Beachwatch

State of the beaches 2021–22

Central Coast Region

Department of Planning and Environment

NSW GOVERNMENT

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Environment and Heritage
Department of Planning and Environment
Locked Bag 5022, Parramatta NSW 2124
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only)
or info@environment.nsw.gov.au
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Contents

Recreational water quality has been monitored in the Central Coast region since 2002 by Central Coast Council under the Department of Planning and Environment's Beachwatch Partnership Program. This report summarises the performance of 32 swimming sites on the Central Coast of NSW, 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 4 coastal lagoons.

In 2021–2022, 53% of swimming sites in the Central Coast region were graded as Very Good or Good, including 13 ocean beaches and 3 ocean baths. These sites were suitable for swimming for most or almost all of the time. While this is a slight decline in overall performance from the previous year, it 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 2021–2022

MacMasters Beach
Photo: Beachwatch/DPE

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 NSW 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 (2–4 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.

Rainfall impacts

During 2021–2022, 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 4 coastal lagoons.

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 2021–2022 are based on water quality data collected over the last 2–4 years. Rainfall over this period has been diverse:

- 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
- 2021–2022: varied rainfall, with extreme wet weather conditions over summer and early autumn, and flooding impacts.

See the section on **How to read this report** on page 51 for an explanation of the graphs, tables and Beach Suitability Grades.

Winter rainfall totals on the Central Coast were average to below average in 2021 and continuing through to October 2021.

Above average rainfall was recorded in November 2021, with several heavy rain events occurring mid and late in the month. More than double the long-term monthly average rainfall was recorded at Norah Head and Avoca in November 2021, with 208 mm and 203 mm respectively.

Summer rainfall totals on the Central Coast were above average, largely due to a very wet February. December rainfall was above average at Norah Head and Avoca due to several heavy rain events. Notably, Avoca Beach recorded a daily rainfall total of 92 mm on 10 December. January rainfall totals were close to the long-term monthly average.

Average to well above average rainfall was experienced from February to April 2022 in the region, with several significant wet weather events at the start and end of February and March. March 2022 was extremely wet, with more than 3 times the long-term monthly average rainfall recorded at Avoca Beach with 562 mm, and more than 2 and half times the long-term monthly average at Norah Head with 355 mm.

Consecutive days of heavy rainfall in early and late March resulted in major flooding of coastal waterways. Beachwatch issued an extreme wet weather pollution alert on the Central Coast daily beach pollution forecast during March 2022, advising stormwater pollution may be impacting swimming sites for an extended period, with lifeguard reports of floating debris and discoloured water continuing after the rain had ceased.

Flood debris washed up on Umina Beach in March 2022
Photo: Beachwatch/DPE

A heavy rainfall event was recorded on 7–8 April, with Swansea receiving a record high daily rainfall total for April of 110 mm, and Avoca Beach recording 112 mm on 8 April. Beachwatch issued an extreme wet weather pollution alert until the stormwater impacts from the wet weather subsided.

Flooding and water quality

Monitoring by Central Coast Council showed flooding events impacted swimming sites beyond the flood zones, making microbial water quality unsuitable for swimming. The most affected areas were in estuaries, lakes and lagoons, which

have a lower level of flushing and took longer to recover from the floodwater events than the ocean beaches.

In 2022, major flooding events on the Hawkesbury River resulted in floodwaters impacting water quality at ocean beaches at the southern end of the Central Coast.

While microbial levels returned to normal at many swimming sites, there was still a large amount of debris or other hazards, such as murky water, which posed a risk to recreational activities.

Marine algal blooms

Marine algal bloom present in the water

Photo: Chad Weston/NPWS, DPE

Water NSW reported the occurrence of marine algal blooms, *Noctiluca scintillans*, in November 2021 that may have impacted beaches in the Central Coast region. Marine algae advisories were issued on the Beachwatch and Water NSW websites.

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
Central Coast Council			
Lakes Beach	Ocean beach	G	
Cabbage Tree Bay Rockpool	Ocean baths	G	
Soldiers Beach	Ocean beach	G	
North Entrance Beach	Ocean beach	VG	↑
The Entrance Beach	Ocean beach	G	
The Entrance Ocean Baths	Ocean baths	G	
Toowoon Bay	Ocean beach	P	↓
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
Central Coast Council (continued)			
Ocean Beach	Ocean beach	G	
Umina Beach	Ocean beach	G	
Pearl Beach Rockpool	Ocean baths	G	
Davistown Baths	Estuarine	P	
Pretty Beach Baths	Estuarine	P	
Woy Woy Baths	Estuarine	P	
Yattalunga Baths	Estuarine	P	

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

Central Coast Council

Overall results

87%
ocean beaches graded Good or Very Good

Seventeen of the 32 swimming sites were graded as Very Good or Good in 2021–2022, 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

	2019–2020	2020–2021	2021–2022	Trend
Ocean beaches (15 sites)	100%	93%	**87%**	
Estuarine sites (4 sites)	0%	0%	**0%**	
Lake/ lagoon sites (10 sites)	10%	10%	**10%**	
Ocean baths (3 sites)	100%	100%	**100%**	

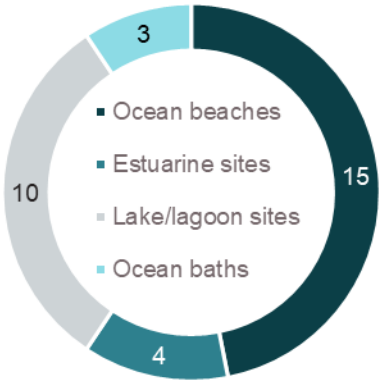
Thirty-two swimming sites were monitored by Central Coast Council. All sampling and laboratory analysis was conducted and fully funded by the council. All sites are sampled weekly between October and April and monthly from May to September.

See the section on **How to read this report** on page 51 for an explanation of the graphs, tables and Beach Suitability Grades.

Best beaches

North Entrance Beach

This site had excellent water quality and was suitable for swimming almost all 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 3 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

North Entrance Beach was graded as Very Good in 2021–2022, improving from Good in the previous year. Water quality at this site was suitable for swimming almost all of the time.

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

Two ocean beaches were graded as Poor in 2021–2022: Toowoon Bay and Terrigal Beach. Toowoon Bay was downgraded from Good in the previous year and Terrigal Beach continued to be graded Poor. Water quality at these sites was mostly suitable for swimming in dry weather conditions, however, elevated enterococci levels were occasionally recorded following little or no rain, and often after light rain.

The microbial water quality at Toowoon Bay and Terrigal Beach remains close to the threshold between Good and Poor, and these sites have fluctuated between Good and Poor for many years. The decline in water quality reflects a slightly higher proportion of samples collected at these sites during wet weather conditions compared to the 2020–2021 assessment period.

During 2019–2020 Central Coast Council, the then Department of Planning, Industry and Environment and the University of Technology Sydney (UTS) 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.

Estuarine beaches

Beach Suitability Grades for Central Coast estuarine beaches

Four estuarine swimming sites in Brisbane Water continued to be graded as Poor in 2021–2022: 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 80% 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 increased in response to increasing rain.

Microbial water quality at Davistown Baths, Pretty Beach Baths and Woy Woy Baths was often elevated during dry weather conditions. At these sites, the bacterial levels continued to increase significantly in response to increasing rainfall, with bacterial levels regularly exceeding the safe swimming limit after light to moderate rain.

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 3 days following rainfall or if there are any signs of stormwater such as discoloured water or floating debris.

Lake/lagoon swimming sites

Beach Suitability Grades for Central Coast lake/lagoon swimming sites

Summerland Point Baths was graded as Good, a similar result to previous years. 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 continued to be graded as Poor, a similar result to the previous years.

Microbial water quality at Gwandalan, Chain Valley Bay, Mannering Park Baths and Lake Munmorah Baths was often suitable for swimming during dry weather conditions, with between 58% and 69% 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 Canton Beach was not always suitable for swimming during dry weather conditions, with 44% of samples within the safe swimming limit when there had been no rain in the previous 24 hours. Enterococci levels continued to increase 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 3 days after rainfall.

The 4 lagoons continued to be graded Poor in 2021–2022: Wamberal Lagoon, Terrigal Lagoon, Avoca Lagoon and Cockrone Lagoon. This result is consistent with previous years.

Microbial water quality at these sites was often elevated in dry weather conditions, and regularly exceeded the safe swimming limit following light rainfall. While microbial water quality increased significantly with increasing rainfall at all 4 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 3 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 then Department of Planning, Industry and Environment and UTS investigated the scale and extent of elevated bacterial levels at the 4 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 continued to be graded as Good in 2021–2022. 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 and Pearl Beach Rockpool were frequently suitable for swimming during dry weather conditions, with 98% and 97% of dry weather samples within the safe swimming limit, respectively. Elevated enterococci were recorded following heavy rain.

Cabbage Tree Bay Rockpool was often suitable for swimming after little or no rain, with elevated levels of enterococci often recorded following moderate to 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

In 2019, the NSW Government committed $500,000 to address poor water quality at Terrigal Beach and surrounding lagoons. Studies by the then Department of Planning, Industry and Environment, in collaboration with Central Coast Council and UTS 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 the Tuggerah Lakes Expert Panel to determine the best way to improve water quality in Tuggerah Lakes. The independent 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. This advice 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

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.

Central Coast Council is responsible for preparing CMPs and the implementing of existing Coastal Zone Management Plans (CZMPs) for its estuary and coastline areas. Council continues to implement 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 also manages a significant area of coastal wetland and undertakes bush regeneration work to protect and restore these important catchment features.

Council is developing a number of CMPs for its estuary and coastline areas, which are expected to be completed in 2022–2023. The Tuggerah Lakes CMP will focus on estuary health, climate risks and entrance management. This CMP will consider and incorporate the Expert Panel's knowledge and recommendations, as appropriate.

Council is also preparing a CMP for its open coast beaches and coastal lagoons. This CMP will focus on coastal hazard risks, water quality health, entrance management and community and recreational needs.

Council is partnering with several Greater Sydney based councils to prepare a Hawkesbury River Estuary CMP. This regional scale CMP will cover Broken Bay, Brisbane Water and the Lower Hawkesbury River.

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 3 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. An interchangeable sign has also been erected at Terrigal Beach, which informs the public of when Terrigal lagoon has been opened manually

and that this could have an impact on the water quality of the beach.

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, the Department of Planning and Environment (DPE) and UTS are driving these audit projects towards detecting and resolving water quality issues at these locations.

Cockrone Lagoon
Photo: Beachwatch/DPE

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, Toowoon Bay and Canton Beach. It is planned to carry out further investigation in future audit programs. Council has also continued to partner with UTS and University of Newcastle (UON) to undertake microbial source tracking across the Central Coast.

Central Coast Council has invested approximately $53 million in sewerage infrastructure over the current Independent Pricing and Regulatory Tribunal (IPART) Determination period, which commenced 1 July 2019. Council has a further $14 million in works underway to conclude by 30 June 2022. Planned and completed sewerage works improve the performance, reliability and capacity of the sewerage reticulation network and treatment systems, reducing environmental incidents throughout the Central Coast local government area.

Works completed recently include:

- upgrades and renewals to the sewer system and sewer pump stations in the catchments of Tuggerawong, Canton Beach, Gorokan and Noraville. These works protect the community and environment against overflows and odours, improve reliability and eliminate service deficiencies
- sewer main relining has been undertaken progressively in coastal lagoon catchments, Brisbane Water, Tuggerah

Soldiers Beach
Photo: Beachwatch/DPE

Lakes, Budgewoi Lake, Lake Munmorah and southern Lake Macquarie catchments, to reduce sewerage overflows through damage prevention intervention in the sewer network.

Major works currently underway include:

- upgrades and renewals to sewage pumping stations at Gwandalan, Ettalong Beach, Green Point, Wagstaffe, Koolewong, Daleys Point, Tacoma, Umina Beach. This will improve reliability, process control and address any existing deficiencies
- continuing CCTV inspections of the sewer network to monitor its condition and identify areas requiring maintenance. Between September 2018 and May 2021, 202 km 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, Charmhaven, Budgewoi, Lake Haven, Buff Point, Gorokan, Hamlyn Terrace, Gosford Blue Haven, Summerland Point and Gwandalan, Bateau Bay, Forresters Beach, Wamberal, Terrigal, North Avoca, Avoca Beach, Erina, Springfield, Green Point, Kincumber, Macmasters Beach, Copacabana, Koolewong, Saratoga, Davistown, Woy Woy, Ettalong
- rehabilitation of sewer mains based on the condition assessments from the CCTV inspection program. A total of 72 km of sewer gravity mains have been relined to date, overcoming issues and other sewer network performance deficiencies
- council has implemented an upgrade program on the control panels for sewer pump stations to improve visibility and diagnosis of potential issues in the network.

Council's sewage capital works program for the upcoming IPART Determination period 2022–2023 to 2025–2026 will see council invest $184 million for further upgrades and renewals to sewerage infrastructure, including:

- upgrades to various sewage treatment plants, pumping stations and rising mains at Bateau Bay, Charmhaven, Forresters Beach, Gwandalan, Kincumber, South Tacoma, Woy Woy and Wyong, to improve reliability, increase the capacity of the sewer system and address deficiencies at ocean outfalls.
- ongoing sewer main relining across the Central Coast region
- major improvements, replacements and upgrades to vacuum sewerage schemes at St Huberts Island and Davistown to improve reliability, increase capacity and prevent overflows entering nearby waterways

- major capacity upgrades to service future growth in Gosford CBD and Warnervale Town Centre, which is funded by the NSW Government through the Housing Acceleration Fund.

With funding from the Australian Government's Environmental Restoration Fund, 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:

Woy Woy Baths
Photo: Beachwatch/DPE

- foreshore, streambank, saltmarsh and wetland rehabilitation
- development of educational programs and initiatives, materials and resources to promote positive local community engagement
- hydrological studies
- a foreshore drainage audit
- construction of new gross pollutant traps
- assessment of existing stormwater treatment devices for their effectiveness
- upgrades to existing stormwater treatment infrastructure.

