah Lake, and four coastal lagoons.

In 2020–2021, 56% of swimming sites in the Central Coast region were graded as Good. These sites were suitable for swimming for most of the time. This is a slight decline in overall performance from the previous year and reflects the wet weather conditions and associated flooding over summer and early autumn. The Central Coast region has a large proportion of lake/lagoon and estuarine swimming locations, which have been most susceptible to impacts from wet weather conditions.

# Central Coast region summary 2020–2021



Avoca Beach  
Photo: Beachwatch/EES,  
DPIE

## Beach monitoring in NSW

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 Central Coast region by Central Coast Council since its amalgamation in 2016. Prior to 2016, swimming sites were monitored by Wyong Shire Council from 2002 and by Gosford City Council from 2004.

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

During 2020–2021, 32 swimming sites were monitored including ocean beaches, ocean baths, estuarine areas in Brisbane Water, designated swimming areas in Lake Macquarie, Lake Munmorah and Tuggerah Lake and four coastal lagoons.

## Rainfall impacts

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: varied rainfall, with mostly average to well below average rainfall, except for some wet months

- 2019–2020: average to below average rainfall, except for isolated wet months
- 2020–2021: variable rainfall with some very wet months over summer and early autumn.

See the section on **How to read this report** on page 50 for an explanation of the graphs, tables and Beach Suitability Grades.

Winter rainfall totals on the Central Coast were slightly above average in 2020. Heavy rainfall events occurred on several occasions in mid and late July 2020, resulting in more than double or triple the long-term monthly rainfall averages at Swansea, Norah Head and Avoca Beach. Swansea had its highest July rainfall total on record with 316 mm of rain for the month, and highest July daily rainfall on record with 172 mm on 27 July.

Spring 2020 rainfall was above average for the season, largely due to severe storms bringing heavy rain to the Central Coast in late October 2020. Norah Head and Avoca Beach recorded 112 mm and 178 mm of rainfall over two days from 26–27 October, respectively.

Wet weather conditions continued through summer and early autumn, with above to well-above average rainfall recorded from December 2020 to March 2021. Norah Head and Swansea had record rainfall totals for December 2020 with 173 mm and 217 mm for the month, respectively.

March 2021 was significantly wet, with more than three times the long-term monthly rainfall average falling in the region. Norah Head had a record March rainfall total with 446 mm of rain for the month.

The severe wet weather resulted in major flooding of coastal waterways, with the Hawkesbury–Nepean experiencing its most significant flooding for more than 30 years. Beachwatch issued an extreme wet weather and flooding alert on the Central Coast 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 was well below the long-term monthly average in April 2021.

## Marine algal blooms



Marine algal bloom present in the water

Photo: Chad Weston/NPWS, DPIE

Water NSW received reports of widespread marine algal blooms from Newcastle to The Entrance in early November 2020 that may have impacted beaches in the Central Coast region. The blooms' appearance was consistent with the genus *Trichodesmium*. 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 Central Coast 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 Central Coast region

Swimming site	Site type	Beach Suitability Grade	Change
<b>Central Coast Council</b>			
Lakes Beach	Ocean beach	G	●
Cabbage Tree Bay Rockpool	Ocean baths	G	●
Soldiers Beach	Ocean beach	G	↓
North Entrance Beach	Ocean beach	G	●
The Entrance Beach	Ocean beach	G	●
The Entrance Ocean Baths	Ocean baths	G	●
Toowoan Bay	Ocean beach	G	●
Shelly Beach	Ocean beach	G	●
Gwandalan	Lake/Lagoon	P	●
Summerland Point Baths	Lake/Lagoon	G	●
Chain Valley Bay	Lake/Lagoon	P	●
Mannering Park Baths	Lake/Lagoon	P	●
Lake Munmorah Baths	Lake/Lagoon	P	●
Canton Beach	Lake/Lagoon	P	●
Wamberal Beach	Ocean beach	G	●
Wamberal Lagoon	Lagoon	P	●
Terrigal Beach	Ocean beach	P	↓
Terrigal Lagoon	Lagoon	P	●
North Avoca Beach	Ocean beach	G	●
Avoca Beach	Ocean beach	G	●
Avoca Lagoon	Lagoon	P	●
Copacabana Beach	Ocean beach	G	●
Cockrone Lagoon	Lagoon	P	●
MacMasters Beach	Ocean beach	G	↓
Killcare Beach	Ocean beach	G	↓

Swimming site	Site type	Beach Suitability Grade	Change
<b>Central Coast Council (continued)</b>			
Ocean Beach	Ocean beach		
Umina Beach	Ocean beach		
Pearl Beach Rockpool	Ocean baths		
Davistown Baths	Estuarine		
Pretty Beach Baths	Estuarine		
Woy Woy Baths	Estuarine		
Yattalunga Baths	Estuarine		

Beach Suitability Grade					Change		
							
Very Good	Good	Fair	Poor	Very Poor	Improved	Stable	Declined

# Central Coast Council

## Overall results



Thirty-two swimming sites were monitored by Central Coast Council. All sampling and laboratory analysis was conducted and fully funded by the council.

All sites are sampled weekly between October and April and monthly from May to September.

Eighteen of the 32 swimming sites were graded as Good in 2020–2021, which is a slight decline in performance from the previous year. While the overall performance is lower than other regions, the result is influenced by a large proportion of monitored swimming sites being in lagoons and estuaries, where the impacts of rainfall are more apparent with reduced dilution and flushing of pollution inputs.

Percentage of sites graded as Very Good or Good:

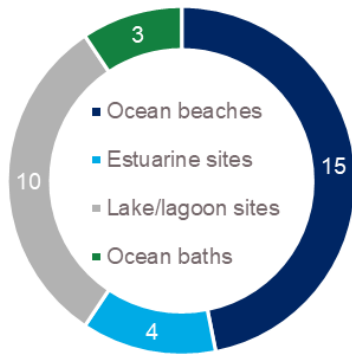
- 2020–2021: 56%
- 2019–2020: 59%
- 2018–2019: 50%
- 2017–2018: 53%.

See the section on **How to read this report** on page 50 for an explanation of the graphs, tables and Beach Suitability Grades.

### Best beaches

Lakes Beach, Cabbage Tree Bay Rockpool, Soldiers Beach, North Entrance Beach, The Entrance Beach, The Entrance Ocean Baths, Toowoong Bay, Shelly Beach, Summerland Point Baths, Wamberal Beach, North Avoca Beach, Avoca Beach, Copacabana Beach, MacMasters Beach, Killcare Beach, Ocean Beach, Umina Beach and Pearl Beach Rockpool.

These sites had good water quality and were suitable for swimming most of the time.



**Site types in Central Coast region**

Swimming sites monitored in the Central Coast region include ocean beaches, estuarine areas in Brisbane Water, lake swimming sites in Lake Macquarie, Lake Munmorah and Tuggerah Lakes, coastal lagoons at Wamberal, Terrigal, Avoca and Cockrone, and ocean baths at The Entrance, Cabbage Tree Bay and Pearl Beach, with each site type having a different response to rainfall-related impacts.

In general, estuarine, lake and lagoon swimming sites did not perform as well as ocean beaches and ocean baths, 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 estuarine areas, or if there are signs of stormwater pollution such as discoloured water or floating debris.

### Ocean beaches



**Beach Suitability Grades for Central Coast ocean beaches**

Fourteen of the 15 ocean beaches were graded as Good: Lakes Beach, Soldiers Beach, North Entrance Beach, The Entrance Beach, Toowoan Bay, Shelly Beach, Wamberal Beach, North Avoca Beach, Avoca Beach, Copacabana Beach, MacMasters Beach, Killcare Beach, Ocean Beach and Umina Beach. Soldiers Beach, MacMasters Beach, Killcare Beach and Umina Beach declined to Good from Very Good in 2019–2020. Water quality at these sites is suitable for swimming most of the time but can be susceptible to pollution following rainfall.

Terrigal Beach was graded as Poor, a decline from Good in the previous year. Water quality at this beach was mostly suitable for swimming in dry weather conditions, with 87% of dry weather samples within the safe swimming limit. However, elevated enterococci levels were occasionally recorded after little or no rain, and often after light rain. While the microbial water quality at Terrigal Beach has shown a decline in performance this year, it remains close to the threshold between Good and Poor, and the site has fluctuated between Good and Poor for several years. The decline in water quality reflects a higher proportion of samples collected at Terrigal Beach during wet weather compared to the 2019–2020 assessment period.

During 2019–2020 Central Coast Council, the Department of Planning, Industry and Environment (DPIE) and the University of Technology Sydney investigated the scale and extent of elevated bacterial levels at Terrigal Beach. Council is using the findings from the investigation to detect and resolve water quality issues in the catchment.

It is recommended that swimming be avoided during and for up to one day after rainfall at ocean beaches or if there are signs of stormwater pollution such as discoloured water, flowing drains or outflow from lagoons, due to the possibility of pollution.



**Beach Suitability Grades for Central Coast estuarine beaches**

### Estuarine beaches

Four estuarine swimming sites in Brisbane Water continued to be graded as Poor: Davistown Baths, Pretty Beach Baths, Woy Woy Baths and Yattalunga Baths. This result is consistent with previous years.

Microbial water quality at Yattalunga Baths was mostly suitable for swimming during dry weather conditions, with 79% of samples within the safe swimming limit when no rain had fallen in the previous 24 hours. Elevated enterococci levels were often recorded following light rainfall, and generally increased in response to increasing rainfall.

Microbial water quality at Davistown Baths, Pretty Beach Baths and Woy Woy Baths was often elevated during dry and wet weather conditions. At these sites, the bacterial levels continued to increase significantly in response to increasing rainfall.

The estuarine beaches may be impacted by several significant potential sources of faecal contamination including stormwater and other sources within Brisbane Water, and have low levels of flushing. Further investigation is required to show the scale and extent of the problem, and the source of microbial contamination.

Swimming at the estuarine beaches is not recommended during and for up to three days following rainfall or if there are any signs of stormwater such as discoloured water or floating debris.



**Beach Suitability Grades for Central Coast lake/lagoon swimming sites**

### Lake/lagoon swimming sites

Summerland Point Baths was graded as Good, a similar result to the previous year. Water quality at this site was mostly suitable for swimming during dry weather conditions, with 85% of samples within the safe swimming limit when no rain had fallen in the previous 24 hours.

Gwandalan, Chain Valley Bay, Mannering Park Baths, Lake Munmorah Baths and Canton Beach were graded as Poor, a similar result to the previous year.

Water quality at Lake Munmorah Baths was mostly suitable for swimming during dry weather conditions, with 77% of

samples within the safe swimming limit when no rain had fallen in the previous 24 hours. However, elevated enterococci levels were often recorded after light rainfall and continued to increase with increasing rainfall.

Microbial water quality at Gwandalan, Chain Valley Bay, Mannering Park Baths and Canton Beach was often unsuitable for swimming during dry and wet weather conditions, with enterococci levels increasing significantly with increasing rainfall. Further investigation is required to show the scale and extent of the problem, and the source of microbial contamination at poorer performing sites.

In 2019 council commenced a preliminary catchment audit at Canton Beach with water sampling, stormwater sampling and sewer network inspections to identify the source of microbial contamination. Council plans to undertake further investigation at this site.

The impact of rainfall-related pollution is more apparent at these sites with low levels of flushing and slower dilution to disperse pollution inputs. Swimming should be avoided during and for at least three days after rainfall.

All four lagoons continued to be graded Poor as in previous years: Wamberal Lagoon, Terrigal Lagoon, Avoca Lagoon and Cockrone Lagoon.

Microbial water quality at these sites was often unsuitable for swimming in dry weather conditions, and regularly unsuitable for swimming following light rainfall. While microbial water quality increased significantly with increasing rainfall at all four lagoon swimming sites, bacteria levels at Terrigal and Avoca lagoons were generally more elevated than levels measured at Wamberal and Cockrone lagoons.

Sampling is undertaken near the lagoon mouths, and showed bacterial levels increased significantly with increasing rainfall. Swimming should be avoided during and for at least three days after rainfall, or if there are any signs of pollution such as discoloured water, odours or floating debris.

During 2019–2020, Central Coast Council, the Department of Planning, Industry and Environment (DPIE) and the University of Technology Sydney investigated the scale and extent of elevated bacterial levels at the four lagoons, and the source of microbial contamination. Council is using the findings from these investigations to detect and resolve water quality issues in these catchments.

Pollution inputs can accumulate in coastal lagoons due to very low levels of flushing. While pollution is usually diluted

when the lagoon entrance is open to the ocean, the outflow can impact the microbial water quality at nearby beaches.

## Ocean baths



**Beach Suitability Grades for Central Coast ocean baths**

Cabbage Tree Bay Rockpool, The Entrance Ocean Baths and Pearl Beach Rockpool were graded as Good in 2020–2021, consistent with the previous year. Water quality at these sites was suitable for swimming most of the time but can be impacted by pollution following rain.

The Entrance Ocean Baths was generally suitable for swimming during dry and wet weather conditions. Cabbage Tree Bay Rockpool and Pearl Beach Rockpool were mostly suitable for swimming after little or no rain, with elevated levels of enterococci mostly recorded following heavy rainfall.

The Entrance Ocean Baths are cleaned regularly year round by council, while Cabbage Tree Bay Rockpool and Pearl Beach Rockpool are flushed irregularly and are dependent on the natural exchange of ocean water over the rocks and pool walls. It is recommended that swimming be avoided during and for up to one day after rainfall, or if there are signs of pollution such as discoloured water or floating debris.

## Management



Patrolled ocean beach  
Photo: Beachwatch/EES,  
DPIE

In 2019, the NSW Government committed \$500,000 to address poor water quality at Terrigal Beach and surrounding lagoons. Studies by DPIE, in collaboration with Central Coast Council and the University of Technology, Sydney have confirmed the majority of faecal contamination is from human sources (sewage), and a small amount of dog and bird faeces in stormwater. In September 2020, the findings of the investigation were released in the [Towards Safer Swimming: Terrigal Beach and Haven](#) report. The report identified priority areas that contribute the greatest amount of pollution in the sewerage and stormwater networks draining to Terrigal Beach, Terrigal Lagoon and Avoca Lagoon. Central Coast Council has commenced action to rectify some priority sites and is continuing to identify and evaluate management options to improve water quality from the priority sites.

In February 2019, the NSW Government committed \$200,000 to establish an expert panel to determine the best way to improve water quality in Tuggerah Lakes. The independent Expert Panel was appointed by the NSW Government on 30 March 2020 and comprised recognised experts in the fields of hydrodynamics, engineering, ecology, catchment management, water sensitive urban design and

community engagement. The panel was chaired by Associate Professor William Glamore from the University of NSW Water Research Laboratory.

The Tuggerah Lakes Expert Panel examined best-practice management approaches to improve water quality in the lake system in accordance with the *Coastal Management Act 2016*. The panel's work included extensive community engagement through social media and online workshops to ensure the views of the wider community were captured and addressed in their recommendations. The panel's final report on Tuggerah Lakes Water Quality was delivered on 31 December 2020. The report contains 52 recommendations for council and the government. The report suggests that strategic and measurable plans are required for dredging, wrack management, nearshore water quality, stormwater management, entrance flood management and sustainable catchment development.

**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.

Central Coast Council is currently developing its coastal management program (CMP) for Tuggerah Lakes. Council is ensuring the Expert Panel's recommendations are considered and incorporated into the CMP. This work will guide council to formulate appropriate strategies and actions to improve water quality and ensure the sustainable health of the Tuggerah Lakes Estuary.

