ASC
PUBLIC HEALTH & FOOD SAFETY

BEACH WATER QUALITY REPORT - 2025

MICROBIOLOGICAL ASSESSMENT OF RECREATIONAL COASTAL WATERS FOR THE NELSON MANDELA BAY METROPOLITAN AREA

BY: ASC Public Health and Food Safety Consultants

STUDY DATE: 16 July 2025 - 03 December 2025

Contents

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1. Introduction

The Nelson Mandela Bay Metropolitan Municipality (NMBM), located along the pristine shores of Algoa Bay in South Africa's Eastern Cape, is a region celebrated for its breathtaking beaches, cultural heritage, and wildlife attractions. Among its many natural treasures, the municipality boasts Blue Flag beaches, a prestigious international eco-label that signifies adherence to rigorous environmental management standards, safety, and water quality. These beaches part of the over 40Km coastline are vital to the well-being of residents and serve as key drivers of tourism and economic growth, attracting visitors from across the Eastern Cape and South Africa. The Nelson Mandela coast line is over

The Blue Flag is an internationally recognised eco-label awarded to beaches, marinas, and sustainable boating tourism operators that meet stringent environmental, educational, safety, and access-related criteria. Administered by the Foundation for Environmental Education (FEE), the Blue Flag certification symbolises excellence in environmental management and water quality, promoting sustainable tourism and environmental stewardship. The Blue Flag program sets stringent beach certification criteria for water quality, safety, environmental education, and sustainable management. One Of the over 30 criteria is the requirement for high water quality standards, particularly concerning microbiological contaminants like *Escherichia coli (E. coli)* and *faecal streptococci*. These bacteria are crucial indicators of faecal contamination and serve as benchmarks for assessing the safety of marine waters. .

As the summer season approaches, the population of beachgoers is expected to increase substantially, with many seeking refreshment and recreation along the coastline. While this period is generally associated with leisure and enjoyment, it is equally important to ensure that public health and environmental safety are not compromised.

This study assessed the microbiological water quality of select coastal swimming beaches to evaluate their suitability for recreational use. Due to constraints in time and resources, the investigation focused exclusively on the most popular coastal destinations.

Methods

Seven strategically selected bathing beaches, representing Seaview, Summerstrand, Humewood, Bluewater Bay, Motherwell/Wells Estate, and New Brighton—were sampled. Water quality monitoring was conducted monthly over a six-month period, from July to December 2025. The study's primary limitations include the restricted number of sampled sites and the defined six-month sampling window. Standard microbiological analyses were performed, and concurrent weather patterns and tidal data were collected to investigate potential environmental influences on water quality.

Overall, the sampled beaches demonstrated **satisfactory microbiological water quality**, with most sites consistently meeting or remaining below established regulatory thresholds. However, elevated microbial concentrations were noted during specific months at **New Brighton** and **Humewood Beach**. Notably, the water quality at New Brighton showed **significant improvement** compared to previous monitoring years. The assessment of external factors concluded that local weather conditions and tidal cycles did not represent a major influence or primary cause of contamination at specific locations and timeframe studied.

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The majority of the sampled popular swimming beaches maintained water quality standards suitable for recreational use during the study period. While localized, transient exceedances were observed, the overall microbiological profile was positive, highlighted by the notable improvements at New Brighton. Continuous monitoring is recommended to ensure public health protection.

The primary objective of this research was to quantitatively assess the microbiological water quality of seven selected recreational swimming beaches within Nelson Mandela Bay. This assessment was achieved through the detection and precise enumeration of two primary Faecal Indicator Organisms (FIOs):

- ***Escherichia coli (E.coli*)** Used as a reliable indicator of recent faecal contamination.
- **Intestinal Enterococci (formerly *Faecal Streptococci*):** Used as a robust indicator of faecal pollution, often correlating strongly with the risk of illness in marine environments.

The data gathered on the presence and concentration of these FIOs was utilized to determine the level of faecal contamination and evaluate the resulting potential health risks associated with full-contact recreational water use.

The secondary objectives supporting this primary goal included:

1. To compare the measured microbiological concentrations against established national and international regulatory standards, specifically the **South African Water Quality Guidelines for Coastal Marine Waters (DEA, 2012)** and the **Blue Flag International Beach Criteria (WESSA, 2024)**, and categorize the water quality status of each sampled beach.
2. To analyze the longitudinal microbiological data collected over the monitoring period (July–December 2025) to identify temporal variations, monthly trends, and potential chronic contamination patterns at each site.
3. To examine the correlation between microbiological results and environmental variables (e.g., local rainfall, weather patterns, and tidal cycles) to determine their influence on contaminant transport and concentration dynamics at the sampled locations.
4. To provide data-driven recommendations to local authorities regarding the operational management of the beaches, aimed at minimizing public health risks and maintaining compliance with recreational water quality standards.

2. Overview of Nelson Mandela Bay Beaches

Nelson Mandela Bay Metropolitan Municipality (NMBM), located in the Eastern Cape province of South Africa, is defined by a significant and varied coastline that borders the Indian Ocean. The Bay area is characterized by a coastal stretch measuring approximately **40 kilometers**, which runs continuously from the semi-urban and industrial areas in the north-east to the more protected and rural areas in the south-west.

This dynamic coastline encompasses diverse physical environments, ranging from protected coves and sandy dunes to industrial ports and urban recreational hubs. The coastal waters are subject to complex oceanographic influences, including varying tidal ranges, near-shore currents, and specific local drainage patterns, all of which critically influence the dispersal and concentration of contaminants.

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2.1 Land-Use and Environmental Influences

The NMBM coastline is characterized by differing patterns of adjacent land use, which directly impact the receiving water quality:

- Areas adjacent to the Coega Development Zone and sections of the inner Bay are subject to potential runoff from industrial, commercial, and highly urbanized residential areas (e.g., portions near New Brighton and Bluewater Bay).
- The central Bay beaches, such as Kings Beach and Hobie Beach, are surrounded by dense residential and commercial areas, making them highly susceptible to increased microbial loading from stormwater drains, sewer infrastructure failures, and high volumes of recreational users.
- Beaches further south (e.g., Maitland Beach and Blue Horizon Bay) are generally situated in less developed areas, often relying on natural attenuation; however, they remain vulnerable to contamination from localized sewage systems and agricultural runoff.

2.2 Study Area Beaches and Recreational Significance

The beaches along the NMBM coastline are highly frequented by both local residents and international tourists, forming a critical part of the region's tourism and recreational economy.

The study focused on seven prominent and consistently monitored beaches, strategically selected to represent the varying land-use and geographical conditions across the Bay:

- Bluewater Bay Beach
- New Brighton Beach
- Humewood Beach
- Kings Beach
- Hobie Beach
- St George's Beach (Motherwell/Well's Estate Area)
- Maitland Beach (Seaview Area)

Note: While Blue Horizon Bay is a known coastal location, it was not included in the seven actively monitored sites for this specific study, which focused on the core recreational beaches.

The high frequency of human activity and the combination of natural environmental factors-including rainfall-induced stormwater runoff and potential sewer network breaches-render these coastal waters susceptible to faecal contamination, thereby posing documented microbiological risks (gastrointestinal illness, skin irritations) to recreational beach users. The need for continuous monitoring and assessment is therefore critical for maintaining public health security and sustaining the Blue Flag status of qualifying beaches within the Bay.

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3. Rationale of the Study

Beaches serve as habitats for numerous marine organisms and are also subject to anthropogenic activities that may compromise water safety. Various pathogenic microorganisms may be introduced into the water through multiple pathways, including stormwater runoff, sewage discharge, and animal waste. The presence of these pathogens can result in adverse health effects, ranging from mild skin irritations to severe gastrointestinal infections. In extreme cases, they can contribute to serious disease outbreaks among beach users.

Between 2024 - 2025, several incidents raised concern about the microbiological safety of the Bay's beaches. For instance:

- New Brighton Beach was closed mid December 2024 due to elevated *Escherichia coli* levels detected in the water. https://www.theherald.co.za/news/2025-06-25-brighton-beach-set-to-reopen-at-end-of-june-after-contamination-scare/#google_vignette
- Kings Beach was previously closed in July following a sewage system disruption that caused flooding in the parking area, increasing the risk of faecal contamination and the potential presence of *Faecal Streptococci*. https://www.dailymaverick.co.za/article/2025-09-21-kings-brach-ongoing-sewage-spills-threaten-tourism-status

In response to these events, ASC Food Safety & Public Health initiated a scientific study to evaluate the microbiological safety and suitability of selected beaches within the Nelson Mandela Bay area. This is part of the company's self-funded community development projects.

4. Sampling Methodology

This study was initiated in response to heightened public concern regarding recurring microbiological contamination events at popular recreational beaches within the Nelson Mandela Bay metropolitan area (e.g., closures at New Brighton and Kings Beach during 2024–2025).

Due to financial and time constraints, water quality monitoring was focused on seven selected popular bathing beaches. Sampling was conducted monthly over a six-month period, extending from July to December 2025.

The specific beaches sampled within the study area were:

- Bluewater Bay Beach
- New Brighton Beach
- Humewood Beach
- St. Georges (Motherwell/Well's Estate Area)
- Kings Beach
- Maitland Beach (Seaview area)
- Hobie Beach

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4.1 Sample Collection and Aseptic Techniques

All water samples were collected by trained personnel adhering strictly to best practices and aseptic techniques to maintain sample integrity. This included the mandatory use of sterile gloves and sanitation of hands with 70% alcohol-based sanitizers prior to and between sampling events.

At each of the seven beaches, sampling was performed at **three designated points** within the primary bathing zone to ensure spatial representation of the area most frequented by swimmers.

The water samples were collected approximately 30cm beneath the water surface and at an average distance of 1m to 2m from the shoreline. This collection depth adheres to Blue Flag Criterion 7, ensuring the sample is representative of the bathing water and avoids surface scum or debris.

4.2 Sample Transport and Handling

Immediately following collection, samples were transferred into a sterile transport cooler box. Samples were maintained under controlled temperature conditions, specifically targeting a temperature of 4°C(±2°C) All samples were delivered to an accredited laboratory and processing commenced within a maximum holding time of 6 hours from the time of collection to minimise potential for microbial growth or die-off.

4.3 Laboratory Analysis

Microbiological analysis was conducted to quantify the concentration of two key indicator organisms: *Escherichia coli* (*E.coli*) and Intestinal Enterococci.

- *E.coli* was enumerated using the Colilert® method (IDEXX Laboratories), which conforms to the defined substrate technology (DST) principle and aligns with recognized standards such as US EPA Method 1604.
- Intestinal Enterococci were enumerated using the **Enterolert® method** (IDEXX Laboratories), also based on DST, which aligns with standards such as **US EPA Method 1600**.

Both methods employ fluorescence-based reactions for the rapid detection and enumeration of the target organisms, with results reported in Most Probable Number (MPN) per 100ML.