Funding has supported local environmental volunteer programs around the catchment and foreshores, contributing to restoration and protection of the Tuggerah Lakes natural environment. Collaborative partnerships with local universities, Darkinjung Local Aboriginal Land Council and Local Land Services are facilitating better outcomes and 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 currently under development.

Council continues to install new gross pollutant traps and upgrade existing infrastructure to improve stormwater quality. Council now maintains over 434 stormwater quality improvement devices that include gross pollutant traps and constructed wetlands. As a result, over 564 tonnes of sediment and pollutants were prevented from entering wetlands, creeks, rivers, lakes, lagoons and the ocean from July 2021 to April 2022.

Council's wrack and algal collection program saw more than 7,000 m^3 of wrack (dead and free-floating seagrass) and algae removed from the Tuggerah Lakes estuary from July 2021 to April 2022, leading to improvements in the water quality of the nearshore zone.

This year council has also had to remove significant amounts of flood debris from ocean and river beaches that were deposited after the flood events of early 2022. In total 1,367 tonnes of flood debris were removed from beaches and taken to landfill, most coming from the southern beaches of Patonga, Ocean Beach, Umina and Killcare.

Toowoon Bay
Photo: Beachwatch/DPE

Council delivered an extensive program of environmental communication and education. These initiatives were designed to encourage positive behaviour change amongst residents to improve water quality across the Central Coast's waterways. Activities included regular social media posts, short film screenings, waterway tours, webinars, stalls at events, letters to residents, interpretive signage, booklets and a 'changemaker' course. These projects were delivered by council staff, often in partnership with other organisations such as Waterwatch and the NSW National Parks and Wildlife Service.

Council has boosted infrastructure and education as part of its Responsible Pet Ownership program. This has seen a change to signage specifying where dogs are allowed and advice on responsible disposal of pet waste. Pop-up education stalls were also held at a number of sites that emphasised this message and gave away dog poo bags to pet owners attending. Beaches, lakes and lagoons were a focus for the new signage and education endeavours.

Council also continued programs such as 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 incorporated not for profit 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. Funding of $300,000 for this project has been provided by the Australian Government via the Environmental Restoration Fund, and council provides the management, guidance and compliance for this grant to support the program. The Clean4Shore program has retrieved 37.9 tonnes of litter from the waterways on the Central Coast from July 2021 to April 2022.

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

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

Lakes Beach is at the southern end of an 8 km stretch of beach. The beach is patrolled during summer.

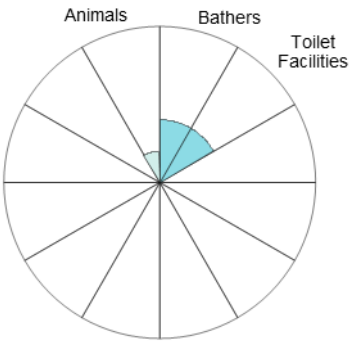
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

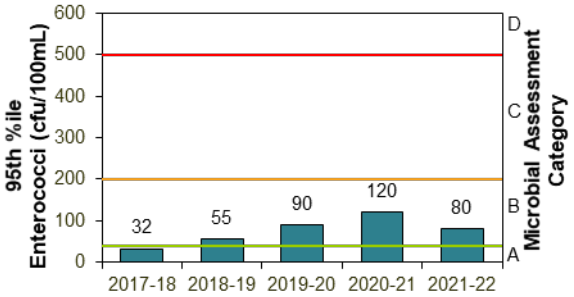
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	96%	100	Stable

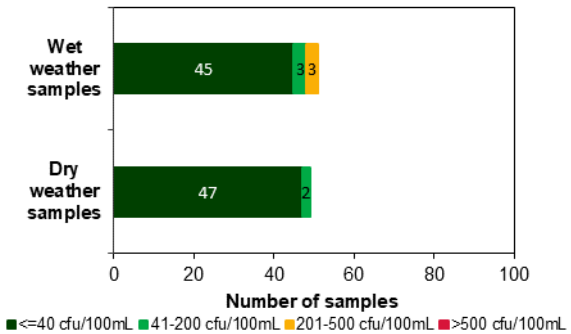
Sanitary inspection: Low



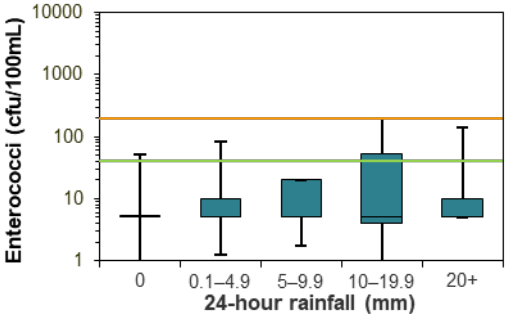
Microbial Assessment Category: B



Dry and wet weather water quality

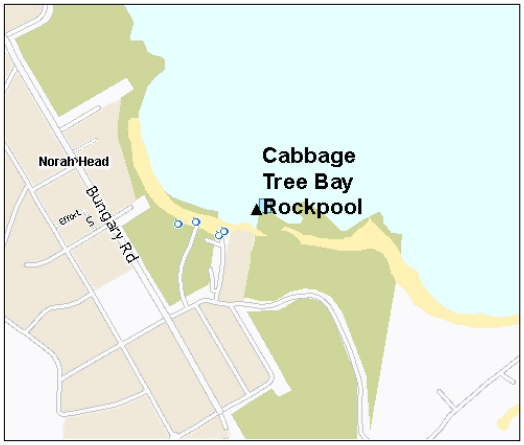


Water quality in response to rainfall



Cabbage Tree Bay Rockpool

Beach grade: G



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

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

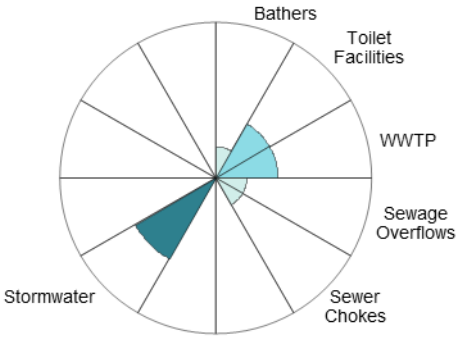
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

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

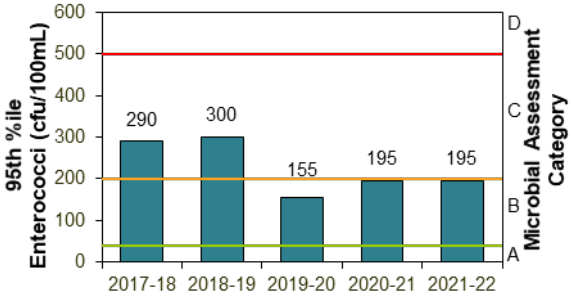
The site was monitored from 2002 until 2005, and since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Jan 2019 to Apr 2022	88%	100	Stable

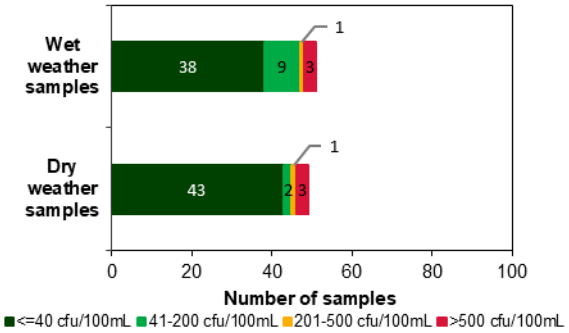
Sanitary inspection: Moderate



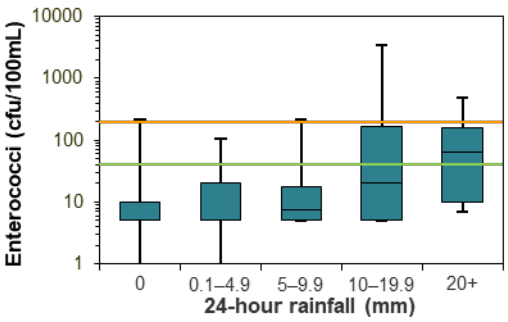
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Soldiers Beach

Beach grade: G

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

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

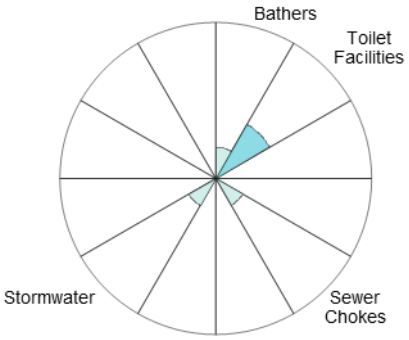
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

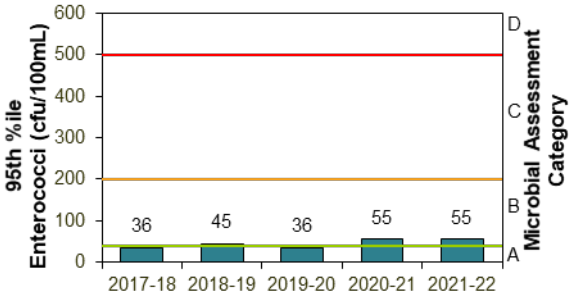
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	96%	100	Stable

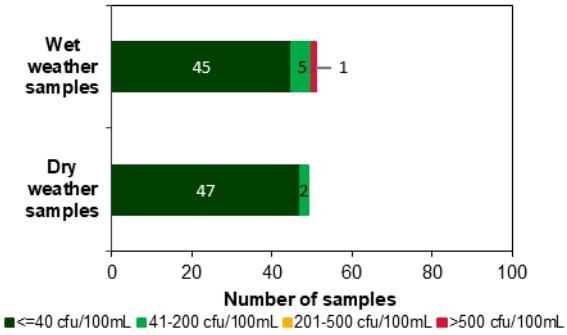
Sanitary inspection: Low



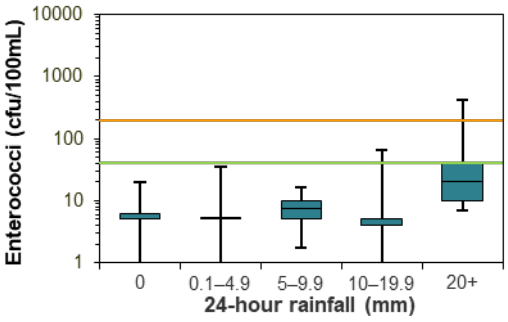
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



North Entrance Beach

Beach grade: VG

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

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

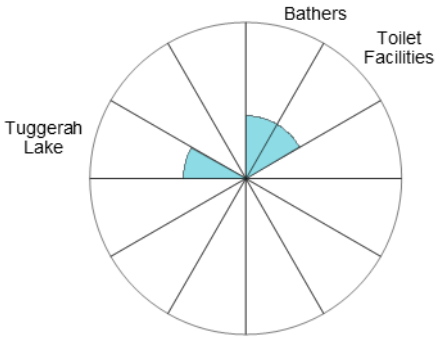
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

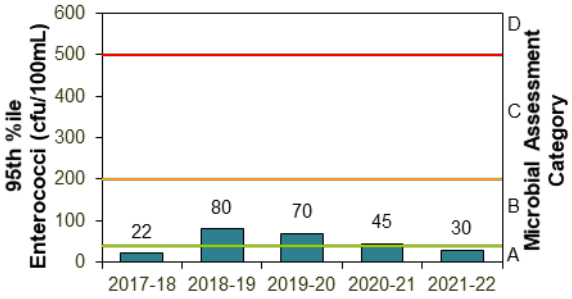
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	95%	100	Improved ↑

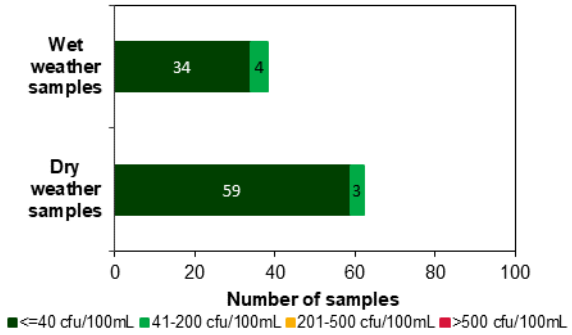
Sanitary inspection: Low



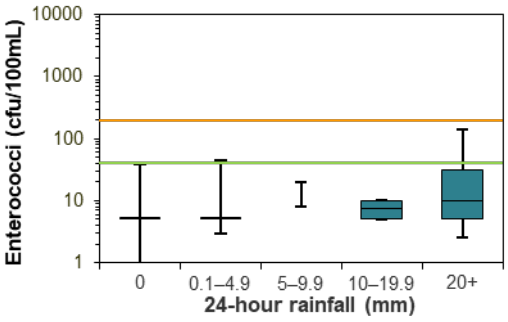
Microbial Assessment Category: A



Dry and wet weather water quality

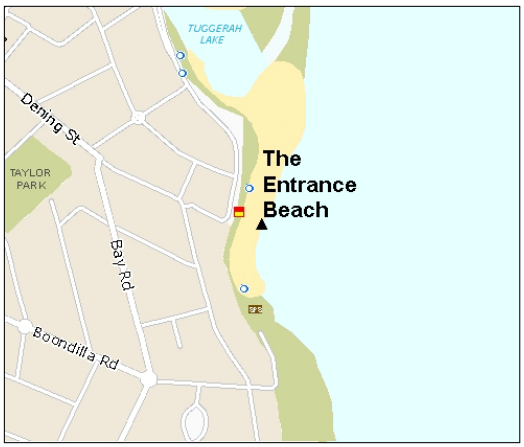


Water quality in response to rainfall



The Entrance Beach

Beach grade: G



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

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

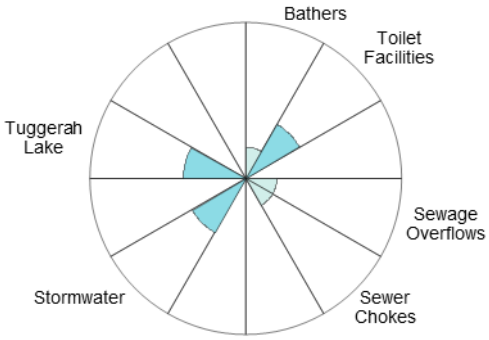
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