### Central Coast Council

Central Coast Council is responsible for the preparation of CMPs and the implementation of existing Coastal Zone Management Plans (CZMPs) for its estuary and coastal areas. Council is presently implementing actions from certified CZMPs for the Tuggerah Lakes, the former Gosford local government area coastline and Pearl Beach Lagoon with the technical and financial assistance of the NSW Government's Coastal and Estuary Grants Program. Council is also preparing CMPs for its open coast beaches and coastal lagoons, Tuggerah Lakes and Brisbane Water in accordance with NSW legislation.

Central Coast Council has a number of monitoring programs that assess catchment, estuary and coastal water quality throughout the Central Coast. The information from these monitoring programs helps inform management actions in council's estuary management plans and CZMPs. An overarching objective of these plans is to achieve long-term improvement in the health of these waterways.

Central Coast Council investigates and advises the community with temporary advisory signs or media releases when algal blooms or elevated bacterial counts are detected at designated swimming sites.



Council has placed permanent advisory signs at each designated swimming site to advise that the area can be affected by stormwater pollution for up to three days following heavy rain at lake, lagoon and estuarine sites and one day at ocean beaches and oceans baths, and that swimming is not recommended during these periods.



The Entrance Ocean Baths  
Photo: Central Coast  
Council

Central Coast Council has developed an audit program to investigate locations with long-term declining trends in recreational water quality as reported in the NSW State of the Beaches reports. At these sites, the audits assess stormwater and sewer networks for breaks or possible contamination points. Council commenced comprehensive water quality catchment audits in 2019 at Terrigal Beach, Terrigal Lagoon, Avoca Lagoon, Cockrone Lagoon and Wamberal Lagoon. The collaborative efforts of council, DPIE and the University of Technology Sydney are driving these audit projects towards detecting and resolving water quality issues at these locations.

Council provided a detailed audit report to the NSW Environment Protection Authority in October 2020 regarding works to be undertaken to improve performance of high-risk stormwater and sewage infrastructure within the Terrigal Lagoon catchment. The report was delivered as a key commitment of the Pollution Reduction Program incorporated into the Environment Protection Licence that encompasses the sewage reticulation system within the Terrigal Lagoon catchment.

Preliminary audits have been undertaken by council at Cabbage Tree Bay, Toowoan Bay and Canton Beach. It is planned to carry out further investigation in future audit programs.

Central Coast Council has invested approximately \$97 million in sewerage infrastructure for the period 1 July 2016 to date, with a further \$39 million of planned investment to 30 June 2022. Planned and completed sewerage works improve the performance, reliability and capacity of the sewerage reticulation network and treatment systems, throughout the Central Coast local government area.

Works completed recently include:



Cabbage Tree Bay Rockpool  
Photo: Central Coast  
Council

- upgrades to the sewer system and sewer pump stations in the catchments of Terrigal, Terrigal Lagoon, Brisbane Water, The Entrance, Chittaway Bay, Chittaway Point and South Wyong. These works protect the community and environment against overflows and odours, improve reliability and eliminate service deficiencies at treatment plants
- upgrades to beachfront sewage pumping stations at Norah Head, Toowoona Bay and Bateau Bay beaches to increase the capacity and address a number of service deficiencies
- sewer main relining performed progressively in the catchments of Terrigal, Terrigal Lagoon, Brisbane Water, The Entrance, Chittaway Bay, Chittaway Point and South Wyong to reduce sewerage overflows through damage in the sewer network.

Major works currently underway include:

- manhole inspections in the Tuggerah Lakes catchment (as part of the 'Reveal and Seal' program) to reduce the risk of undetected blockages, which can lead to untreated sewage overflows to nearby waterways. The 'Reveal and Seal' program will be a continuing preventative maintenance activity
- upgrades to sewage pumping stations at Summerland Point, Ettalong, Green Point, Wagstaffe, Springfield, Erina, Koolewong, Umina Beach, Tascott, Terrigal, Wamberal, West Gosford, Gosford, Hamlyn Terrace, Forresters Beach, Daleys Point, Kincumber, The Entrance, Tacoma, Woy Woy, Tuggerawong, Narara, Noraville, Tuggerah, Berkeley Vale, Blackwall, Toukley, Gorokan and Budgewoi. This will improve reliability, process control and address other existing deficiencies
- continuing CCTV inspections of the sewer network to monitor its condition and identify areas requiring maintenance. Between September 2018 and May 2021, 188 kilometres of the sewer network has been CCTV inspected by contractors across many areas, including Killarney Vale, Berkeley Vale, Chittaway Point, Tuggerah, Tacoma, Wyong, Wyongah, Norah Head, Canton Beach, Noraville, Buff Point, Budgewoi, Lake Haven, Gorokan, Hamlyn Terrace, Blue Haven, Summerland Point and Gwandalan, Forresters Beach, Wamberal, Terrigal, North Avoca, Avoca Beach, Erina, Springfield, Green Point, Kincumber, Macmasters Beach, Copacabana, Saratoga and Davistown
- rehabilitation of sewer mains based on the condition assessments from the CCTV inspection program. A total of 36 kilometres of sewer gravity mains have been relined to date, overcoming issues and other sewer network performance deficiencies

- review of automated control schemes for sewage pumping stations that will provide information to enable quicker diagnosis and understanding of malfunctioning equipment and infrastructure.

Council's sewage capital works program for 2020–2022 will invest \$49 million into upgrades to council's sewage infrastructure, including:



Ocean and Umina beaches  
Photo: Beachwatch/EES,  
DPIE

- upgrades to various sewage treatment plants, pumping stations, gravity mains and vacuum and pressure systems at Wamberal, Terrigal, Avoca, The Entrance, Noraville, Budgewoi, Toukley and Tuggerah to improve reliability and increase capacity of the sewer system
- replacement and upgrades to sewage schemes at Tacoma South, Mooney Mooney, Cheero Point, St Huberts Island and Davistown to improve reliability, increase capacity and prevent overflows entering nearby waterways.

With funding from the Australian Government's Environmental Restoration Fund grants program, several projects in line with the Tuggerah Lakes Estuary Management Plan have been undertaken to improve water quality in the Tuggerah Lakes catchment. These projects include foreshore, streambank, saltmarsh and wetland rehabilitation, development of educational materials, hydrological studies, a foreshore drainage audit, construction of new gross pollutant traps and upgrades to existing stormwater treatment infrastructure. Collaborative partnerships with local universities, Darkinjung Local Aboriginal Land Council and Local Land Services are facilitating better outcomes and are guiding sound environmental management in the estuary catchment. Since 2008, a total of \$31.85 million in grant funding has been invested in initiatives to improve the health of the Tuggerah Lakes estuary. The NSW Government's Tuggerah Lakes Expert Panel has provided further advice on future opportunities to improve water quality in Tuggerah Lakes to be considered as a component of the CMPs.

Council continues to install new gross pollutant traps and upgrade existing infrastructure to improve stormwater quality. Council now maintains over 400 stormwater quality improvement devices that include gross pollutant traps and constructed wetlands. As a result, over 524.4 tonnes of sediment and pollutants were prevented from entering wetlands, creeks, rivers, lakes, lagoons and the ocean from July 2020 to April 2021.

Council's wrack and algal collection program saw more than 6367 cubic metres of wrack (dead and free-floating seagrass) and algae removed from the Tuggerah Lakes

estuary from July 2020 to March 2021, leading to improvements in the water quality of the nearshore zone.



Pearl Beach Rockpool  
Photo: Beachwatch/EES,  
DPIE

Council also continued programs such as: installation of dog poo bins in popular dog walking areas with increased signage advising pet owners to pick up and dispose of waste appropriately; stormwater and waterway community education projects; maintenance of key wetlands across the Central Coast; riparian rehabilitation; and enforcement of council's erosion, sediment and nutrient control regulations.

Central Coast Council supports many innovative programs that work towards improving our natural environment. Clean4Shore is a small not-for-profit community organisation that aims to remove litter and waste materials from our waterways, with a local focus on the Hawkesbury River, Brisbane Water, Tuggerah Lakes and Southern Lake Macquarie. Council provides the management, guidance and compliance for the Environmental Restoration Fund grant that helps financially support this program. During 2020, the Clean4Shore program retrieved 9490 kilograms of litter from the waterways on the Central Coast.



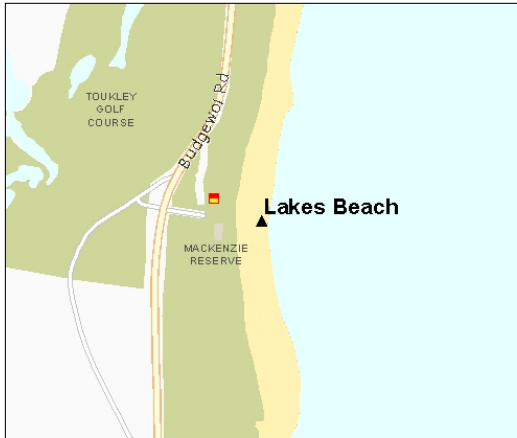
Sampling sites and Beach Suitability Grades in Central Coast Council (northern)



Sampling sites and Beach Suitability Grades in Central Coast Council (southern)

# Lakes Beach

Beach grade: G



Lakes Beach is at the southern end of an eight kilometre stretch of beach. The beach is patrolled during summer.

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 minor faecal contamination.

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

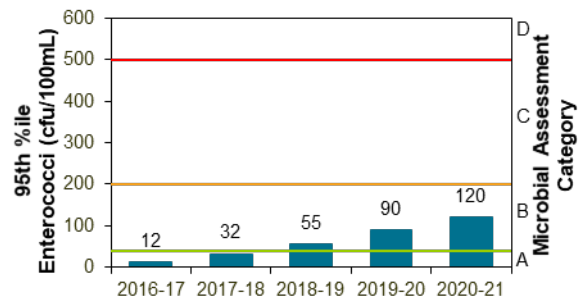
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	93%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

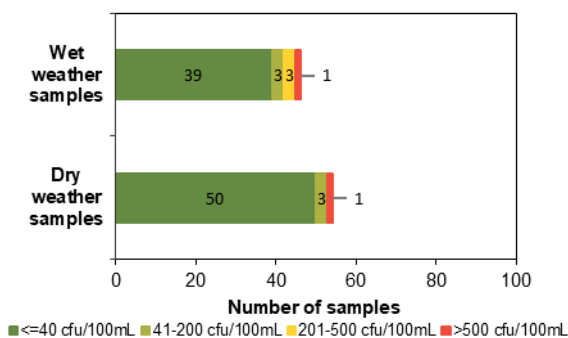
### Sanitary inspection: Low



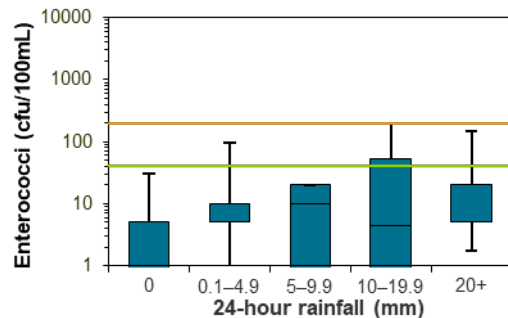
### Microbial Assessment Category: B



### Dry and wet weather water quality

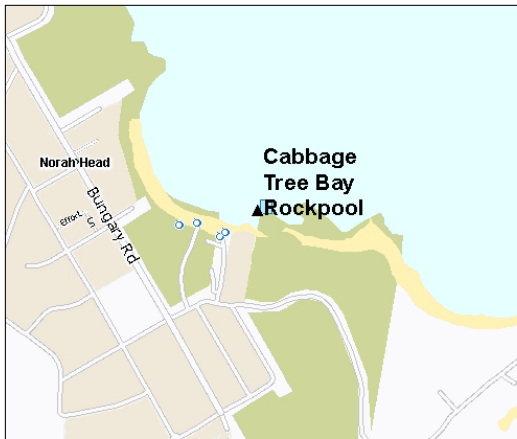


### Water quality in response to rainfall



# Cabbage Tree Bay Rockpool

Beach grade: G



Cabbage Tree Bay Rockpool is located within a sheltered bay of Cabbage Tree Harbour, Norah Head and is naturally flushed by the ocean.

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.

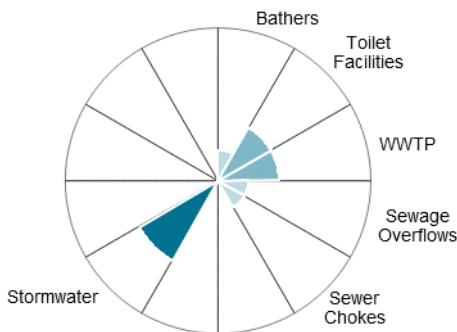
Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 10 mm or more.

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

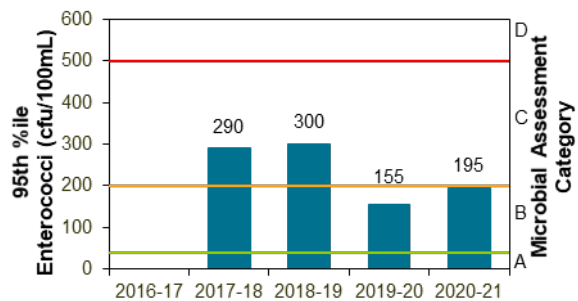
The site was monitored from 2002 until 2005, and since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Feb 2018 to Apr 2021	89%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

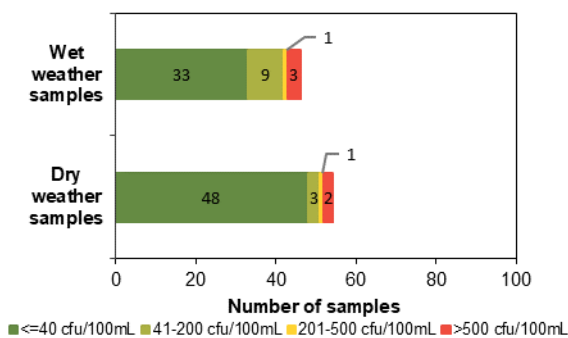
## Sanitary inspection: Moderate



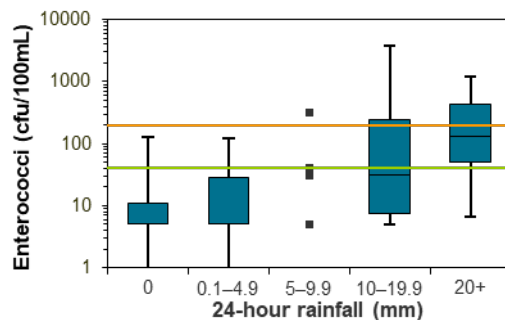
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall





# Soldiers Beach

Beach grade: **G**



Soldiers Beach is a popular beach surrounded by reserve, and is patrolled over summer.

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 minor faecal contamination.

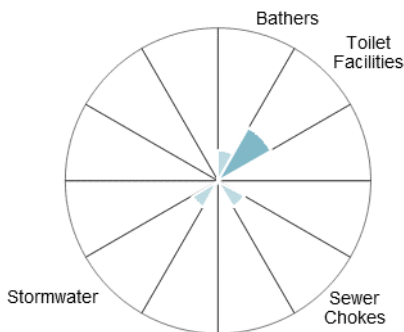
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 5 mm or more of rain.

The site has been monitored since 2002.