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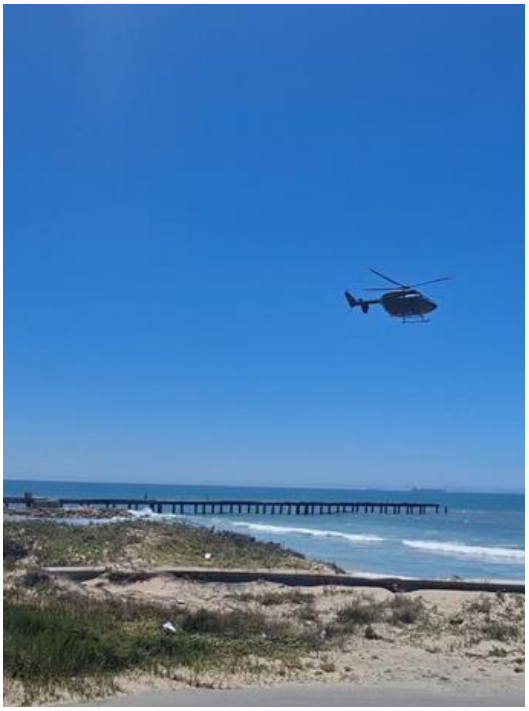

Figure 1: ASC at New Brighton Beach

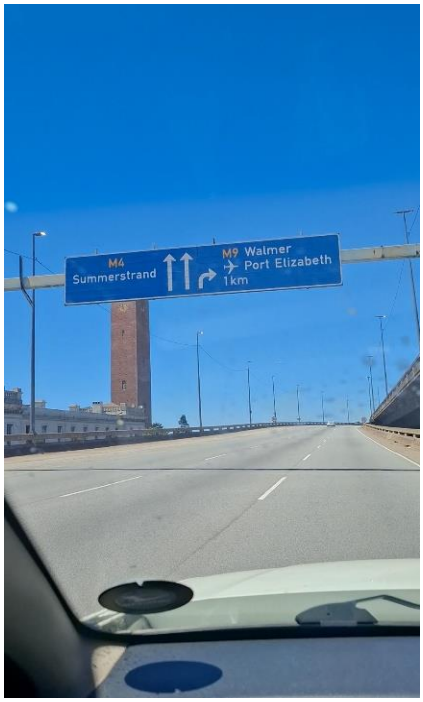

Figure 2: M4 to Summerstrand and Humewood Beaches

Figure 3: Sampling Kit

Figure 4: Water Sample

5. Study Objective

The primary objective of this study was to assess the microbiological quality of seawater at selected beaches in Nelson Mandela Bay through the detection and enumeration of two key indicator pathogens:

- *Escherichia coli* (E. coli)
- *Faecal streptococci*

The presence and concentration of these microorganisms serve as indicators of faecal contamination and help determine the potential health risks associated with recreational water use.

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6. Pathogen Background

6.1 Escherichia coli (E. coli)

Escherichia coli is a Gram-negative, rod-shaped bacterium belonging to the family *Enterobacteriaceae*. While most *E. coli* strains are harmless commensals, several pathogenic variants have been identified, including:

- *Enteropathogenic E. coli* (EPEC)
- *Enterohemorrhagic E. coli* (EHEC)
- *Enterotoxigenic E. coli* (ETEC)

The ingestion of water contaminated with these pathogenic strains can lead to acute infections, resulting in severe gastrointestinal illnesses (e.g., watery or bloody diarrhea), as well as extra-intestinal infections.

In the field of environmental and public health microbiology, *E.coli* is globally recognized as the primary indicator organism for faecal contamination in water.

Its presence in recreational waters is strongly correlated with the recent introduction of faecal material from human or warm-blooded animal sources. Consequently, the detection of excessive concentrations of *E.coli* is directly associated with an elevated risk of waterborne illnesses among recreational users, including:

- Gastrointestinal diseases
- Dermal infections (skin irritations)
- Otitis externa (ear infections)
- Conjunctivitis (eye irritations)

Therefore, monitoring the concentration of *E.coli* serves as a critical, real-time tool for assessing water safety and managing public health risk associated with contact recreation.

6.2 Faecal streptococci (Enterococci)

Faecal streptococci are Gram-positive, coccoid bacteria that primarily inhabit the intestines of humans and animals. They are considered robust indicators of faecal pollution, particularly in marine and estuarine environments, due to their resistance to salinity, desiccation, and temperature fluctuations.

High levels of *Faecal streptococci* in beach water may arise from sewage discharges, stormwater inflows, animal waste, or leaking sanitation systems, all of which pose potential risks to public health and environmental integrity.

For this reason, Enterococci are used by regulatory agencies such as the WHO and EPA to set water quality standards for recreational waters. Their environmental persistence makes them especially valuable for monitoring saltwater bodies.

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7. Study Design and Sampling Phases

7.1 Compliance and Sample Collection Protocol

Water quality monitoring was conducted in strict adherence to scientifically established protocols and regulatory guidelines. Samples were collected in sterile polypropylene bottles provided by a South African National Accreditation System (SANAS)-accredited analytical laboratory to ensure the chemical and microbial integrity of the samples.

The sampling depth was maintained at below the water surface, consistent with Blue Flag International Mandatory Criterion 7. This protocol ensures the collection of a representative sample of the bathing water where contact recreational users are most active, while avoiding surface film or debris. Samples were transported immediately under controlled temperature conditions (optimally) and processed within the stipulated holding time of 6–8 hours to mitigate the degradation of the microbiological indicators, especially in saline environments.

7.2 South African Water Quality Guidelines and Risk Criteria

The microbiological water quality of the sampled beaches was assessed against the South African Water Quality Guidelines for Coastal Marine Waters, Volume 2: Recreational Use (2012), published by the Department of Environmental Affairs (DEA, now DFFE).

These national guidelines utilize a risk-based management framework centered on two primary faecal indicator organisms (FIOs): Intestinal Enterococci and Escherichia coli (). The guidelines define four water quality categories-Excellent, Good, Sufficient (or Fair), and Poor (Unacceptable)-based on the estimated risk of gastrointestinal (GI) illness per exposure event.

A. Target Water Quality Ranges (TWQR)

For full-contact recreation (e.g., swimming and surfing), the Recommended Target Water Quality Ranges (TWQR) are based on the 95th percentile concentration of the FIOs, which must be maintained over a monitoring period to classify the water as Excellent or Good.

Category	Estimated Risk of GI Illness (Per Exposure)	Intestinal Enterococci (Counts per)**	(Counts per)**
Excellent		(95th percentile)	(95th percentile)
Good		(95th percentile)	(95th percentile)

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B. Minimum Requirement for Compliance

The minimum acceptable standard for bathing water is the Sufficient (or Fair) category, which corresponds to an estimated GI illness risk of. This is defined by a 90th percentile limit:

- **Intestinal Enterococci: ≤ 185 Counts per 100 ML (90th percentile)**
- ***E.coli:* ≤500 Counts per 100 ML (90th percentile)**

Any water quality classification falling into the Poor (Unacceptable) category (estimated risk) necessitates immediate management intervention, including potential public warnings or beach closures, aligning with the operational management programme recommended by the guidelines.

7.3 Blue Flag Compliance Limits (WESSA, 2024)

The microbiological results were also interpreted according to the more stringent criteria of the **Blue Flag Beach Criteria and Explanatory Notes (2024)**, issued by the Wildlife and Environment Society of South Africa (WESSA). These criteria align with the "Excellent" water quality classification of the national guidelines and represent the highest standard for recreational safety, corresponding to an estimated GI illness risk of 2.9%.

Table 1: The Blue Flag Beach Criteria and Explanatory Notes (2024)

Indicator Organism	Water Type	Compliance Limit (CFU/100 mL)*	Reference
Intestinal Enterococci	Coastal & Transitional Waters	≤ 100ML (95th percentile)	Blue Flag Beach Criteria (2024)
Escherichia coli	Coastal & Transitional Waters	≤ 250 (95th percentile)	Blue Flag Beach Criteria (2024)
Intestinal Enterococci	Inland Waters	≤ 200ML (95th percentile)	Blue Flag Beach Criteria (2024)
Escherichia coli	Inland Waters	≤ 500ML (95th percentile)	Blue Flag Beach Criteria (2024)

** Compliance is determined using the 95th percentile of results over the monitoring period.*

The study was initially designed to be executed over four distinct sampling phases occurring monthly between July and November 2025. This operational strategy was intended to facilitate both seasonal comparison and a longitudinal trend analysis of the microbiological water quality indicators.

However, execution encountered a logistical constraint: the scheduled sampling phase for August 2025 could not be completed due to unforeseen operational circumstances. Consequently, the time series data for the study is characterized by discontinuity between the July and September monitoring events, impacting the direct comparison of consecutive monthly data points within this period. The final analysis will therefore be based on a non-continuous sampling record comprising the remaining phases (July, September, October, November 2025 and 2 beaches were included in the December 2025 study).

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Table 2: Water Sampling Phases

Phase	Month	Purpose
Phase 1	July 2025	Establish baseline microbial data
Phase 2	September 2025	Comparative assessment and validation
Phase 3	October 2025	Comparative assessment and validation
Phase 4	November 2025	Final confirmation of water quality trends
Phase 5	December 2025	Retesting of Humewood Beach and New Brighton Beach

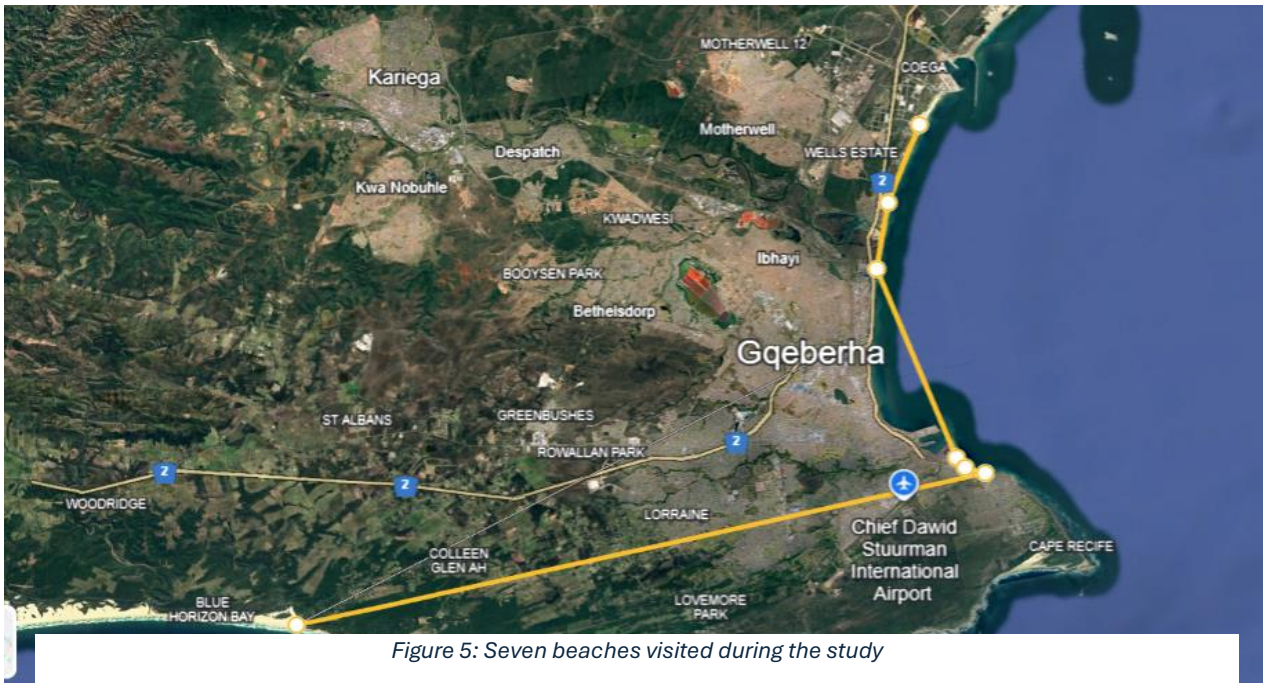

Figure 5: Seven beaches visited during the study

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8. Beach Water Results

Table 3: Microbiological Results for Nelson Mandela Bay Beaches (2025)

