NSW GOVERNMENT

DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

State of the beaches 2018-2019

Hunter region

Beachwatch

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Contents

Recreational water quality has been monitored in the Hunter region since 1996 by Hunter Water Corporation as a requirement of Environment Protection Licences, and by Port Stephens Council and Lake Macquarie City Council under the Department of Planning, Industry and Environment's Beachwatch Partnership Program. This report summarises the performance of 24 swimming sites in the Hunter region of New South Wales, providing a long-term assessment of how suitable a site is for swimming. Monitored sites include ocean beaches and estuarine areas in Port Stephens.

In 2018–2019, 96% of swimming sites in the Hunter region were graded as Good or Very Good. These sites were suitable for swimming for most or almost all of the time. While this is an excellent result and an improvement from the previous year, it largely reflects the recent changes in the monitoring program with 14 Lake Macquarie swimming sites no longer monitored under the Beachwatch Partnership Program.

Hunter region summary 2018–2019

Beach monitoring in New South Wales

Dudley Beach
Photo: Beachwatch/EES, DPIE

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

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

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

Recreational water quality has been monitored in the Hunter region by Hunter Water Corporation since 1996 and Port Stephens Council since 2004.

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

Rainfall impacts

During 2018–2019, 24 swimming sites were monitored including ocean beaches and estuarine areas in Port Stephens.

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 2018–2019 are based on water quality data collected over the last two to four years. Rainfall over this period has been diverse:

- 2015–2016: wet summer, with well above average rainfall during January, including significant storm events causing heavy rain and flooding in coastal areas

- 2016–2017: the wettest March on record for many coastal areas and intense storm activity over summer
- 2017–2018: prolonged dry weather periods broken by heavy rainfall at times
- 2018–2019: relatively dry weather conditions, with a few wet months and occasional heavy falls.

See the section on **How to read this report** on page 42 for an explanation of the graphs, tables and Beach Suitability Grades.

Heavy rain fell on the Hunter coast during June 2018. Monthly rainfall totals were more than double the long-term average with Nelson Bay receiving 393mm, Nobbys Beach (Newcastle) 301mm and Swansea 300mm of rainfall for the month. Very dry weather followed with well below average rainfall recorded in July to August 2018.

While average rainfall conditions were experienced in September 2018, consistent rain fell during October. Swansea had its highest monthly rainfall total on record, totalling more than three times the long-term monthly average with 220mm.

Relatively dry weather conditions continued through the warmer months, with average to mostly below average rainfall recorded in the region from November 2018 to April 2019. Nelson Bay and Nobbys Beach (Newcastle) recorded their lowest total summer rainfall since 1986.

Several thunderstorms brought moderate to heavy rain in late December 2018, a few times in March and in early April 2019.

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

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

www.environment.nsw.gov.au/beachwatch

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 Hunter region

Swimming site	Site type	Beach Suitability Grade	Change
Port Stephens Council			
Zenith Beach	Ocean beach	VG	●
Box Beach	Ocean beach	VG	●
Fingal Beach	Ocean beach	G	●
One Mile Beach	Ocean beach	VG	●
Birubi Beach	Ocean beach	VG	●
Little Beach	Estuarine	G	●
Dutchmans Beach	Estuarine	G	●
Bagnalls Beach	Estuarine	P	●
Georges Reserve	Estuarine	G	●
Lemon Tree Passage Tidal Pool	Estuarine	G	●
Karuah Tidal Pool	Estuarine	G	●
Newcastle City Council			
South Stockton Beach	Ocean beach	VG	●
Nobbys Beach	Ocean beach	VG	●
Newcastle Beach	Ocean beach	VG	●
Bar Beach	Ocean beach	VG	●
Merewether Beach	Ocean beach	VG	●
Burwood North Beach	Ocean beach	VG	●
Burwood South Beach	Ocean beach	VG	●
Lake Macquarie City Council			
Glenrock Lagoon Beach	Ocean beach	VG	●
Dudley Beach	Ocean beach	VG	●
Redhead Beach	Ocean beach	G	●
Blacksmiths Beach	Ocean beach	VG	●
Swansea Heads Little Beach	Ocean beach	G	●
Caves Beach	Ocean beach	VG	●

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

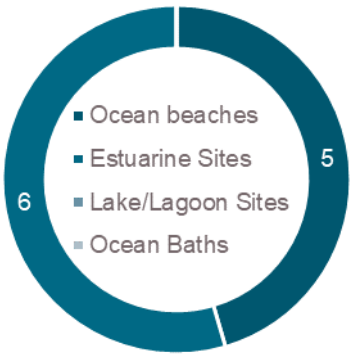
Port Stephens Council

91%
swimming sites graded Good or Very Good

Eleven swimming sites were monitored in the Port Stephens local government area.

Four locations were monitored by Hunter Water Corporation as a requirement of Environment Protection Licences. Samples were collected every sixth day throughout the year.

Seven locations were monitored by Port Stephens Council. Samples were collected weekly between October and April. Sampling and laboratory analysis was fully funded by council.



Site types in Port Stephens Council

Overall results

Ten of the 11 swimming sites were graded as Very Good or Good in 2018–2019. This is a similar result to the previous year.

Percentage of sites graded as Very Good or Good:

- 2018–2019: 91%
- 2017–2018: 91%
- 2016–2017: 82%
- 2015–2016: 82%.

See the section on **How to read this report** on page 42 for an explanation of the graphs, tables and Beach Suitability Grades.

Best beaches

Zenith Beach, Box Beach, One Mile Beach and Birubi Beach.

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

Swimming sites monitored in the Port Stephens region include ocean beaches and estuarine areas in Port Stephens, with each site type having a different response to rainfall-related impacts.

In general, estuarine swimming sites did not perform as well as ocean beaches, due to lower levels of flushing to disperse and dilute pollution inputs, taking longer to recover from stormwater events.

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

Ocean beaches

Beach Suitability Grades for Port Stephens Council ocean beaches

Four of the five ocean beaches were graded as Very Good in 2018–2019: Zenith Beach, Box Beach, One Mile Beach and Birubi Beach. Water quality at these sites was suitable for swimming almost all of the time.

Fingal Beach was graded as Good in 2018–2019, a similar result to the previous year. The water quality at this site was suitable for swimming most of the time, with elevated enterococci levels occasionally recorded following little or no rainfall.

Swimming should be avoided for 24 hours after rainfall at ocean beaches, or if signs of pollution are present such as discoloured water or flowing stormwater drains.

Estuarine beaches

Beach Suitability Grades for Port Stephens Council estuarine beaches

Five of the six estuarine beaches in Port Stephens were graded as Good: Little Beach, Dutchmans Beach, Georges Reserve, Lemon Tree Passage Tidal Pool and Karuah Tidal Pool. Water quality at these sites is mostly suitable for swimming during dry weather conditions but may be susceptible to pollution for up to three days after rainfall.

Bagnalls Beach was graded Poor in 2018–2019, similar to previous years. While microbial water quality at this site has improved over the past five years, enterococci levels often exceeded the safe swimming limit in dry weather conditions and after low levels of rainfall. Swimming should be avoided at this site during and for at least three days following rainfall, or if signs of pollution are present such as discoloured water or flowing stormwater drains.

Little Beach
Photo: Beachwatch/EES, DPIE

Management

Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

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

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

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

Port Stephens Council

Port Stephens Council is preparing a coastal management program (CMP) for the Port Stephens estuary and open coast, using funding received from the NSW Government's Coastal and Estuary Grants Program. The CMP will identify the priority coastal hazards, issues and risks to the Port Stephens coastal zone and will yield a range of short, medium and long-term management options for the area. Water quality management actions to improve land and river practices for the catchment will be a key component of the CMP.

Port Stephens Council responds to reports of suspected algal contamination, stormwater and sewage pollution by managing swimming areas to minimise the risk to the swimmers. Council utilises various methods to communicate information to the public including council's website and social media. If sewage or stormwater contamination is suspected, the swimming area may be closed and further water quality testing is undertaken until samples indicate that water quality is suitable for swimming.

There are more than 4800 onsite sewage management systems in the Port Stephens Council area, many of which are located in semi-rural villages and rural areas. Potential environmental and health impacts are managed by the council through routine inspections, application assessment and management, and an 'approval to operate' database.

Sampling sites and Beach Suitability Grades in Port Stephens Council

Zenith Beach

Beach grade: VG

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

Zenith Beach is 400 metres long and is within Tomaree National Park. The beach is not patrolled by lifeguards.

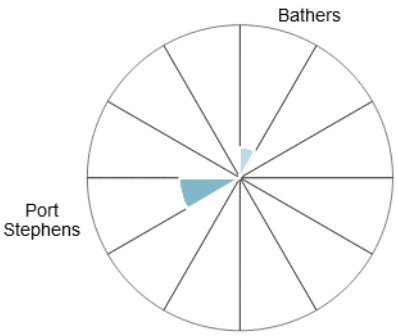
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with very few potential sources of faecal contamination.

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

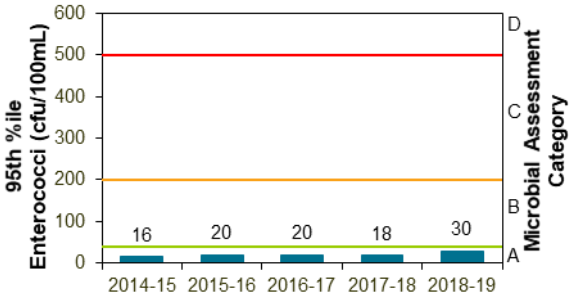
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	97%	100	Stable

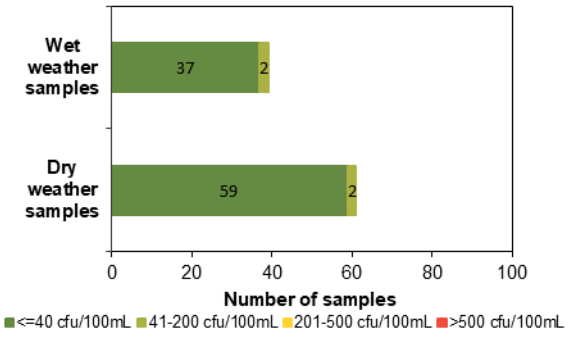
Sanitary inspection: Low



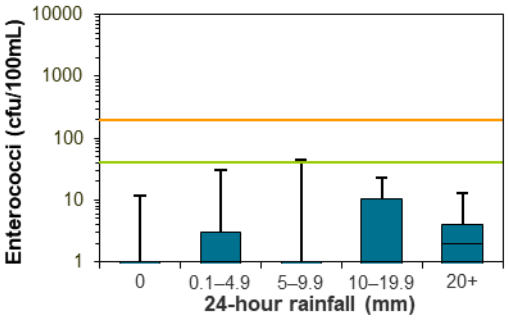
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Box Beach

Beach grade: VG

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

Box Beach is 350 metres long and within Tomaree National Park. The beach is not patrolled by lifeguards.

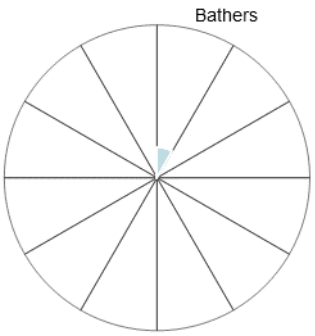
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with only one potential source of faecal contamination.