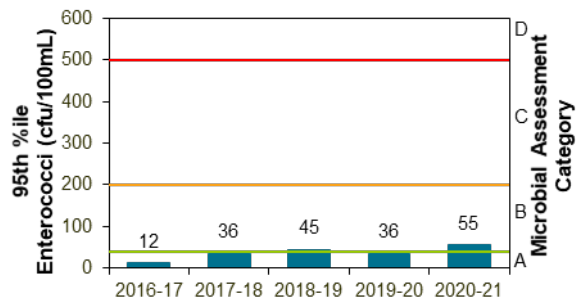
See 'How to read this report' for key to map.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	98%	100	Declined

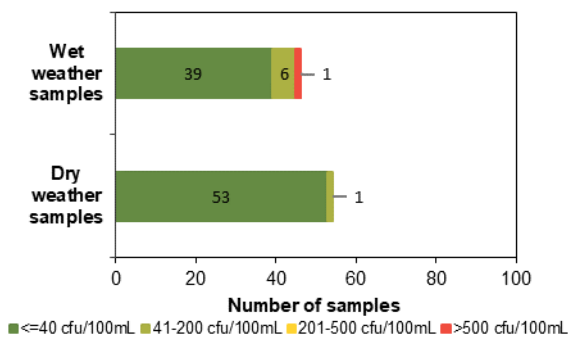
## Sanitary inspection: Low



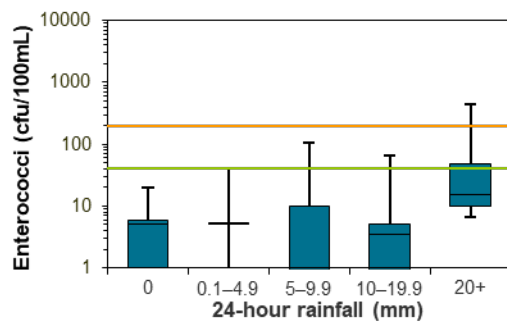
## Microbial Assessment Category: B



## Dry and wet weather water quality

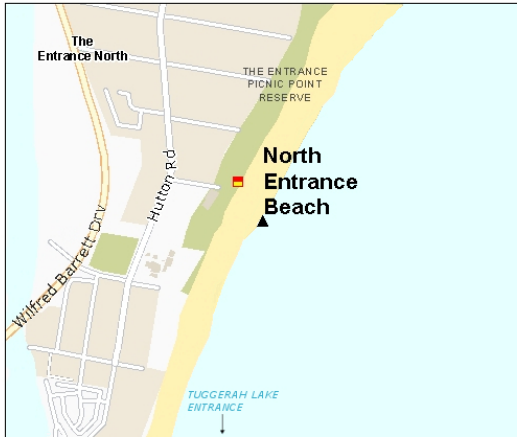


## Water quality in response to rainfall



# North Entrance Beach

Beach grade: **G**



North Entrance Beach is located to the north of the entrance to Tuggerah Lake, and is patrolled over summer.

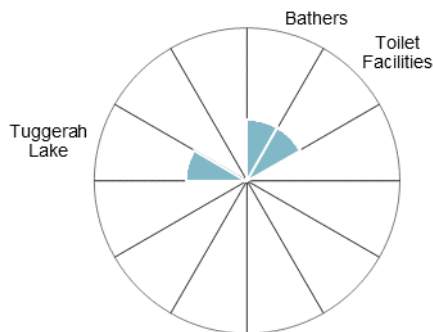
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

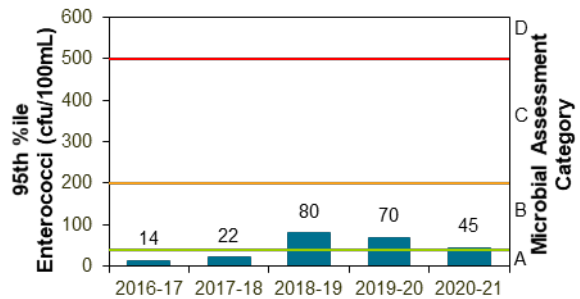
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	92%	100	Stable <span style="color: blue;">●</span>

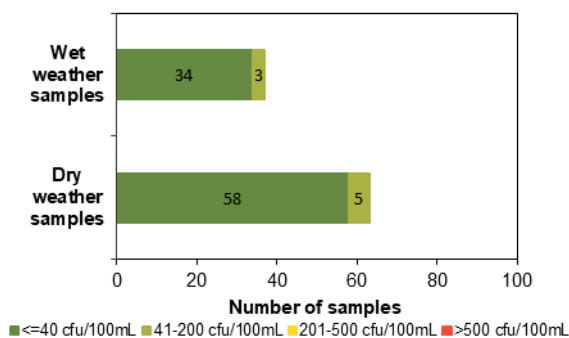
## Sanitary inspection: Low



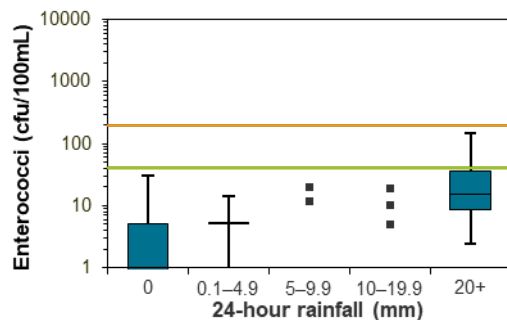
## Microbial Assessment Category: B



## Dry and wet weather water quality

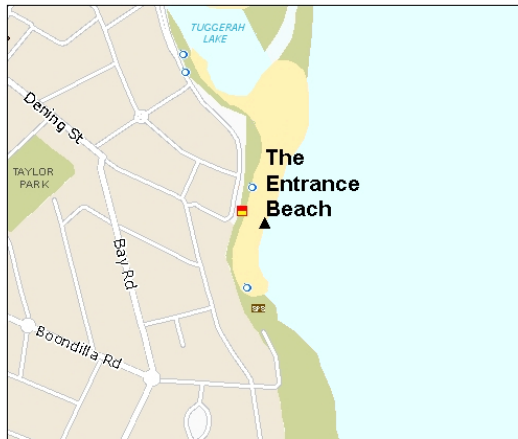


## Water quality in response to rainfall



# The Entrance Beach

Beach grade:



The Entrance Beach is located to the south of the entrance to Tuggerah Lake and is patrolled over summer.

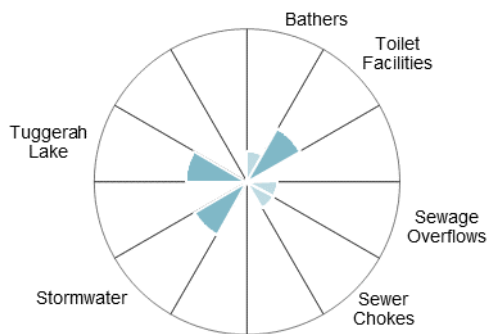
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

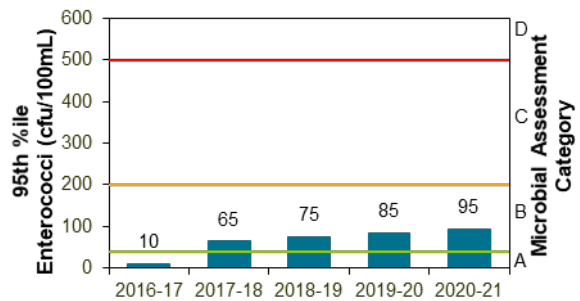
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	92%	100	Stable

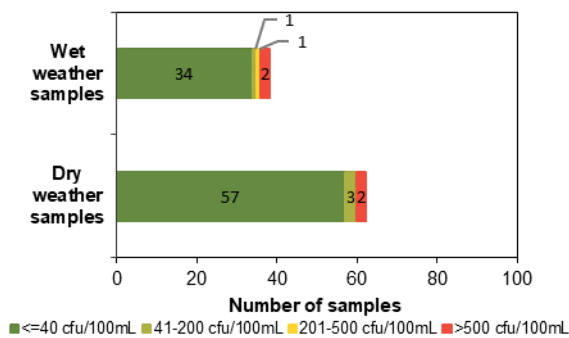
## Sanitary inspection: Low



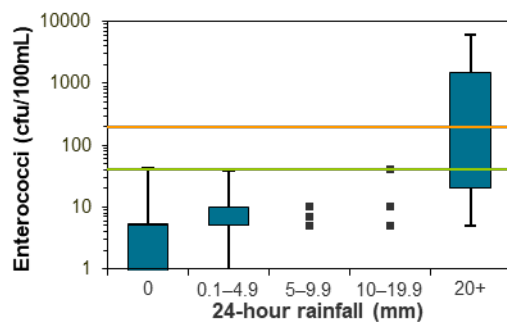
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# The Entrance Ocean Baths

Beach grade: **G**



The Entrance Ocean Baths include a 50 metre concrete pool and two smaller wading pools located at the southern end of The Entrance Beach, and are patrolled over summer.

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 minor faecal contamination.

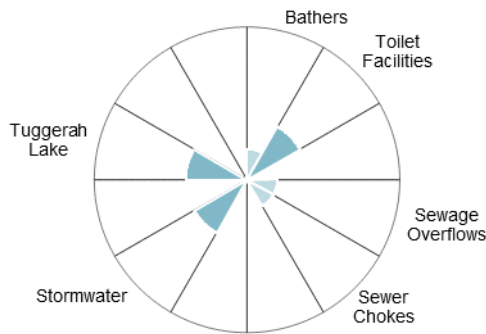
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little rain.

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

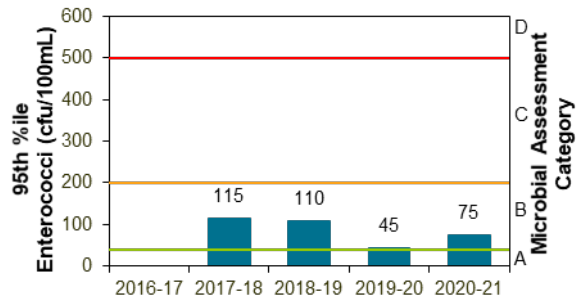
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Nov 2017 to Apr 2021	94%	100	Stable <span style="color: blue;">●</span>

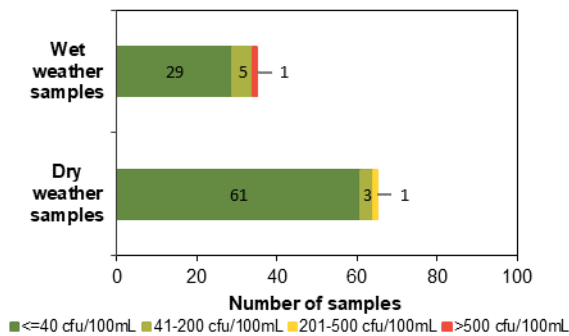
## Sanitary inspection: Low



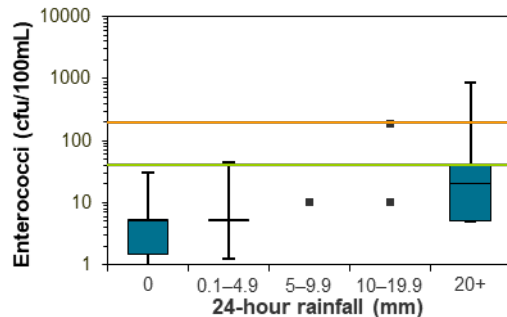
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Toowoona Bay

**Beach grade:** G



Toowoona Bay is a relatively calm ocean beach protected by headlands and a tombola. The beach is patrolled during summer.

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.

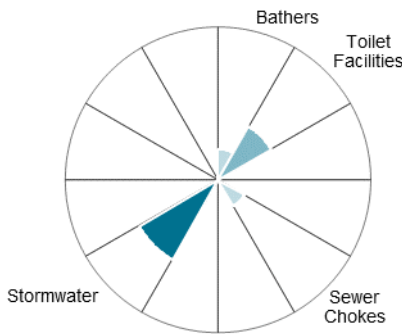
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain and regularly after 20 mm or more of rain.

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

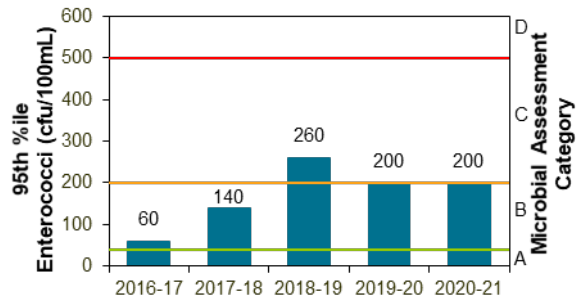
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	81%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

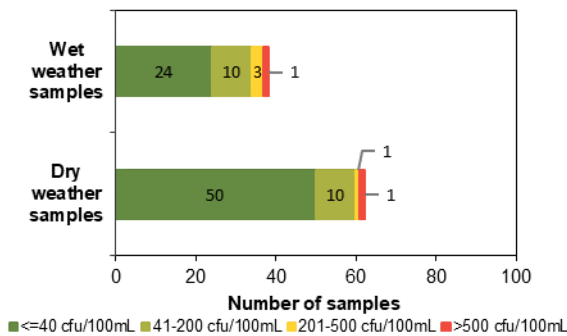
### Sanitary inspection: Moderate



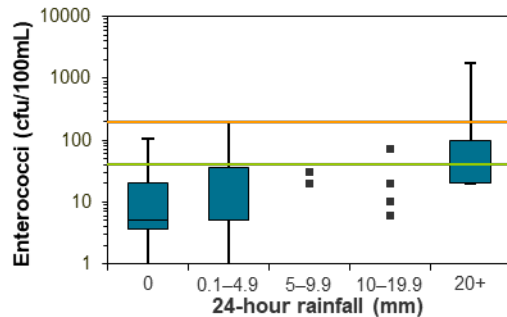
### Microbial Assessment Category: B



### Dry and wet weather water quality



### Water quality in response to rainfall



# Shelly Beach

Beach grade:



Shelly Beach is a popular patrolled beach, backed by a high dune system and golf course.

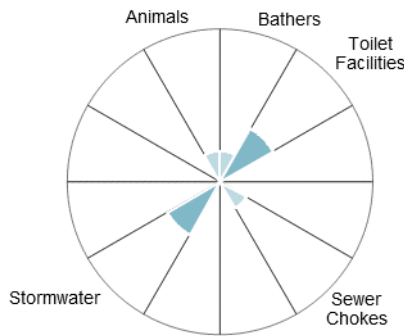
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and often after 20 mm or more.

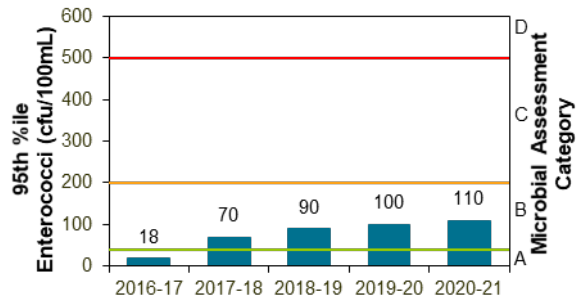
See 'How to read this report' for key to map. The site has been monitored since 2002.