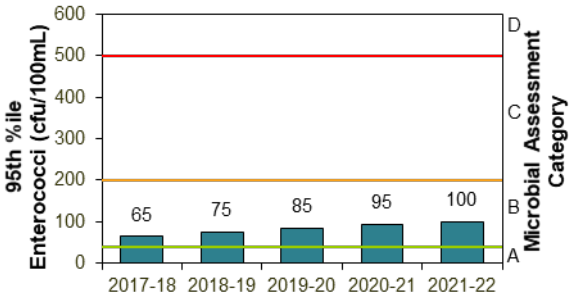
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	92%	100	Stable

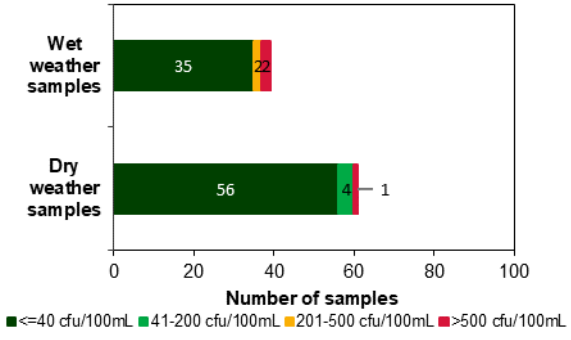
Sanitary inspection: Low



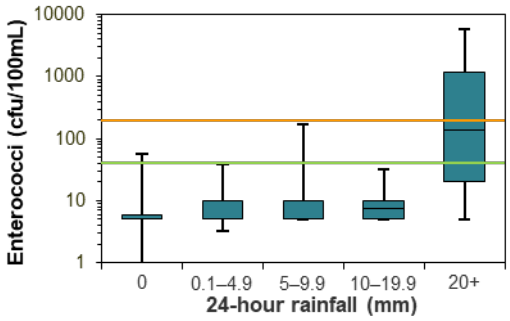
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



The Entrance Ocean Baths

Beach grade: G

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

The Entrance Ocean Baths include a 50 m concrete pool and 2 smaller wading pools located at the southern end of The Entrance Beach, and are patrolled over summer.

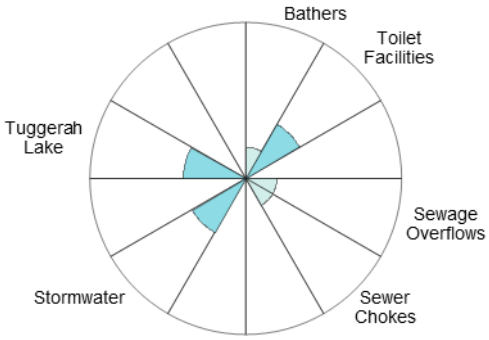
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but can be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit after 10 mm or more of rain, and often after 20 mm or more.

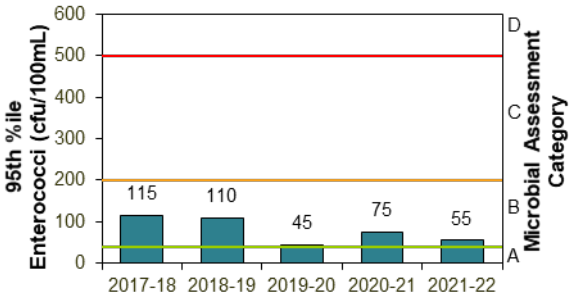
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Oct 2018 to Mar 2022	98%	100	Stable

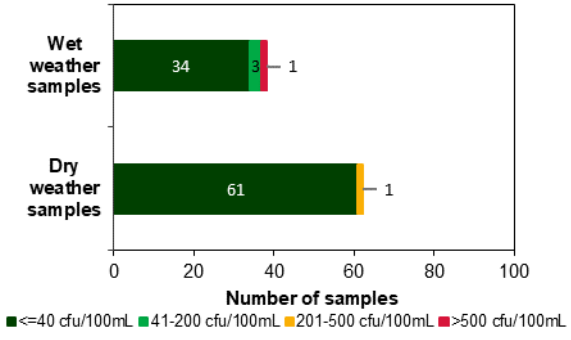
Sanitary inspection: Low



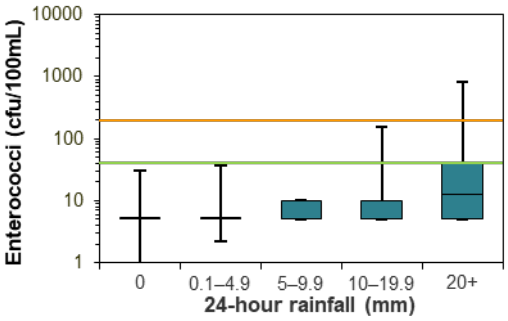
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Toowoon Bay

Beach grade: P

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

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

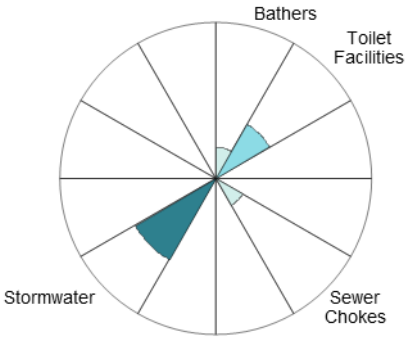
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with potential faecal contamination from stormwater.

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

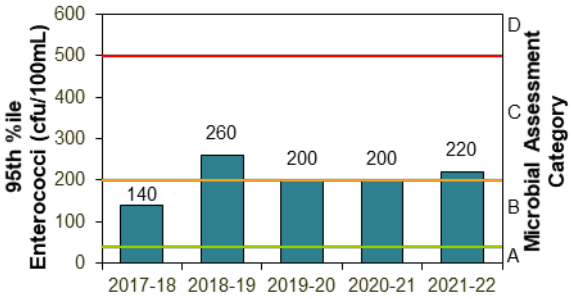
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	80%	100	Declined ↓

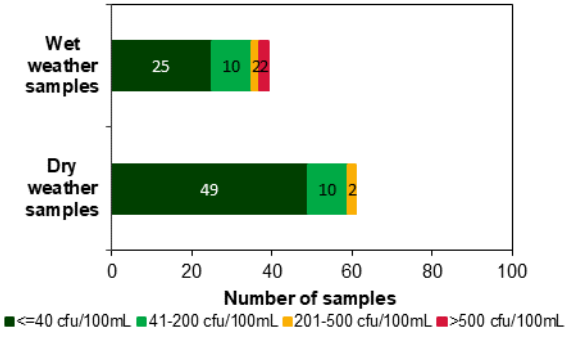
Sanitary inspection: Moderate



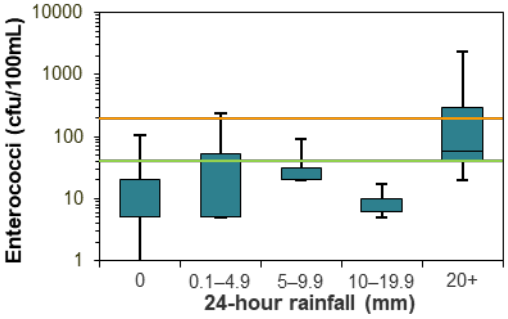
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Shelly Beach

Beach grade: G

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

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

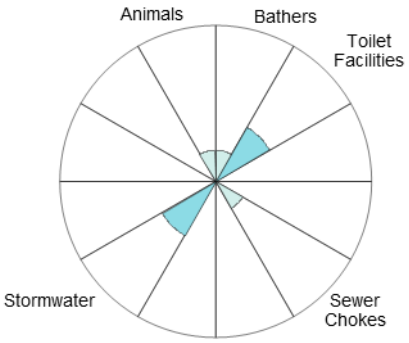
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

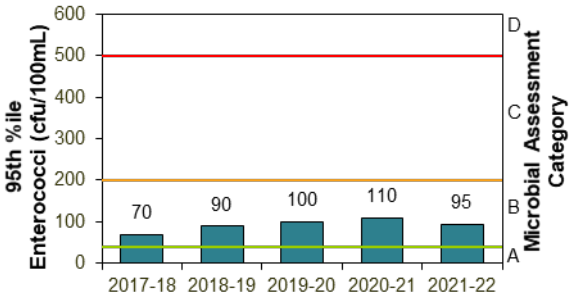
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	93%	100	Stable

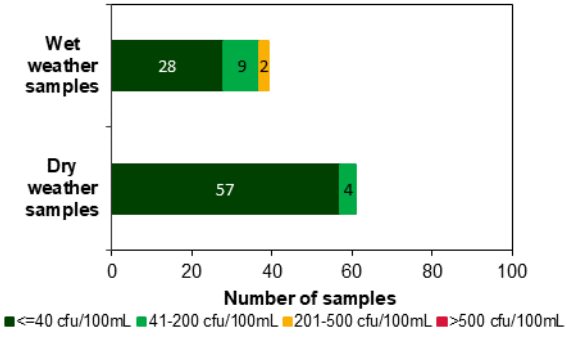
Sanitary inspection: Low



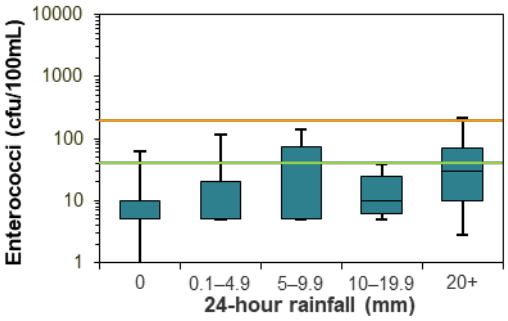
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Gwandalan

Beach grade: P

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

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

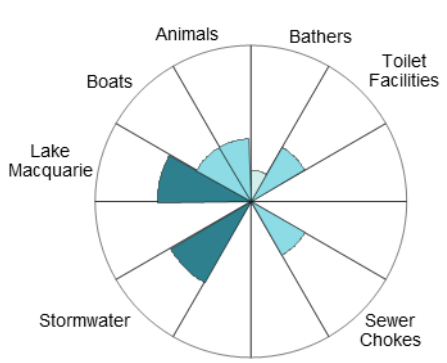
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and sources from elsewhere within the lake.

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

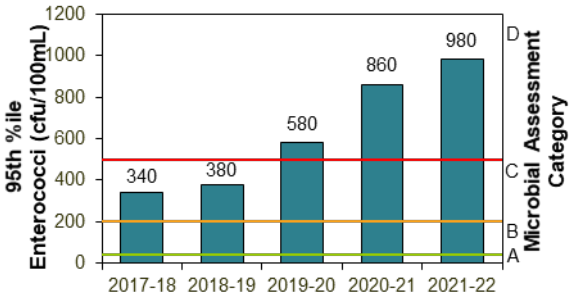
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2019 to Ap 2022	60%	100	Stable ◯

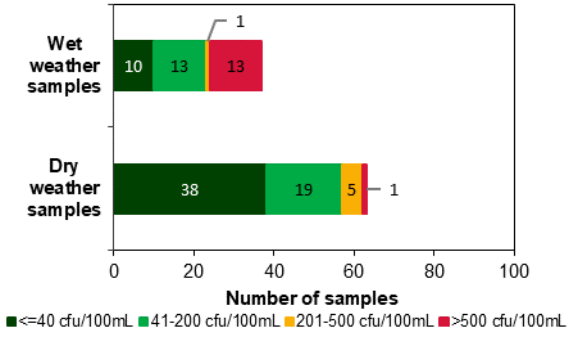
Sanitary inspection: Moderate



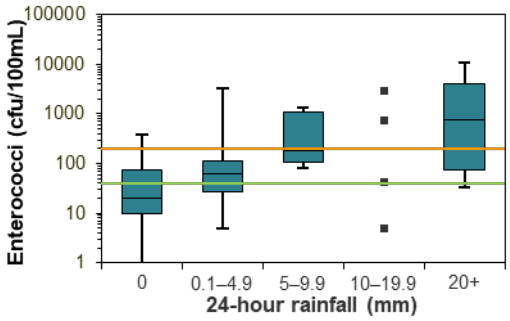
Microbial Assessment Category: D



Dry and wet weather water quality

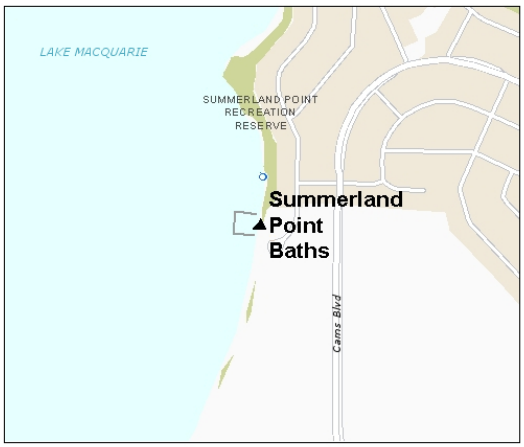


Water quality in response to rainfall



Summerland Point Baths

Beach grade: G



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

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

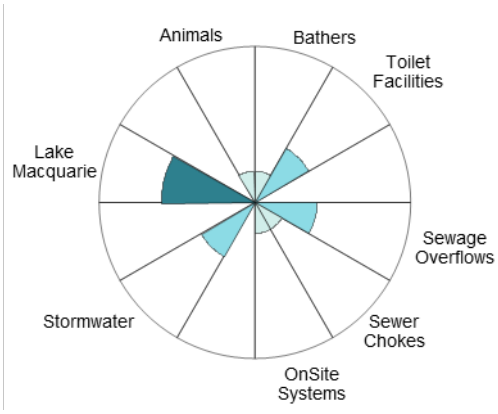
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including sources from elsewhere within the lake.