Beach Name	Pathogen Tested	Method	Result (CFU/100 mL)				
			July	Sept	Oct	Nov	Dec
Humewood Beach	*Escherichia coli*	Colilert	52	789	0	341	2723
	Faecal streptococci	Enterolert	63	20	0	96	450
Kings Beach	*Escherichia coli*	Colilert	0	41	0	0	
	Faecal streptococci	Enterolert	0	0	0	0	
Hobie Beach	*Escherichia coli*	Colilert	10	0	0	0	
	Faecal streptococci	Enterolert	10	0	0	10	
Bluewater Bay Beach	*Escherichia coli*	Colilert	0	0	0	0	
	Faecal streptococci	Enterolert	0	10	52	0	
New Brighton Beach	*Escherichia coli*	Colilert	6 867	488	24 196	84	173
	Faecal streptococci	Enterolert	2 613	420	24 196	154	20
St Georges Beach	*Escherichia coli*	Colilert	0	0	0	0	
	Faecal streptococci	Enterolert	0	0	0	0	
Maitland Beach	*Escherichia coli*	Colilert	0	0	0	0	
	Faecal streptococci	Enterolert	0	0	0	0	

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9. Statistical Analysis

9.1 Humewood Beach

Humewood Beach recorded *E. coli* concentrations above the safe limits during September and again in November. Due to the variability observed over the monitoring period, ASC conducted an additional test outside the planned study schedule to obtain a more definitive understanding of the current water quality status at Humewood Beach. The November exceedances were further confirmed by the December results, which showed a significant deterioration, with *E. coli* levels rising to 2,723 CFU/100 mL.

A similar trend was observed for faecal streptococci (Enterococci). For the first time in the four-month monitoring period, concentrations exceeded the acceptable limits, reaching 450 CFU/100 mL in December.

Based on these findings, Humewood Beach is demonstrating clear signs of being unsafe for recreational use, failing to meet the Blue Flag microbiological criteria for December. Early indicators of concern were noted in September, followed by an apparent improvement in October when both *E. coli* and *Staphylococcus* results fell within acceptable limits. However, this improvement was short-lived, as subsequent testing revealed a sharp increase in contamination levels.

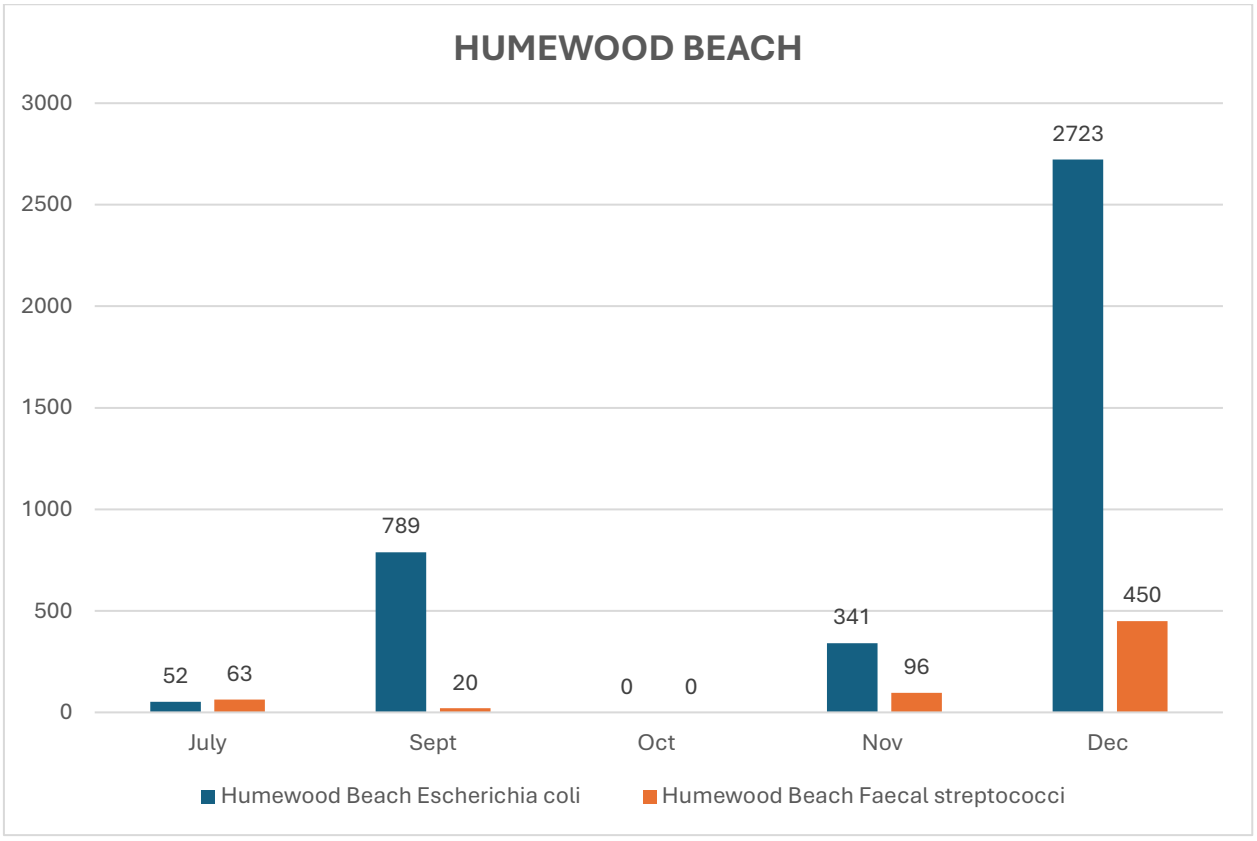

Figure 1:Humewood Beach Graph

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9.2 Kings Beach

Kings Beach remains one of the better performing beaches in this study. A minor increase in *E. coli* was observed in September (41 CFU/100 mL), which still falls well within safe recreational limits. Although the beach parking lot experienced a sewage outburst in September 2025, the microbiological results show that the seawater itself remained unaffected. Across all four months tested, no Enterococci were detected, further confirming consistently good water quality.

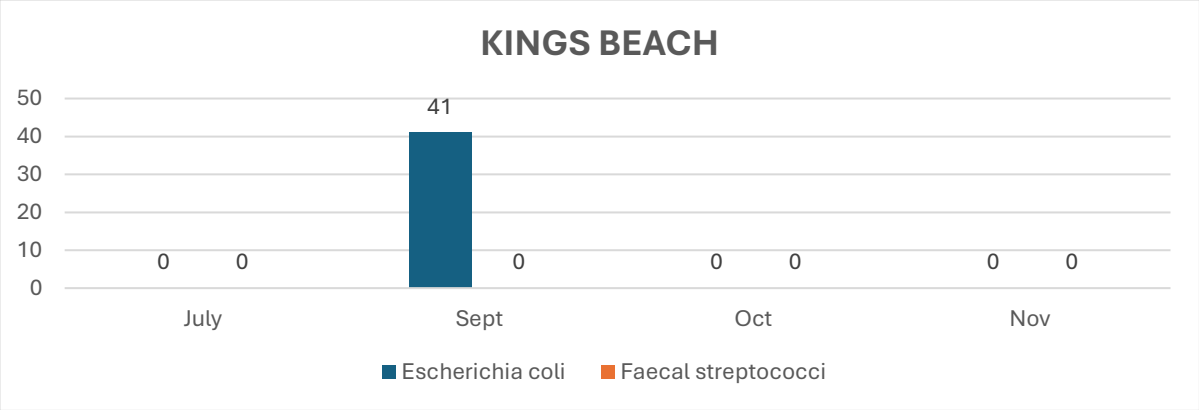

Figure 2:Kings Beach Graph

9.3 Hobie Beach

Hobie Beach remains with low baseline *E. coli* and Enterococci values (10 CFU/100 mL) recorded in July and November. Given its location near the popular Boardwalk Mall and its status as a major tourism site in Nelson Mandela Bay, these results are encouraging for both local residents and visitors. They reflect stable and safe microbiological conditions at this mostly visited beach.

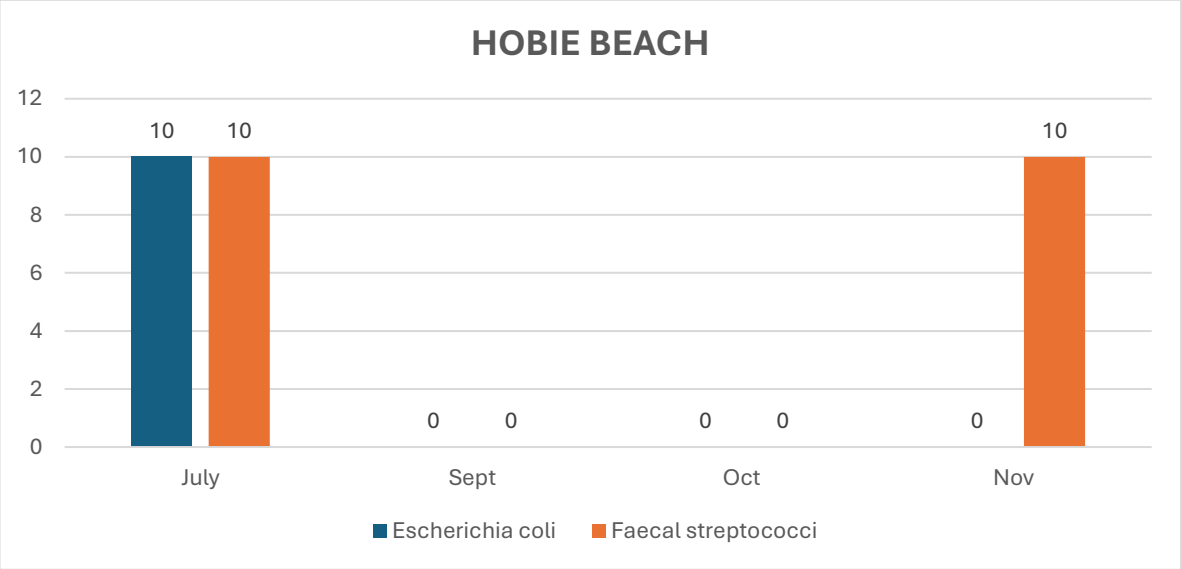

Figure 3: Hobie Beach Graph

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9.4 Bluewater Bay Beach

Bluewater Bay Beach remains in good condition overall. Enterococci levels showed a moderate peak in October (52 CFU/100 mL), which, while not alarming, suggests a temporary contamination event. Despite this, the beach continues to present a favourable option for recreational use among beaches in the Nelson Mandela Bay area.