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

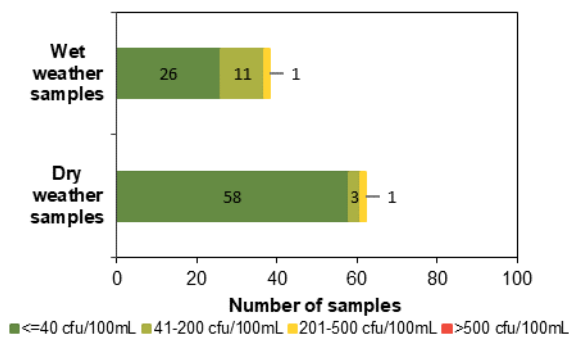
## Sanitary inspection: Low



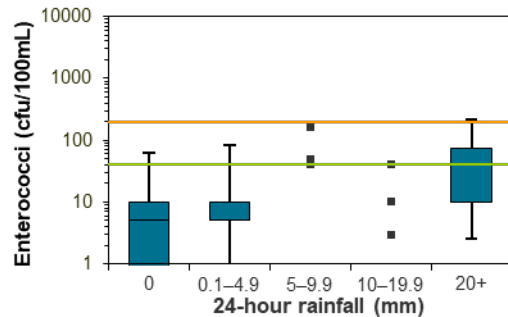
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Gwandalan

Beach grade: P



Gwandalan is a netted swimming enclosure within Crangan Bay in southern Lake Macquarie.

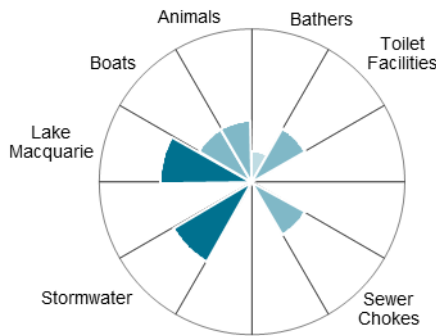
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and sources from elsewhere within the lake.

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

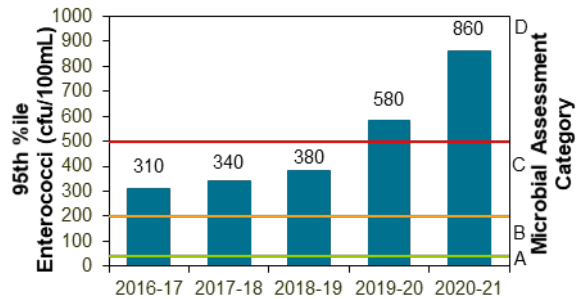
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Feb 2018 to Ap 2021	66%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px; font-weight: bold;">●</span>

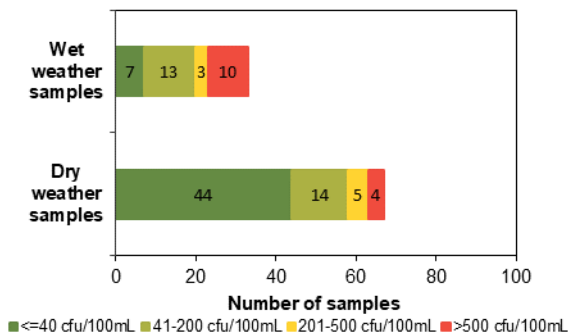
### Sanitary inspection: Moderate



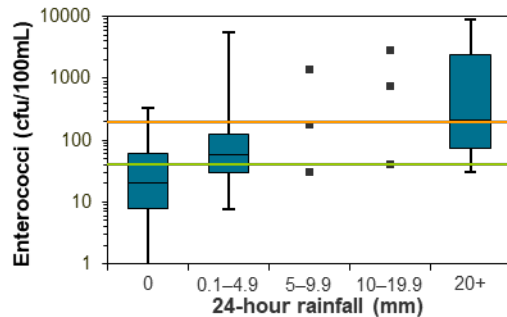
### Microbial Assessment Category: D



### Dry and wet weather water quality

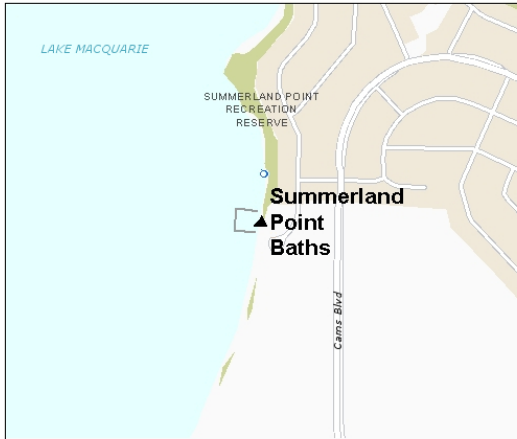


### Water quality in response to rainfall



# Summerland Point Baths

Beach grade: G



Summerland Point Baths is a netted swimming area located at the southern end of Lake Macquarie.

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 sources from elsewhere within the lake.

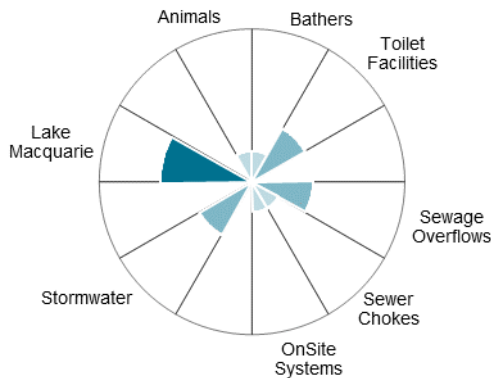
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and regularly after 20 mm or more.

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

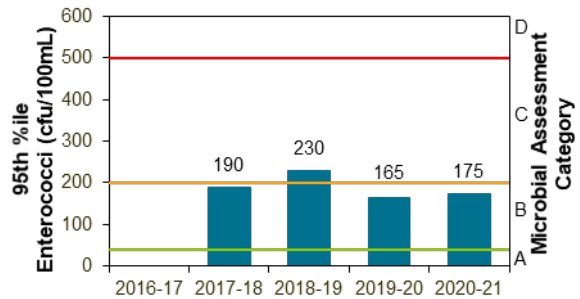
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2018 to Apr 2021	85%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

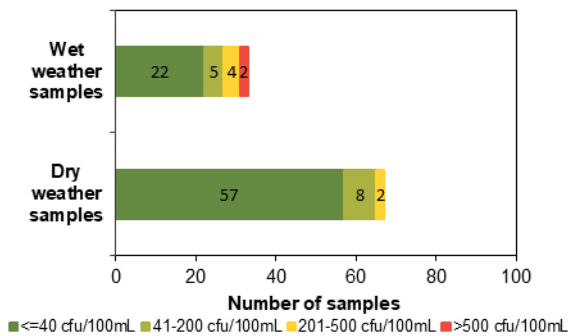
## Sanitary inspection: Moderate



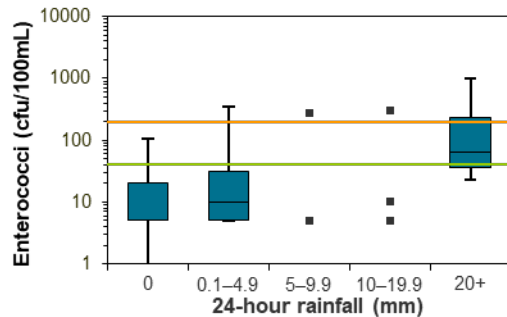
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall





# Chain Valley Bay

Beach grade: P



Chain Valley Bay is an enclosed swimming area located at the southern end of Lake Macquarie.

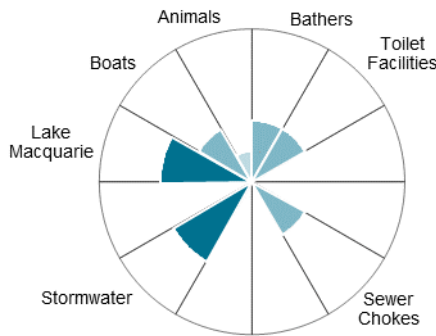
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions from several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to little or no rain, and frequently after 5 mm or more.

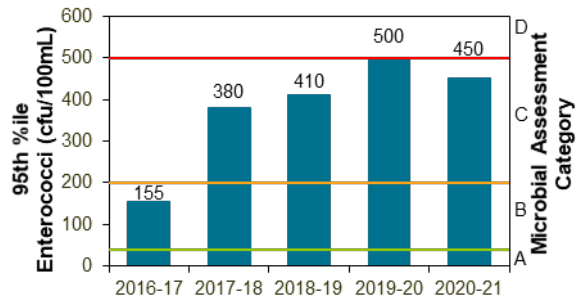
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2018 to Apr 2021	71%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 6px; font-weight: bold;">●</span>

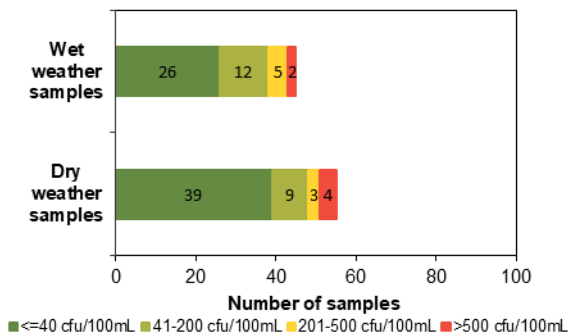
## Sanitary inspection: Moderate



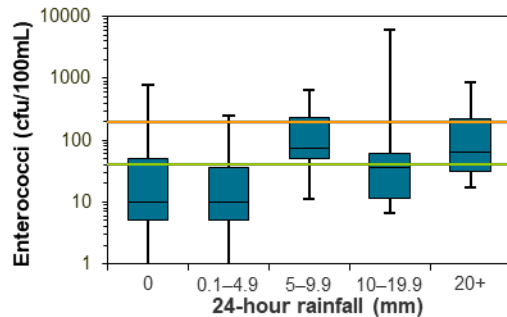
## Microbial Assessment Category: C



## Dry and wet weather water quality



## Water quality in response to rainfall



# Manning Park Baths

Beach grade: P



Manning Park Baths is a netted swimming area located at Vales Point at the southern end of Lake Macquarie.

The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

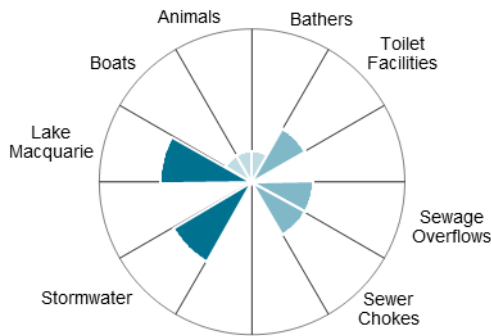
Enterococci levels generally increased with increasing rainfall, often exceeding the safe swimming limit in response to little or no rain, and usually after 20 mm or more.

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

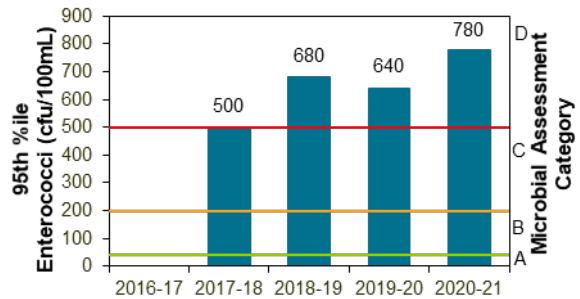
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Feb 2018 to Apr 2021	54%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px; font-weight: bold;">●</span>

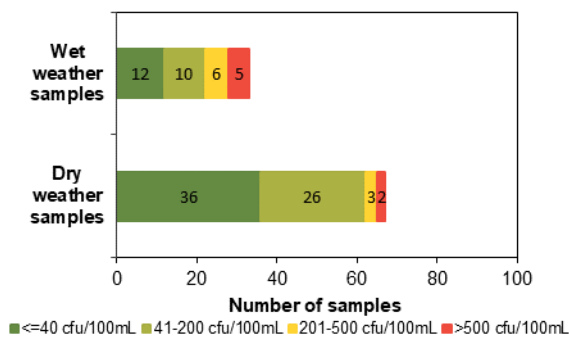
## Sanitary inspection: Moderate



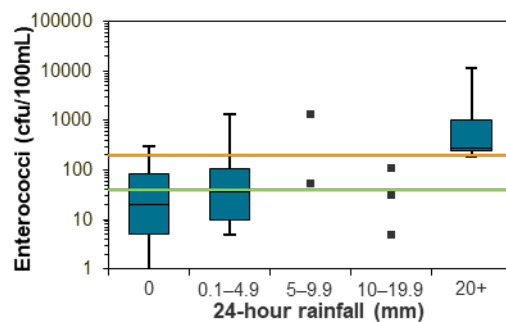
## Microbial Assessment Category: D



## Dry and wet weather water quality



## Water quality in response to rainfall



# Lake Munmorah Baths

Beach grade: P



Lake Munmorah Baths is an enclosed swimming area in the north of Lake Munmorah.

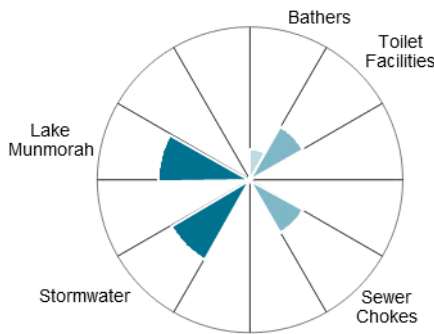
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after no rain and regularly after 5 mm or more of rain.

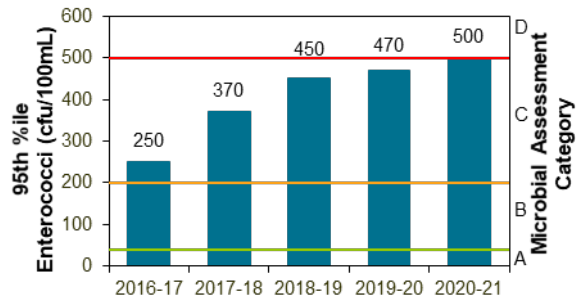
See 'How to read this report' for key to map. The site has been monitored since 2010.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2018 to Apr 2021	77%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px;">●</span>

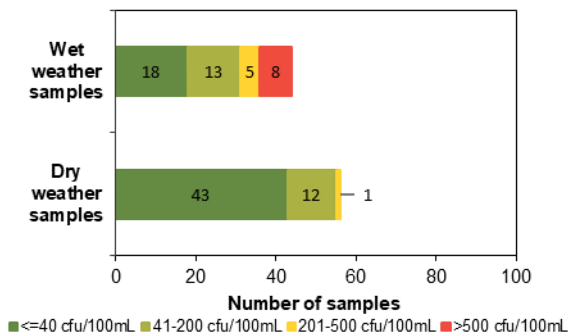
### Sanitary inspection: Moderate



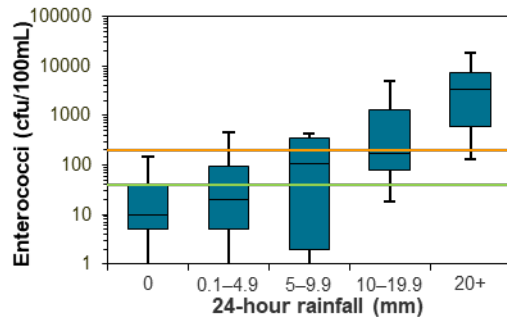
### Microbial Assessment Category: C



### Dry and wet weather water quality



### Water quality in response to rainfall



# Canton Beach

**Beach grade:** P



Canton Beach is within Tuggerah Lake and is backed by a narrow reserve and picnic area.

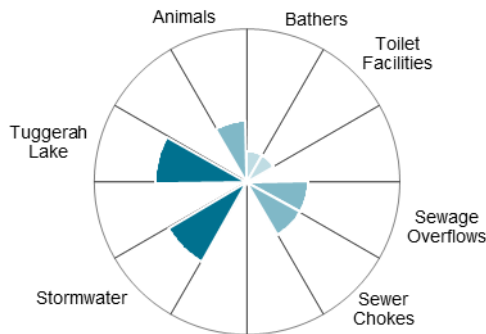
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain, and regularly after rainfall.