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

The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	98%	100	Stable

Sanitary inspection: Very low



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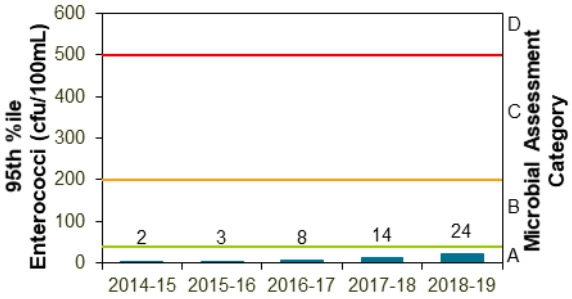
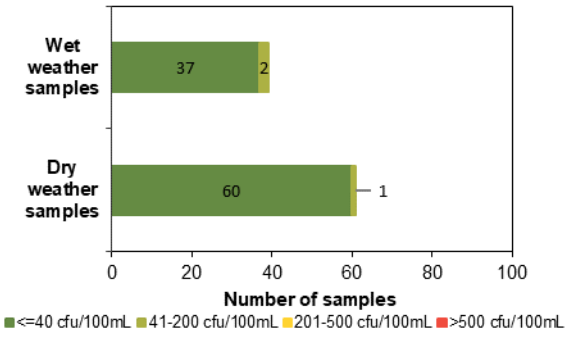
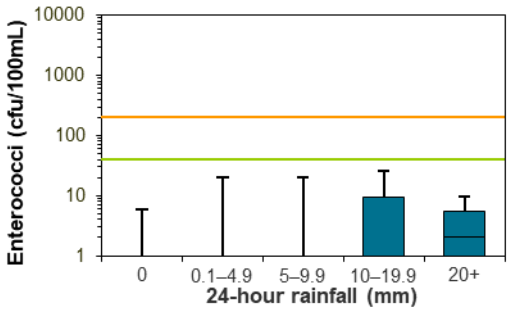


Dry and wet weather water quality



Water quality in response to rainfall



Fingal Beach

Beach grade: G

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

Fingal Beach is approximately 2.7 kilometres long and within Fingal Bay. The beach is patrolled from September to April.

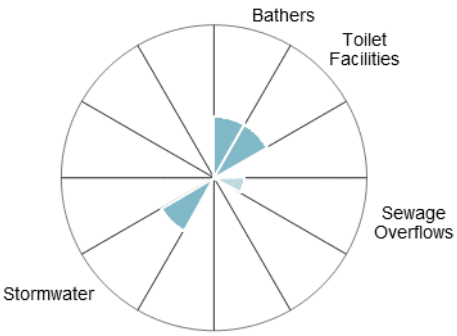
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination.

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

The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	93%	100	Stable

Sanitary inspection: Low



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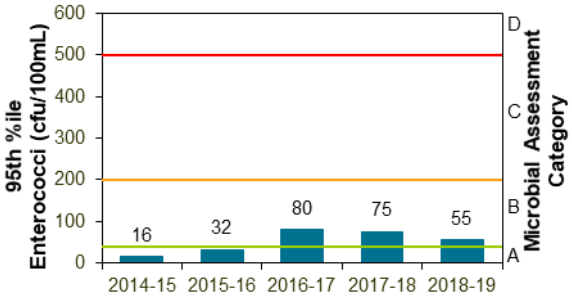
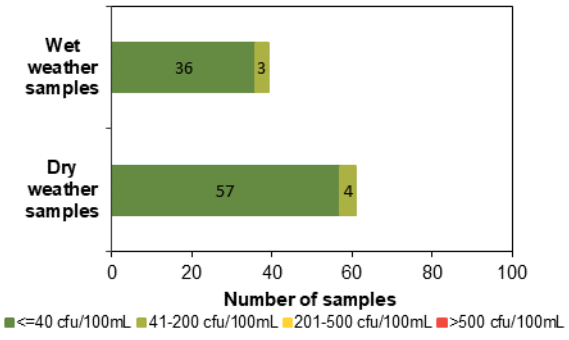
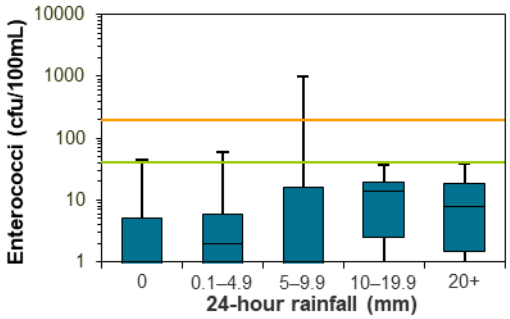


Dry and wet weather water quality



Water quality in response to rainfall



One Mile Beach

Beach grade: VG

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

This 1.3 kilometre stretch of beach is at the southern end of Anna Bay and is patrolled from September to April.

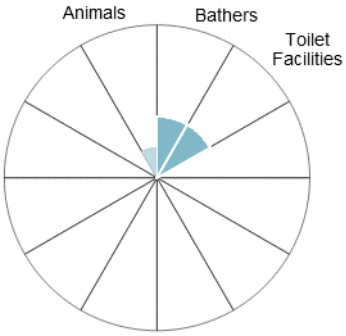
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	98%	100	Stable

Sanitary inspection: Low



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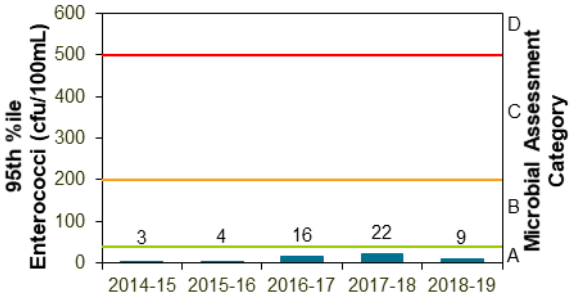
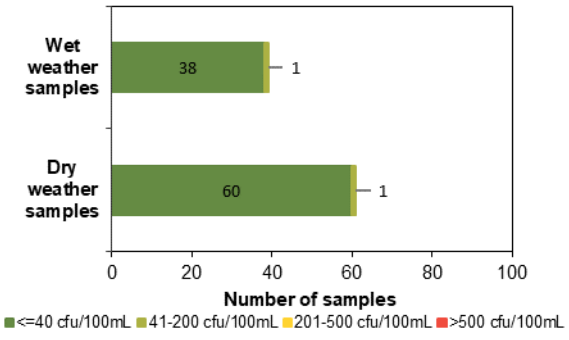
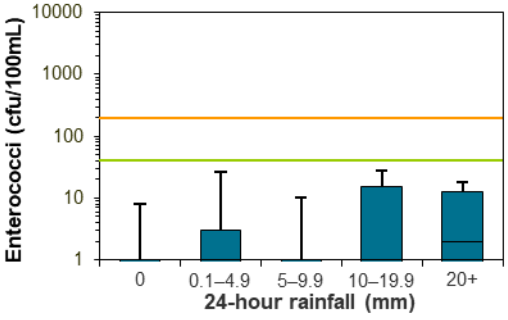


Dry and wet weather water quality

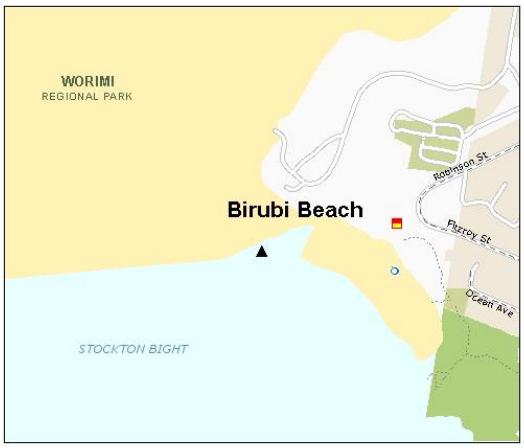


Water quality in response to rainfall



Birubi Beach

Beach grade: VG



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

Birubi Beach lies among rocky outcrops at the northern end of Stockton Bight and is patrolled from September to April.

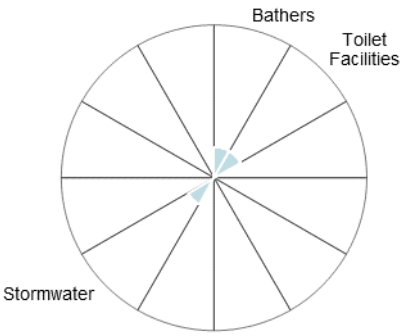
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

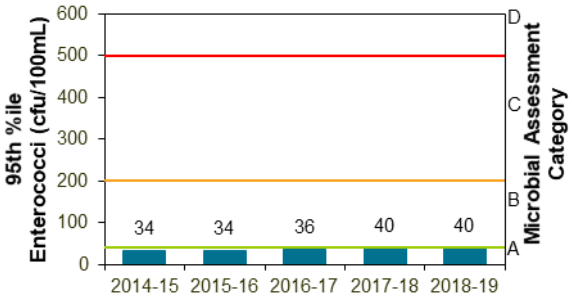
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Dec 2015 to Apr 2019	97%	100	Stable

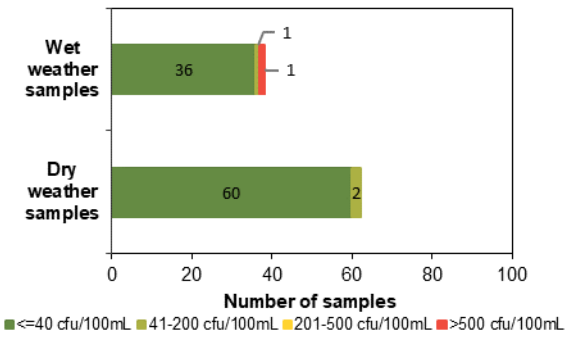
Sanitary inspection: Low



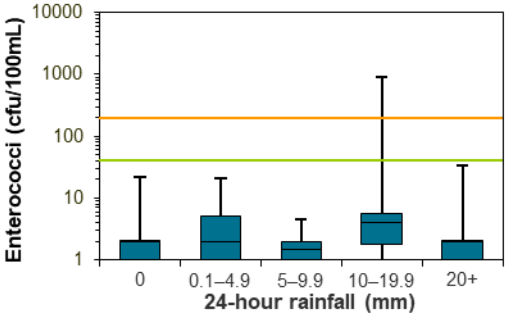
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Little Beach

Beach grade: G

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

Little Beach is a netted swimming enclosure located on the southern shore of Port Stephens.

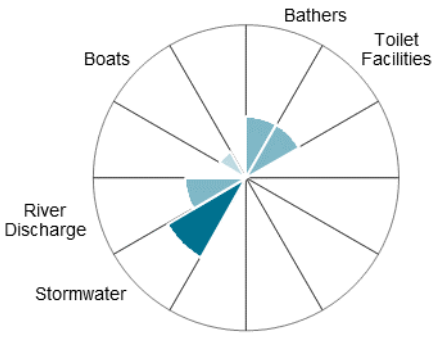
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including stormwater.

