BEACH WATER QUALITY REPORT

NELSON MANDELA BAY METROPOLITAN *GQEBERHA (PORT ELIZABETH)*

BY: ASC Public Health and Food Safety Consultants

STUDY DATE: 02 November 2024 – 08 December 2024

TABLE OF CONTENTS

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 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 **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. Central to this certification 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.

Clean and safe marine water is important beyond compliance with Blue Flag standards. It ensures a safe and enjoyable recreational experience for beachgoers, free from the health risks associated with contaminated water. For the tourism sector, it enhances the appeal of coastal destinations, fosters sustainable tourism and supports the local economy. Moreover, maintaining uncontaminated beach water is essential for preserving marine ecosystems, which are integral to the region's biodiversity and ecological balance.

Microbiological Water Quality Criteria

One of the core components of the Blue Flag program is maintaining high standards of **marine water quality**, which is assessed through microbiological testing. This ensures that the water is safe for recreational activities such as swimming and other water-based sports. The program requires compliance with specific microbiological parameters, focusing on the presence of faecal contamination indicators.

Key Microbiological Parameters

1. ***Escherichia coli (E. coli):***
    - A bacterium commonly found in the intestines of humans and animals.
    - Its presence in marine water indicates faecal contamination, which may be caused by untreated sewage, agricultural runoff, or stormwater discharge.
    - Blue Flag Criterion: Coastal and transitional waters must have E. coli levels below **250 CFU/100 mL**, while inland waters must remain below **500 CFU/100 mL**.

2. Intestinal Enterococci (*Faecal streptococci*):

    - A group of bacteria found in the gastrointestinal tracts of warm-blooded animals.
    - These bacteria are more resistant to environmental factors than E. coli, making them reliable indicators of long-term faecal contamination.
    - Blue Flag Criterion: Coastal and transitional waters must have intestinal enterococci levels below **100 CFU/100 mL**, while inland waters must remain below **200 CFU/100 mL**.

This study, conducted by ASC—Public Health and Food Safety Consultants—evaluated the water quality at different beaches within the NMBM. By analysing the presence of E. coli and faecal streptococci, the research aimed to provide essential insights into the safety of these beaches during the festive season, a peak time for tourism and recreational activities. The results highlight the importance of continuous monitoring, efficient infrastructure management, and public education to maintain the safety and sustainability of the region's beaches.

METHODOLOGY

The study was designed and executed in three distinct phases, each involving systematic sample collection from the city's most frequented beaches. This thorough approach ensured the findings' reliability, accuracy, and representativeness. The decision to conduct the study in multiple phases was rooted in the need to capture temporal variations in water quality, influenced by factors such as weather conditions, human activity, and tidal patterns.

The following laboratory-grade equipment and materials were employed to maintain the integrity of the samples:

- **Sterile gloves:** To prevent contamination of samples during collection.
- **Sterile bottles:** Provided by an accredited laboratory to ensure the samples were uncontaminated during transportation and analysis.
- **Laboratory ice packs:** Used to maintain the required low temperature for sample preservation.
- **Styrofoam cooler box:** Ensured temperature control during transport to the laboratory.

The study adhered to the stringent requirements of Criterion 8 of the Blue Flag standard, which mandates rigorous protocols for water quality testing. This included:

1. **Sample Collection Depth:** Samples were collected 30 cm beneath the water's surface to ensure consistency and alignment with international standards.
2. **Independent Collection:** Samples were collected by trained and authorised individuals to eliminate biases and ensure procedural integrity.
3. **Accredited Laboratory Analysis:** All samples were analysed by an independent laboratory accredited by the South African National Accreditation System (SANAS), specialising in microbiological and physical-chemical testing.

In cases where the sampler's or laboratory's independence could not be ensured, a formal dispensation accompanied by a detailed justification was required. This ensured compliance with the Blue Flag standard, even under logistical constraints.

Sampling Sites

The study encompassed seven beaches within the Nelson Mandela Bay Metropolitan Municipality (NMBM):

1. Hobbie Beach
2. New Brighton Beach
3. Maitland Beach
4. Blue Horizon Bay
5. Humewood Beach
6. St. Georges Beach
7. Bluewater Bay

These beaches were selected based on their popularity and significance for recreational activities, ensuring that the study addressed areas of high public interest and potential risk.

Microbiological Parameters

The study focused on two critical microbiological indicators of faecal contamination:

1. ***Escherichia coli (E. coli):*** A key indicator of faecal pollution, with a limit value of 250 CFU/100 mL for coastal and transitional waters and 500 CFU/100 mL for inland waters.
2. **Intestinal Enterococci (faecal streptococci)**: Another reliable marker of faecal contamination, with a limit value of 100 CFU/100 mL for coastal waters and 200 CFU/100 mL for inland waters.