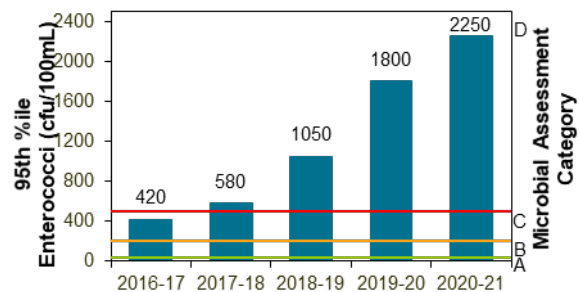
See 'How to read this report' for key to map. The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Feb 2018 to Apr 2021	43%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

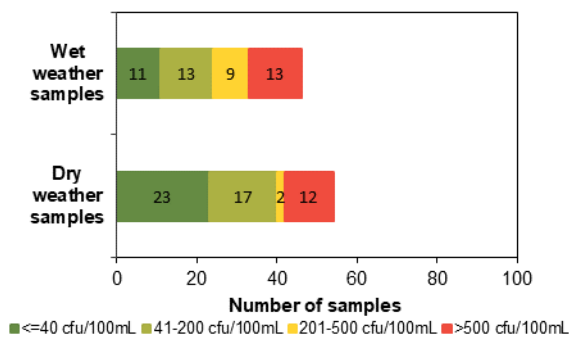
### Sanitary inspection: Moderate



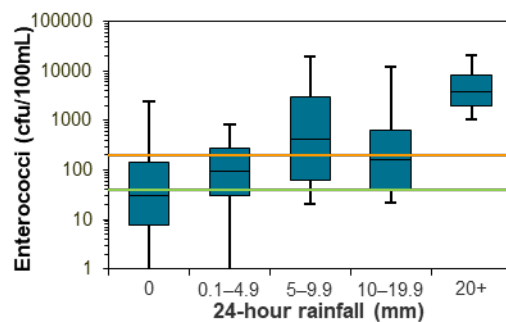
### Microbial Assessment Category: D



### Dry and wet weather water quality



### Water quality in response to rainfall



# Wamberal Beach

Beach grade: G



Wamberal Beach is a long open beach backed by a lagoon and is patrolled over summer.

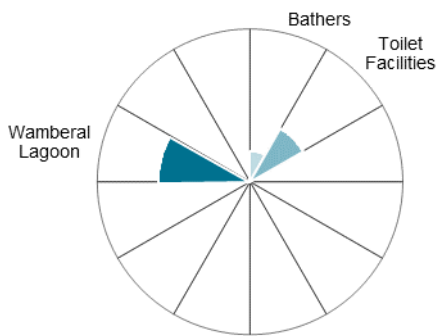
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with potential sources of faecal contamination including discharge from Wamberal Lagoon.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain.

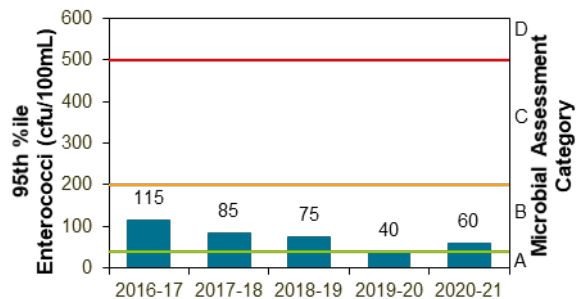
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Mar 2018 to Apr 2021	93%	100	Stable <span style="color: blue;">●</span>

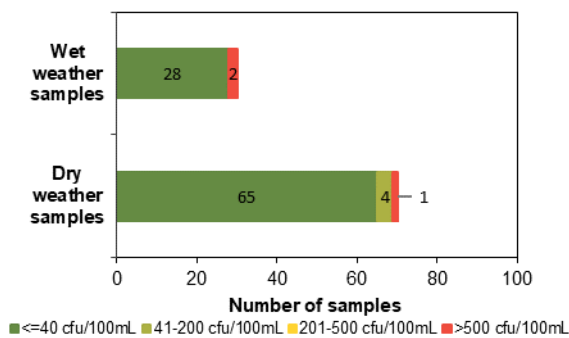
## Sanitary inspection: Moderate



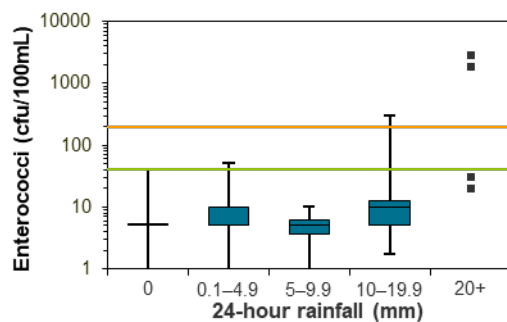
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Wamberal Lagoon

Beach grade: P



Wamberal Lagoon is intermittently open to the ocean toward the southern end of Wamberal Beach.

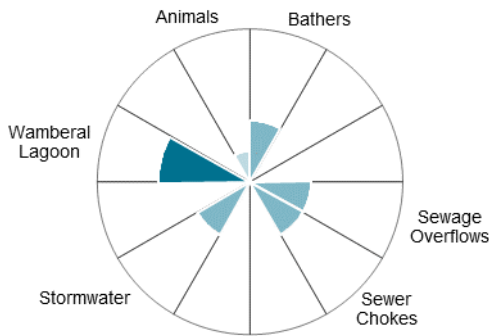
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including from elsewhere within the lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain and regularly after light rain.

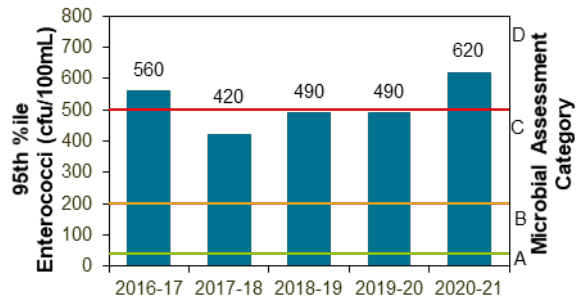
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2018 to Apr 2021	68%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px;">●</span>

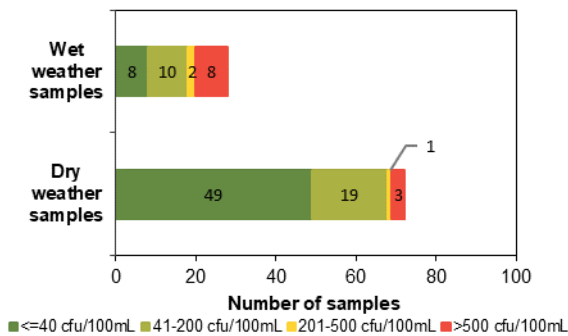
## Sanitary inspection: Moderate



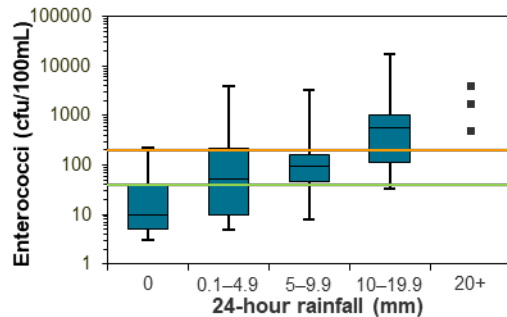
## Microbial Assessment Category: D



## Dry and wet weather water quality



## Water quality in response to rainfall



# Terrigal Beach

Beach grade: P



Terrigal Beach is a very popular north-east facing beach and is patrolled during the warmer months.

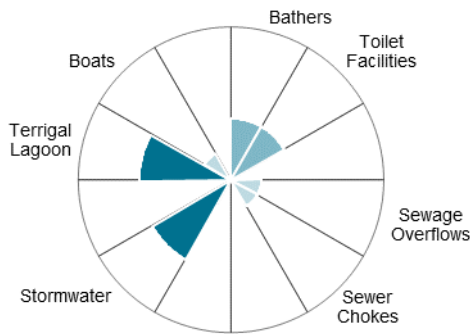
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Terrigal Lagoon.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 5 mm or more.

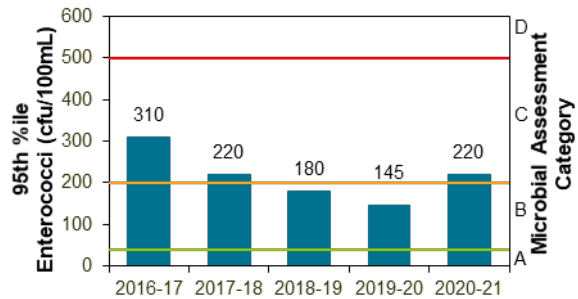
See 'How to read this report' for key to map. The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Mar 2018 to Apr 2021	87%	100	Declined <span style="color: blue; font-size: 2em;">↓</span>

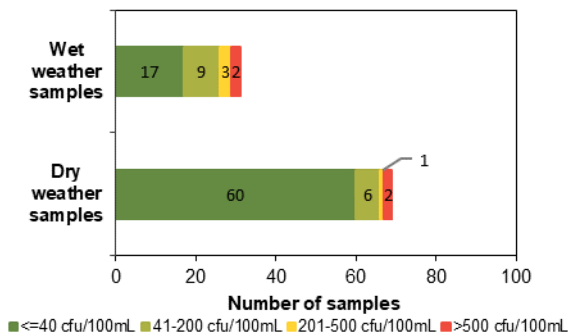
## Sanitary inspection: Moderate



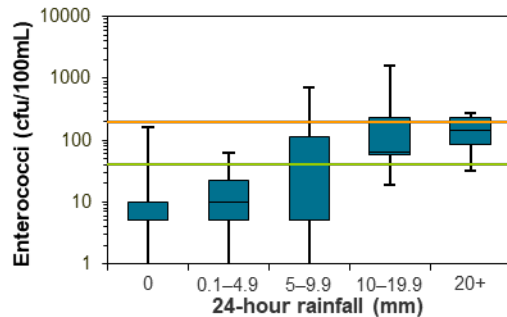
## Microbial Assessment Category: C



## Dry and wet weather water quality



## Water quality in response to rainfall



# Terrigal Lagoon

Beach grade: P



Terrigal Lagoon is intermittently open to the ocean to the north of Terrigal Beach.

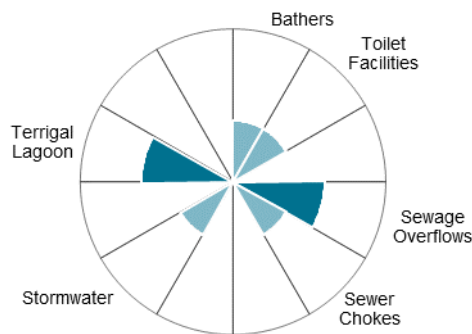
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from elsewhere within the lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain, and regularly after light rain.

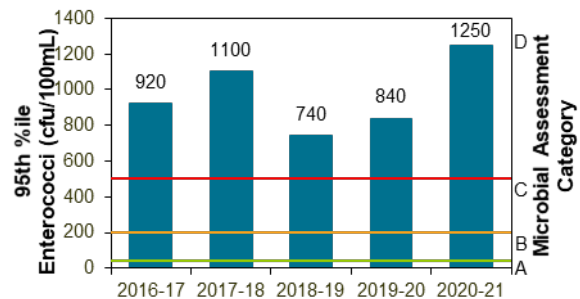
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Apr 2018 to Apr 2021	55%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px; display: inline-block;">●</span>

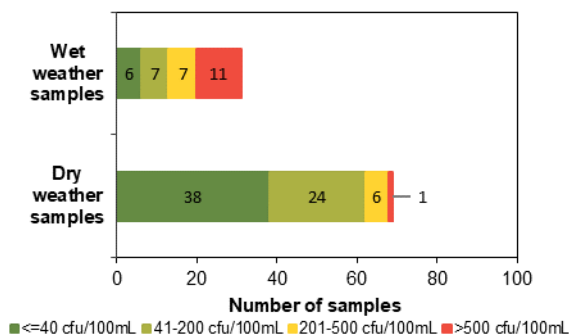
## Sanitary inspection: Moderate



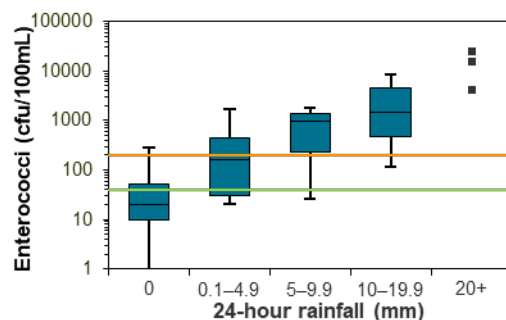
## Microbial Assessment Category: D



## Dry and wet weather water quality



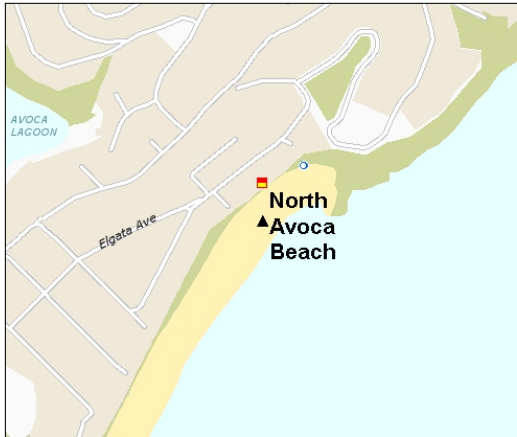
## Water quality in response to rainfall





# North Avoca Beach

Beach grade: G



North Avoca Beach is at the northern end of the beach and is patrolled during the summer swimming season.

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 minor faecal contamination.

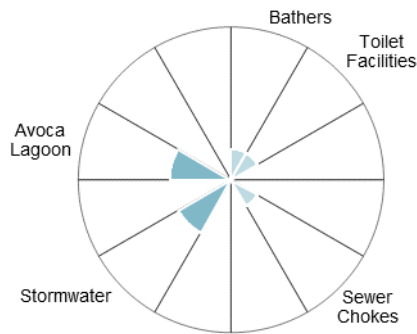
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and regularly after 20 mm or more.