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

The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	93%	100	Stable

Sanitary inspection: Moderate



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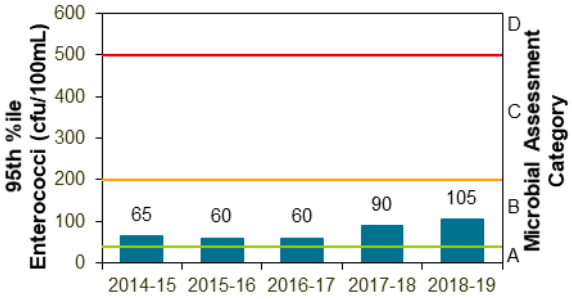
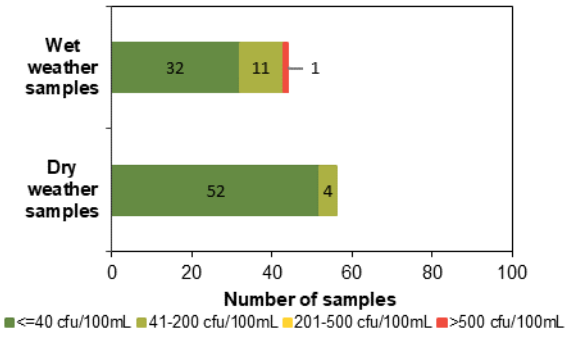
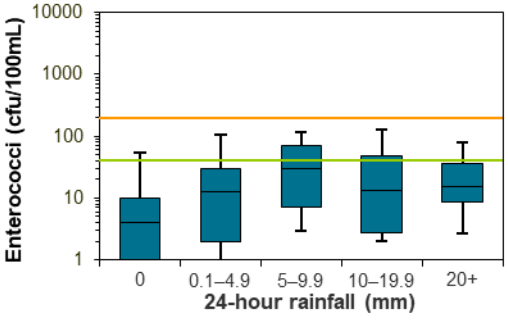


Dry and wet weather water quality



Water quality in response to rainfall



Dutchmans Beach

Beach grade: G

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

Dutchmans Beach (also known as Dutchies Beach) is on the southern shore of Port Stephens.

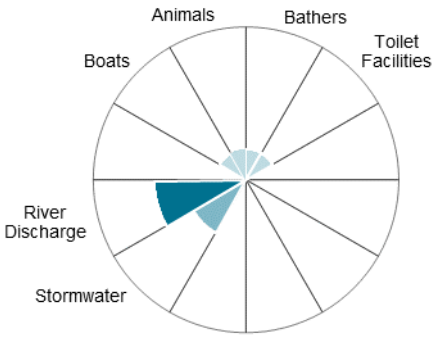
The Beach Suitability Grade of Good indicates microbial water quality is considered safe for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including river discharge.

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

The site has been monitored since 2006.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	82%	100	Stable

Sanitary inspection: Moderate



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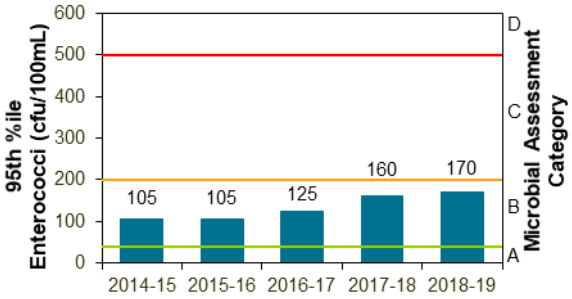
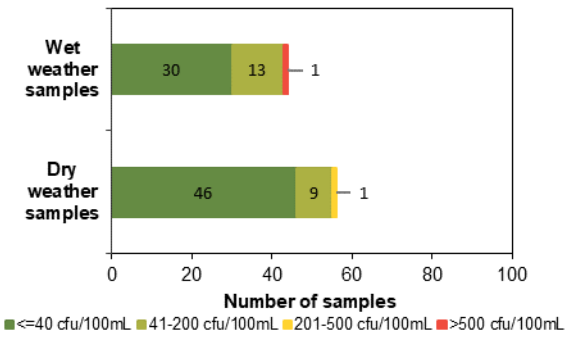
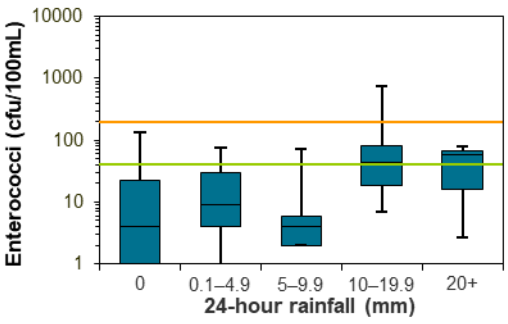


Dry and wet weather water quality



Water quality in response to rainfall



Bagnalls Beach

Beach grade: P

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

Bagnalls Beach is located on the southern shore of Port Stephens.

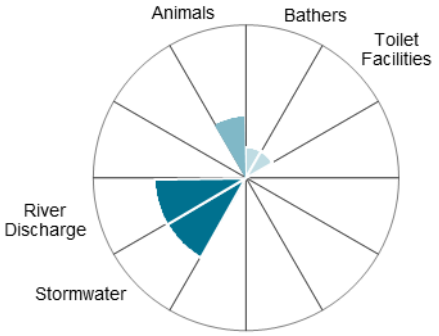
The Beach Suitability Grade of Poor indicates microbial water quality is susceptible to faecal pollution, particularly after rainfall and occasionally during dry weather conditions, with potential faecal contamination from river discharge and stormwater.

Enterococci levels increased with increasing rainfall, often exceeding the safe swimming limit in response to little or no rainfall.

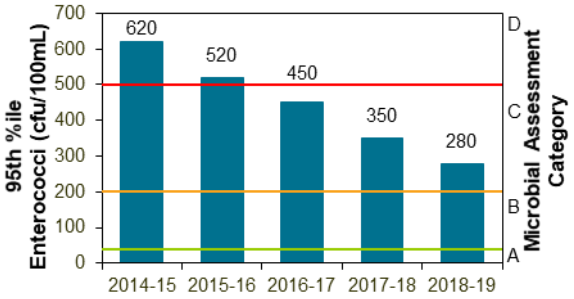
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	69%	100	Stable

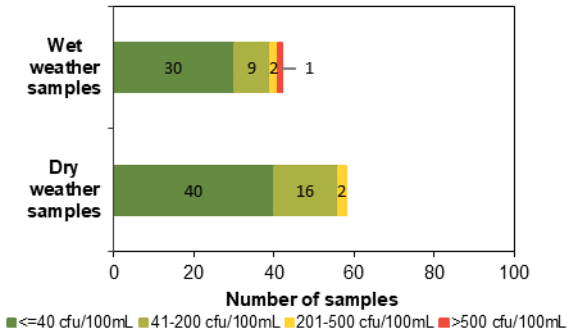
Sanitary inspection: Moderate



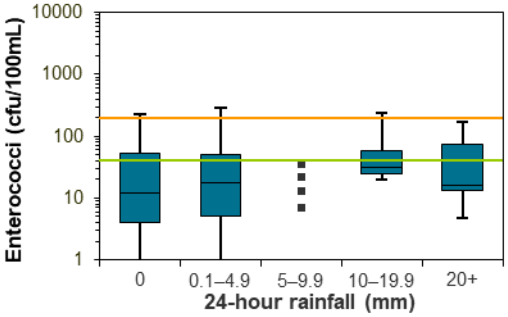
Microbial Assessment Category: C



Dry and wet weather water quality



Water quality in response to rainfall



Georges Reserve

Beach grade: G

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

Georges Reserve is a narrow sandy beach located on the southern shore of Port Stephens.

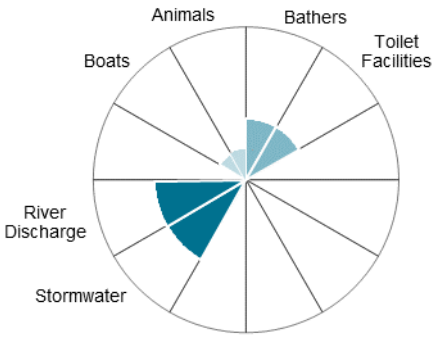
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may susceptible to faecal pollution after rain, with several potential sources of faecal contamination including river discharge and stormwater.

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

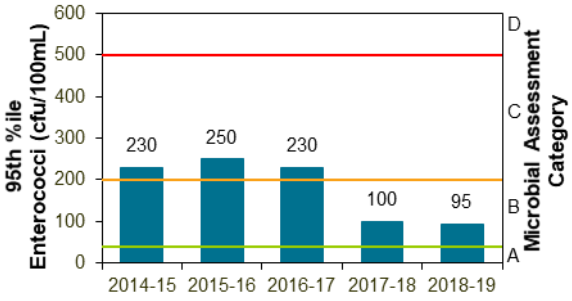
The site has been monitored since 2005.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	75%	100	Stable

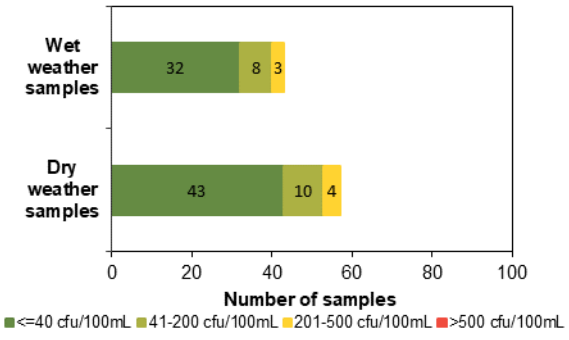
Sanitary inspection: Moderate



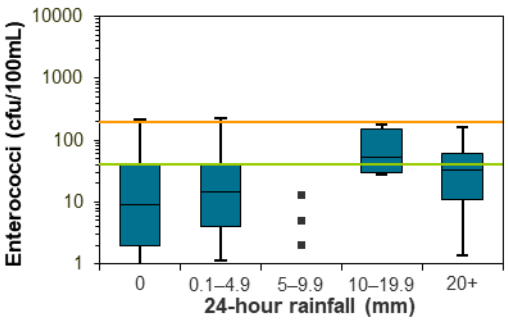
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Lemon Tree Passage Tidal Pool

Beach grade: G

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

Lemon Tree Passage Tidal Pool is a netted swimming enclosure located in a shallow arm of Port Stephens.

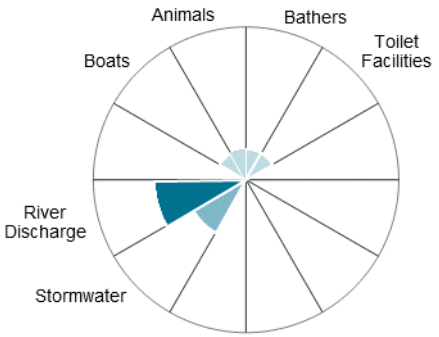
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including river discharge.

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

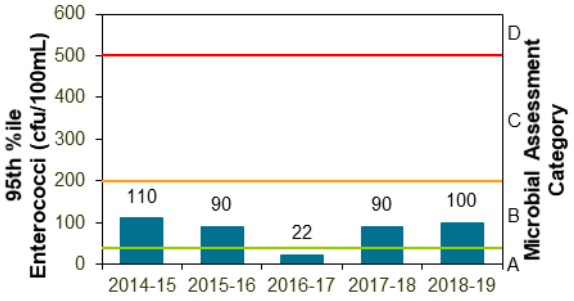
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	93%	100	Stable

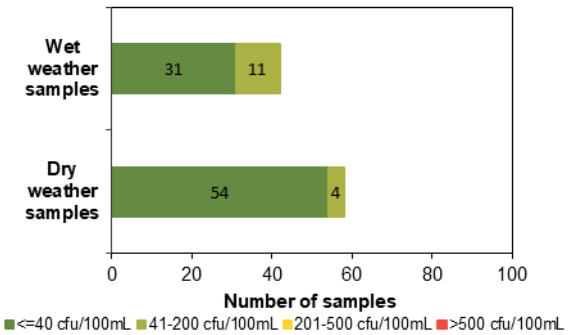
Sanitary inspection: Moderate



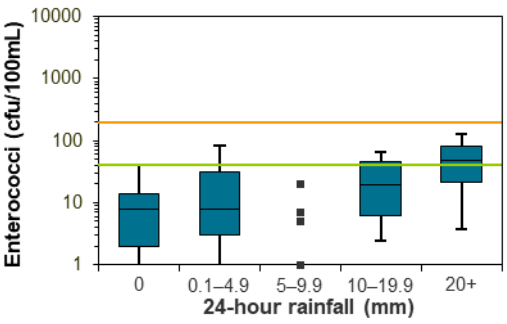
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Karuah Tidal Pool

Beach grade: G

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

Karuah Tidal Pool is a netted swimming enclosure located in the lower reaches of the Karuah River leading to Port Stephens.