Note: CFU stands for "colony-forming units," which measure the number of viable bacterial colonies in a given volume of water.

Sample Handling and Analysis

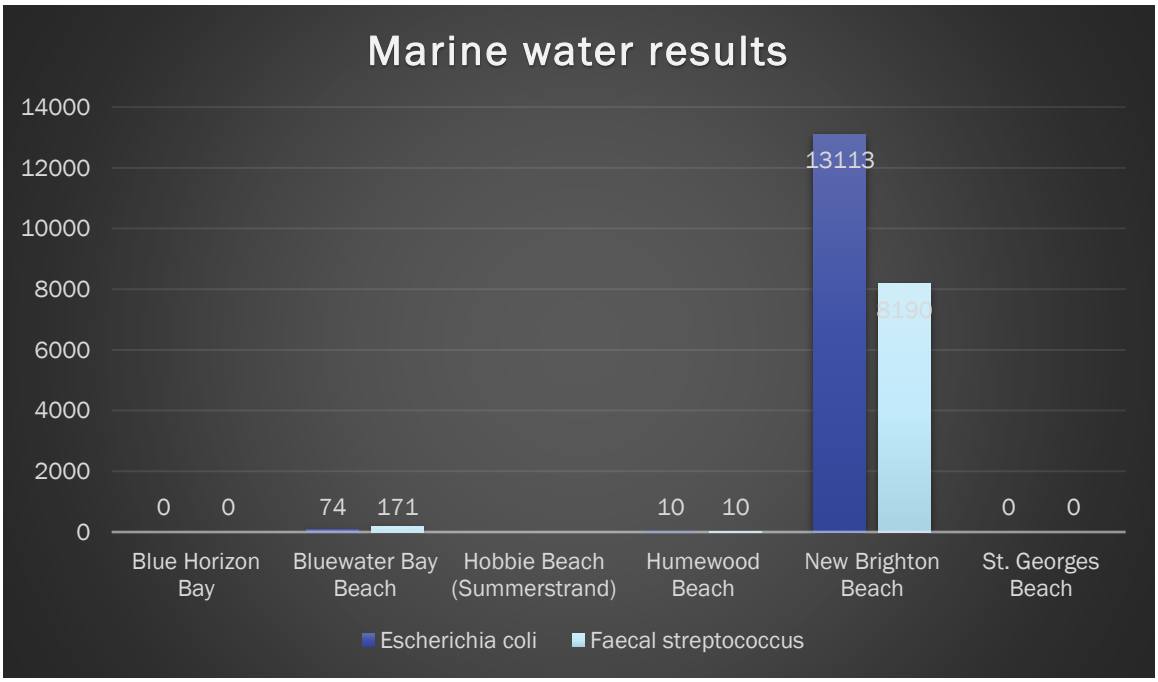
- **Sealing and Storage:** Samples were sealed in sterile bottles to prevent contamination and stored in temperature-controlled conditions below 10°C, per laboratory recommendations.
- **Transportation:** Samples were transported to the laboratory within two hours of collection to preserve their integrity and ensure accurate results.
- **Testing Methods:** The laboratory employed **Enterolert** and **Colilert** methods, which are internationally recognised for their precision in detecting and quantifying E. coli and intestinal enterococci.

The study spanned three months, from November 2, 2024, to December 8, 2024, to identify temporal trends in water quality. Results were received on December 10, 2024, and were analysed to assess compliance with established standards.

STATISTICAL ANALYSIS AND RESULTS

The study was conducted over three trials, with samples collected on November 2, November 14, and December 8, 2024. The results were analysed to evaluate water quality at each beach and identify potential health risks.