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

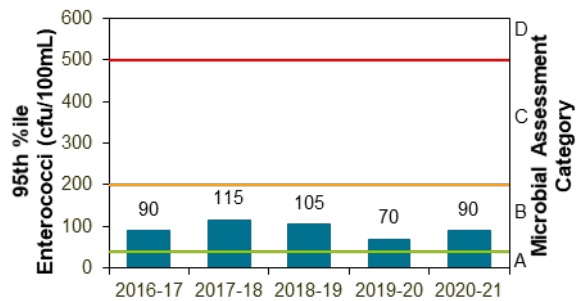
The site has been monitored since 2007.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Mar 2018 to Apr 2021	93%	100	Stable <span style="background-color: #333366; color: white; border-radius: 50%; padding: 2px 8px; font-weight: bold;">●</span>

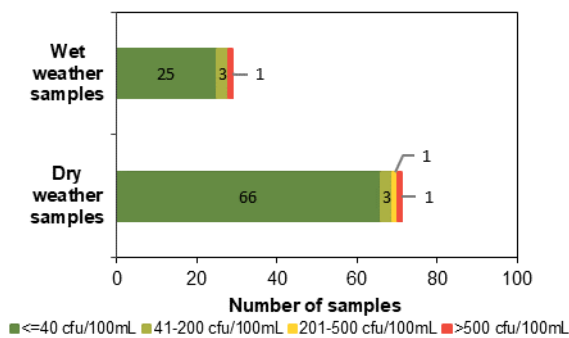
## Sanitary inspection: Low



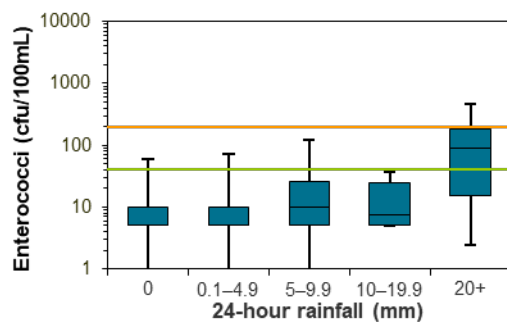
## Microbial Assessment Category: B



## Dry and wet weather water quality

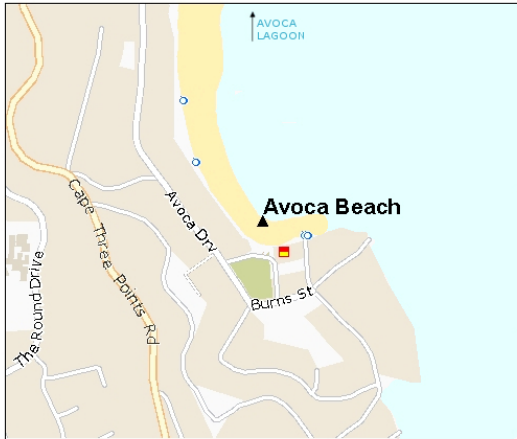


## Water quality in response to rainfall



# Avoca Beach

Beach grade:



Avoca Beach is in the southern corner of the beach and is patrolled during summer.

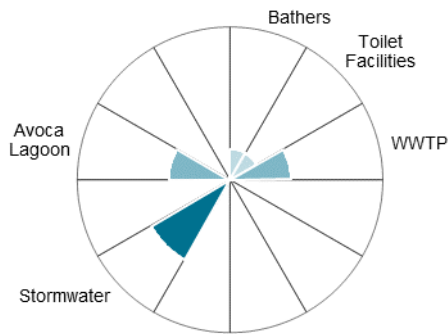
The Beach Suitability Grade of Good indicates microbial water quality is suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit in response to little or no rain, and often after 10 mm or more.

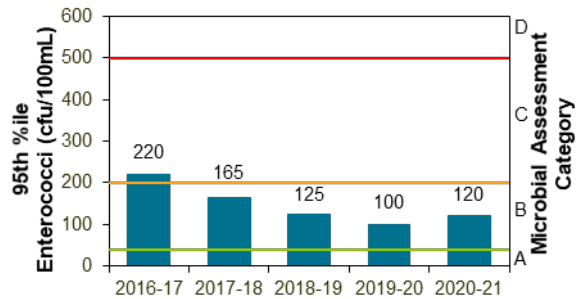
See 'How to read this report' for key to map. The site has been monitored since 2006.

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

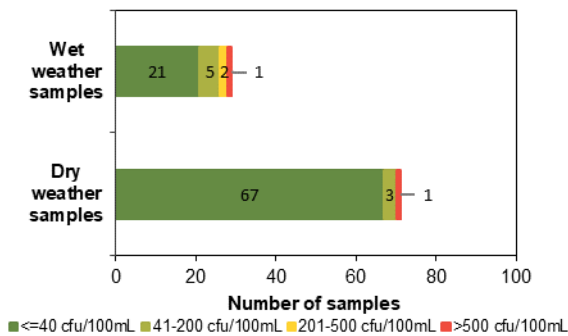
## Sanitary inspection: Moderate



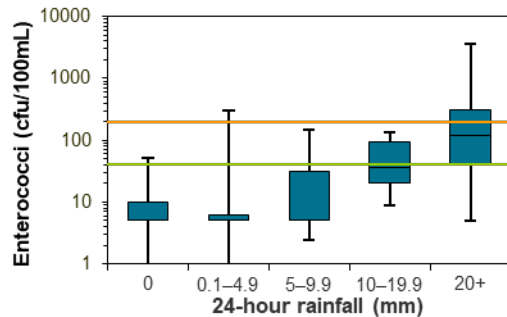
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Avoca Lagoon

Beach grade: P



Avoca Lagoon is intermittently open to the ocean and located to the north of Avoca Beach.

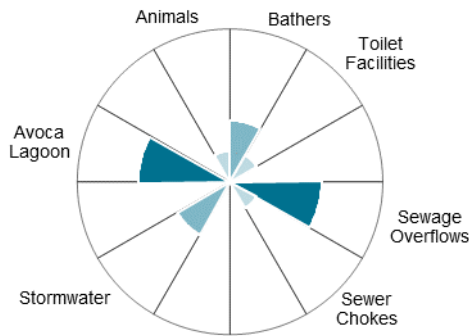
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and often during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from elsewhere within the lagoon.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain, and regularly after rainfall.

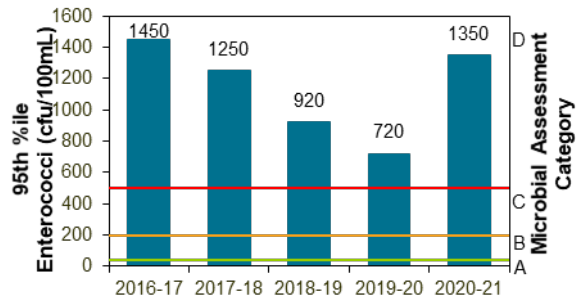
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Apr 2018 to Apr 2021	51%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px;">●</span>

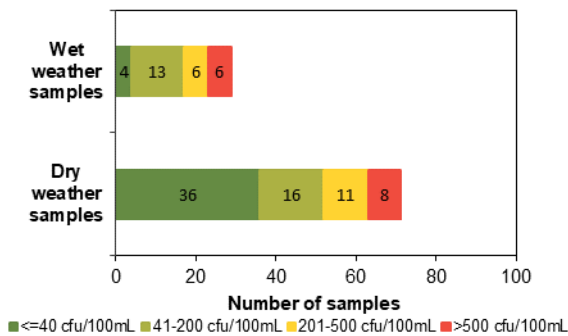
## Sanitary inspection: Moderate



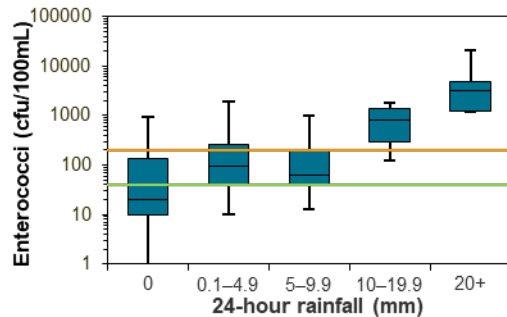
## Microbial Assessment Category: D



## Dry and wet weather water quality



## Water quality in response to rainfall



# Copacabana Beach

Beach grade: G



Copacabana Beach is at the northern end of a one kilometre stretch of beach and is patrolled during the summer swimming season.

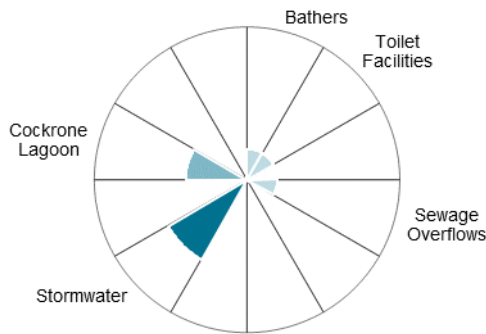
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, occasionally exceeding the safe swimming limit after little or no rain, and often after 5 mm or more.

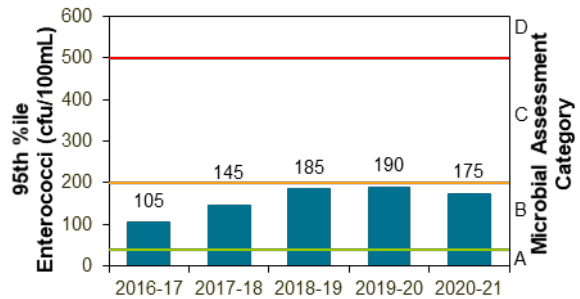
See 'How to read this report' for key to map. The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Mar 2018 to Apr 2021	93%	100	Stable <span style="background-color: #333366; color: white; border-radius: 50%; padding: 2px 8px; font-weight: bold;">●</span>

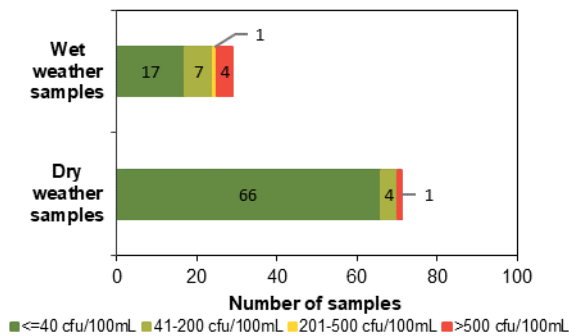
## Sanitary inspection: Moderate



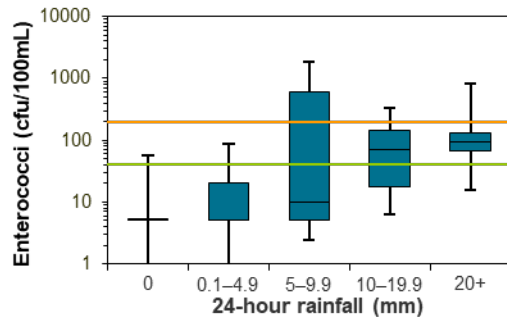
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Cockrone Lagoon

Beach grade: P



Cockrone Lagoon is intermittently open to the ocean and is located between Copacabana and MacMasters beaches.

The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including from elsewhere within the lagoon.

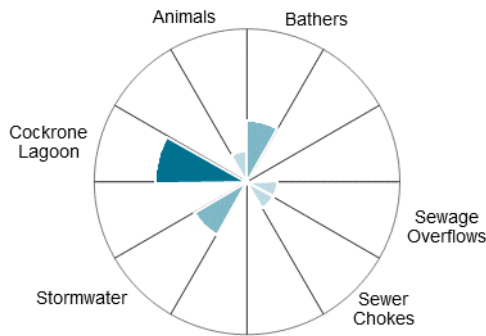
Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after no rain and regularly after rainfall.

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

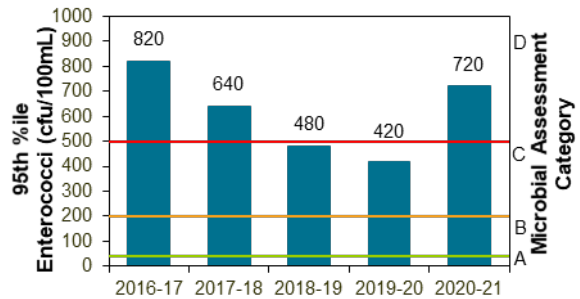
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Apr 2018 to Feb 2021	65%	100	Stable <span style="color: blue;">●</span>

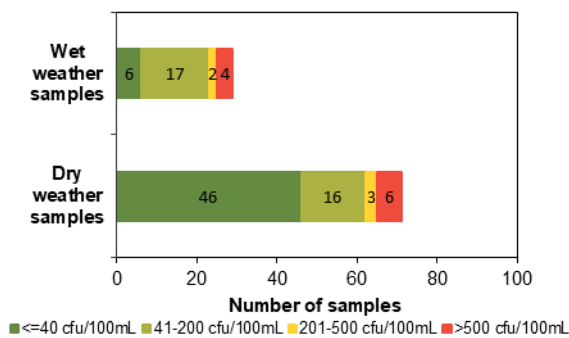
## Sanitary inspection: Moderate



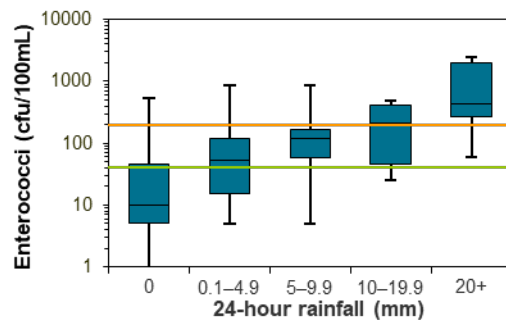
## Microbial Assessment Category: D



## Dry and wet weather water quality

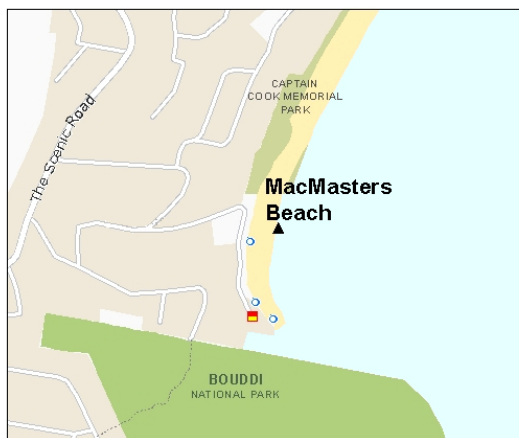


## Water quality in response to rainfall



# MacMasters Beach

Beach grade:



MacMasters Beach is at the southern end of a one kilometre stretch of beach and is patrolled during the warmer months.

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.

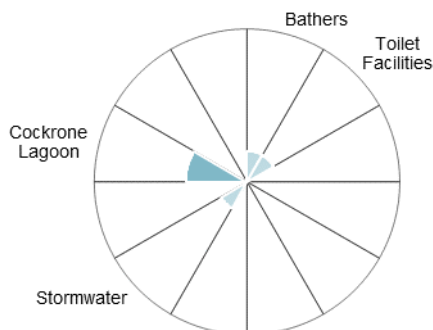
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 5 mm or more of rain, and often after 20 mm or more.

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

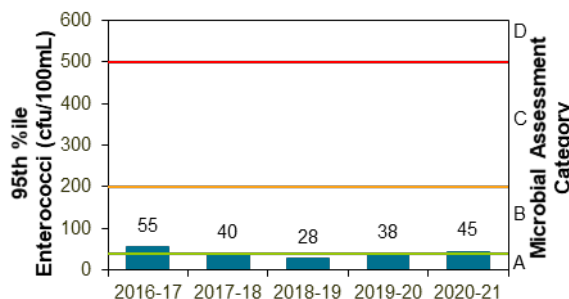
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Mar 2018 to Apr 2021	97%	100	Declined

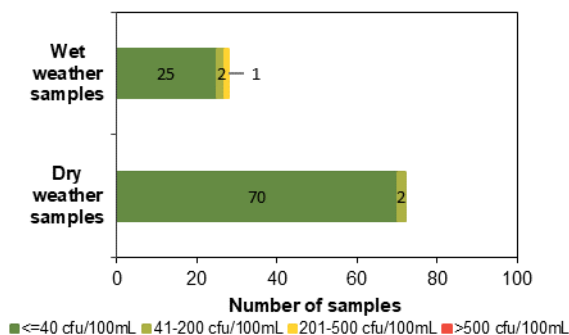
## Sanitary inspection: Low



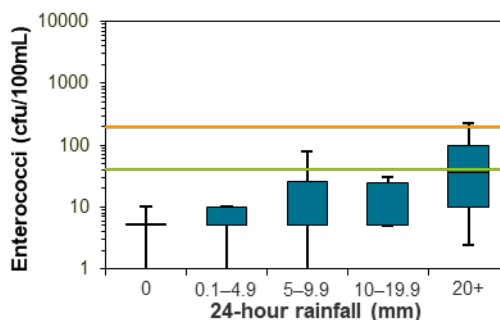
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Killcare Beach

Beach grade: G



Killcare Beach is a south facing beach backed by vegetated dunes. It is patrolled over the summer swimming season.