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.

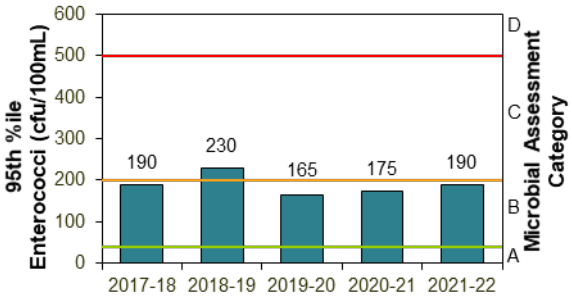
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2019 to Apr 2022	85%	100	Stable

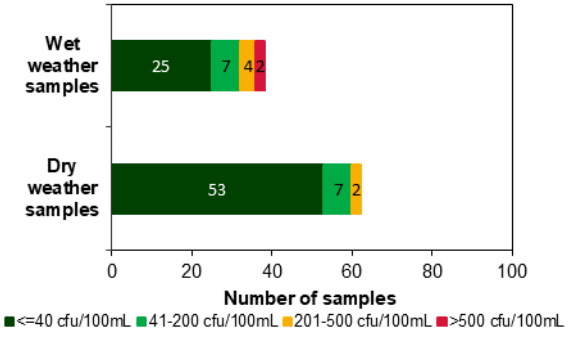
Sanitary inspection: Moderate



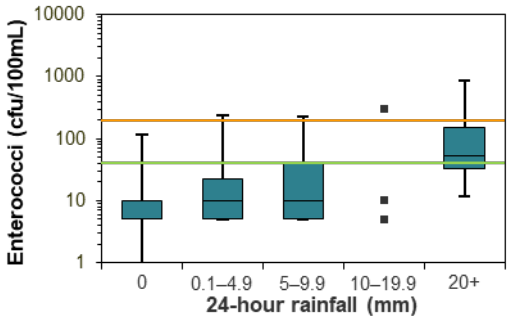
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Chain Valley Bay

Beach grade: P

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

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

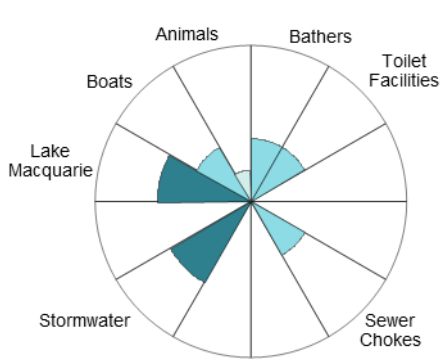
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions from several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

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

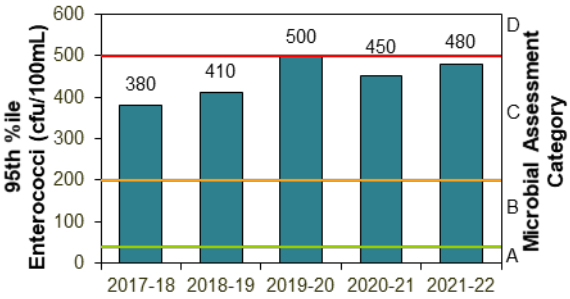
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2019 to Apr 2022	69%	100	Stable

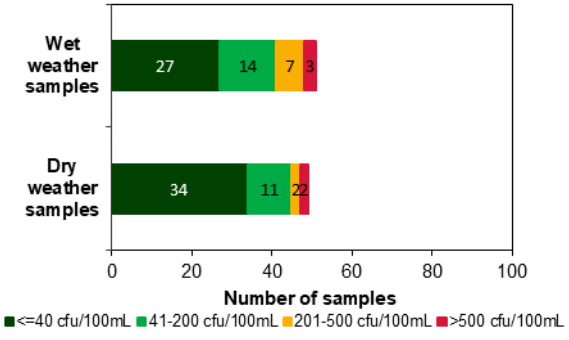
Sanitary inspection: Moderate



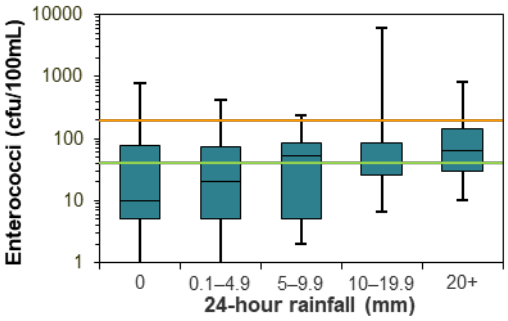
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Mannering Park Baths

Beach grade: P

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

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

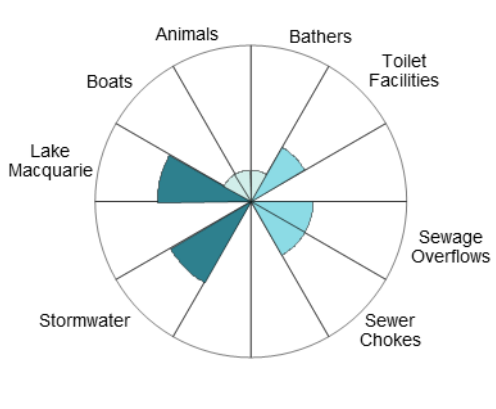
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

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

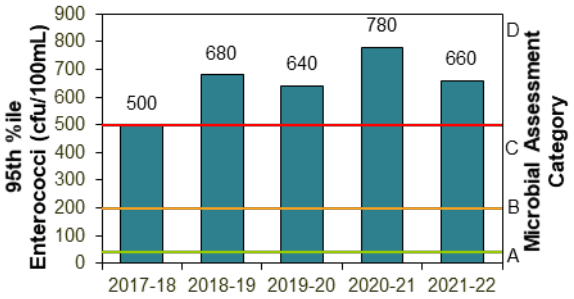
The site has been monitored since 2017.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2019 to Apr 2022	58%	100	Stable

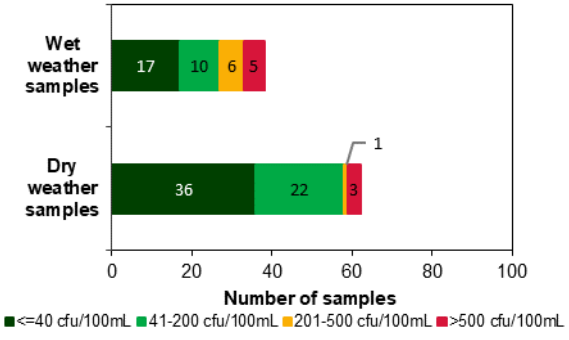
Sanitary inspection: Moderate



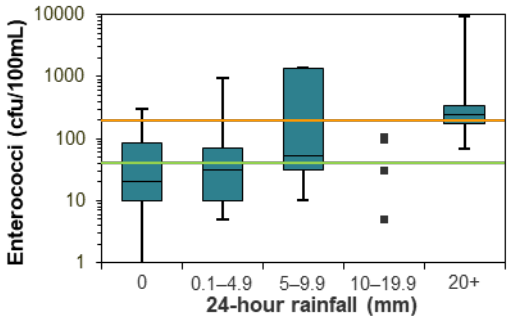
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Lake Munmorah Baths

Beach grade: P

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

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

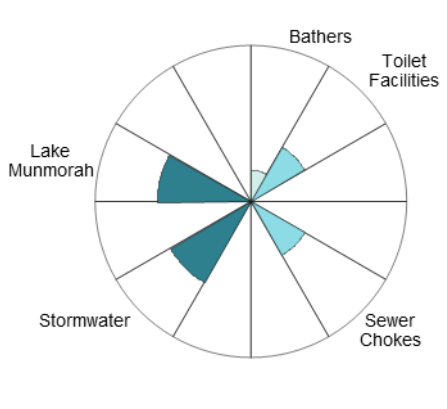
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

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

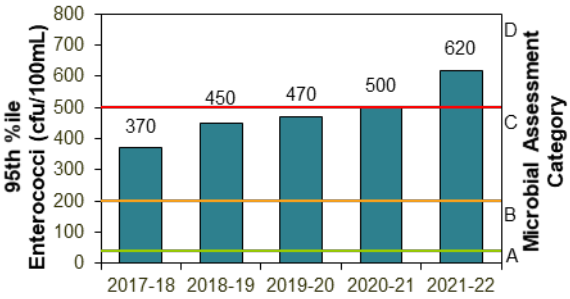
The site has been monitored since 2010.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Jan 2019 to Apr 2022	65%	100	Stable

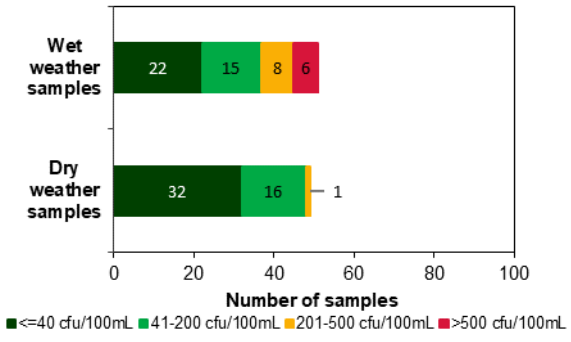
Sanitary inspection: Moderate



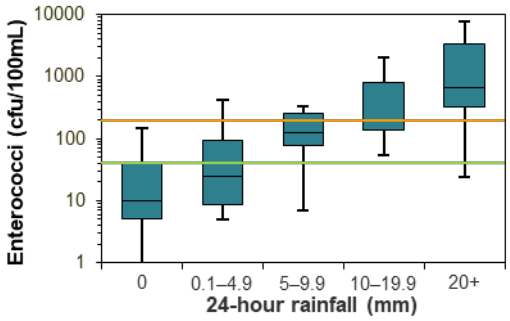
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Canton Beach

Beach grade: P

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

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

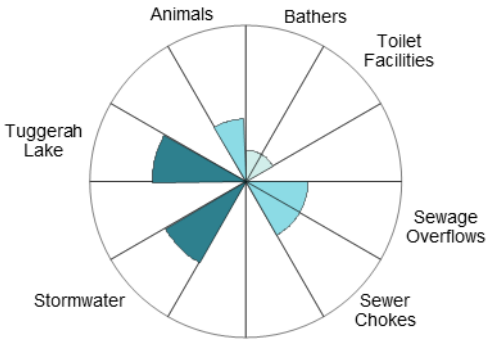
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within the lake.

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

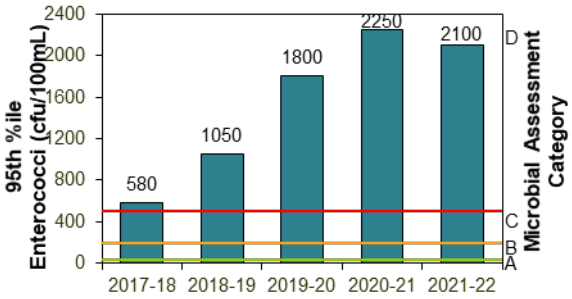
The site has been monitored since 2002.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lake/Lagoon	Feb 2019 to Apr 2022	44%	100	Stable

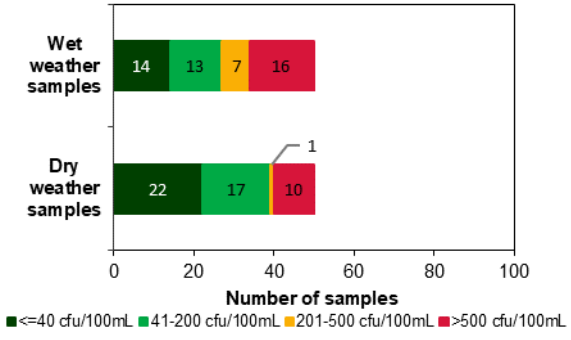
Sanitary inspection: Moderate



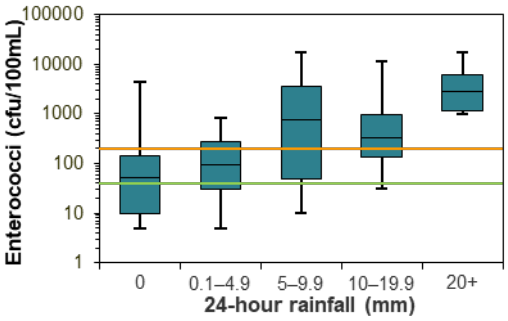
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Wamberal Beach

Beach grade: G

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

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

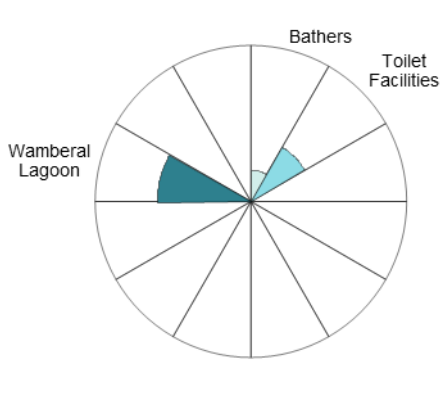
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with potential sources of faecal contamination including discharge from Wamberal Lagoon.