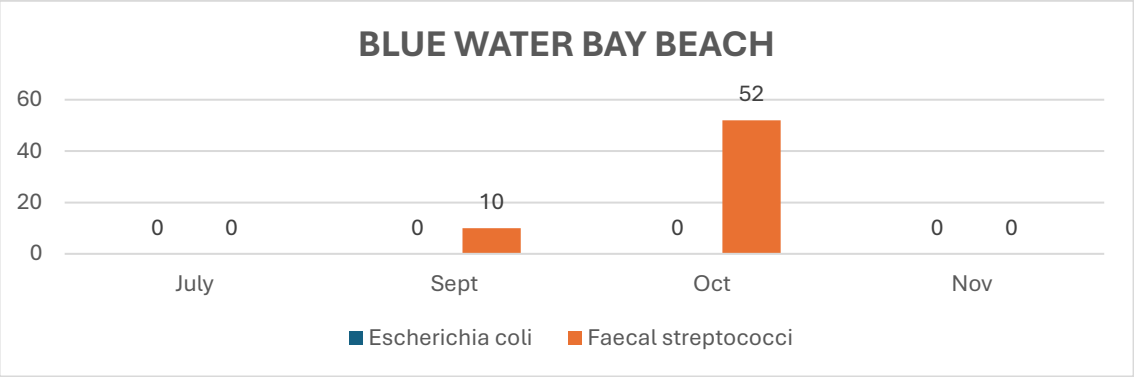

Figure 4: Bluewater Bay Beach

9.5 New Brighton Beach

Historically, New Brighton Beach has been one of the most challenging sites throughout the three-year monitoring period. However, for the first time in several years, the November 2025 results indicated a marked improvement, with *Escherichia coli* levels falling within the Blue Flag compliance threshold (<250 CFU/100 mL). Despite this positive trend, Enterococci concentrations for the same period exceeded the acceptable limit (<100 CFU/100 mL), signifying that the water continued to present potential public health risks.

Given the unexpectedly improved microbiological profile observed in November, a confirmatory assessment was undertaken to verify the accuracy of the results. The subsequent analysis conducted in December corroborated the November findings, with New Brighton Beach meeting the Blue Flag microbiological criteria for the first time in the three-year duration of the water quality study for both *Escherichia coli and* Enterococci.

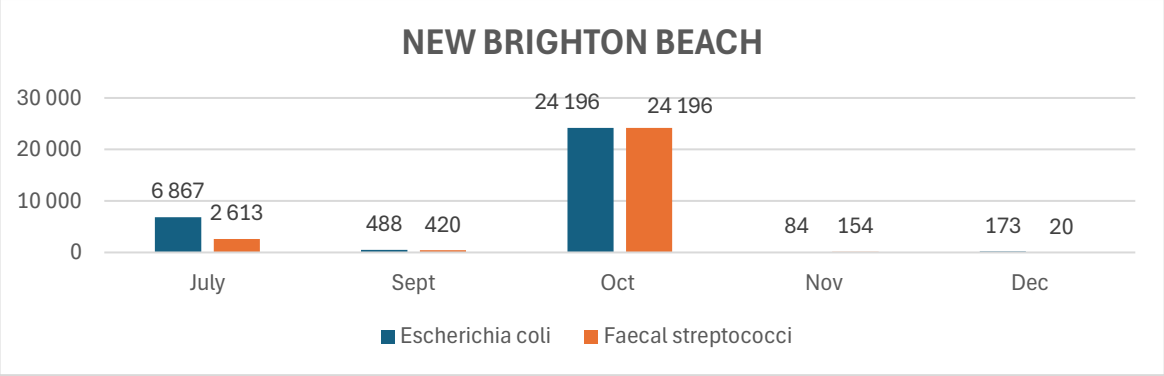

Figure 5: New Brighton Beach Graph

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9.6 St Georges Beach

St Georges Beach demonstrated excellent water quality throughout the monitoring period. No faecal contamination was detected in any of the sampling months, confirming its status as one of the cleanest and safest beaches in the assessment.

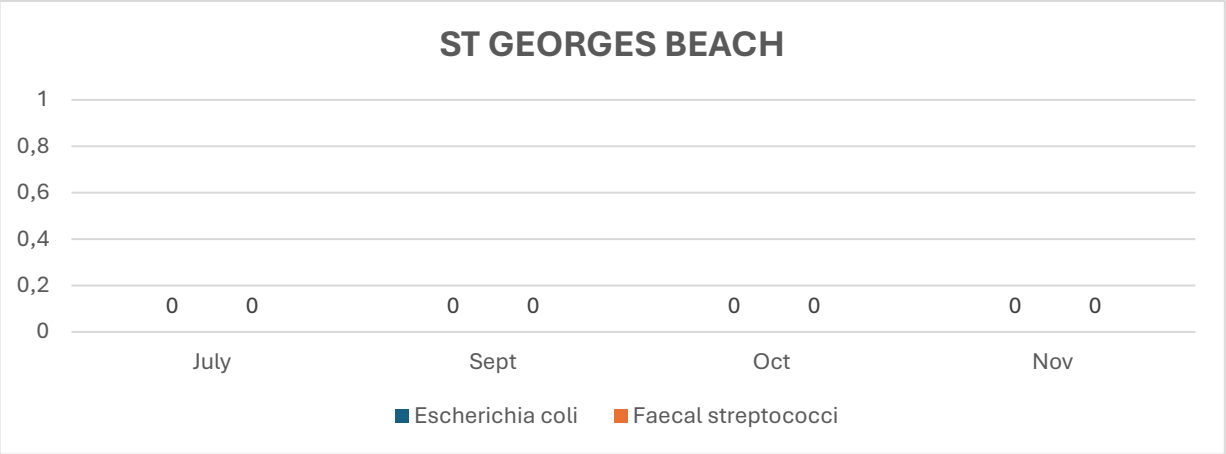

Figure 6: St Georges Graph

9.7 Maitland Beach

Maitland Beach demonstrated excellent microbiological quality. No *E. coli* or Enterococci were detected across all sampling months, indicating consistently clean water and minimal risk of faecal contamination.

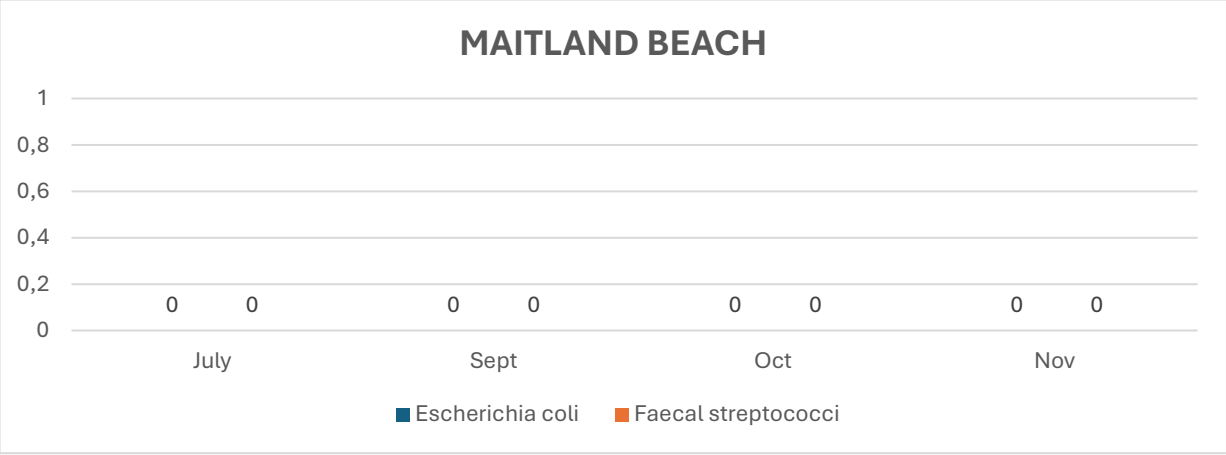

Figure 7: Maitland Beach Graph

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10. Analysis of Possible External Influences

The study also evaluated whether external environmental factors specifically rainfall, stormwater drainage, and poor infrastructure may have influenced the microbial results. Due to certain limitations, ASC Food Safety primarily focused on assessing natural occurrences to determine whether they interfered with the results obtained during the sampling period.

To achieve this, ASC reviewed the weekly weather forecasts preceding each sampling day, with particular attention to rainfall events and their possible interaction with nearby stormwater drainage systems.

Sample 1: 13th July 2025

The first set of samples was collected on 13 July 2025. Weather data indicated no rainfall recorded within the two weeks prior to sampling. This confirms that rainfall could not have influenced the microbial results obtained during this period.