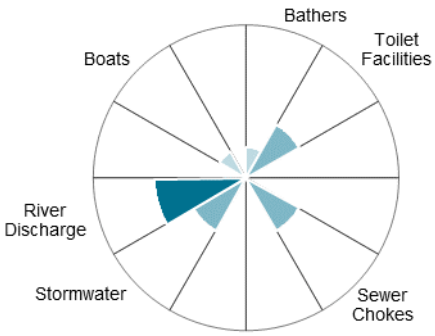
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of faecal contamination including river discharge.

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

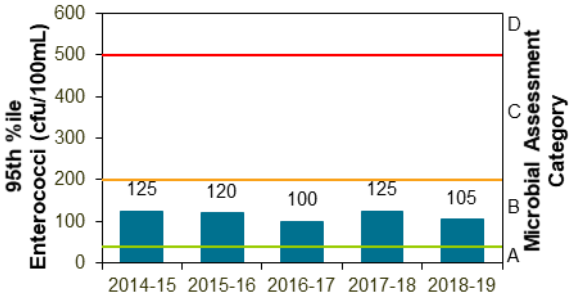
The site has been monitored since 2004.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Estuarine	Dec 2015 to Apr 2019	90%	100	Stable

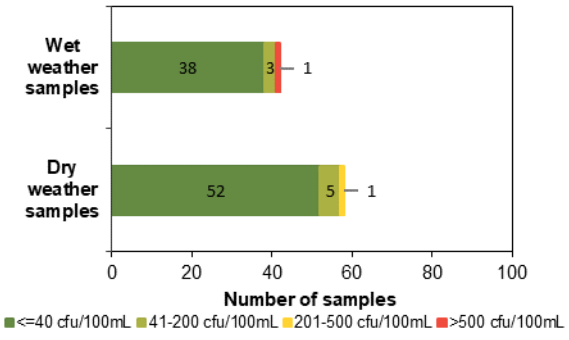
Sanitary inspection: Moderate



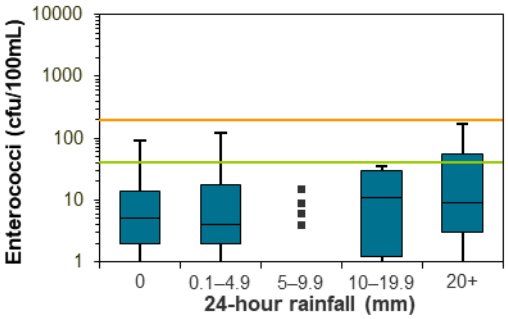
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Newcastle City Council

Overall results

100%
swimming sites graded Good or Very Good

All seven swimming sites were graded as Very Good in 2018–2019. Excellent results have also been recorded in previous years.

Percentage of sites graded as Very Good or Good:

- 2018–2019: 100%
- 2017–2018: 100%
- 2016–2017: 100%
- 2015–2016: 100%.

See the section on **How to read this report** on page 42 for an explanation of the graphs, tables and Beach Suitability Grades.

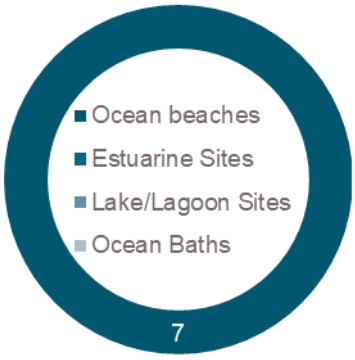
Seven swimming sites were monitored in the Newcastle local government area.

All locations were monitored by Hunter Water Corporation as a requirement of Environment Protection Licences. Samples were collected every sixth day throughout the year and every third day during the swimming season at four sites.

Best beaches

South Stockton Beach, Nobbys Beach, Newcastle Beach, Bar Beach, Merewether Beach, Burwood North Beach and Burwood South Beach.

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



Site types in Newcastle City Council

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

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

Ocean beaches

Beach Suitability Grades for Newcastle City Council ocean beaches

All seven ocean beaches were graded as Very Good: South Stockton Beach, Nobbys Beach, Newcastle Beach, Bar Beach, Merewether Beach, Burwood North Beach and Burwood South Beach. Water quality at these sites has been consistently excellent for many years and is suitable for swimming almost all of the time.

Management

Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

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

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

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

Newcastle City Council

Newcastle City Council is preparing a Newcastle Coastal Management Program (CMP), with funding provided by the NSW Government's Coastal and Estuary Grants Program. The CMP will consider catchment pressures and potential management initiatives to manage issues relating to coastal and estuary health. Water quality management actions such as stormwater infrastructure improvements and strategic land-use planning may be considered during the process.

Newcastle City Council currently manages over 400 water quality devices in the local government area to reduce and recycle stormwater to mitigate its impact on waterways and beaches. Council mostly uses primary pollution control devices to remove coarse sediment and rubbish from stormwater, while in some areas, secondary treatment of stormwater further removes fine sediments, nutrients and heavy metals.

Stormwater quality targets are set for new developments through council's Development Control Plan. Council's own water quality solutions in coastal areas typically focus on complete treatment train approaches; often culminating in infiltration back to the groundwater table and using vegetation to recycle stormwater and nutrients.

In recent years council has built several new stormwater pollution control devices in the beachside areas of Stockton, Newcastle East, Bar Beach, Dixon Park and Merewether.

Newcastle City Council undertakes regular ocean bath cleaning, street sweeping, beach grooming, litter patrols and waste management actions to reduce the impact of stormwater pollution on beaches. Council's environmental compliance and stormwater education programs encourage stormwater pollution prevention actions such as sediment and erosion controls on building sites and picking up of dog poo by owners. Interpretive environmental signage has been installed in conjunction with city renewal to increase knowledge amongst beach visitors and users of the coastline's natural and historic value.

Council monitors the water quality at its two ocean baths in accordance with the National Health and Medical Research Council's guidelines for managing risks in recreational water (NHRMC 2008).

Hunter Water

Hunter Water completed a $13 million upgrade to its wastewater system in Adamstown in 2012. The new pumping station and 4.5km of piping operates in periods of heavy rain to remove wastewater faster and greatly reduce the potential for overflows in the area.

Stockton Beach
Photo: Beachwatch/EES, DPIE

Hunter Water has an ongoing program of testing for illegal stormwater connections to ensure excess water does not enter the wastewater system in wet weather.

Although water quality is of a high standard at Merewether, Bar, Burwood North and Burwood South beaches, a health risk assessment completed by Hunter Water in 2010 indicated there was a small risk that the effluent plume from Burwood Beach wastewater treatment plant (WWTP) could be driven back to the coast under certain combinations of wind and current. In March 2017 Hunter Water upgraded the WWTP with a UV disinfection system, at a cost of $13 million, to address the small health risk identified in the study. Since its commissioning, monitoring of the UV system has shown a reduction in pathogen concentrations in the effluent, meeting EPA requirements. The risk from the WWTP has been lowered in the sanitary inspections for these beaches as a result of the upgrade.

Sampling sites and Beach Suitability Grades in Newcastle City Council

South Stockton Beach

Beach grade: VG

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

South Stockton Beach is at the southern end of a 32 kilometre stretch of beach and is patrolled from September to April.

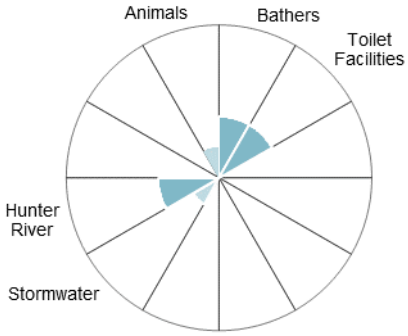
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

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

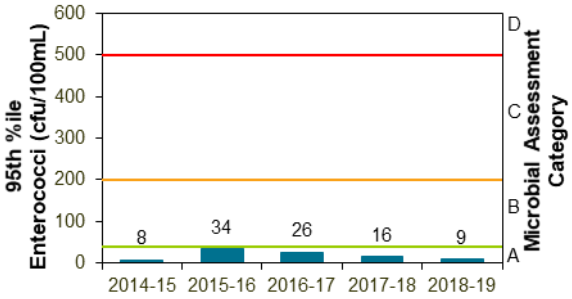
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Aug 2017 to Apr 2019	95%	100	Stable

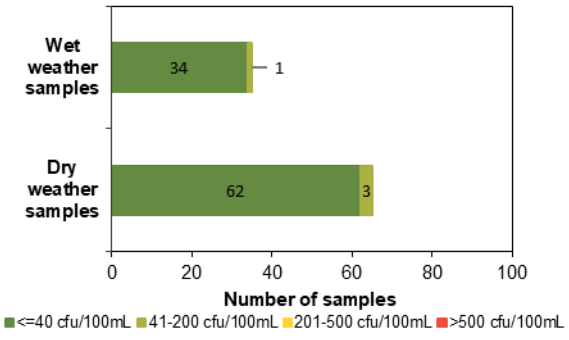
Sanitary inspection: Low



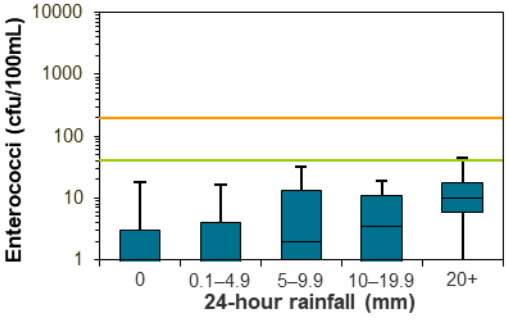
Microbial Assessment Category: A



Dry and wet weather water quality

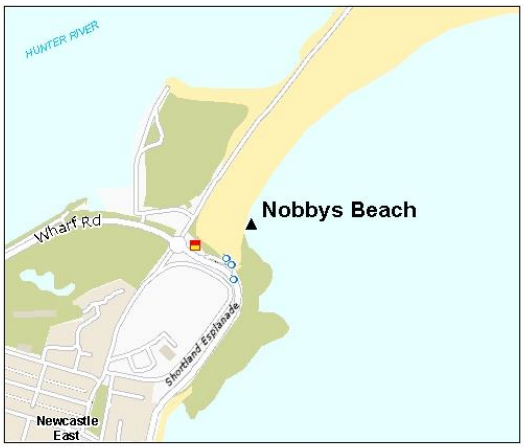


Water quality in response to rainfall



Nobbys Beach

Beach grade: VG



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

Nobbys Beach is one kilometre long and is patrolled year round.