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

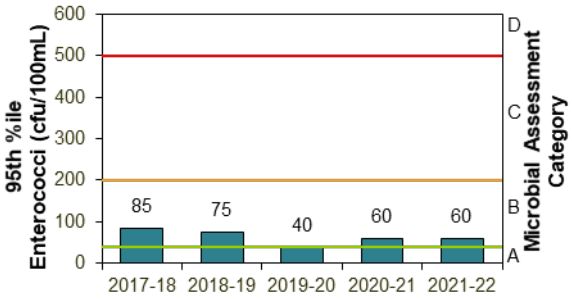
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	94%	100	Stable

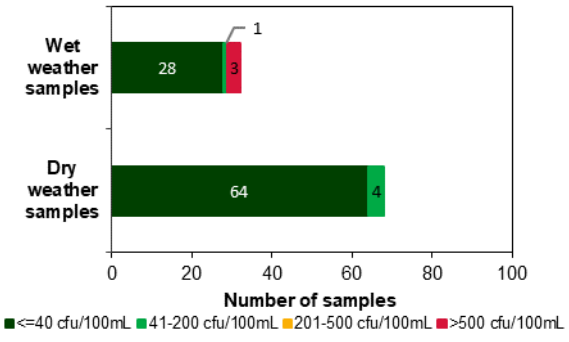
Sanitary inspection: Moderate



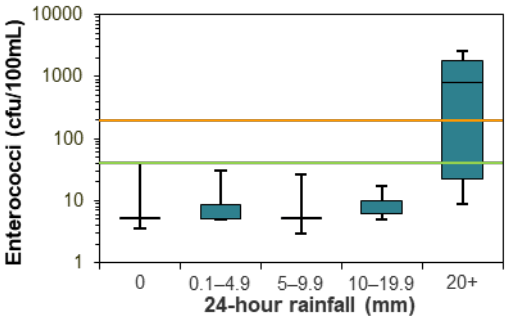
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Wamberal Lagoon

Beach grade: P

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

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

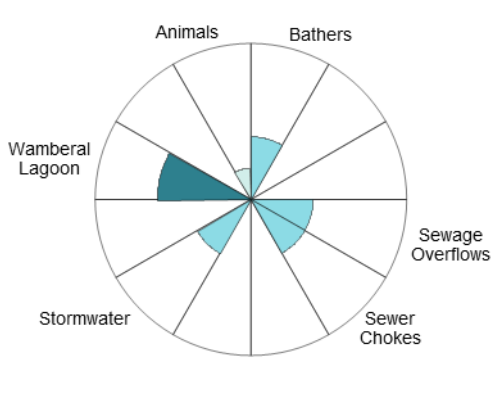
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including from elsewhere within the lagoon.

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

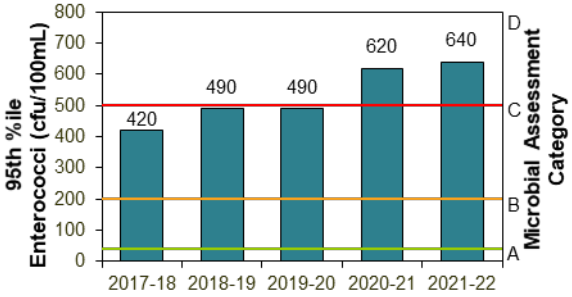
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Feb 2019 to Apr 2022	64%	100	Stable

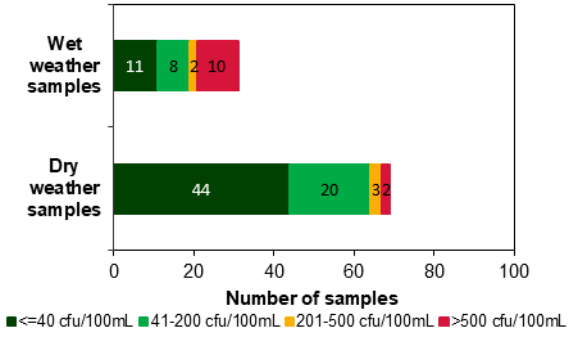
Sanitary inspection: Moderate



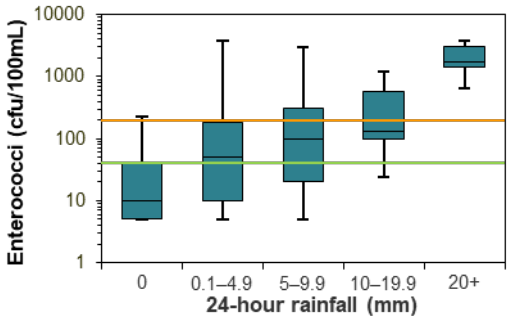
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Terrigal Beach

Beach grade: P

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

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

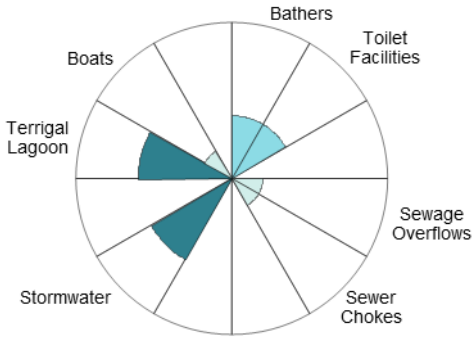
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including Terrigal Lagoon.

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

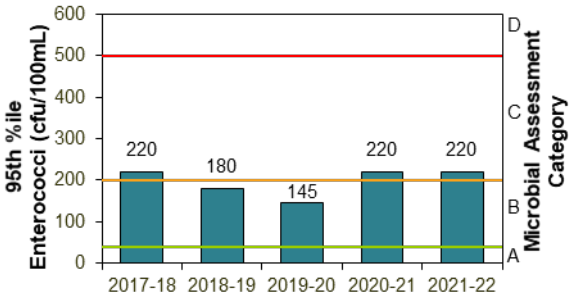
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	86%	100	Stable

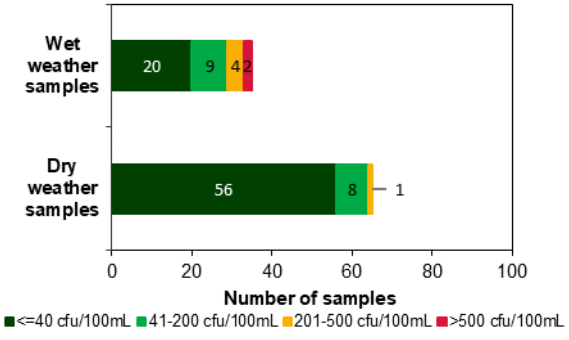
Sanitary inspection: Moderate



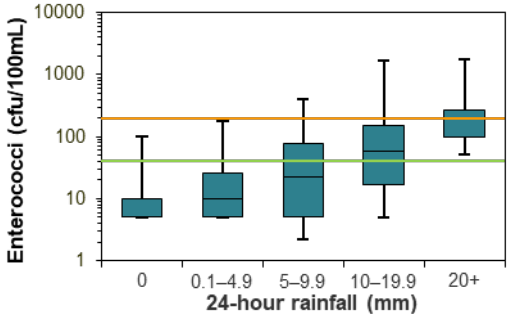
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Terrigal Lagoon

Beach grade: P

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

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

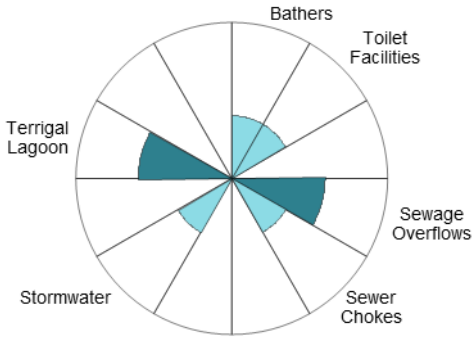
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from elsewhere within the lagoon.

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

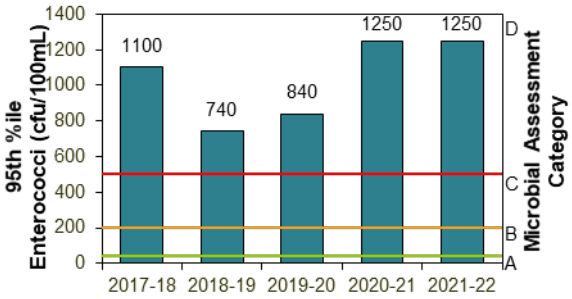
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2019 to Apr 2022	57%	100	Stable

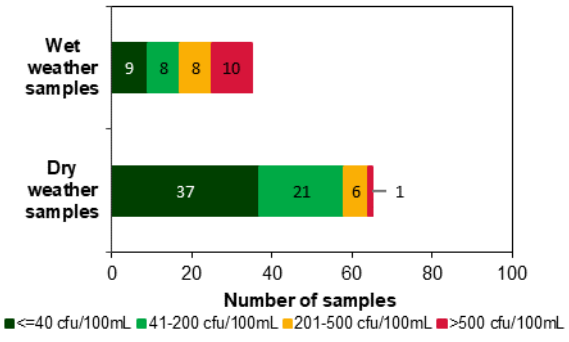
Sanitary inspection: Moderate



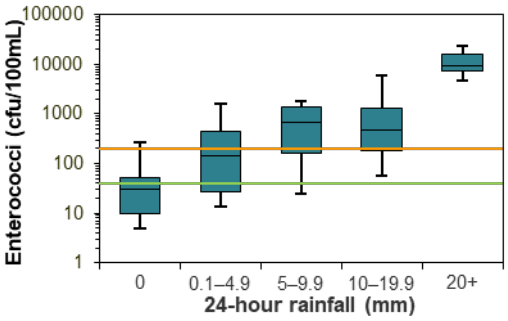
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



North Avoca Beach

Beach grade: G

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

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

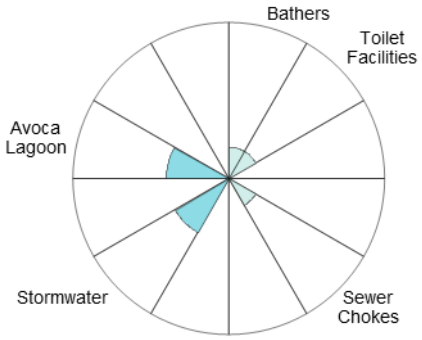
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

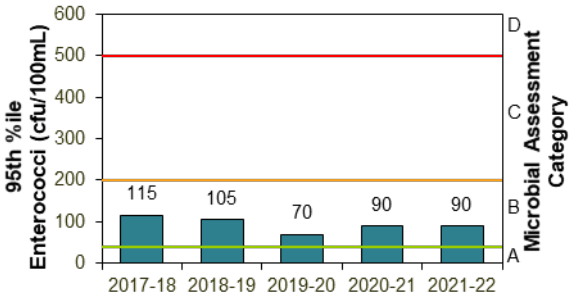
The site has been monitored since 2007.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	96%	100	Stable

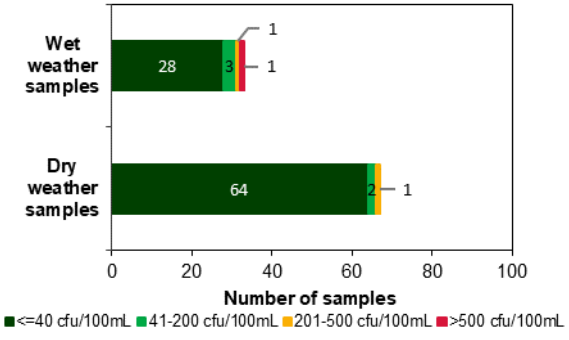
Sanitary inspection: Low



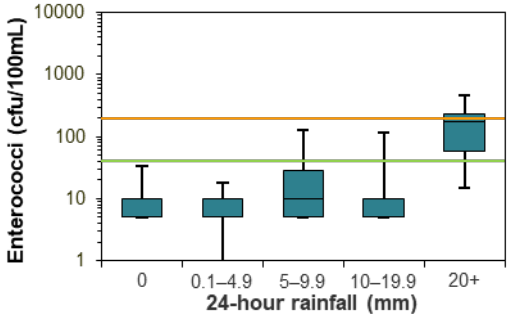
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Avoca Beach

Beach grade: G

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

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

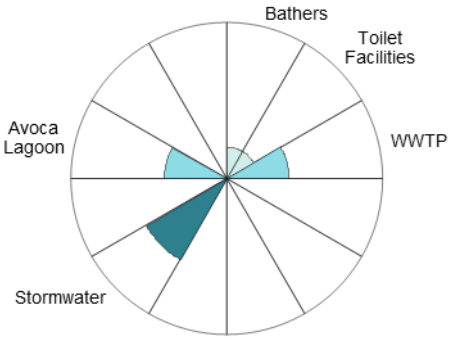
The Beach Suitability Grade of Good indicates microbial water quality is suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

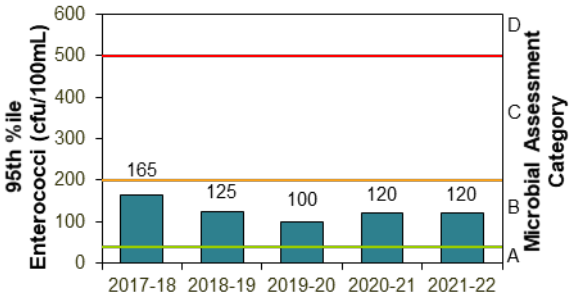
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	99%	100	Stable

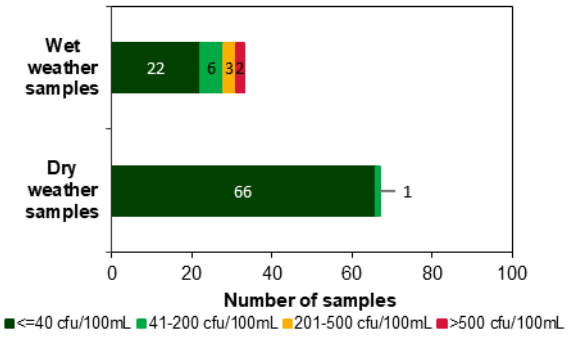
Sanitary inspection: Moderate



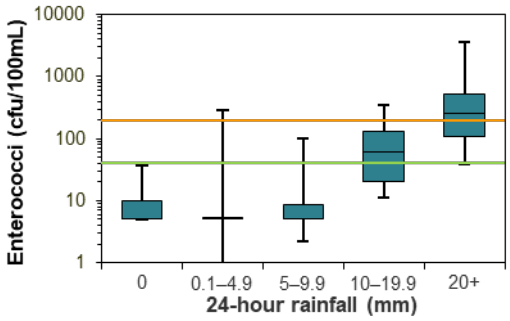
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Avoca Lagoon

Beach grade: P

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

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

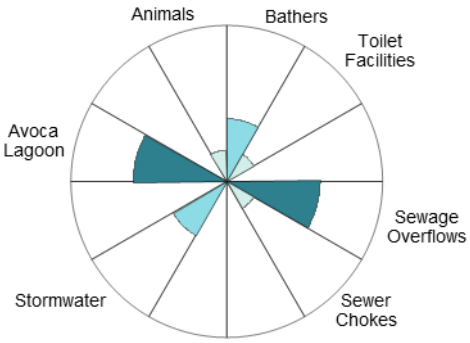
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and often during dry weather conditions, with several potential sources of faecal contamination including sewage overflows and from elsewhere within the lagoon.