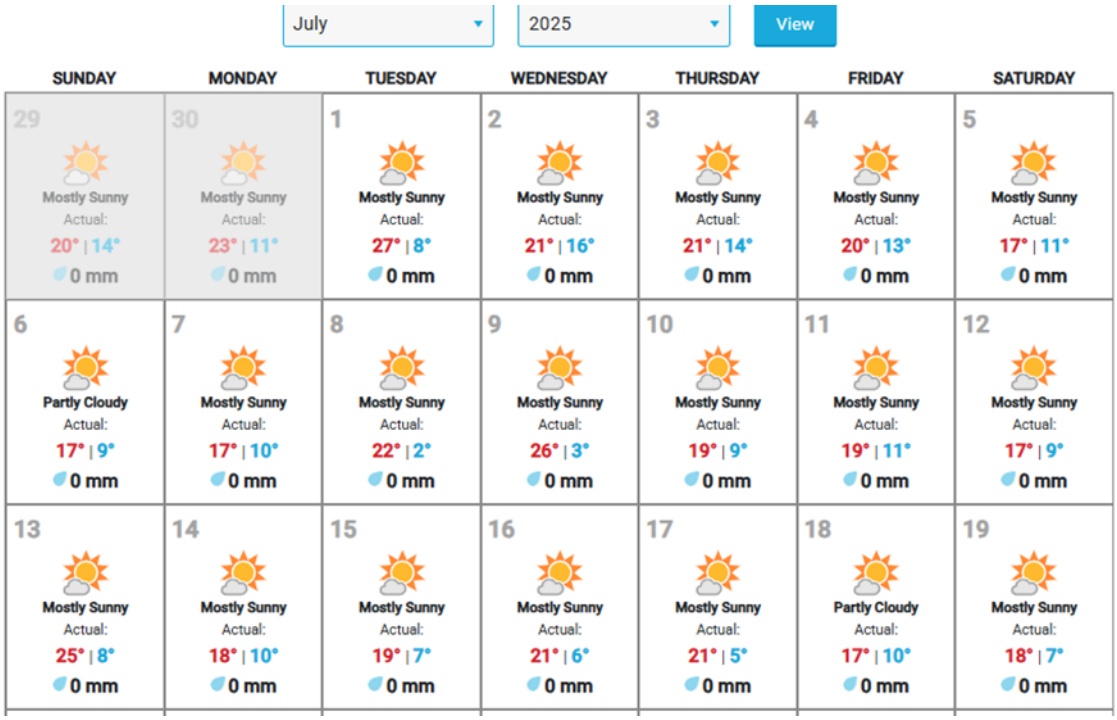

Figure 8: July weather forecast

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Sample 2: 25th September 2025

The second samples were taken on 25 September 2025. Light rainfall occurred four times during the month, including the day before sampling (24 September).

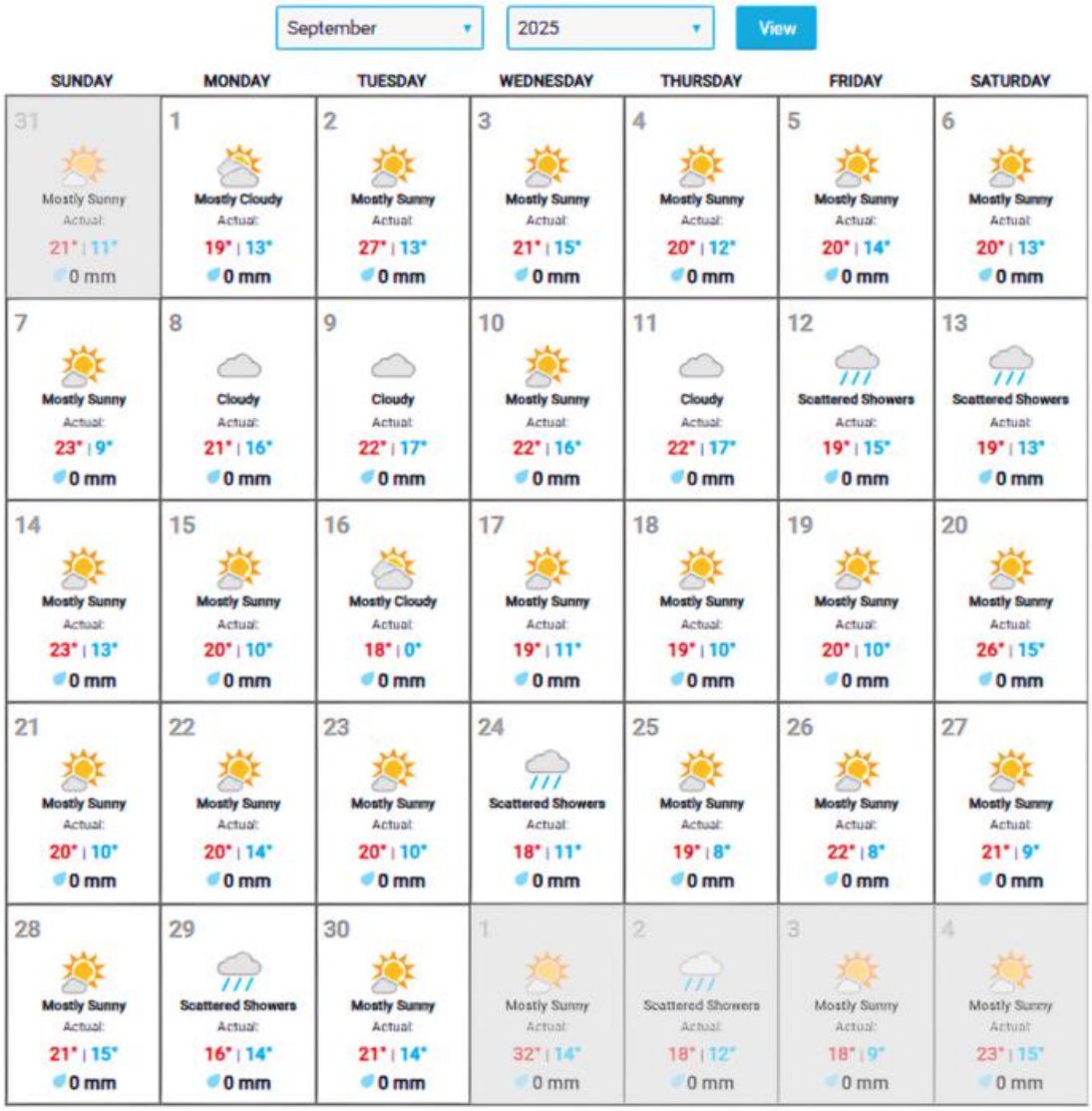

Figure 9: September weather forecast

Microbial results showed contrasting changes at the two monitored beaches:

Beach Name	July 2025 E. coli	Sept 2025 E. coli	July 2025 FS	Sept 2025 FS
Humewood Beach	52	789	63	20
New Brighton Beach	6867	488	2613	420

Humewood Beach recorded an increase in E. coli, while New Brighton Beach showed an improvement in both indicators. Since the beaches displayed opposite microbial trends, it is unlikely that the light rainfall was the primary influence. This suggests that other factors such as infrastructure or localized contamination sources may be responsible.

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Sample 3: 30th October 2025

The third samples were collected on 30 October 2025. There were five light rainfall occurrences earlier in the month, with two on 24 and 25 October five days before sampling.

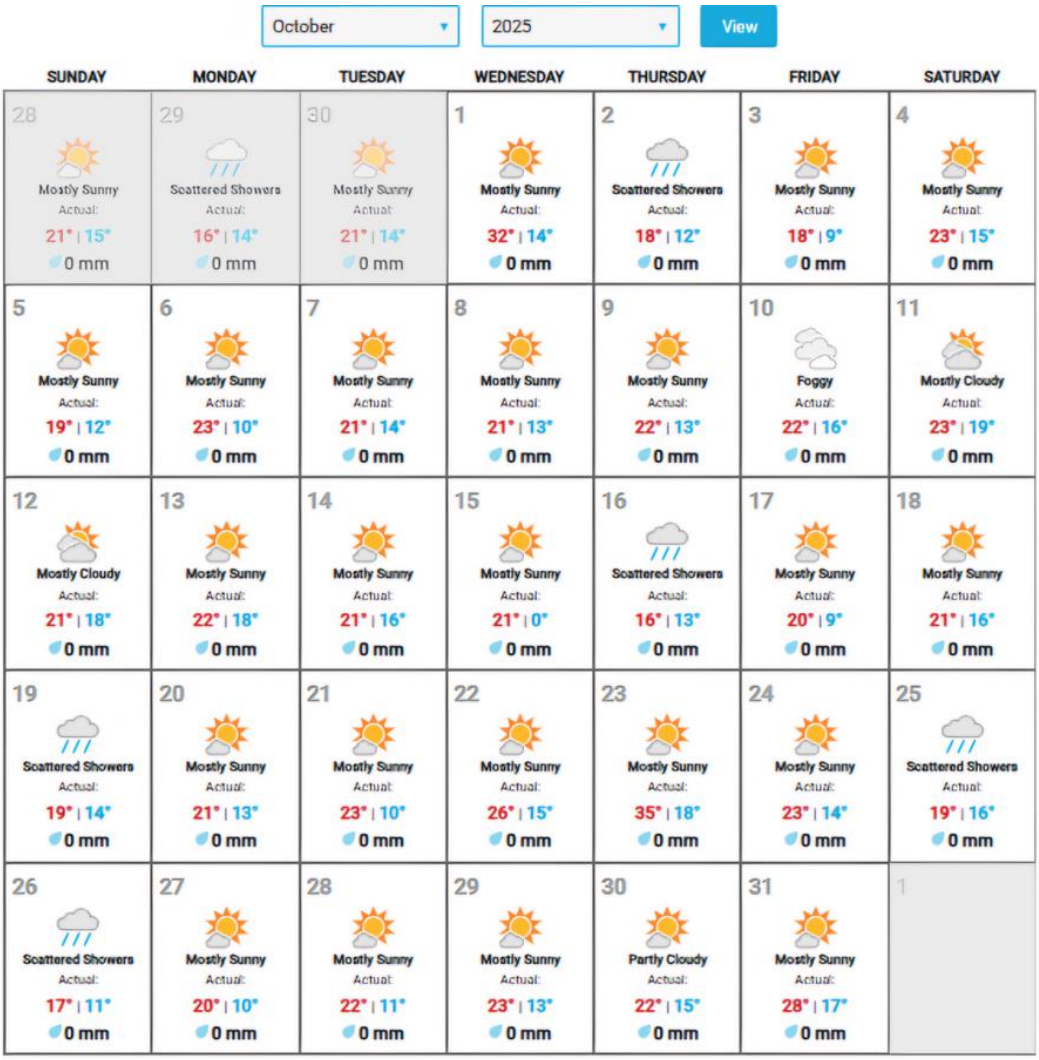

Figure 10: October weather forecast

The results again showed opposing trends:

Beach Name	July 2025 E. coli	Sept 2025 E. coli	Oct 2025 E. coli	July 2025 FS	Sept 2025 FS	Oct 2025 FS
Humewood Beach	52	789	0	63	20	0
New Brighton Beach	6867	488	24 196	2613	420	24 196

Humewood Beach exhibited an absence of both faecal indicator organisms, whereas New Brighton Beach showed a marked increase in contamination levels. These contrasting trends suggest that weather conditions, specifically rainfall, were not a consistent influencing factor, as such events would be expected to affect both beaches in a similar manner.