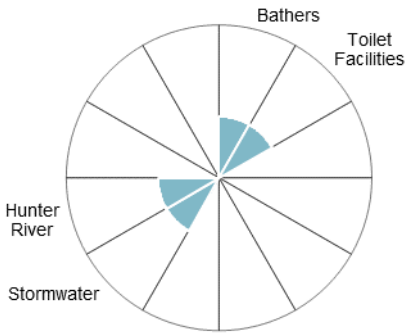
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

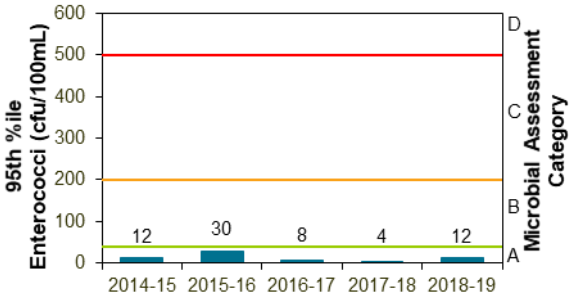
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	100%	100	Stable

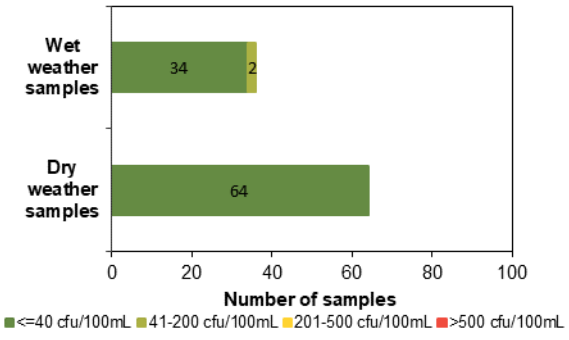
Sanitary inspection: Low



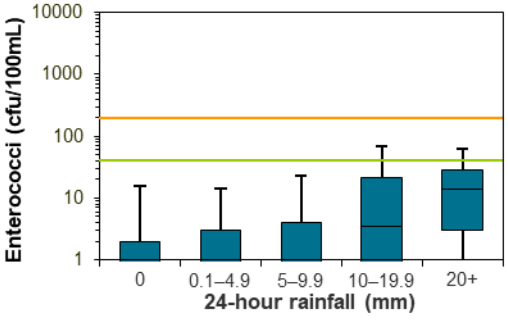
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Newcastle Beach

Beach grade: VG

Newcastle Beach is approximately 650 metres long and is patrolled from September to April.

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

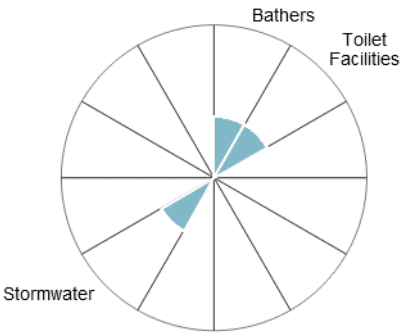
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming after 10mm or more of rainfall.

The site has been monitored since 1996.

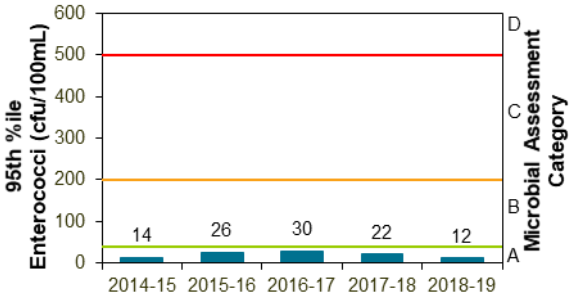
See ‘How to read this report’ for key to map.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	100%	100	Stable

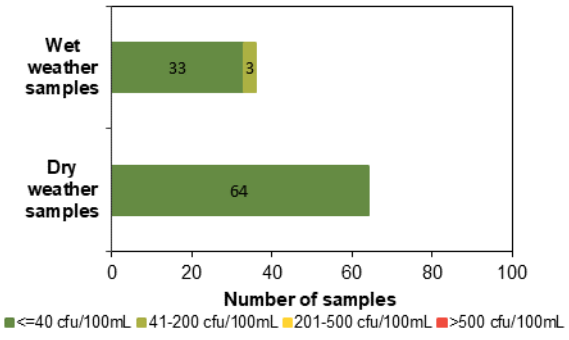
Sanitary inspection: Low



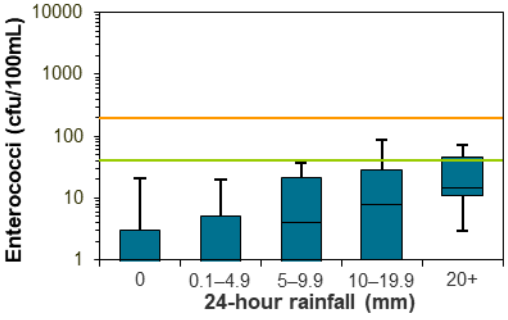
Microbial Assessment Category: A



Dry and wet weather water quality

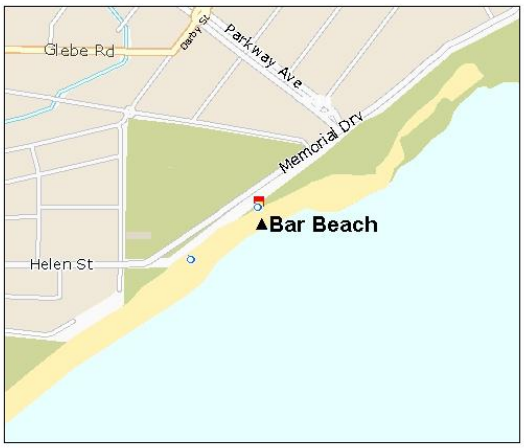


Water quality in response to rainfall



Bar Beach

Beach grade: VG



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

Bar Beach is approximately 500 metres long and is patrolled all year round.

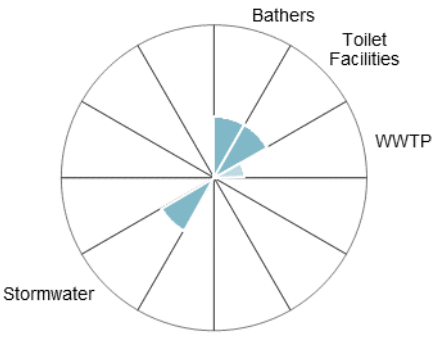
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

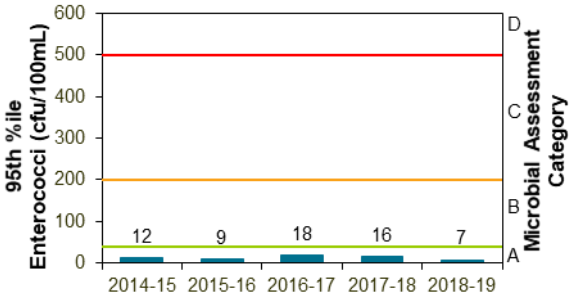
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2018 to Apr 2019	98%	100	Stable

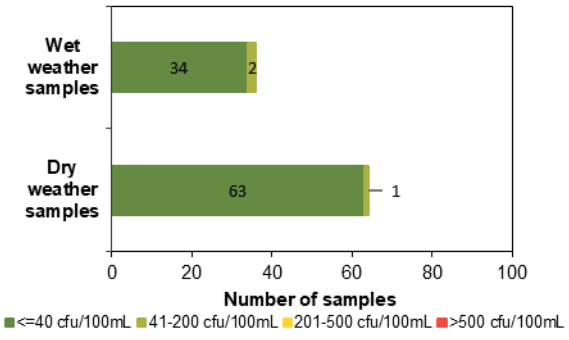
Sanitary inspection: Low



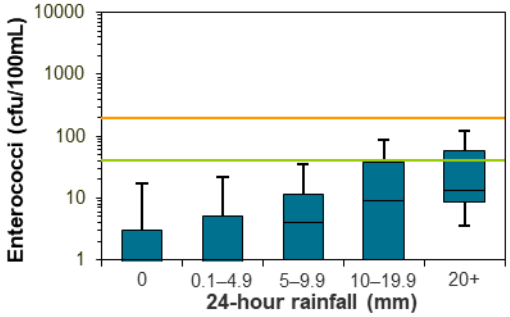
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Merewether Beach

Beach grade: VG

Merewether Beach is at the southern end of a 900 metre stretch of beach and is patrolled year round.

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

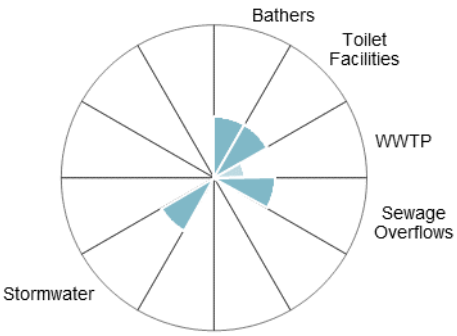
Enterococci levels generally increased with increasing rainfall, often exceeding the safe swimming limit after 20mm or more of rainfall.

The site has been monitored since 1996.

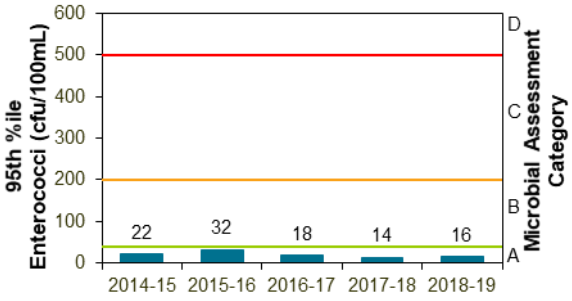
See 'How to read this report' for key to map.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2018 to Apr 2019	99%	100	Stable

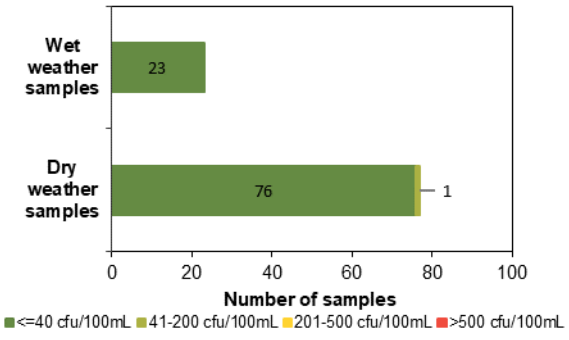
Sanitary inspection: Low



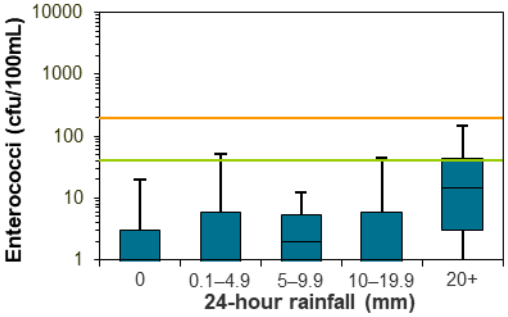
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Burwood North Beach

Beach grade: VG

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

Burwood North Beach is at the northern end of an 800 metre stretch of beach and is not patrolled by lifeguards.

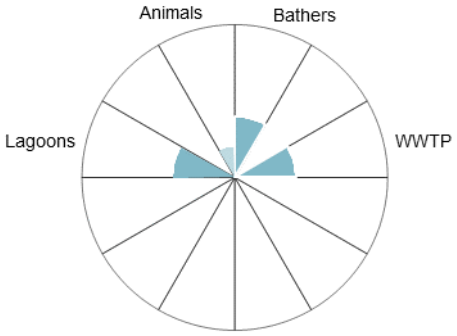
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time with few potential sources of faecal contamination.