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

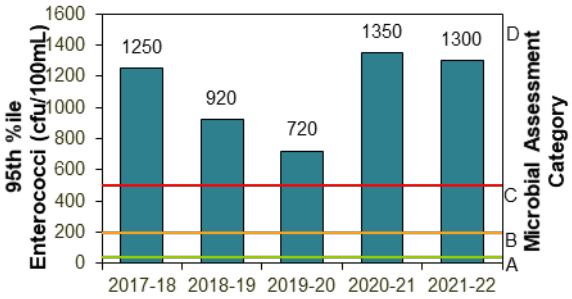
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Mar 2019 to Apr 2022	53%	100	Stable

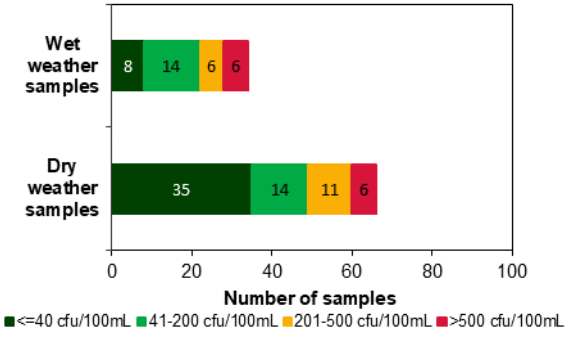
Sanitary inspection: Moderate



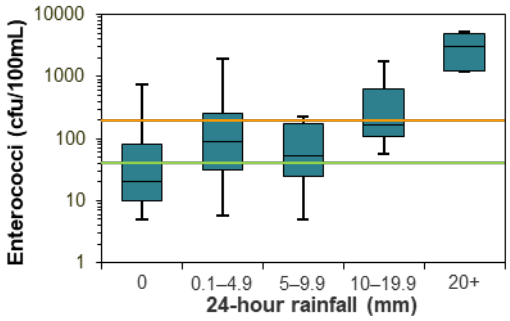
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Copacabana Beach

Beach grade: G

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

Copacabana Beach is at the northern end of a 1 km stretch of beach and is patrolled during the summer swimming season.

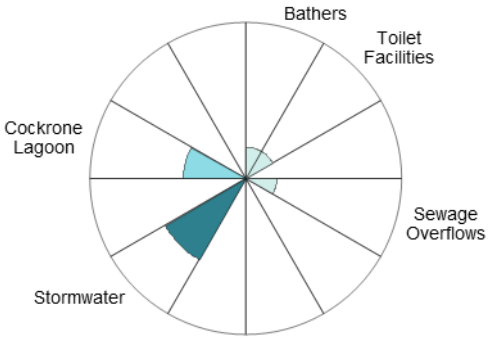
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

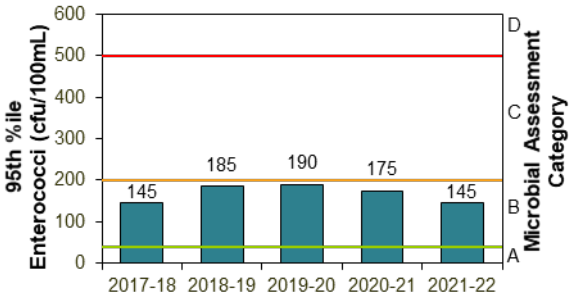
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	97%	100	Stable

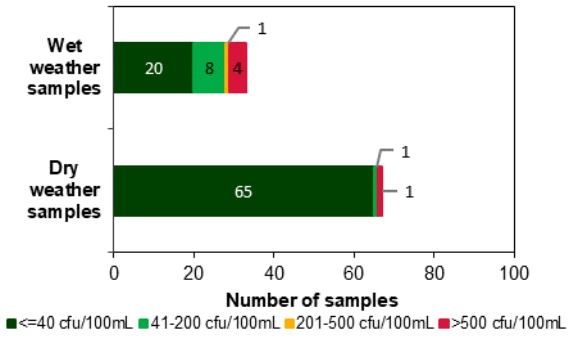
Sanitary inspection: Moderate



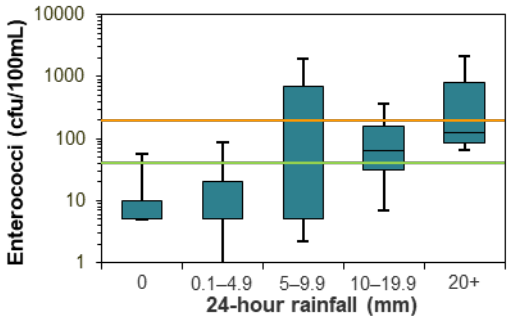
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Cockrone Lagoon

Beach grade: P

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

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

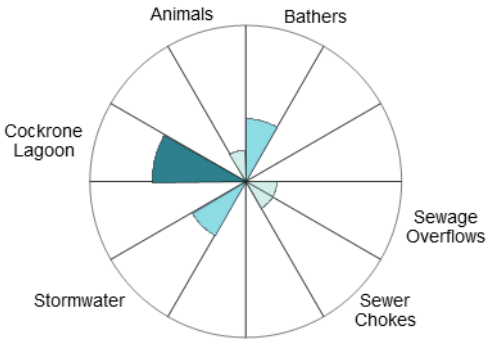
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including from elsewhere within the lagoon.

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

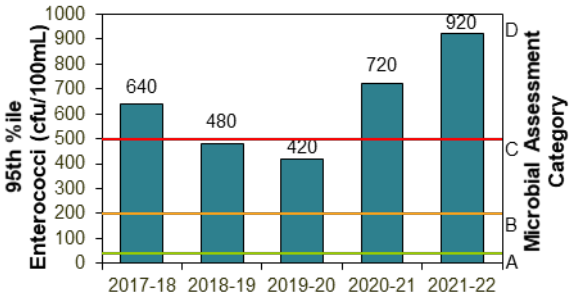
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Lagoon	Feb 2019 to Apr 2022	54%	100	Stable

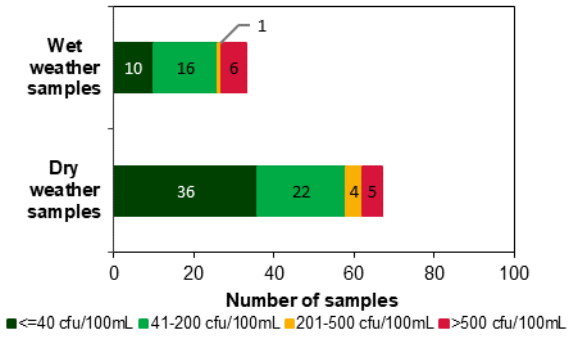
Sanitary inspection: Moderate



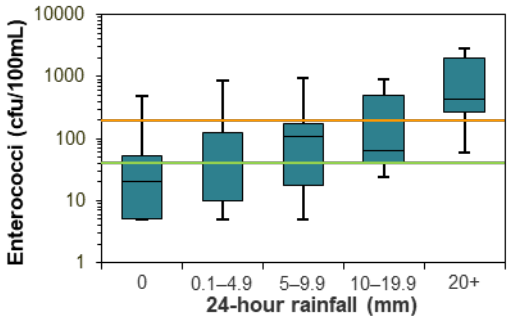
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



MacMasters Beach

Beach grade: G

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

MacMasters Beach is at the southern end of a 1 km stretch of beach and is patrolled during the warmer months.

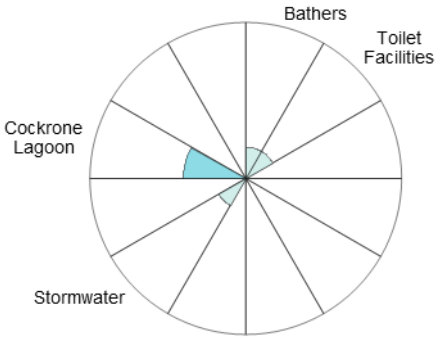
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

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

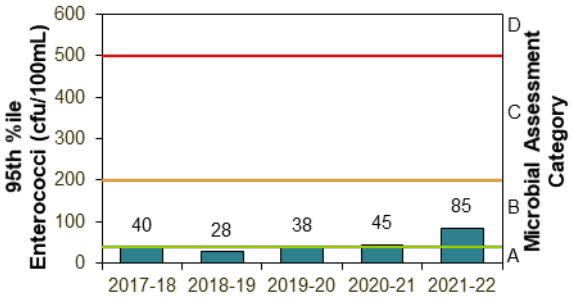
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Feb 2019 to Apr 2022	94%	100	Stable

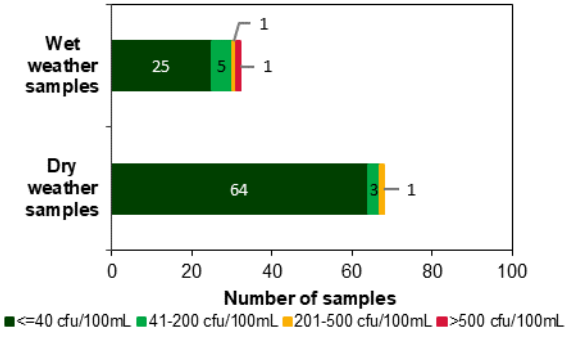
Sanitary inspection: Low



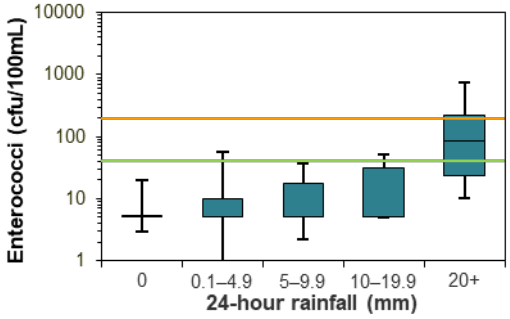
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Killcare Beach

Beach grade: G

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

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

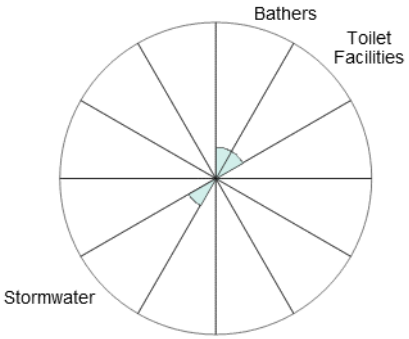
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

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

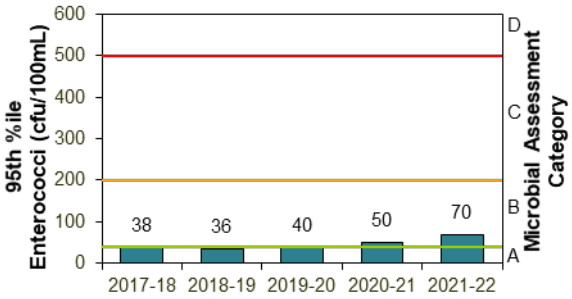
The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	96%	100	Stable

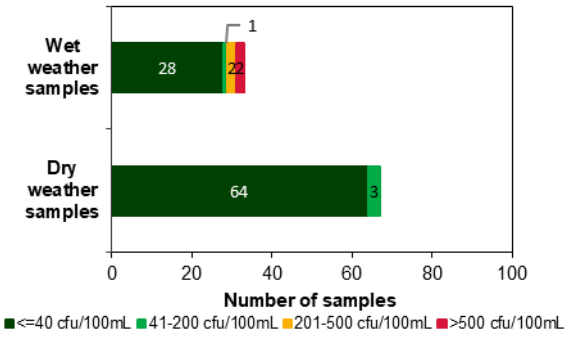
Sanitary inspection: Low



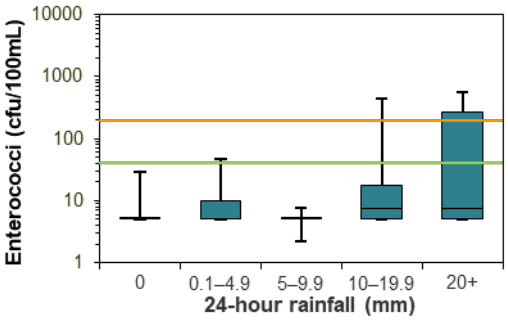
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Ocean Beach

Beach grade: G

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

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

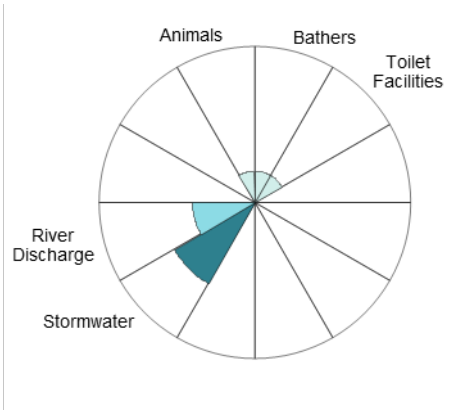
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