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Final Sample 4: 12th November 2025

During the week of 12 November 2025, no rainfall was recorded. Nevertheless, some of the water quality results still failed to meet the microbiological criteria.:

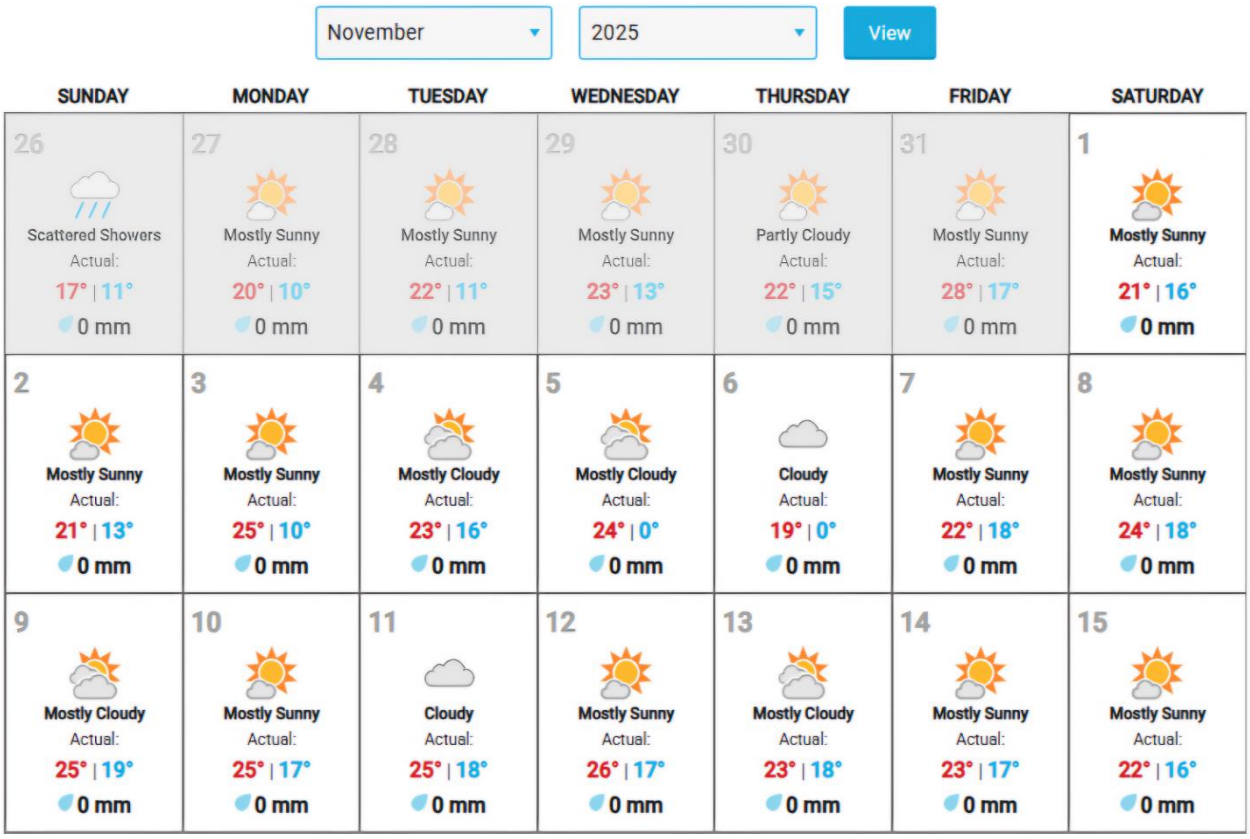

Figure 11: November weather forecast

Beach Name	Oct 2025 E. coli	Nov 2025 E. coli	Oct 2025 FS	Nov 2025 FS
Humewood Beach	0	341	0	96
New Brighton Beach	24 196	84	24 196	154

Humewood Beach shifted from absence to the presence of pathogens, while New Brighton Beach showed a significant decrease. The lack of rainfall combined with contradictory movement in results reinforces that rainfall was not a key driver of contamination.

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Additional Testing: 3rd December 2025

Due to fluctuating results, ASC conducted an additional sampling on 3 December 2025. No rainfall was recorded in the days prior to sampling. Once again, the results trended in opposite directions:

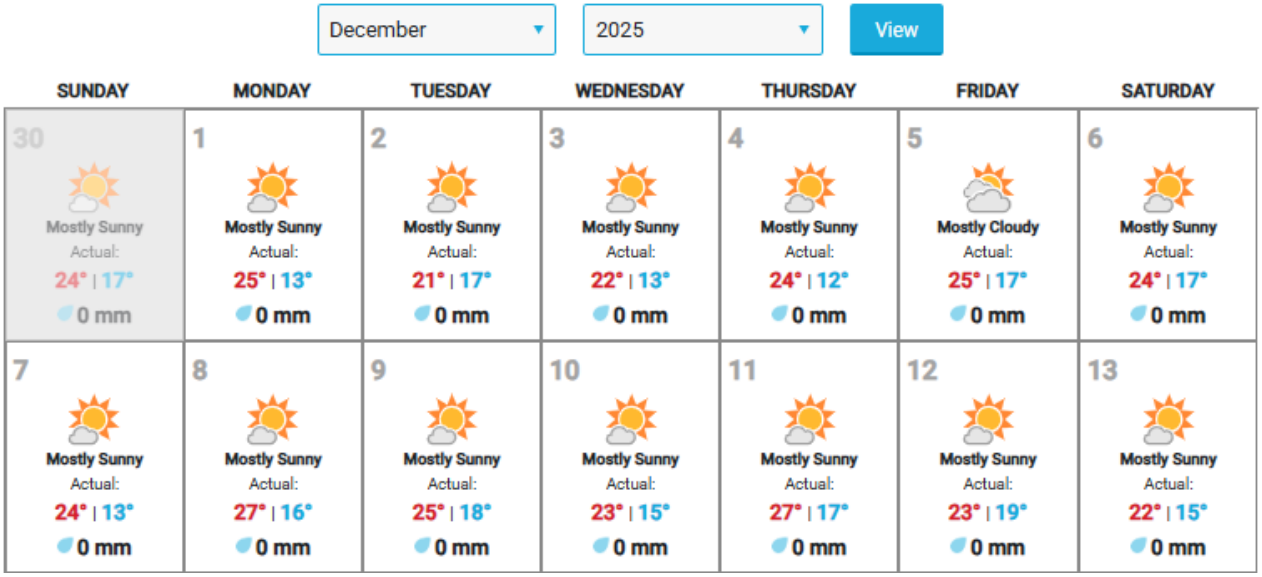

Figure 12: December weather forecast

Beach Name	Nov 2025 E. coli	Dec 2025 E. coli	Nov 2025 FS	Dec 2025 FS
Humewood Beach	341	2723	96	450
New Brighton Beach	84	173	154	20

The persistence of opposite patterns between the beaches, even without rainfall, confirms that natural weather occurrences were not the dominant cause of contamination.

Across all five sampling events spanning six months, microbial results consistently demonstrated contradicting trends between Humewood Beach and New Brighton Beach. If rainfall or other natural factors were responsible, both beaches would be expected to show similar directional changes following rain events.

Instead, the data shows that:

- Contamination increased at one beach while decreasing at the other.
- Absence of rainfall did not correlate with improved results.
- Spikes occurred even after several dry days.
- Improvements occurred during rainy months for one beach but not the other.

These findings strongly suggest that positive detection of E. coli and faecal streptococci is influenced by factors beyond natural occurrences.

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The most plausible explanation is contamination associated with poor infrastructure, particularly:

- Compromised stormwater drainage systems
- Structural leaks or overflows
- Faulty sewer connections
- Localized infrastructure failures unique to each beach area

Therefore, the results point to infrastructure-related contamination rather than rainfall,

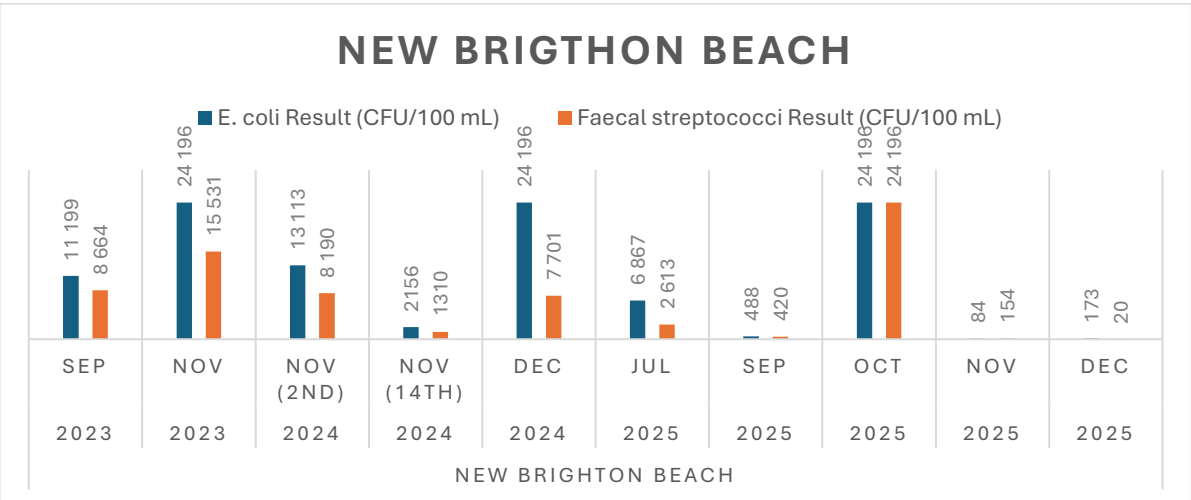
11. Comparative Analysis

ASC did a comparative analysis of the microbiological water quality of seven beaches monitored over a three-year period, focusing on trends, performance differences, and potential underlying causes. By assessing *E. coli* and *faecal streptococci* results across multiple sampling seasons, the analysis highlights which beaches consistently maintain safe water conditions and which are repeatedly affected by contamination. The comparison reveals distinct performance gaps, with some beaches demonstrating stable water quality while others show persistent or episodic pollution linked to ageing and inadequate wastewater infrastructure.

11.1 New Brighton Beach

New Brighton Beach continues to show the most severe and persistent microbiological contamination over the three-year period. The repeated extreme spikes such as the values of 24,196 CFU/100 mL documented in 2023, 2024 and 2025 indicate a sustained and unresolved contamination issue. These elevated results occur across different seasons and sampling periods, and the consistency of the problem strongly suggests that poor and deteriorating wastewater infrastructure is the primary contributor.