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

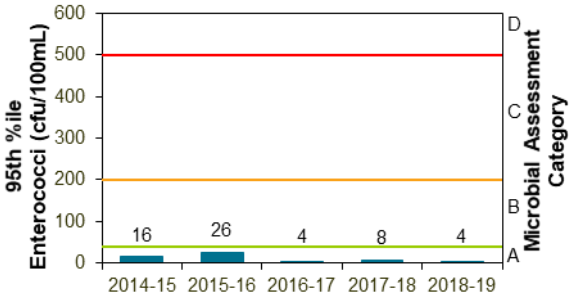
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2018 to Apr 2019	100%	100	Stable

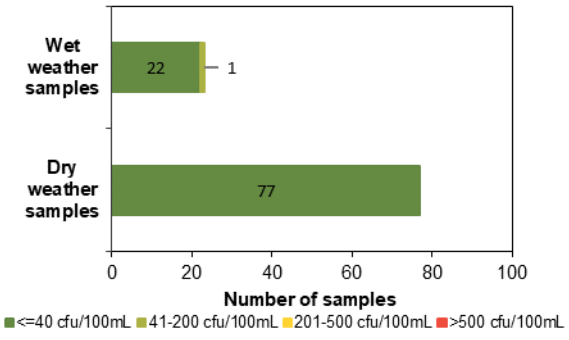
Sanitary inspection: Low



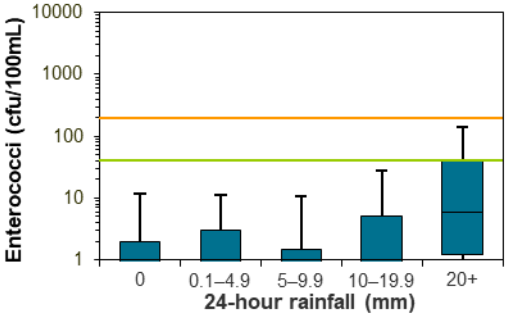
Microbial Assessment Category: A



Dry and wet weather water quality

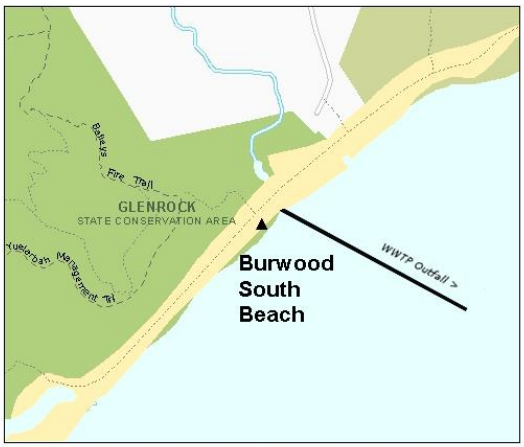


Water quality in response to rainfall



Burwood South Beach

Beach grade: VG



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

Burwood South Beach is located at the southern end of an 800 metre stretch of beach and is not patrolled by lifeguards.

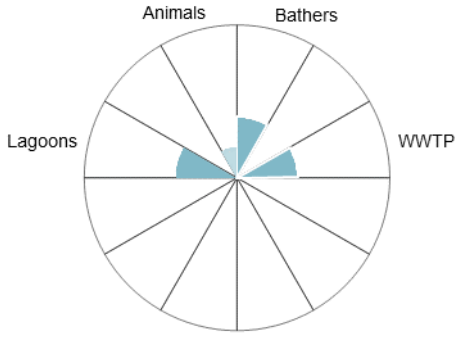
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time with few potential sources of faecal contamination.

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

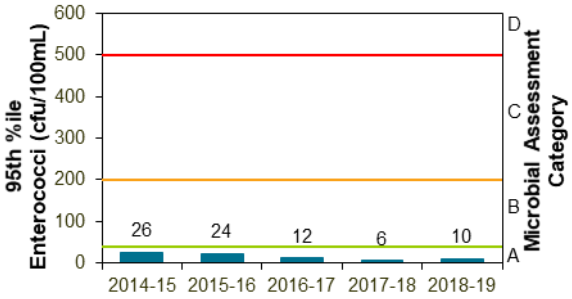
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Apr 2018 to Apr 2019	100%	100	Stable

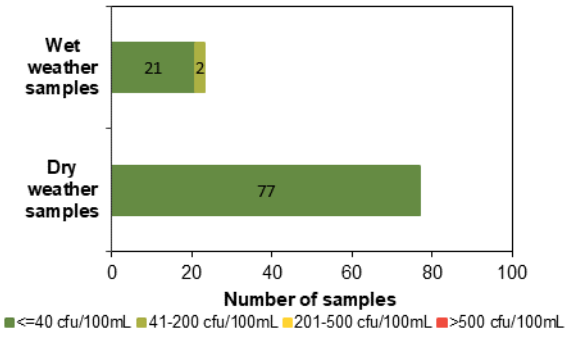
Sanitary inspection: Low



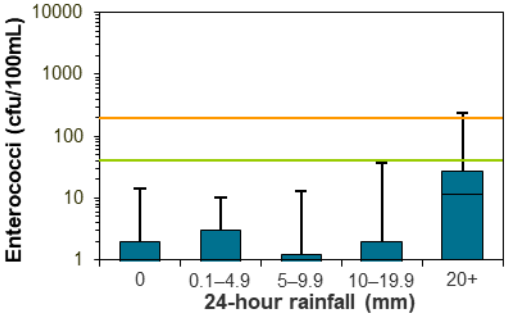
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Lake Macquarie City Council

Overall results

All six swimming sites were graded as Very Good or Good in 2018–2019. While this is an excellent result and an improvement from the previous year, it largely reflects the recent changes in the monitoring program with 14 designated swimming sites in the Lake Macquarie area no longer monitored under the Beachwatch Partnership Program.

Percentage of sites graded as Very Good or Good:

- 2018–2019: 100%
- 2017–2018: 75%
- 2016–2017: 70%
- 2015–2016: 70%.

Six swimming sites were monitored in the Lake Macquarie local government area.

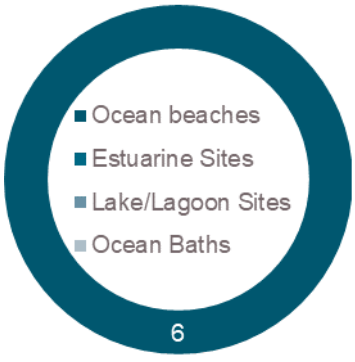
All locations were monitored by Hunter Water Corporation as a requirement of Environment Protection Licences. Samples were collected every sixth day throughout the year.

See the section on **How to read this report** on page 42 for an explanation of the graphs, tables and Beach Suitability Grades.

Best beaches

Glenrock Lagoon Beach, Dudley Beach, Blacksmiths Beach and Caves Beach.

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



Site types in Lake Macquarie City Council

In October 2018, Lake Macquarie City Council withdrew from the Beachwatch Partnership Program. The recreational water quality results for one ocean beach and 13 designated swimming sites in Lake Macquarie are no longer reported by Beachwatch.

Ocean beaches were the only site type monitored in the Lake Macquarie region.

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

Ocean beaches

Beach Suitability Grades for Lake Macquarie City Council ocean beaches

Four of the six ocean beaches were graded as Very Good: Glenrock Lagoon Beach, Dudley Beach, Blacksmiths Beach and Caves Beach. The water quality at these beaches is suitable for swimming almost all of the time.

Redhead Beach and Swansea Heads Little Beach were graded as Good, same as the previous year. Water quality at these sites was suitable for swimming for most of the time. Elevated enterococci levels were occasionally recorded after rainfall.

Management

Patrolled ocean beach
Photo: Beachwatch/EES, DPIE

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

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

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

Lake Macquarie City Council

Council coordinates the development and implementation of the Lake Macquarie Coastal Zone Management Plan (CZMP). The plan covers Lake Macquarie's coastline, estuary, and Swansea Channel. It contains actions to manage coastal hazards, improve the health of the coastal zone, and improve community access to coastal areas.

With funding from the NSW Government's Coastal and Estuary Grants Program, Council is currently undertaking a number of priority actions identified in the CZMP, including the removal of weeds from coastal dunes (especially bitou bush), reshaping of dunes, wetland and saltmarsh rehabilitation, revegetation works, the installation of stormwater treatment devices in priority locations (recent installations include Cardiff and Glendale), as well as completing works to stabilise eroding streambanks and foreshore areas around the lake and on the coastal dunes. Council and DPIE collaborate to undertake an integrated coastal zone monitoring program that considers water quality, seagrass habitat and coastal dunes to help inform future rehabilitation works. These projects aim to maintain and improve the ecological health of the Lake Macquarie estuary and surrounding beaches.

Lake Macquarie City Council continues to invest significant resources to improve water quality, especially within the Lake Macquarie estuary. Council currently manages and maintains over 300 stormwater quality improvement devices (including gross pollutant traps, constructed wetlands and bioretention basins). Council also requires that all new development complies with strict criteria for water quality discharges to the estuary, coast and other receiving waters.

Hunter Water

Over the last 10 years, Hunter Water has invested more than $50 million in wastewater system upgrades around Lake Macquarie to cater for population growth and reduce wet weather overflows. The upgrade of regional wastewater pump station infrastructure in Belmont by 2016, at a cost of more than $9 million, further reduces wet weather overflows in the north-east of Lake Macquarie.

Wastewater system upgrades in Glenrock State Conservation Area were completed in 2010 and 2016 by Hunter Water to reduce wastewater overflows to the environment. The cost of the works was in excess of $5 million. Recent analysis of the current system performance indicates a reduction in the frequency and volume of wet weather overflows since the upgrades were implemented.

Redhead Beach
Photo: Beachwatch/EES, DPIE

Although water quality was of a high standard at Glenrock Lagoon Beach, a health risk assessment completed by Hunter Water in 2010 indicated there was a small risk that the effluent plume from Burwood Beach WWTP could be driven back to the coast under certain combinations of wind and current. In March 2017 Hunter Water upgraded the WWTP with a UV disinfection system, at a cost of $13 million, to address the small health risk identified in the study. Since its commissioning, monitoring of the UV system has shown a reduction in pathogen concentrations in the effluent, meeting EPA requirements. The risk from the WWTP has been lowered in the sanitary inspection for Glenrock Lagoon Beach as a result of the upgrade.

Sampling sites and Beach Suitability Grades in Lake Macquarie City Council

Glenrock Lagoon Beach

Beach grade: VG

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

Glenrock Lagoon Beach is 300 metres long and is located at the southern end of Burwood Beach. The beach is not patrolled by lifeguards.

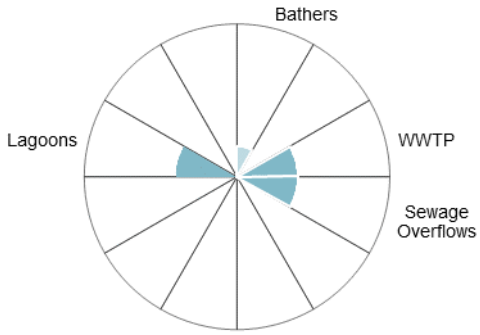
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time with few potential sources of faecal contamination.