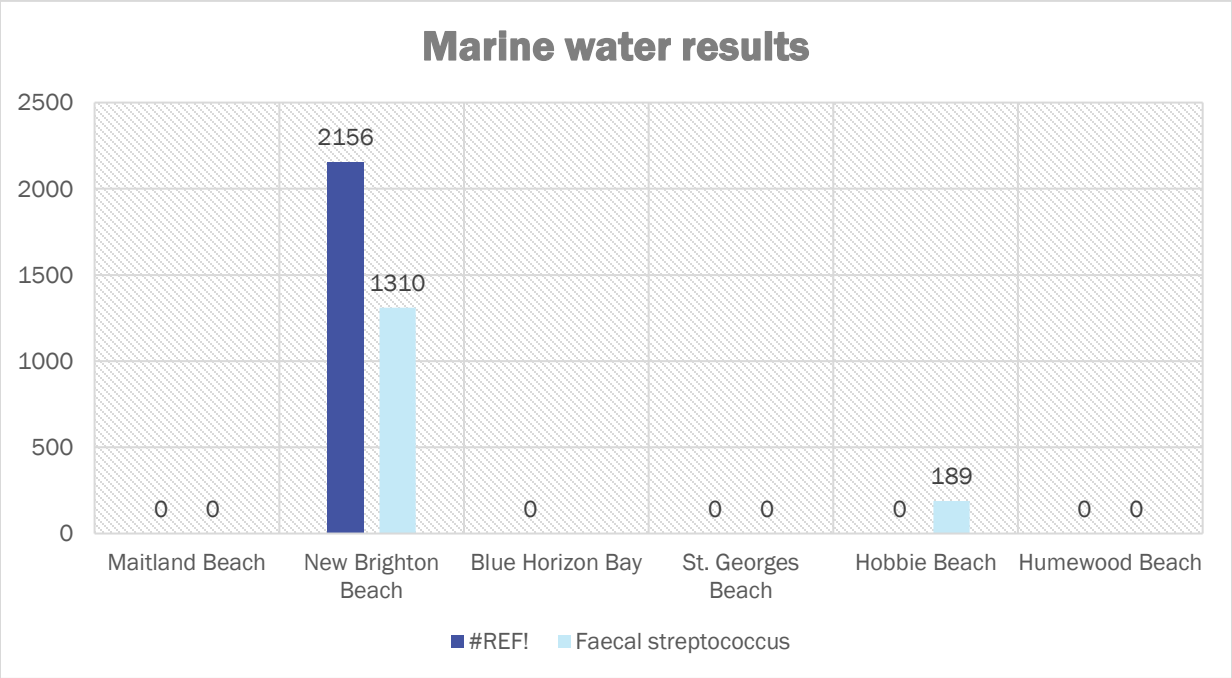
Trial 1: November 2, 2024



1. **Hobbie Beach, and Blue Horizon Bay:**
    - Results: Zero presence of E. coli and intestinal enterococci.
    - Interpretation: Excellent water quality, indicating no faecal contamination.
2. **Humewood Beach:**
    - Results: E. coli and intestinal enterococci at 10 CFU/100 mL.
    - Interpretation: Within acceptable limits, posing no immediate health risks but requiring regular monitoring.
3. **Bluewater Bay:**
    - Results: E. coli at 171 CFU/100 mL and intestinal enterococci at 74 CFU/100 mL.
    - Interpretation: Moderate contamination within limits.

4. New Brighton Beach:
    - Results: E. coli at 8190 CFU/100 mL and intestinal enterococci at 13113 CFU/100 mL.
    - Interpretation: High contamination levels pose significant health risks to beachgoers

Trial 2: November 14, 2024



1. Hobbie Beach:
    - Results: E. coli at 189 CFU/100 mL; intestinal enterococci absent.
    - Interpretation: Elevated E. coli levels suggest some form of faecal contamination, albeit at a moderate level.
2. Maitland Beach, St. Georges Beach, and Humewood Beach:
    - Results: Zero presence of E. coli and intestinal enterococci.
    - Interpretation: Excellent water quality, safe for recreational activities.
3. New Brighton Beach:
    - Results: E. coli at 1310 CFU/100 mL; intestinal enterococci at 2156 CFU/100 mL.
    - Interpretation: High levels of contamination.

Due to the aforementioned beaches' popularity, Bluewater Bay and Blue Horizon Bay were omitted from the subsequent sampling to save sampling costs.

Trial 3: December 8, 2024

1. Hobbie Beach and Maitland Beach:
    - Results: Zero presence of E. coli and intestinal enterococci.
    - Interpretation: Consistently safe water quality for recreational use.
2. Humewood Beach:
    - Results: E. coli at 213 CFU/100 mL; intestinal enterococci at 30 CFU/100 mL.
    - Interpretation: Elevated E. coli levels indicate moderate faecal contamination, necessitating further investigation.
3. New Brighton Beach:
    - Results: E. coli at 24,196 CFU/100 mL; intestinal enterococci at 7,701 CFU/100 mL.
    - Interpretation: Alarmingly high contamination levels pose severe health risks to swimmers and require immediate remedial action.