The pattern reflects a scenario where sewage overflows, leaking pipelines, unmaintained pump stations, or compromised reticulation systems are repeatedly discharging or seeping into the marine environment. The fact that contamination persists even during dry weather conditions confirms that infrastructure failure, not necessarily environmental factors, is driving the issue however notable improvements have been seen in the recent tests for November and December 2025



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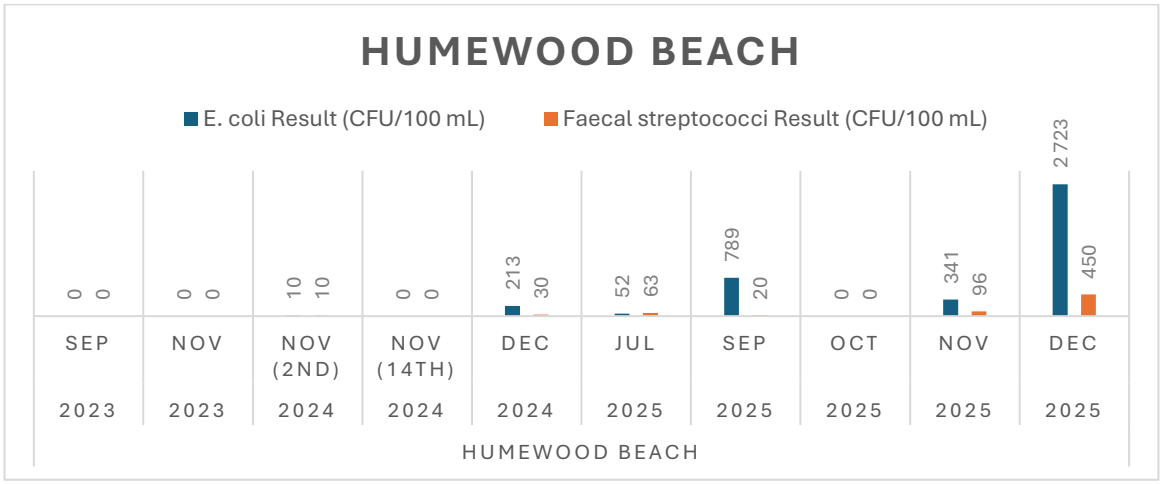
11.2 Humewood Beach

Humewood Beach shows largely stable and low contamination levels throughout many sampling months; however, it also experiences intermittent spikes, most notably the sharp increase in December 2025 *(E. coli 2*,723 CFU/100 mL) and elevated readings in several 2025 months.

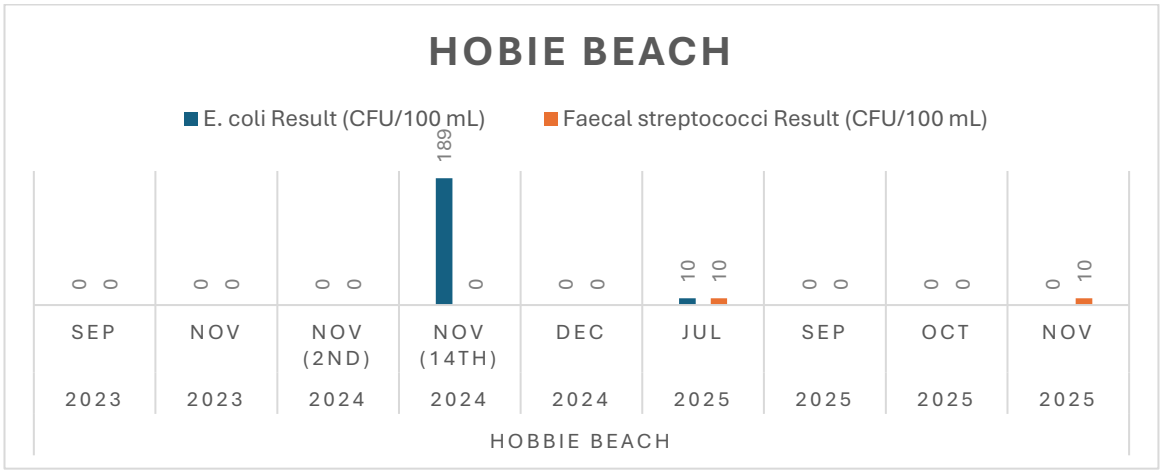
Given the absence of rainfall influence on these sampling days and the lack of correlation with natural events, the most plausible explanation is episodic infrastructure failures. These may include intermittent pump station malfunctions, overflow events upstream, or faulty sewage conveyance systems that intermittently release contaminants into the coastal area. The nature of the spikes aligns with the behaviour of aging or poorly maintained wastewater networks rather than continuous environmental drivers.

Overall, Humewood is not consistently polluted, but it is significantly affected whenever infrastructural issues arise.



11.3 Hobie Beach

Hobie Beach shows generally clean and stable water quality, with contamination only detected once (November 2024, E. coli 189 CFU/100 mL).



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11.4 Maitland Beach

Maitland Beach continues to show excellent water quality across all three years, with all E. coli and *faecal streptococci* results recorded as zero. Maitland remains one of the cleanest and lowest-risk sites in the dataset.

11.5 St Georges Beach

St Georges Beach also displays consistently clean results, with only a single minor detection (faecal streptococci 10 CFU/100 mL) across the three-year dataset. No meaningful contamination is observed, and the results remain unaffected by weather or seasonal patterns.

11.6 Kings Beach

Kings Beach exhibited consistently low levels of contamination throughout the monitoring period. A single, minor detection was recorded in September 2025 (E. coli: 41 CFU/100 mL), while all other samples yielded non-detectable results. Overall, Kings Beach can be considered a low-risk site, with no evidence of persistent or chronic contamination.

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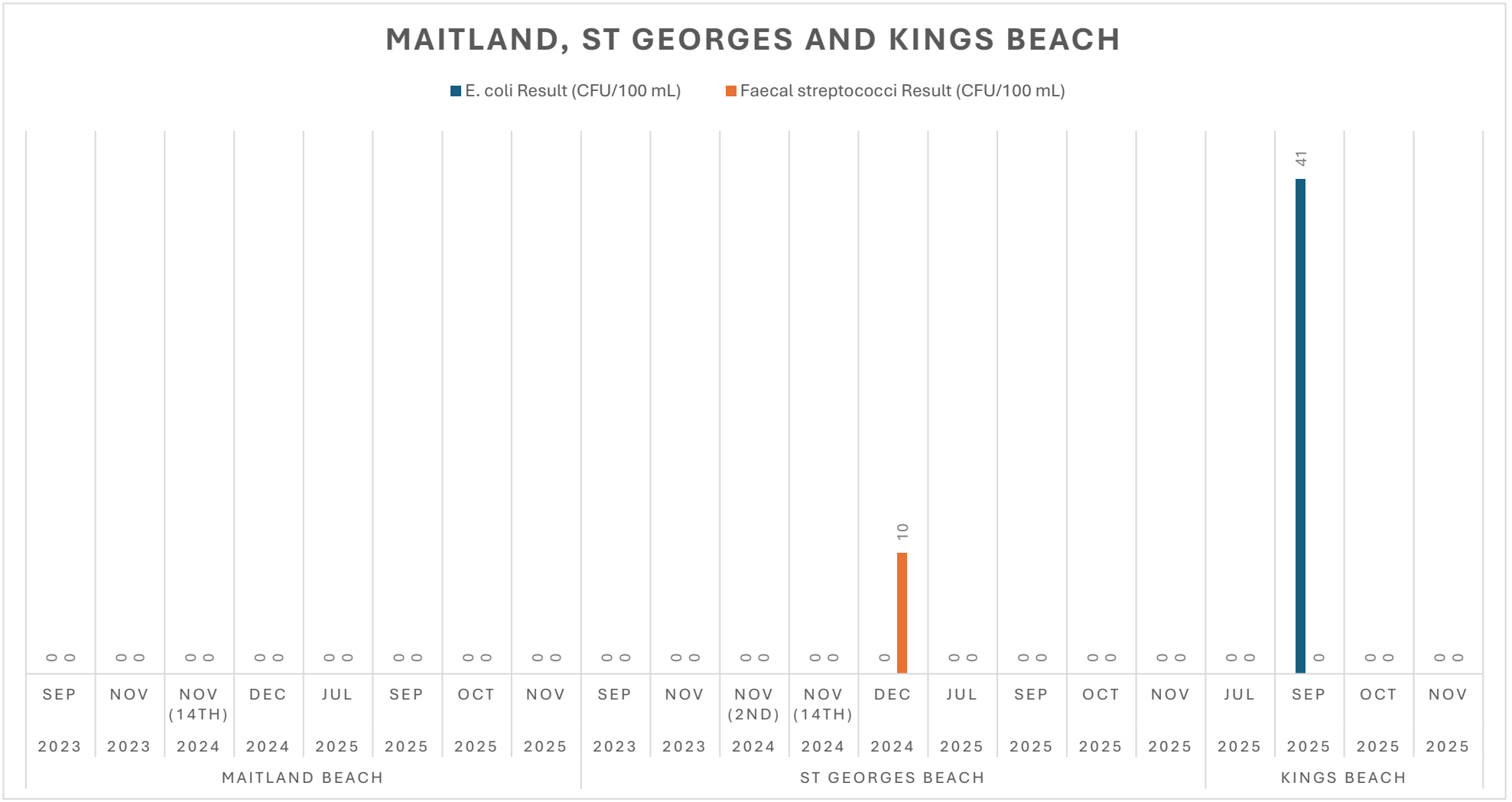

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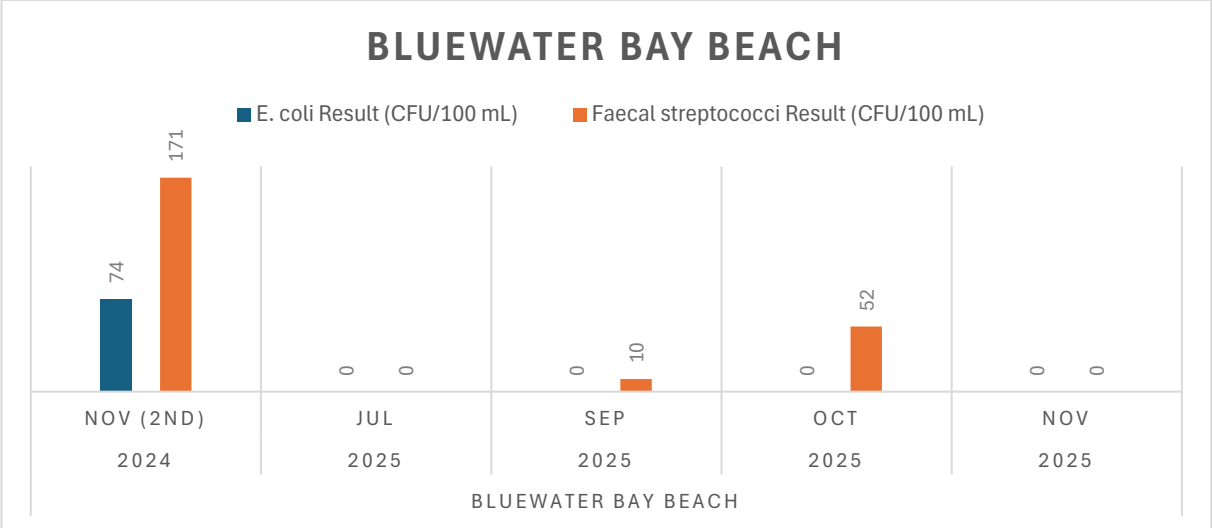
11.7 Bluewater Bay Beach

Bluewater Bay Beach displays mostly clean water throughout the dataset, with one elevated reading in November 2024 (E. coli 74 CFU/100 mL; faecal streptococci 171 CFU/100 mL). Despite this isolated event, Bluewater Bay remains largely stable and low-risk, but it demonstrates that even relatively clean beaches can be affected when infrastructure pressure increases.