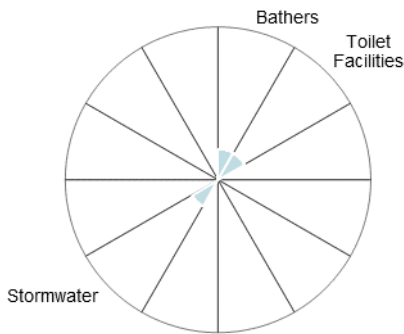
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

Enterococci levels had little response to rainfall and generally remained below the safe swimming limit across most rainfall categories.

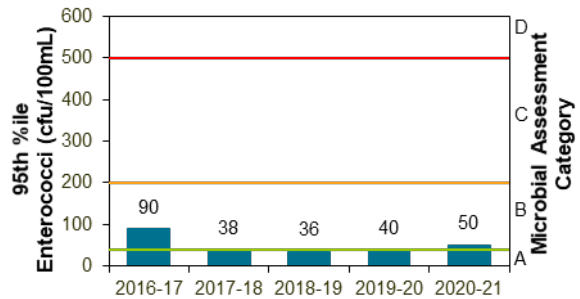
See 'How to read this report' for key to map. The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	96%	100	Declined <span style="font-size: 2em;">↓</span>

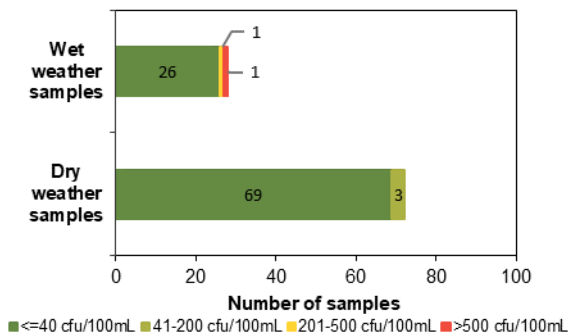
## Sanitary inspection: Low



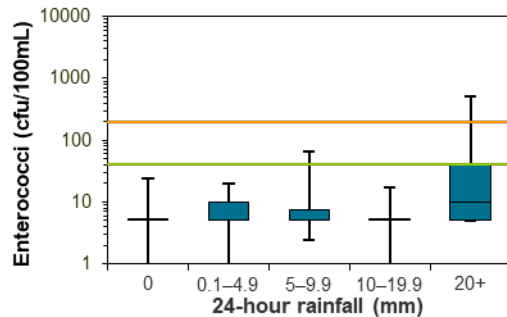
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall



# Ocean Beach

Beach grade: G



Ocean Beach is in Broken Bay near the entrance to Brisbane Water. The beach is patrolled during the summer swimming season.

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.

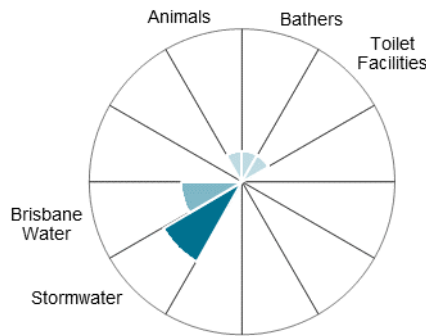
Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and frequently after 20 mm or more.

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

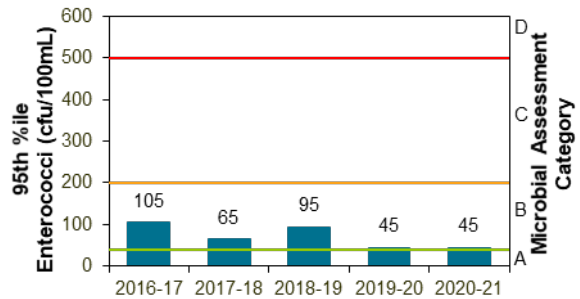
The site has been monitored since 2011.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	97%	100	Stable <span style="background-color: #333366; color: white; border-radius: 50%; padding: 2px 6px; font-weight: bold;">●</span>

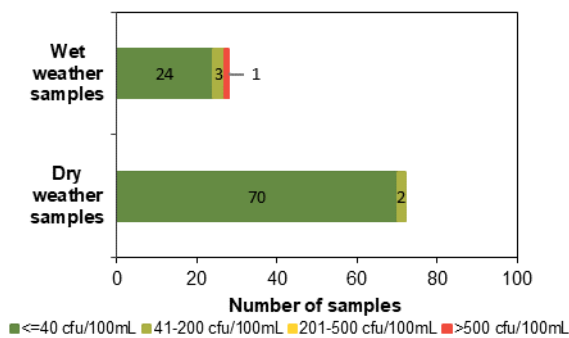
## Sanitary inspection: Moderate



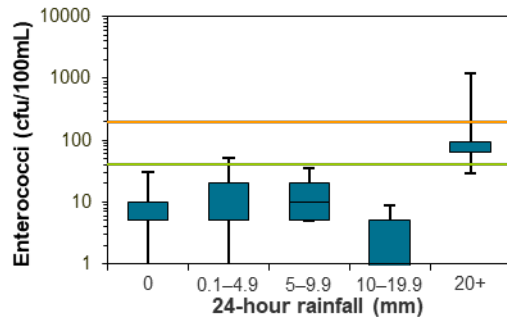
## Microbial Assessment Category: B



## Dry and wet weather water quality



## Water quality in response to rainfall





# Umina Beach

Beach grade:



Umina Beach is in Broken Bay near the entrance to Brisbane Water. The beach is patrolled during the summer swimming season.

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.

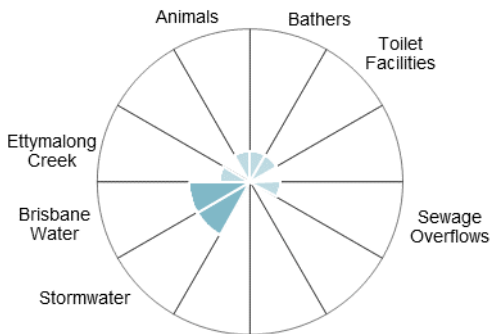
Enterococci levels generally increased with increasing rainfall, occasionally exceeding the safe swimming limit after light rain, and frequently after 20 mm or more.

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

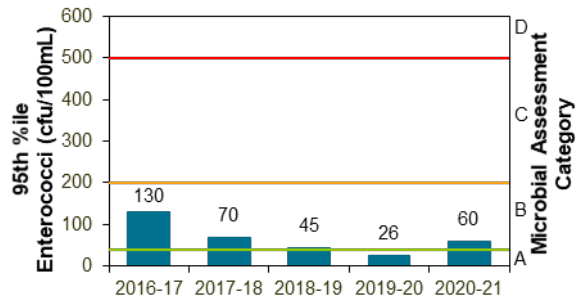
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2018 to Apr 2021	99%	100	Declined

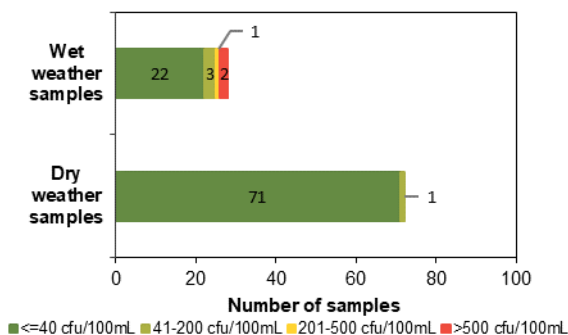
## Sanitary inspection: Low



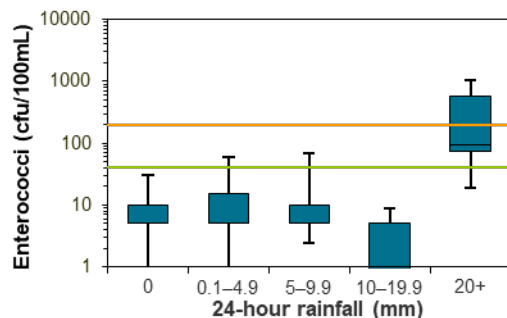
## Microbial Assessment Category: B



## Dry and wet weather water quality

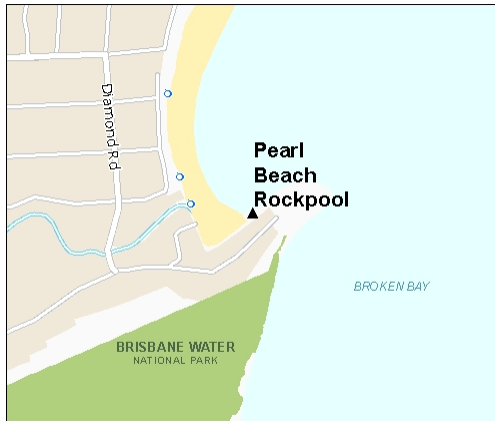


## Water quality in response to rainfall



# Pearl Beach Rockpool

Beach grade: G



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

Pearl Beach Rockpool is a constructed ocean pool at the southern end of Pearl Beach.

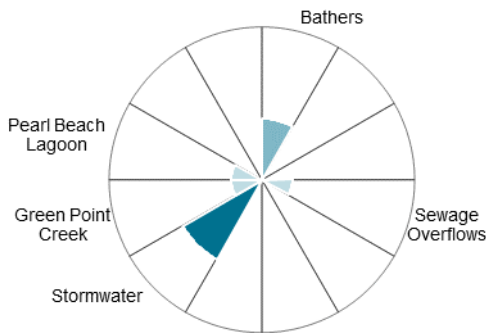
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

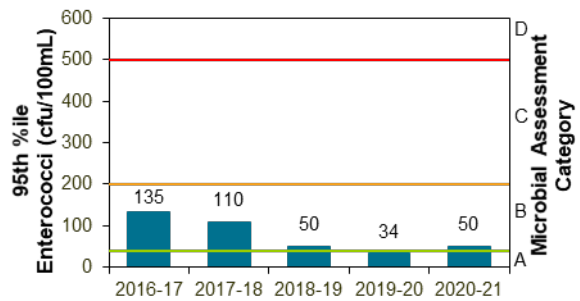
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Feb 2018 to Apr 2021	100%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

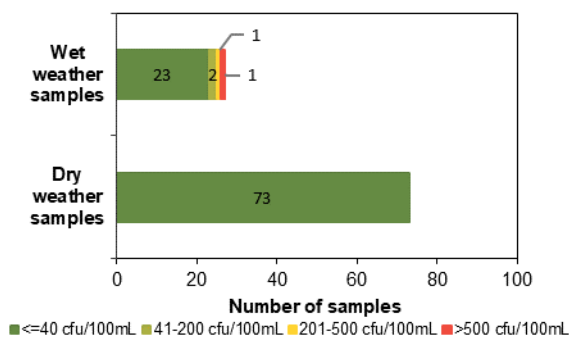
## Sanitary inspection: Moderate



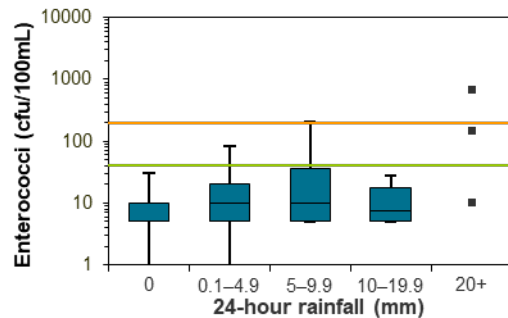
## Microbial Assessment Category: B



## Dry and wet weather water quality

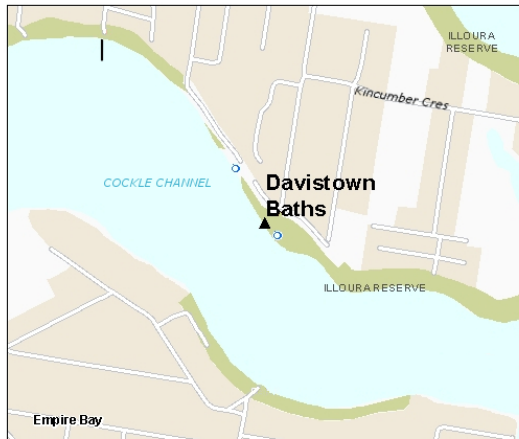


## Water quality in response to rainfall



# Davistown Baths

**Beach grade:** P



The Davistown Baths are a netted swimming enclosure in the channel between Brisbane Water and the Kincumber Broadwater.

The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

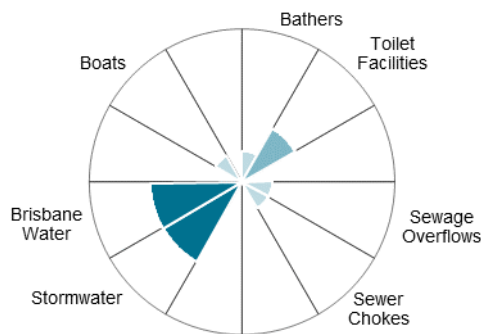
Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and regularly after 5 mm or more.

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

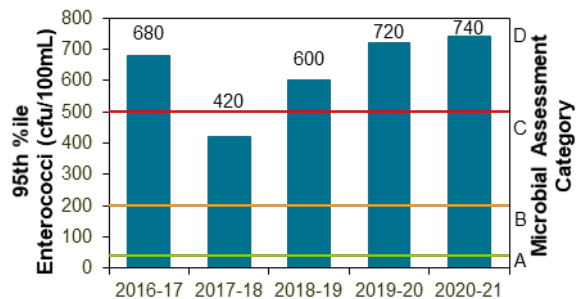
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Mar 2018 to Apr 2021	55%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

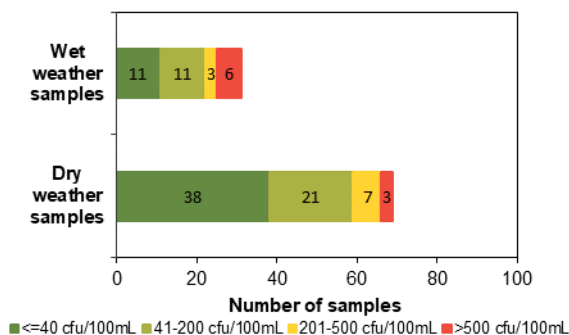
## Sanitary inspection: Moderate



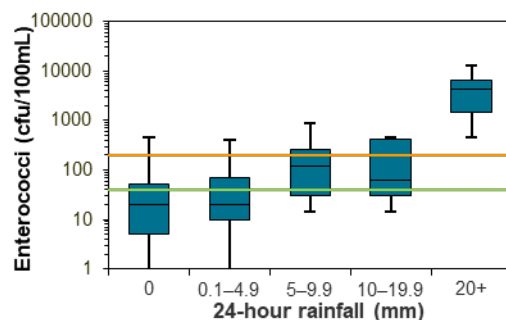
## Microbial Assessment Category: D



## Dry and wet weather water quality

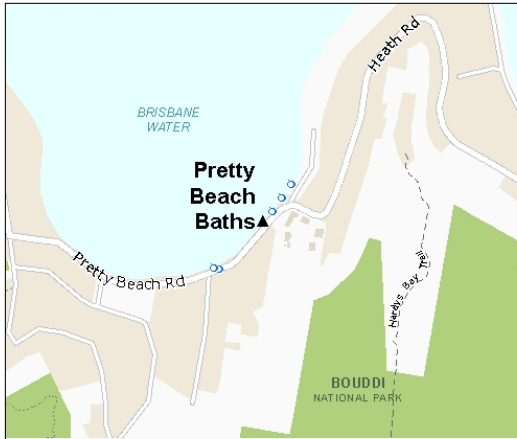


## Water quality in response to rainfall



# Pretty Beach Baths

Beach grade: P



Pretty Beach Baths is a netted swimming enclosure in Brisbane Water near the entrance to Broken Bay.