DISCUSSION

Escherichia coli (E. coli) and faecal streptococci in marine water pose significant public health risks, especially during peak periods such as the festive season when beaches experience a surge in visitors. These bacteria are widely recognised as indicators of faecal contamination, and their presence in recreational waters signals potential exposure to harmful pathogens that can cause severe illnesses. The WHO Guidelines for Safe Recreational Water Environments emphasise the importance of monitoring FIB to protect public health, particularly in high-use recreational areas.

Analysis of Affected Beaches

The study reveals contamination levels at specific beaches, necessitating immediate attention and intervention.

1. New Brighton Beach:

    - This beach exhibited alarmingly high levels of contamination in the third trial, with E. coli counting 24,196 CFU/100 mL and faecal streptococci at 7,701 CFU/100 mL. These figures exceed the Blue Flag standards by 40 and 92 times, respectively.

    - Such extreme contamination levels suggest a direct influx of untreated sewage, likely exacerbated by an ageing infrastructure and stormwater runoff. The health risks here are severe, rendering the beach unsafe for recreational use. Community members who use this beach for spiritual purposes, as observed during one of the visits when samples were collected, are at significant risk of exposure to waterborne pathogens.

2. Humewood Beach:

    - While contamination levels were relatively low in the first two trials, the third trial revealed E. coli counts of 213 CFU/100 mL, nearing the upper limit of acceptable standards.

    - The fluctuating results may indicate episodic pollution events linked to stormwater discharges or localised sewage leaks. Although the contamination levels are not immediately hazardous, they warrant continuous monitoring to prevent potential health risks.

3. Hobbie Beach and Maitland Beach:

    - These beaches consistently demonstrated excellent water quality, with no detectable E. coli or faecal streptococci levels. Their compliance with Blue Flag standards underscores the effectiveness of existing management practices and infrastructure.

4. **Bluewater Bay Beach:**

    - Elevated E. coli levels (175 CFU/100 mL) were observed in the first trial, suggesting intermittent contamination. This trend highlights the need for proactive measures to identify and mitigate pollution sources.

The Positive Outcomes: Beaches Free from Contamination

The absence of faecal contamination at Hobbie Beach, St. Georges Beach, Maitland Beach, and Blue Horizon Bay is a testament to the effectiveness of local water quality management. These beaches consistently met the stringent standards the Blue Flag program set, which requires compliance with limits for E. coli and faecal streptococci of 250 CFU/100 mL and 100 CFU/100 mL, respectively. Such results demonstrate that these beaches are safe for recreational use, providing residents and tourists a clean and enjoyable environment.

Why E. coli and Faecal Streptococci Are Major Concerns

Due to their association with human and animal waste, E. coli and faecal streptococci are used as faecal indicator bacteria (FIB). Their presence in marine waters indicates contamination that can stem from sewage spills, stormwater runoff, or poorly managed waste systems. These bacteria are not inherently pathogenic but serve as proxies for the presence of other harmful microorganisms, including viruses, protozoa, and bacteria capable of causing gastrointestinal, respiratory, and skin infections. A study by Prüss (1998) in the *Journal of Epidemiology* found a strong correlation between faecal indicator bacteria levels and the incidence of gastrointestinal illnesses among swimmers. Cabelli et al. (1983) demonstrated that enterococci levels above 104 CFU/100 mL significantly increase the risk of illness, supporting the use of these bacteria as reliable indicators of water quality.

The Risks of Contaminated Marine Water

E. coli and faecal streptococci at New Brighton Beach and, intermittently, at Humewood Beach raise significant concerns. These bacteria are widely recognised as indicators of faecal contamination and signal the potential presence of harmful pathogens, such as *Salmonella*, *Shigella*, and noroviruses, which can cause serious illnesses in humans.

1. **Health Risks for Beachgoers:**

    - Contaminated water is a major source of waterborne diseases, including diarrhoea, dysentery, and typhoid fever. Studies, such as those by Prüss (1998), have established a strong correlation between faecal indicator bacteria levels and the incidence of gastrointestinal illnesses among swimmers. According to WHO (World Health Organization), waterborne pathogens are a leading cause of morbidity globally, particularly in recreational settings.

    - Contact with contaminated water can result in rashes, dermatitis, and infections of open wounds.

    - Inhalation of aerosols containing contaminated water during swimming or sports can lead to respiratory illnesses.

    - **Vulnerable Populations:** Children, the elderly, pregnant women, and immunocompromised individuals are especially susceptible to the harmful effects of contaminated water.