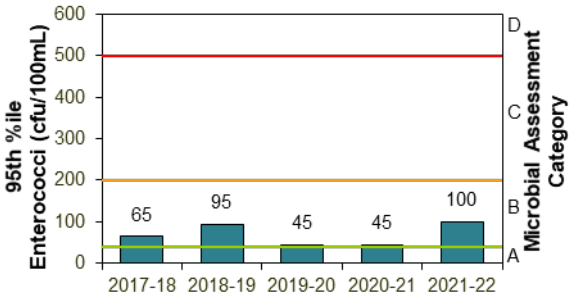
The site has been monitored since 2011.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	96%	100	Stable

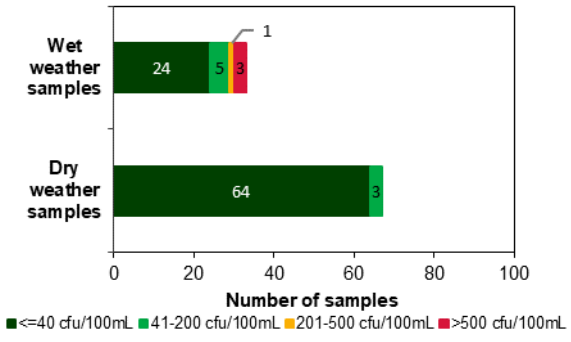
Sanitary inspection: Moderate



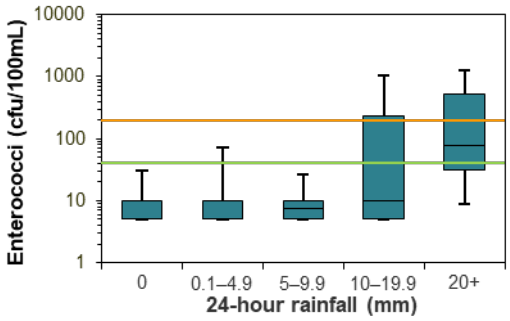
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Umina Beach

Beach grade: G

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

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

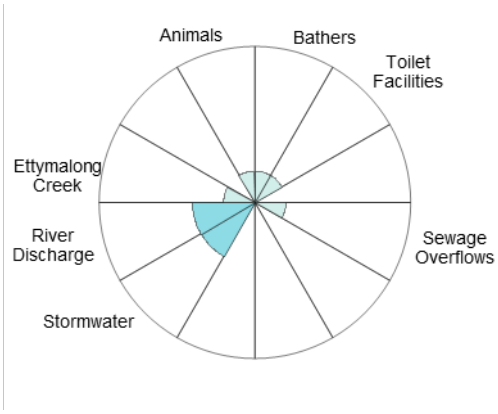
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

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

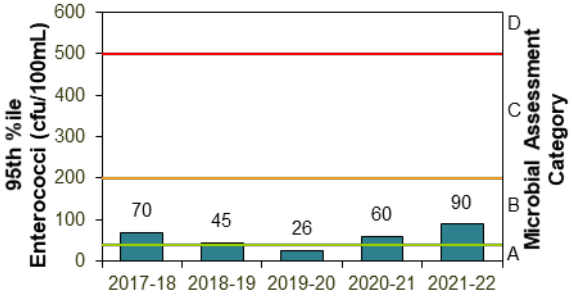
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Jan 2019 to Apr 2022	97%	100	Stable

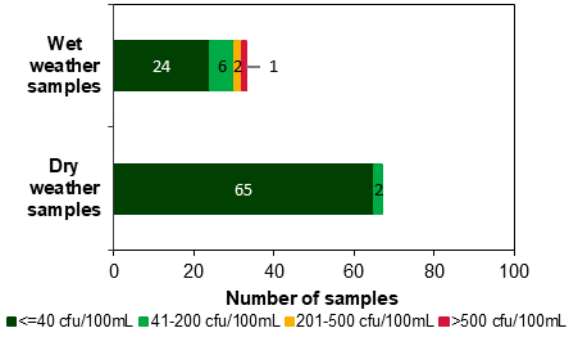
Sanitary inspection: Low



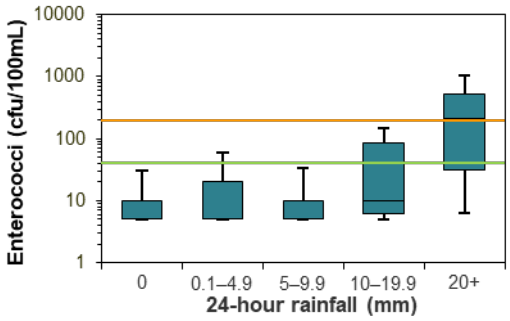
Microbial Assessment Category: B



Dry and wet weather water quality

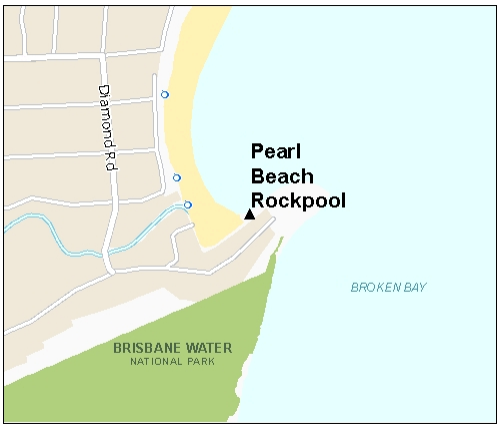


Water quality in response to rainfall



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.

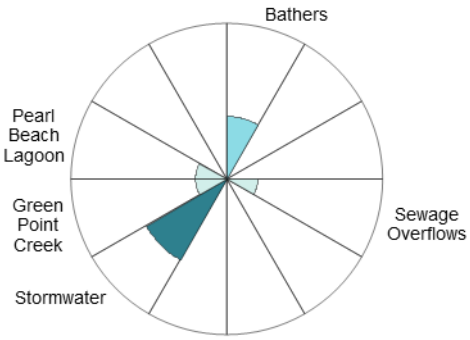
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

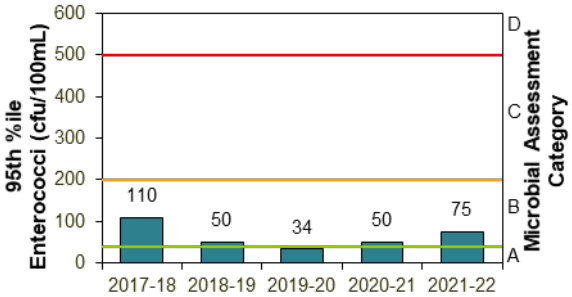
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean baths	Dec 2018 to Apr 2022	97%	100	Stable

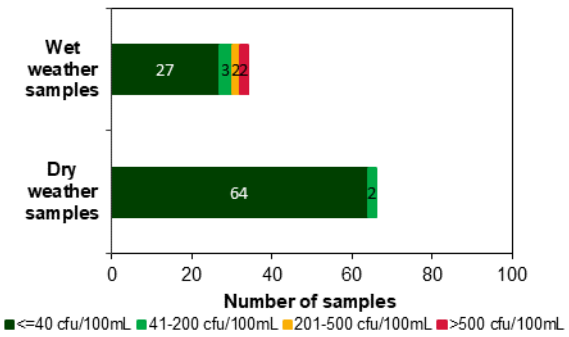
Sanitary inspection: Moderate



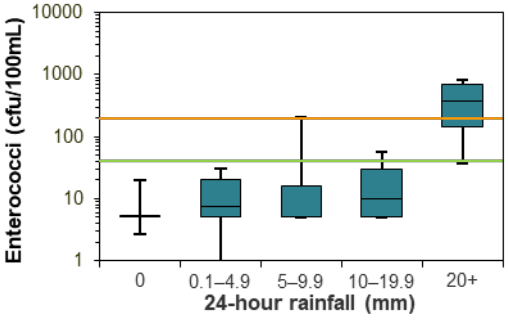
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Davistown Baths

Beach grade: P

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

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

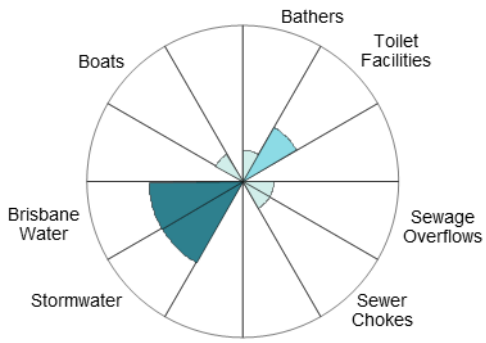
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

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

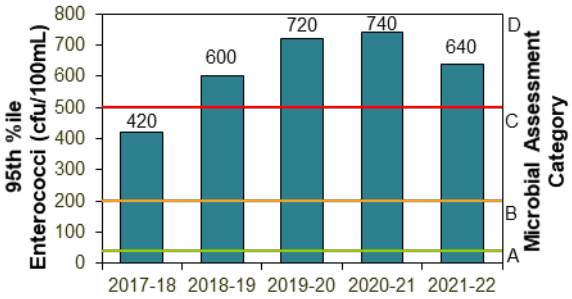
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Jan 2019 to Apr 2022	64%	100	Stable

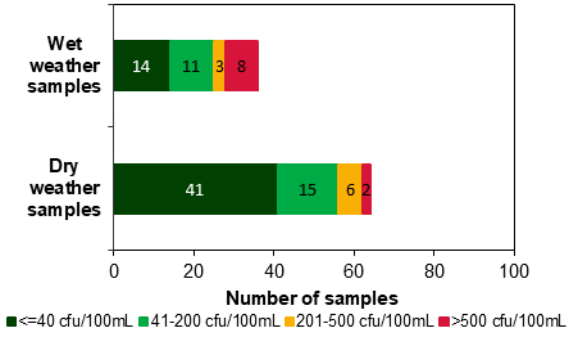
Sanitary inspection: Moderate



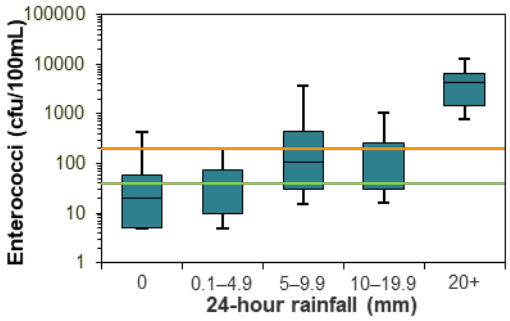
Microbial Assessment Category: D



Dry and wet weather water quality



Water quality in response to rainfall



Pretty Beach Baths

Beach grade: P

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

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

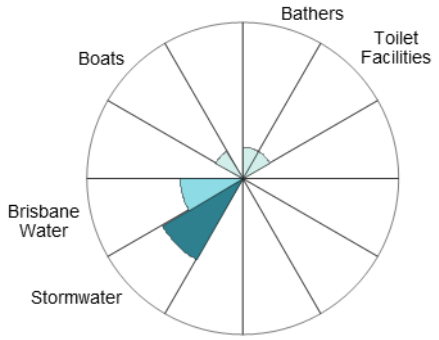
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater.

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.

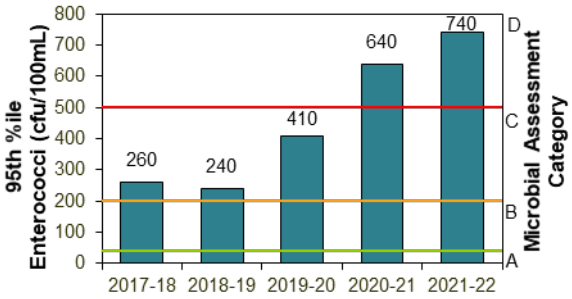
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Jan 2019 to Apr 2022	64%	100	Stable

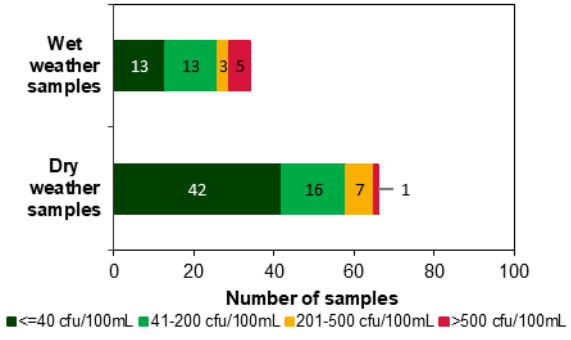
Sanitary inspection: Moderate



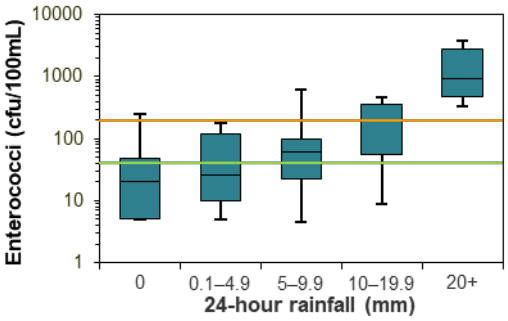
Microbial Assessment Category: D



Dry and wet weather water quality

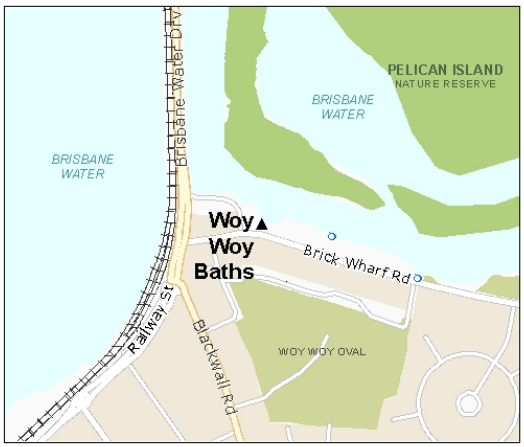


Water quality in response to rainfall



Woy Woy Baths

Beach grade: P



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

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

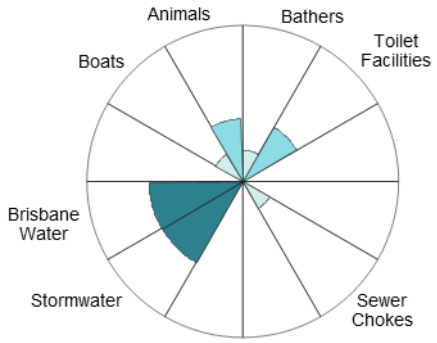
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