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

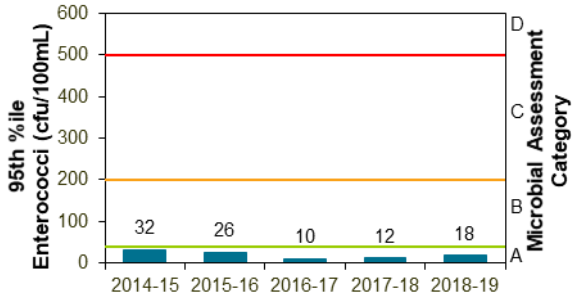
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	97%	100	Stable

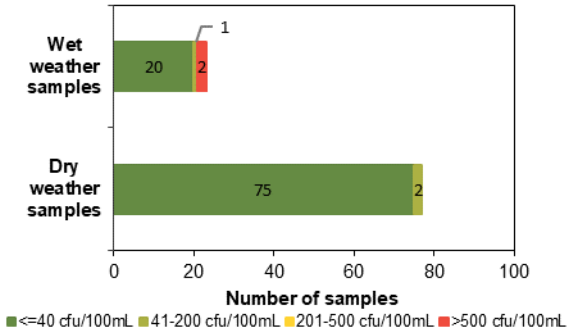
Sanitary inspection: Low



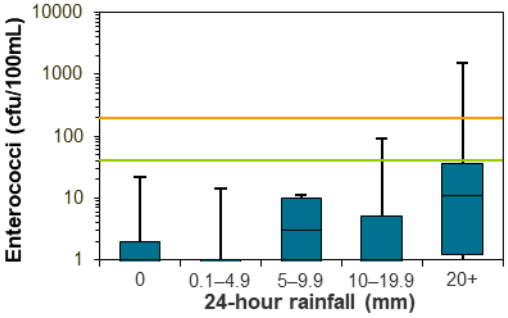
Microbial Assessment Category: A



Dry and wet weather water quality

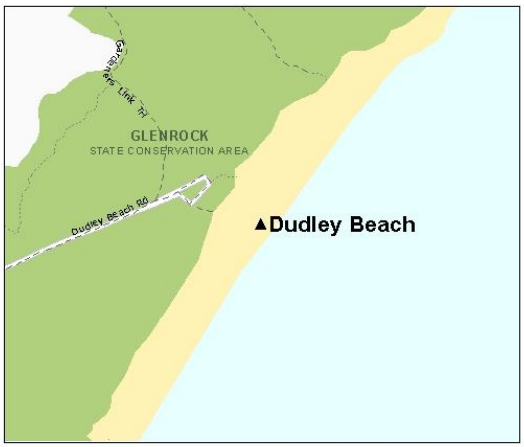


Water quality in response to rainfall



Dudley Beach

Beach grade: VG



Dudley Beach is one kilometre long and is not patrolled by lifeguards.

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

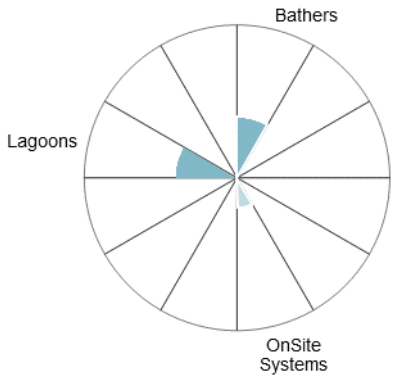
Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit in response to 20mm or more of rainfall.

The site has been monitored since 1996.

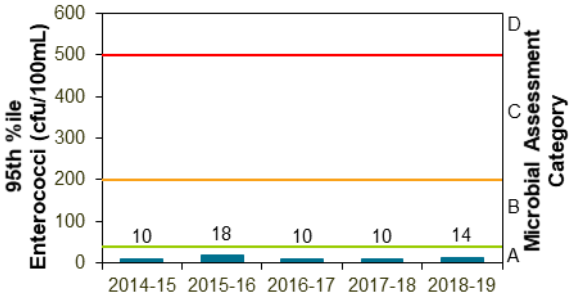
See 'How to read this report' for key to map.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	97%	100	Stable

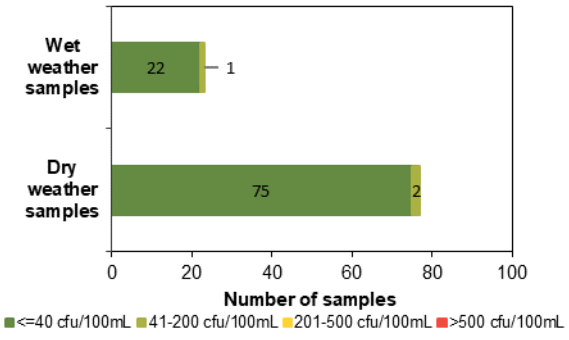
Sanitary inspection: Low



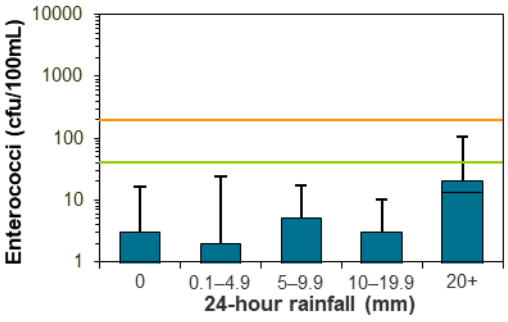
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Redhead Beach

Beach grade: G

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

Redhead Beach is located at the northern end of a 10 kilometre stretch of beach and is patrolled between September and April.

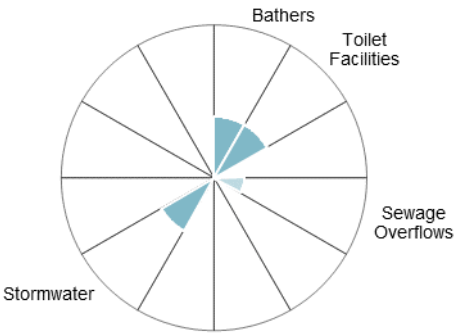
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, with several potential sources of minor faecal contamination.

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

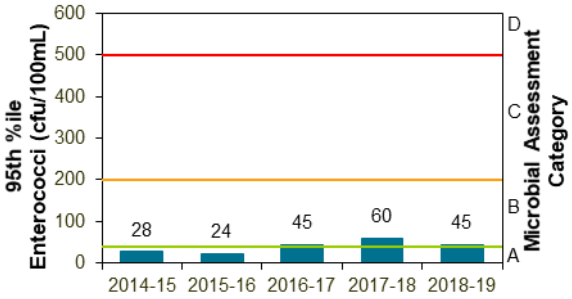
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	96%	100	Stable

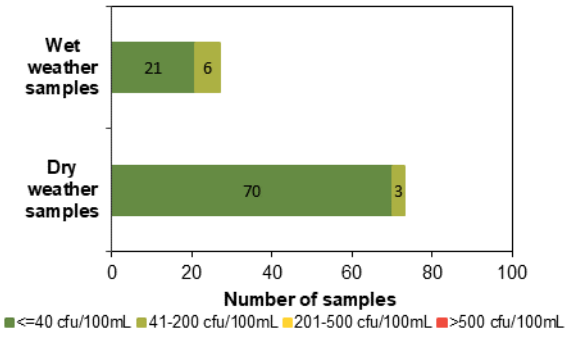
Sanitary inspection: Low



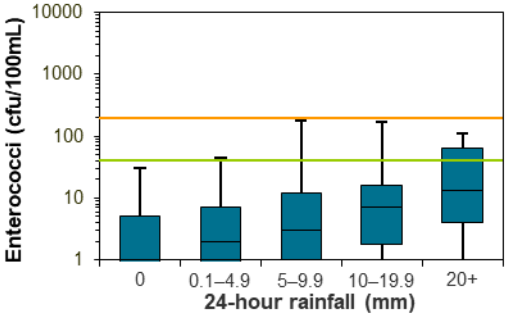
Microbial Assessment Category: B



Dry and wet weather water quality



Water quality in response to rainfall



Blacksmiths Beach

Beach grade: VG

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

Blacksmiths Beach is at the southern end of a 10 kilometre stretch of beach and is patrolled between September and April.

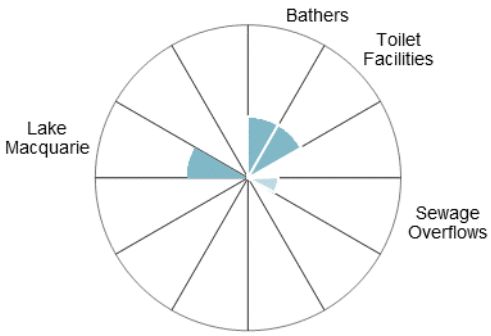
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of faecal contamination.

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

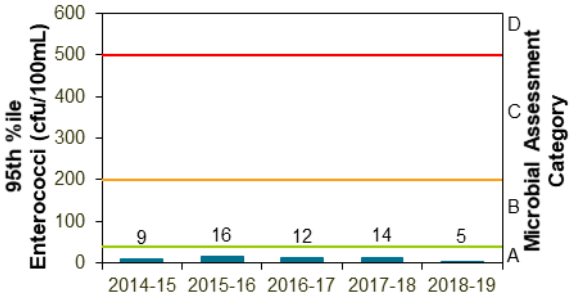
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	100%	100	Stable

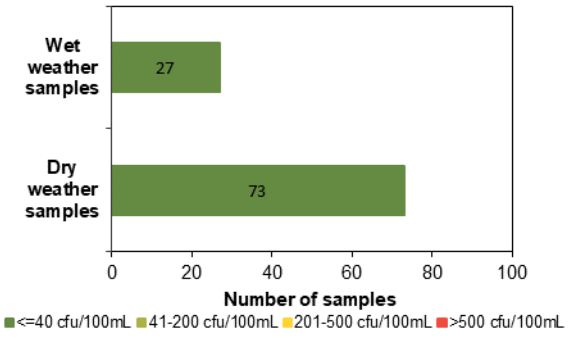
Sanitary inspection: Low



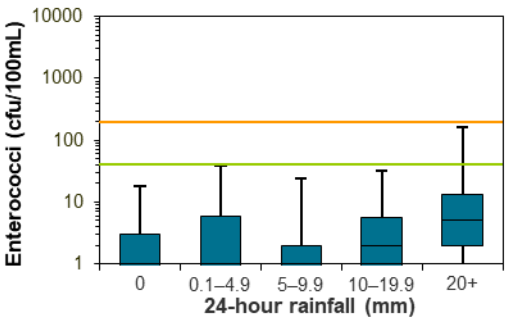
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



Swansea Heads Little Beach

Beach grade: G

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

Swansea Heads Little Beach is 60 metres long and located on the southern side of the entrance to Lake Macquarie. The beach is patrolled from September to April.

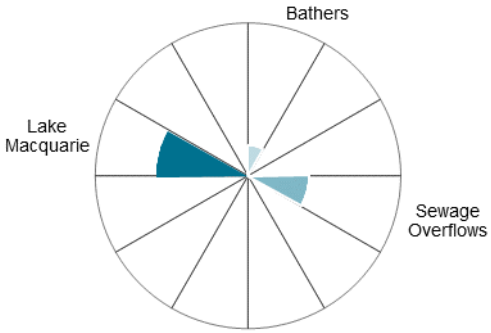
The Beach Suitability Grade of Good indicates microbial water quality is considered suitable for swimming most of the time but may be susceptible to pollution after rain, from several potential sources of faecal contamination including outflow from Lake Macquarie.

Enterococci levels increased slightly with increasing rainfall, occasionally exceeding the safe swimming limit across all rainfall categories.