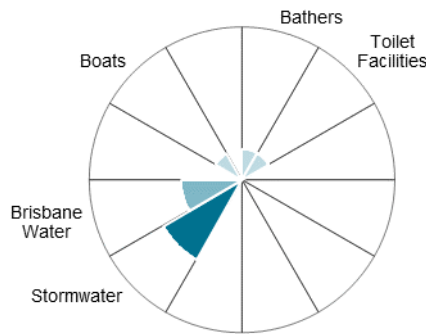
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to little or no rain, and regularly after 5 mm or more.

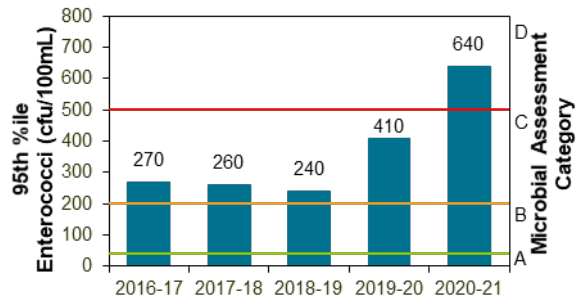
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Feb 2018 to Apr 2021	64%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px;">●</span>

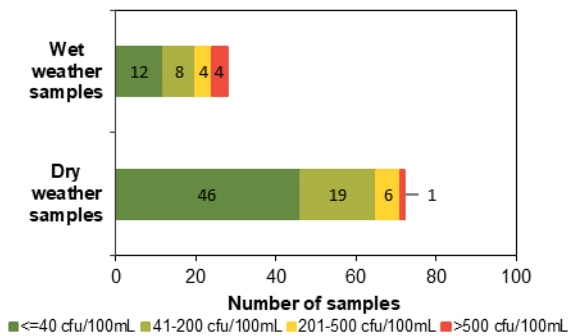
### Sanitary inspection: Moderate



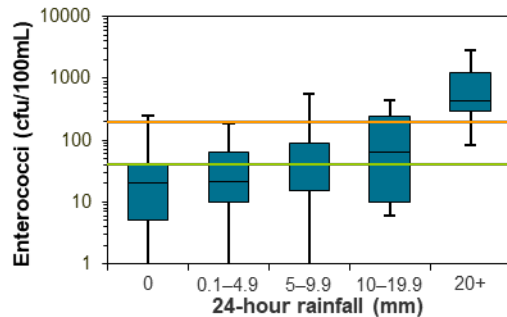
### Microbial Assessment Category: D



### Dry and wet weather water quality

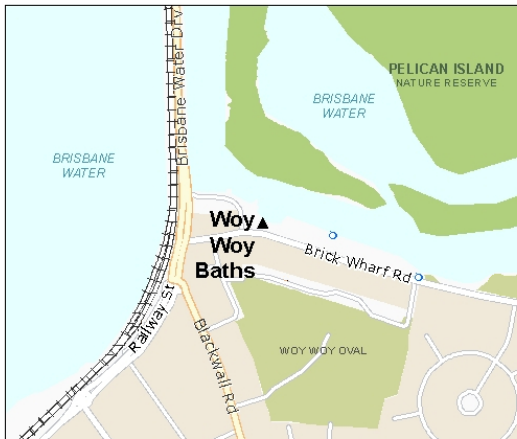


### Water quality in response to rainfall



# Woy Woy Baths

Beach grade: P



Woy Woy Baths is a netted swimming area located in Woy Woy channel in Brisbane Water.

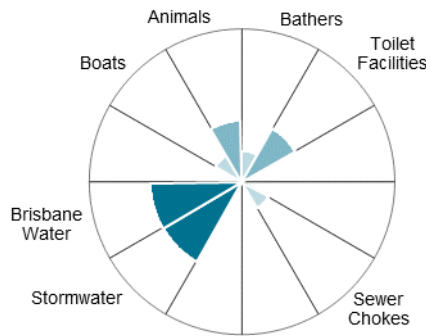
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit after little or no rain, and usually after 20 mm or more.

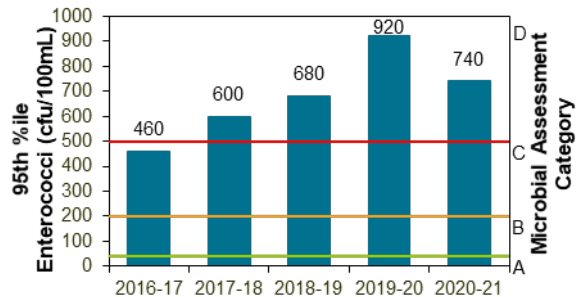
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Jan 2018 to Apr 2021	52%	100	Stable <span style="background-color: blue; color: white; border-radius: 50%; padding: 2px 5px;">●</span>

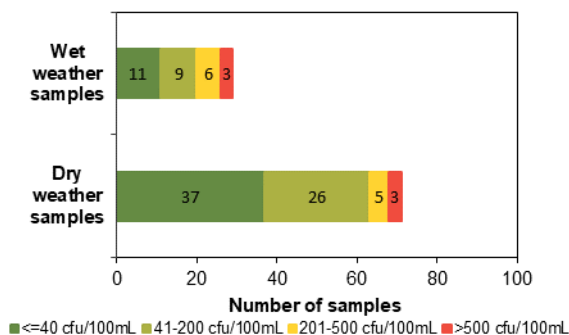
## Sanitary inspection: Moderate



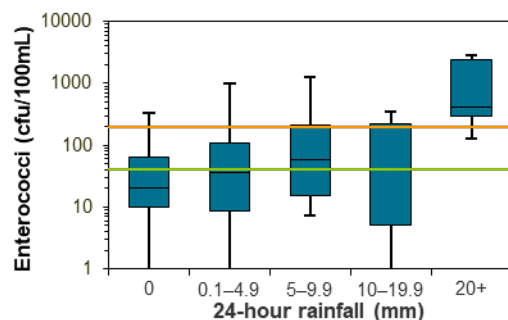
## Microbial Assessment Category: D



## Dry and wet weather water quality



## Water quality in response to rainfall



# Yattalunga Baths

**Beach grade:** P



Yattalunga Baths is a netted swimming enclosure located in the upper reaches of Brisbane Water.

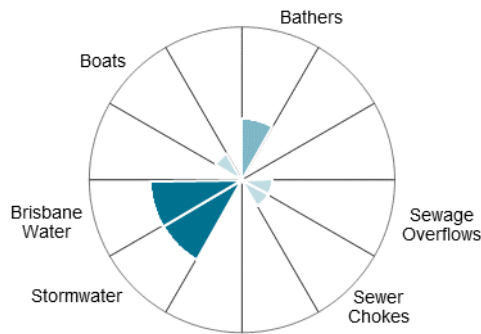
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

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

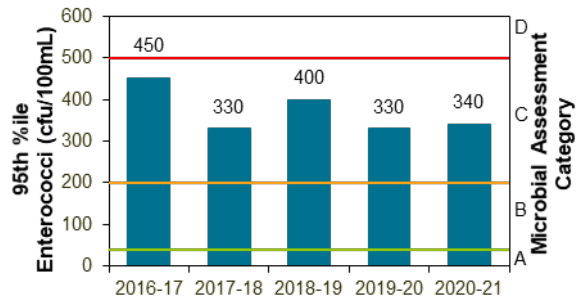
See 'How to read this report' for key to map. The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Mar 2018 to Apr 2021	79%	100	Stable <span style="color: blue; font-weight: bold;">●</span>

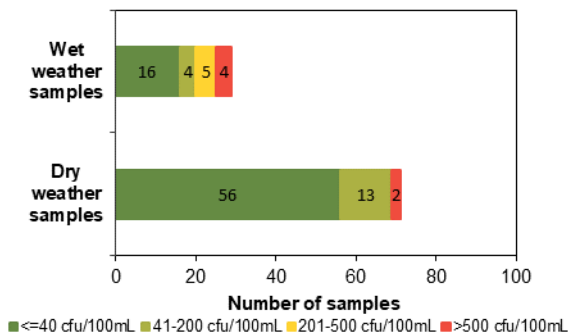
## Sanitary inspection: Moderate



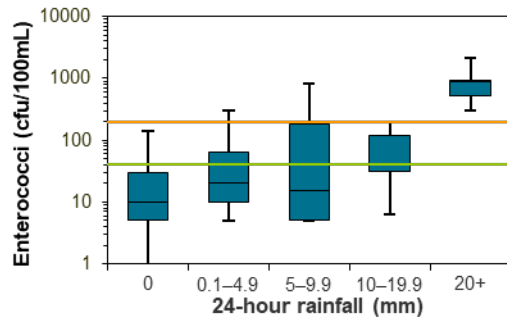
## Microbial Assessment Category: C



## 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*<sup>1</sup> 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<sup>2</sup>.

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

<sup>2</sup>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](http://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 95<sup>th</sup> 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 95<sup>th</sup> percentile<sup>1</sup>.

### Risk of illness associated with Microbial Assessment Categories

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

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

### Calculating the MAC

The 95<sup>th</sup> 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 95<sup>th</sup> 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.

<sup>1</sup>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 95<sup>th</sup> percentile that takes into account the distribution of data. This tool has been used to calculate the 95<sup>th</sup> 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

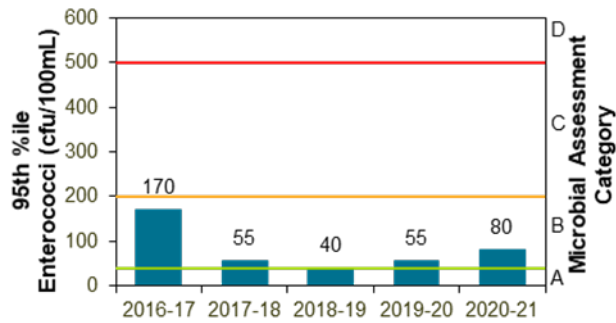
A provisional grade indicates the assessment is based on limited data collected during the assessment period and should not be compared to the beach grade from the previous year.

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

### Microbial Assessment Category (MAC) chart

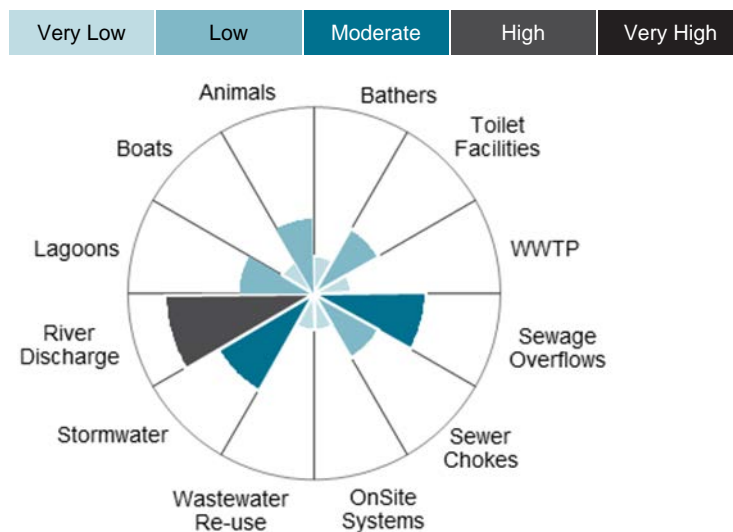
On each beach page, the MACs for the last five years are displayed on a simple bar chart. The MAC for the current year is based on enterococci data collected during the assessment period. The bars are labelled with the 95<sup>th</sup> percentile value for each year and the thresholds dividing the

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



### Sanitary Inspection Category (SIC) chart

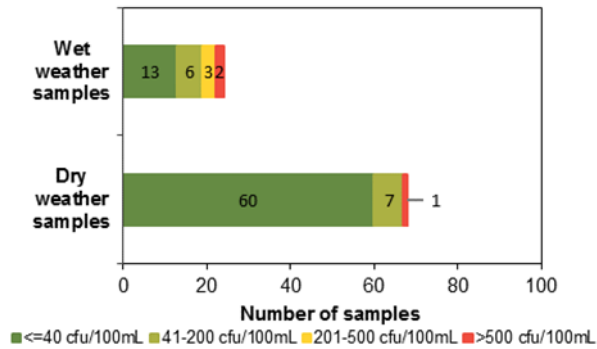
The results of the sanitary inspection for each swimming location are presented in a radar pie chart. The chart shows the likelihood that each identified pollution source will contribute to faecal contamination at a swimming site, as indicated by the size and colour of the segment, ranging from very 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

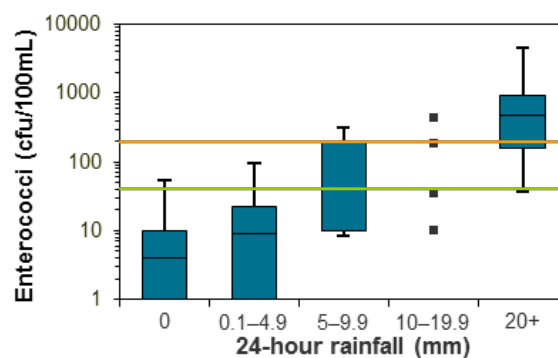
coloured on the graph as dark green, light green, amber and red respectively.



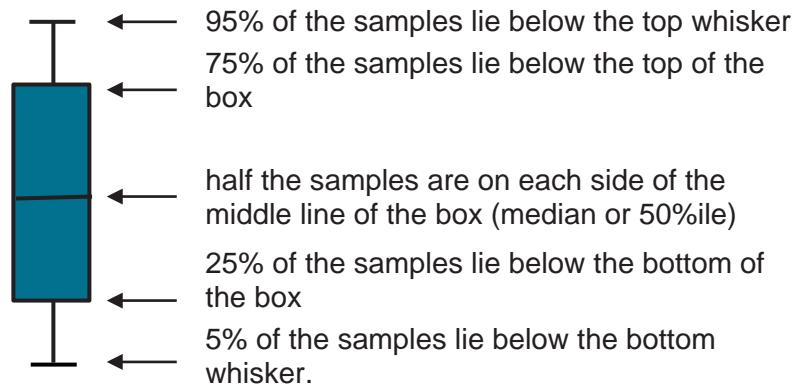
It is expected that swimming sites with lower levels of flushing will show some elevated bacterial results in dry weather samples (no rainfall in the previous 24 hours) due to the longer time needed to recover from a rainfall event. At some estuarine and lake/lagoon swimming locations the impacts of 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:



### 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.

Key to maps	
	Sampling Site
	Surf Life Saving Club
	Wastewater Treatment Plant
	Sewage Pumping Station
	Sewage Overflow
	Stormwater Drain
	Water
	Baths
	National Park/Reserve/ Other Park
	Built-up Area
	Sand
	Roads
	Major Roads
	Baths – Netted Area
	Breakwater/Wharf