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

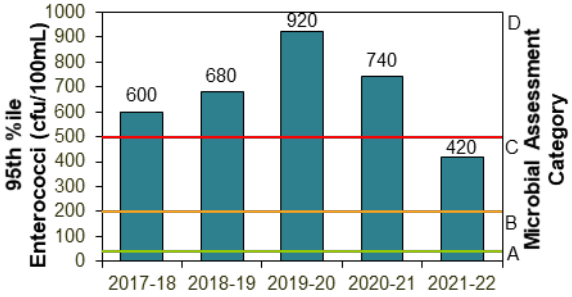
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2018 to Apr 2022	67%	100	Stable ◯

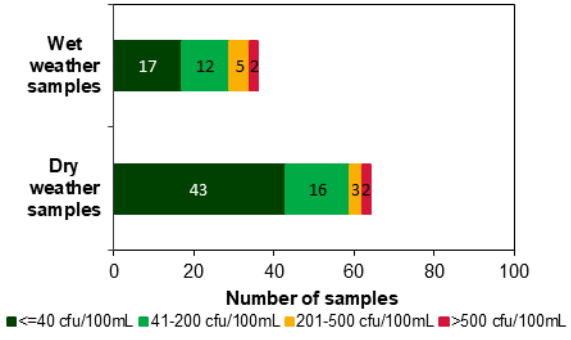
Sanitary inspection: Moderate



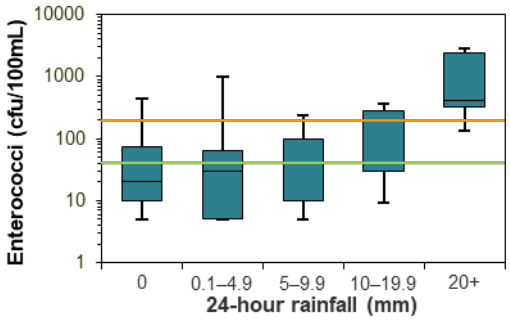
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Yattalunga Baths

Beach grade: P

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

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

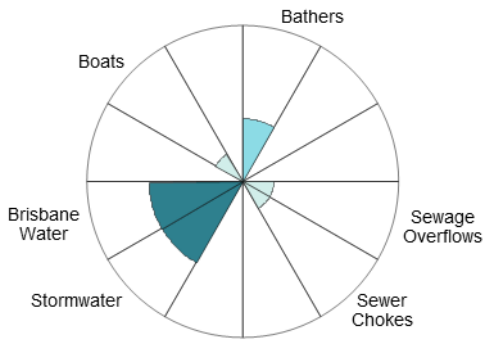
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with several potential sources of faecal contamination including stormwater and from elsewhere within Brisbane Water.

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

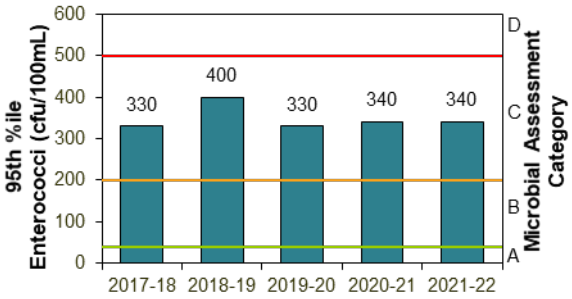
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Jan 2019 to Apr 2022	80%	100	Stable

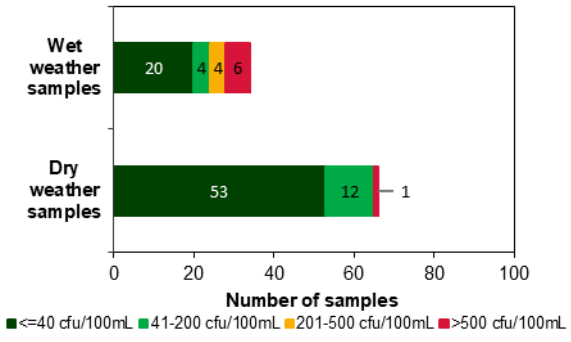
Sanitary inspection: Moderate



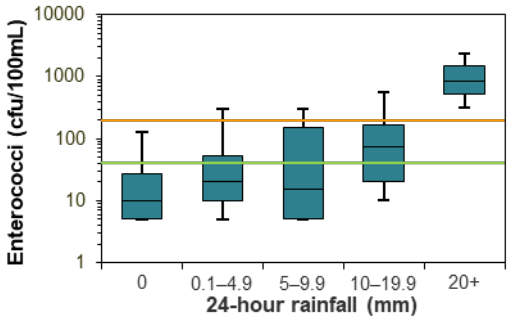
Microbial Assessment Category: C



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 5 grades ranging from Very Good to Very Poor:

VG 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

G 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 3 days at estuarine sites

F 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 3 days following rainfall or if there are signs of pollution such as discoloured water or odour or debris in the water

P 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 3 days following rainfall

VP 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 (NHMRC 2008) were adopted for use in NSW 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 (WA Department of Health 2007).

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 (Standards Australia 2007).

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 4 Microbial Assessment Categories (A to D) and these are determined from the 95th percentile of an enterococci dataset of at least 100 data points. Each MAC is associated with a risk of illness determined from epidemiological studies. The risks of illness shown below are not those associated with a single data point but are the overall risk of illness associated with an enterococci dataset with that 95th percentile (Wyer et al. 1999).

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

The 95th percentile values for each of the 4 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 NSW differs from the European distribution.

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

The tool can be downloaded from the WA Government's 'Environmental waters publications' webpage, under *Forms and templates*.

Sanitary Inspection Category (SIC)

More information about the **sanitary inspection** process is available on the DPE 'Sanitary inspection of beaches' webpage.

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 5 categories: Very Low, Low, Moderate, High and Very High.

Stormwater drain flow
Photo: Beachwatch/DPE

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

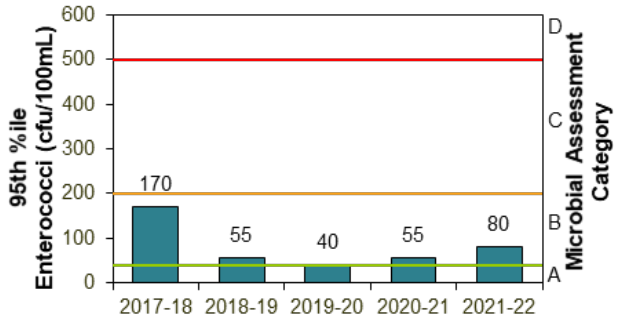
Declined

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

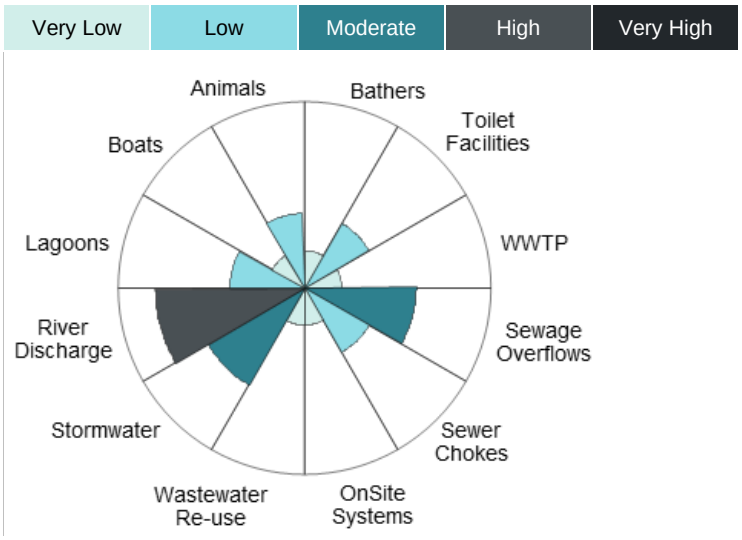
On each beach page, the MACs for the last 5 years are displayed on a simple bar chart. The MAC for the current year is based on enterococci data collected during the assessment period. The bars are labelled with the 95th percentile value for each year and the thresholds dividing the A, B, C and D categories are marked in green, amber and red for reference.



Sanitary Inspection Category (SIC) chart

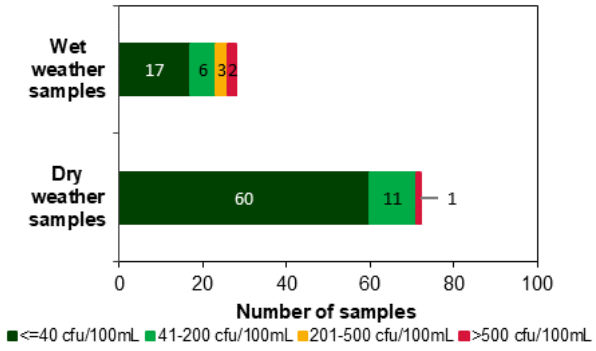
The results of the sanitary inspection for each swimming location are presented in a radar pie chart. The chart shows the likelihood that each identified pollution source will contribute to faecal contamination at a swimming site, as indicated by the size and colour of the segment, ranging from

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

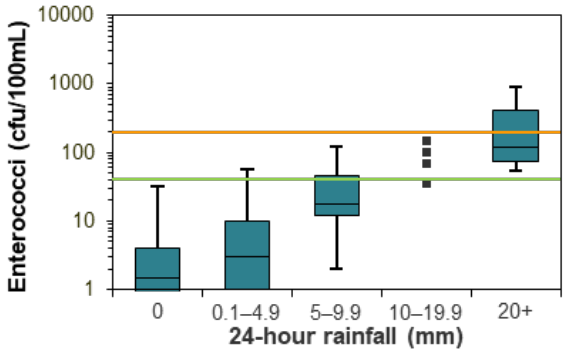
Enterococci levels in wet and dry weather conditions are presented for each swimming location as a bar graph. All data collected during the assessment period is included in the analysis. Dry weather is defined as no rainfall recorded in the previous 24 hours. Each bar is colour coded to show the number 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.



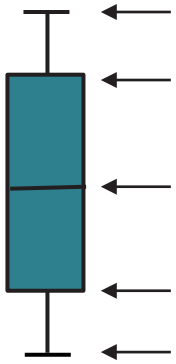
It is expected that swimming sites with lower levels of flushing will show some elevated bacterial results in dry weather samples (no rainfall in the previous 24 hours) due to the longer time needed to recover from a rainfall event. At some estuarine and lake/lagoon swimming locations the impacts of stormwater pollution on beach water quality may be detected up to 3 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 5 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 5 enterococci data points in a rainfall category, individual data points are presented instead of a box plot. At sites where many results are below the detection limit (1 cfu/100 mL), only the upper portion of the box plots will be visible.



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



95% of the samples lie below the top whisker

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

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

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

5% of the samples lie below the bottom whisker.

Information bars

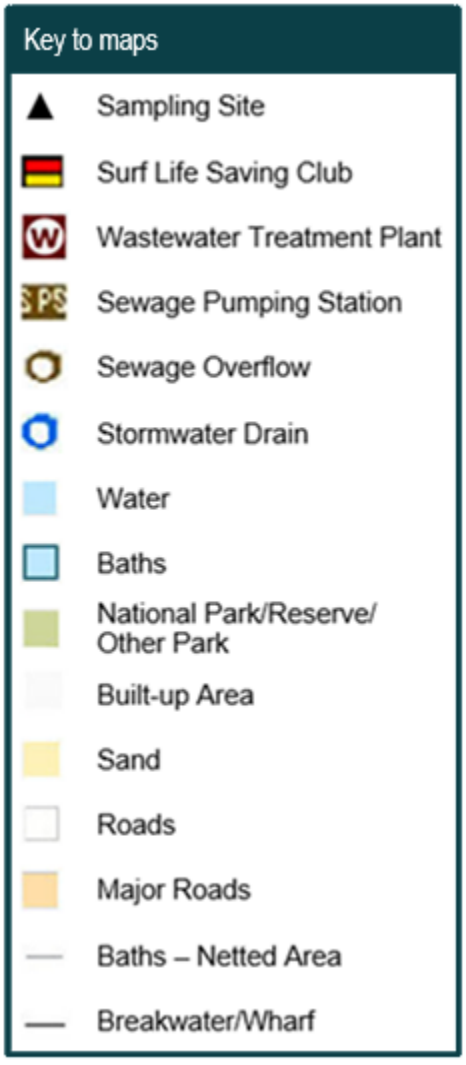
Information bars on each beach page provide a summary of details about the swimming site.

The **assessment period** shows the timeframe in which the water samples were collected. The NHMRC guidelines state beach grades should be determined from the most recent 100 water quality results collected within a 5-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 3 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.



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

Standards Australia (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.

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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*, 33(3):715–722.

More information

- Beachwatch NSW on Twitter
- Beachwatch NSW on Facebook
- Beachwatch webpage
- Coastal management program progress
- Sanitary inspection of beaches
- Subscribe to environment and heritage newsletters
- Towards Safer Swimming: Terrigal Beach and Haven
- Tuggerah Lakes Water Quality
- WA Government environmental water publications