12. Discussion and Analysis

The microbiological quality of recreational waters in the Nelson Mandela Bay Metropolitan Municipality (NMBM) was rigorously assessed in this study, with results interpreted against one of the criteria set by the internationally recognised Blue Flag Beach Criteria established by WESSA, alongside other marine water parameters relevant to recreational use.

According to these standards and guidelines, the maximum allowable concentrations for recreational water are 250 CFU/100 mL for *Escherichia coli* (*E. coli*) and 100 CFU/100 mL for faecal streptococci (*Enterococci*). The selection of these two faecal indicator bacteria is grounded in their reliability for detecting sewage contamination in coastal environments. *E. coli* serves as a direct indicator of recent faecal contamination from warm-blooded animals and humans, whilst *Enterococci*, due to their resilience in saline conditions, provide a robust marker for cumulative sewage pollution. The simultaneous detection of both organisms indicates faecal contamination and increases the risk of waterborne illnesses, including gastroenteritis and skin infections, for beach users.

The study results reveal a distinct bifurcation in water quality profiles across the monitored beaches. The majority of sites, including St George's, Maitland, Kings, Hobie, and Bluewater Bay, consistently maintained excellent microbiological quality throughout the monitoring period (July–December 2025). For instance, Maitland Beach and St George's Beach recorded zero or near-zero detections of both *E. coli* and *Enterococci* across all sampling phases. Hobie Beach and Kings Beach also demonstrated stable, low-level contamination that remained well within Blue Flag thresholds, suggesting effective coastal management, strong dispersion by ocean currents, and minimal impact from surrounding infrastructure. Bluewater Bay

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Beach generally conformed to this trend, confirming that most of the NMBM coastline offers safe recreational water for public use.

In contrast, New Brighton Beach and, to a lesser extent, Humewood Beach exhibited significant microbiological failures, albeit with distinctly different underlying patterns. New Brighton Beach has historically been the most severely polluted site, with persistent, chronic contamination documented over a three-year monitoring history and several severe spikes, including concentrations as high as 24,196 CFU/100 mL. This long-term pattern points to unresolved failures in the underlying wastewater infrastructure, such as chronic sewage leaks or ongoing discharges. Notably, the late 2025 results marked a critical turning point, as both *E. coli* and *Enterococci* levels declined sharply and ultimately met the microbiological criteria in the final confirmatory test conducted in December 2025. This sudden, sustained improvement strongly suggests the implementation of a targeted intervention, such as major infrastructure repairs or successful containment of a persistent sewage outfall, shortly before or during the end of the monitoring period.

By contrast, Humewood Beach exhibited highly episodic and volatile contamination events. After periods of acceptable compliance, the site recorded sharp, isolated spikes, such as *E. coli* levels of 789 CFU/100 mL in September and a catastrophic peak of 2,723 CFU/100 mL for *E. coli* and 450 CFU/100 mL for *Enterococci* in December. The interim compliance observed in October indicates that pollution is not continuous but rather the result of acute, intermittent infrastructure failures. Such patterns are highly indicative of temporary pump station malfunctions, episodic overflow events, or localised structural leaks that release significant volumes of faecal matter into the marine environment during specific, non-rain-related events.

Statistical analysis of weather data and microbial results further isolates the primary sources of contamination. The study demonstrates that light rainfall was not the dominant factor driving contamination spikes. Across five sampling events, microbial trends at Humewood Beach and New Brighton Beach consistently moved in opposite directions, even following light rainfall. If rainfall were the primary driver of non-point source pollution, such as stormwater run-off, both beaches would typically exhibit concurrent increases in contamination levels. Moreover, significant exceedances occurred during periods with no preceding rainfall, such as the severe December spike at Humewood Beach. This evidence strongly supports the conclusion that the observed contamination is structural and point-source in nature, arising from poor or failing wastewater infrastructure unique to the catchment area of each affected beach.

The findings of this study have important management implications. Persistent public health risks are associated with the use of non-compliant beaches, particularly for vulnerable population groups such as children, the elderly, and the immunocompromised. The data demand urgent and targeted intervention, with a focus on addressing infrastructure degradation at Humewood Beach to prevent catastrophic episodic failures. Additionally, the municipality needs to maintain monitoring at New Brighton Beach to verify that the recent positive trend is permanent and not a short-term anomaly. The high variability observed at Humewood Beach necessitates an increase in sampling frequency, potentially weekly, during periods of high usage, to provide timely public safety warnings rather than relying on monthly data that may miss acute contamination events. Finally, the consistently high performance of beaches such as Maitland and St George's should be protected through ongoing maintenance and proactive environmental management, ensuring their Blue Flag status remains an indicator of excellence for the metropolitan area.

In summary, the 2025 water quality analysis reveals a critical environmental dichotomy: whilst the majority of NMBM beaches remain safe for recreational use, contamination hotspots are directly attributable to

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compromised civil engineering assets rather than natural ecological factors. Addressing these infrastructure challenges is essential for safeguarding public health and sustaining the environmental and recreational value of the region's coastal waters.

13. Summary the Study

This study evaluated the microbiological status of selected recreational coastal waters within the Nelson Mandela Bay. The analysis focused on faecal indicator bacteria (*Escherichia coli* and *Enterococci*) as markers of faecal contamination, in accordance with national and international water quality guidelines.

The following aspects summarise the findings, risks, and implications of the assessment.

14.1 Positive Aspects

Several beaches demonstrated consistently favourable microbiological profiles throughout the monitoring period:

- St Georges Beach, Maitland Beach, Hobie Beach, Bluewater Bay and Kings Beach maintained *E. coli* and *Enterococci* levels well below the South African Water Quality Guidelines (SAWQG) and Blue Flag thresholds. The absence or near-absence of indicator organisms suggests minimal faecal contamination pressure and stable ecosystem function.
- Humewood Beach recorded *E. coli* exceedances in both September and November, while *faecal streptococci* consistently remained within acceptable limits. Although the November *E. coli* elevation was moderate, any exceedance of the compliance threshold indicates a potential contamination event and highlights the need for continued and frequent monitoring to ensure that microbial water quality remains within safe recreational standards.

Collectively, these results signify sound environmental conditions, low public health risk, and effective coastal water circulation dynamics across the majority of assessed sites.

14.2 Negative Aspects

- The data demonstrated notable fluctuations in microbial contamination levels, particularly at Humewood Beach, where *E. coli* and Enterococci results varied significantly from month to month. Such variability complicates trend interpretation and limits the ability to predict contamination risks reliably.

- Despite isolated improvements, both New Brighton and Humewood Beaches recorded months where microbiological indicators exceeded Blue Flag compliance thresholds. Humewood Beach, in particular, showed severe deterioration in December, with *E. coli* and Enterococci levels reaching levels indicative of substantial faecal pollution, compromising recreational safety.
- Multiple exceedances of *E. coli* and Enterococci throughout the study indicate persistent potential health hazards. Humewood Beach, in particular, showed a progressive decline in water quality towards the end of the monitoring period.

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14.3 Risks Associated with Using Contaminated Beaches

Exposure to seawater contaminated with *E. coli* and *Enterococci* presents several public health risks.

- Health impacts may include gastroenteritis, skin and ear infections, respiratory illnesses, and eye infections, particularly in children and immunocompromised individuals.
- Prolonged exposure to contaminated water may also negatively affect local businesses and tourism, given the potential reputational damage.

14.4 Vulnerable Population Groups

Certain population groups exhibit heightened susceptibility to waterborne infections due to physiological, immunological, or health-related factors. These include:

- Young children: immature immune responses and increased likelihood of accidental ingestion.
- Elderly individuals: age-related immune system degradation increases risk of severe outcomes.
- Pregnant women: heightened vulnerability to dehydration, systemic infections, and complications.
- Individuals with open wounds or pre-existing skin conditions: increased risk of dermal infection and septic complications.
- Persons with chronic respiratory illnesses: potential exacerbation of symptoms following aerosol or waterborne pathogen exposure.

These groups should avoid high-risk beaches, particularly during documented contamination events.

15. Recommendations

To improve and maintain safe coastal water quality, the following actions are recommended:

15.1 Strengthen Pollution Source Identification and Control

- Conduct targeted investigations into pollution sources at New Brighton.
- Prioritise repairs and upgrades to sewage and stormwater infrastructure in high-risk zones.
- Implement regular inspection and maintenance of pump stations, coastal sewer lines, and stormwater outlets.

15.2 Enhance Monitoring and Rapid Response

- Increase the frequency of water sampling during high-risk months such as rainy seasons.
- Establish rapid communication channels for the public when contamination exceeds thresholds.

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15.3 Strengthen Blue Flag Readiness

- For beaches aiming to maintain or regain Blue Flag status, ensure proactive compliance through routine auditing, infrastructure planning, and environmental management.

16 Conclusion

The assessment indicates that while several beaches within Nelson Mandela Bay specifically St George's, Maitland, Hobie, and Kings Beach continue to demonstrate safe and reliable water quality for recreational use, others show ongoing microbial contamination concerns.

New Brighton Beach initially exhibited elevated concentrations of both *Escherichia coli* and Enterococci; however, a notable improvement was observed from November 2025 onwards. During this period, *E. coli* levels declined substantially, meeting the Blue Flag compliance threshold for water safety, with further improvement confirmed during an additional December sampling event. This trend reflects a significant reduction in microbial contamination at this site.

Humewood Beach presented variable results throughout the monitoring period. While July results fell within acceptable limits, September recorded elevated *E. coli* concentrations. October showed marked improvement, with both *E. coli* and Enterococci reported as absent. Nevertheless, *E. coli* levels increased again in November, and an additional December test revealed the highest microbial counts recorded at this site over the entire study period.

The analysis of microbial data and concurrent weather patterns strongly indicated that the observed contamination is structural and point-source in nature, rather than being driven by diffuse non-point source pollution (e.g., light rainfall). Specifically, New Brighton Beach showed a history of chronic contamination, while Humewood Beach exhibited highly episodic and volatile failures, consistent with acute, intermittent malfunctions of sewer pump stations or temporary overflow events. This evidence directly attributes the contamination hotspots to compromised civil engineering assets unique to the catchment area of each affected beach.

In conclusion, while the majority of NMBM beaches remain safe for recreational use, the persistent public health risks associated with the non-compliant sites demand urgent intervention. Recommendations focus on targeted infrastructure repair and upgrade at Humewood and New Brighton, alongside enhanced, high-frequency monitoring to provide timely public safety warnings. Addressing these fundamental infrastructure challenges is essential for safeguarding public health, preventing severe gastroenteritis risks, and sustaining the environmental and recreational value of the region's coastal waters.

Best Regards

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17. References

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