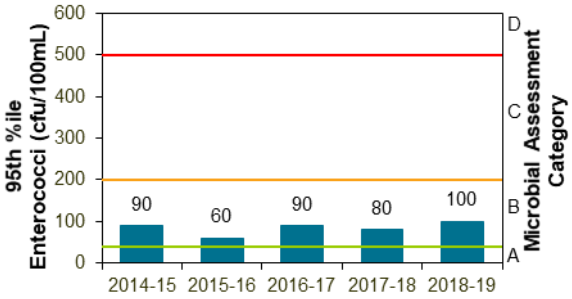
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	93%	100	Stable

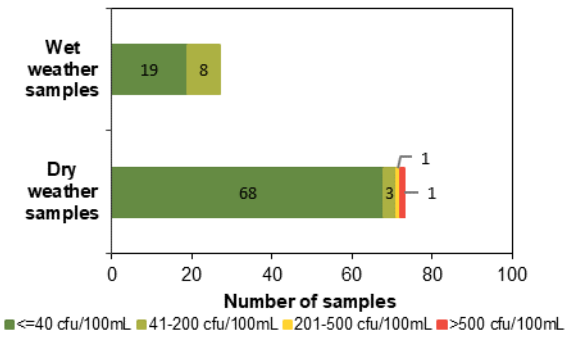
Sanitary inspection: Moderate



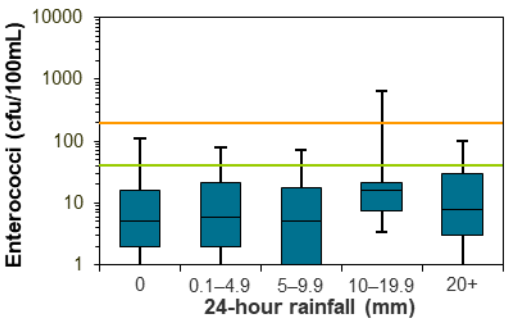
Microbial Assessment Category: B



Dry and wet weather water quality

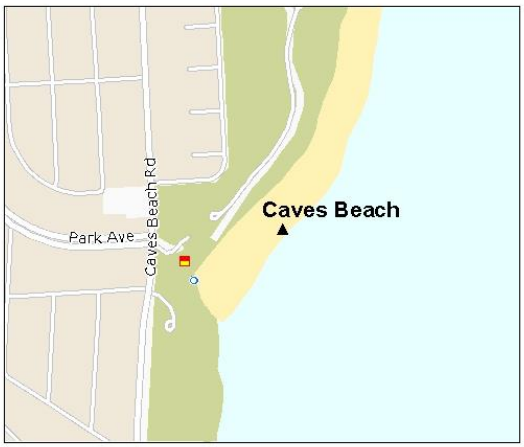


Water quality in response to rainfall



Caves Beach

Beach grade: VG



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

Caves Beach is located at the southern end of a 1.8 kilometre beach and is patrolled between September and April.

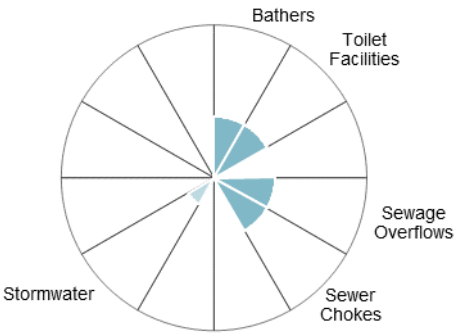
The Beach Suitability Grade of Very Good indicates microbial water quality is considered suitable for swimming almost all of the time, with few potential sources of significant faecal contamination.

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

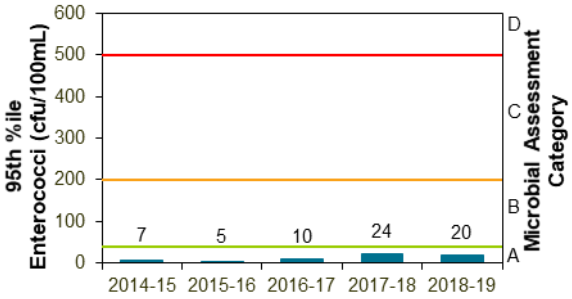
The site has been monitored since 1996.

Site type	Assessment period	Dry weather samples suitable for swimming	Water samples	Beach grade status
Ocean beach	Sep 2017 to Apr 2019	99%	100	Stable

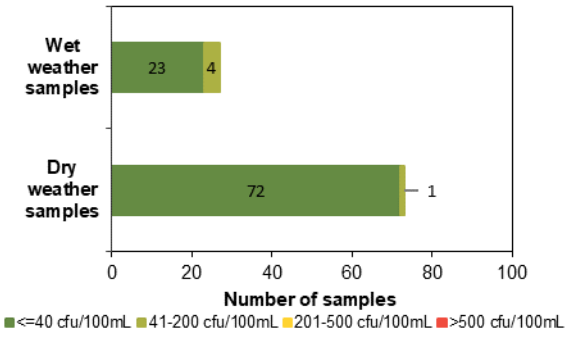
Sanitary inspection: Low



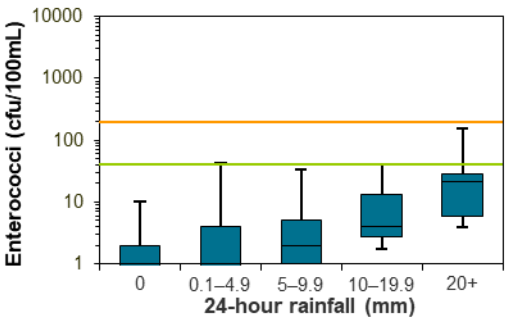
Microbial Assessment Category: A



Dry and wet weather water quality



Water quality in response to rainfall



How to read this report

Beach Suitability Grades

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

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 three 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 three 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 three 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*[1] were adopted for use in New South Wales in May 2009. These guidelines have been adopted in all Australian states and territories and are supported by guidance notes developed by the Department of Health Western Australia[2].

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

[2]Department of Health, Western Australia 2007, *Microbial quality of recreational water guidance notes in support of chapter 5 of the National Health and Medical Research Council guidelines for managing risks in recreational water, 2006*, Department of Health, Western Australia and The University of Western Australia, October 2007, available at ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications, accessed on 17/06/19.

Enterococci

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

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

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

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

Beach Suitability Grades are determined by using the following matrix:

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

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

Microbial Assessment Category (MAC)

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

Risk of illness associated with Microbial Assessment Categories

Category	Enterococci (cfu/100mL)	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 four Microbial Assessment Categories were determined by the World Health Organization using enterococci data collected from swimming locations across Europe. These values will represent different probabilities of illness if the distribution of enterococci data from swimming locations in New South Wales differs from the European distribution.

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

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

The tool can be downloaded from: http://ww2.health.wa.gov.au/Articles/A_E/Environmental-waters-publications under *Forms and templates* [accessed 17/06/19].

Sanitary Inspection Category (SIC)

More information about the **sanitary inspection** process is available at:

www.environment.nsw.gov.au/topics/water/beaches/reporting-beach-water-quality/guidelines/sanitary-inspection.

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

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

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

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

Stormwater at Coogee Beach
Photo: Beachwatch/EES, DPIE

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

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

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

Where there is a known history or evidence of sewage overflows or sewer chokes in the catchment they are identified as sources of potential faecal contamination, particularly if they are located close to the swimming location. In these instances, the risk posed by stormwater is adjusted accordingly to ensure the overall risk to public health is not overestimated.

Explanation of tables

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

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

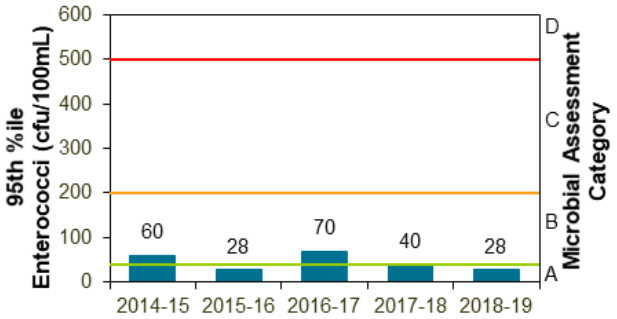
- Stable
- Improved
- Declined

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

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

Microbial Assessment Category (MAC) chart

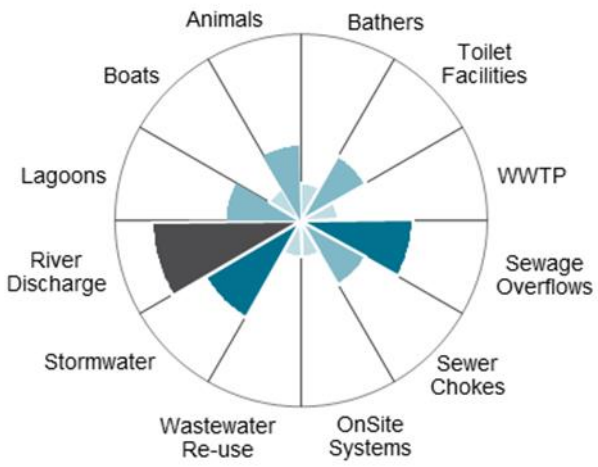
On each beach page, the MACs for the last five years are displayed on a simple bar chart. The MAC for the current year is based on enterococci data collected during the assessment period. The bars are labelled with the 95th percentile value for each year and the thresholds dividing the A, B, C and D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



Sanitary Inspection Category (SIC) chart

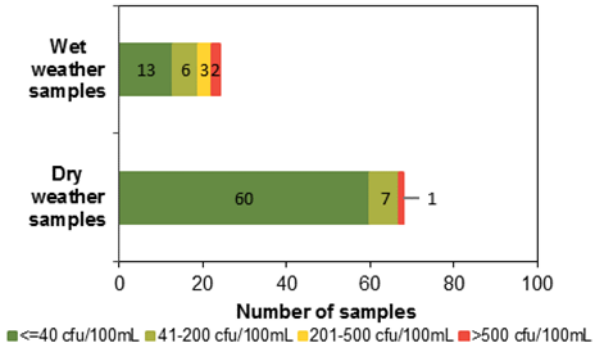
The results of the sanitary inspection for each swimming location are presented in a radar pie chart. The chart shows the likelihood that each identified pollution source will contribute to faecal contamination at a swimming site, as indicated by the size and colour of the segment, ranging from very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

Very Low	Low	Moderate	High	Very High



Wet and dry weather water quality chart

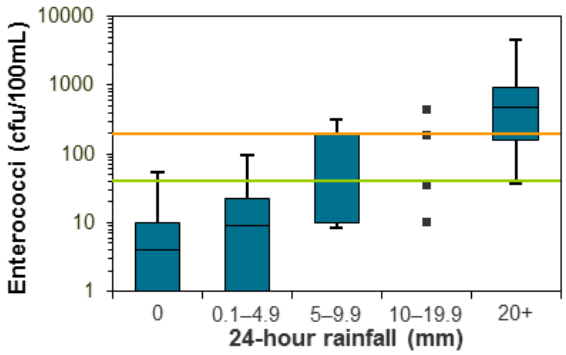
Enterococci levels in wet and dry weather conditions are presented for each swimming location as a bar graph. All data collected during the assessment period is included in the analysis. Dry weather is defined as no rainfall recorded in the previous 24 hours. Each bar is colour coded to show the number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



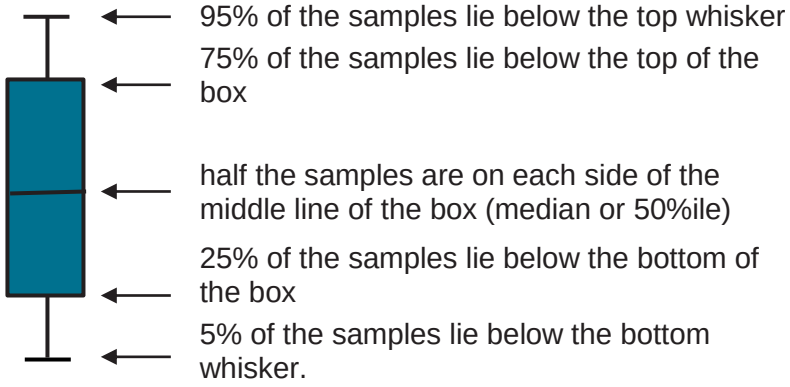
It is expected that swimming sites with lower levels of flushing show some elevated bacterial results in dry weather samples (no rainfall in the previous 24 hours) due to the longer time needed to recover from a rainfall event. At some estuarine and lake/lagoon swimming locations the impacts of stormwater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

Water quality in response to rainfall

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



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



Information bars

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

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

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

Explanation of maps

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