2. **Environmental Impacts:**

    - **Ecosystem Disruption:** Faecal contamination introduces organic matter and nutrients that can fuel algal blooms, deplete oxygen levels, and harm marine life. This can have cascading effects on biodiversity and the health of coastal ecosystems.

    - **Marine Resource Degradation:** Contaminated waters can affect fisheries and other marine resources, impacting livelihoods that depend on these ecosystems.

3. **Economic and Social Consequences:**

    - Poor water quality on beaches deters visitors, leading to economic losses for local businesses and communities. Contaminated beaches also risk losing their Blue Flag status, diminishing their appeal.

    - Treating waterborne illnesses burdens healthcare systems, particularly during peak tourist seasons when beach usage is highest.

Vulnerable Populations

Certain groups are more susceptible to the adverse effects of contaminated beach water:

- Children are vulnerable due to their developing immune systems and tendency to ingest water while swimming; children are at higher risk of contracting waterborne illnesses.
- Age-related immune decline increases their vulnerability to infections; in other words, the elderly are also at risk.
- Those with weakened immune systems, such as those undergoing chemotherapy or chronic illnesses such as H.I.V., face heightened risks.
- Exposure to contaminated water pathogens can harm the mother and the developing fetus.

Given the festive season's influx of beachgoers, the risk of widespread exposure to contaminated water is amplified. Crowded beaches increase the likelihood of accidentally ingesting contaminated water and spreading infections among visitors.

Implications for Public Health and Tourism

In marine waters, E. coli and faecal streptococci endanger public health and undermine tourism's economic and social benefits. Beaches are vital assets for coastal communities, attracting tourists and supporting local businesses. Contaminated waters can deter visitors, resulting in economic losses and reputational damage for the region.

Moreover, the health impacts of exposure to contaminated water place additional burdens on healthcare systems, particularly during peak tourist seasons. Addressing these issues is critical to ensuring the long-term sustainability of the region's beaches.

Recommendations for Mitigation

To address the risks posed by contaminated marine waters, the following measures are recommended:

1. **Infrastructure Upgrades:** Repairing and upgrading sewage systems can prevent leaks and overflows contributing to faecal contamination.

2. **Stormwater Management:** Reducing stormwater runoff, such as green infrastructure and retention basins, can minimise pollution.

3. **Regular Monitoring:** Establishing a robust water quality monitoring program can provide early warnings of contamination and ensure timely interventions.

4. **Public Awareness:** Educating the public about water quality issues and promoting responsible beach usage can reduce the risks associated with contaminated water.

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CONCLUSION

This comprehensive study reveals significant water quality variations across the different Nelson Mandela Bay Metropolitan Municipality beaches. While some beaches demonstrated exemplary water quality, others exhibited levels of contamination that posed serious health risks to beachgoers. However, generally, the water quality was excellent for the majority of the beaches.

St Georges, Hobbie Beach and Maitland Beach consistently showed excellent water quality throughout the study, with no detectable E. coli or faecal streptococci levels, except in the second sampling regine where there was some evidence of contamination at Hobbie Beach. These results affirm their suitability for recreational activities and highlight the effectiveness of existing management practices in maintaining clean and safe marine environments. The absence of contamination at these beaches aligns with the rigorous standards required for Blue Flag certification, reassuring residents and tourists.

Humewood Beach, however, presented mixed results. While two of the three trials indicated minimal contamination, the third trial revealed a significant presence of E. coli (213 CFU/100 mL), suggesting potential sources of faecal pollution. This inconsistency highlights the need for regular monitoring and proactive measures to address potential contamination sources, such as stormwater runoff or inadequate waste management systems. Although the contamination levels were within acceptable limits during most trials, the occasional spikes warrant attention to prevent future risks.

Bluewater Bay Beach the first trial revealed elevated levels of E. coli (175 CFU/100 mL), raising concerns about intermittent pollution. This finding emphasises the importance of sustained monitoring to identify and mitigate episodic contamination events, which could compromise the safety of beachgoers.

New Brighton Beach emerged as the most concerning site, with alarmingly high levels of faecal contamination recorded during the third trial. The presence of E. coli (24,196 CFU/100 mL) and faecal streptococci (7,701 CFU/100 mL) far exceeded the acceptable limits, rendering the beach unsafe for recreational use. Such severe contamination poses significant health risks, including gastrointestinal illnesses and infections, particularly for vulnerable populations such as children and the elderly.

Additionally, the deteriorating conditions at New Brighton Beach, including litter and debris, further compromises its safety and appeal. Addressing these issues requires a coordinated effort involving local authorities, community stakeholders, and environmental organisations to implement sustainable waste management practices, restore infrastructure, and enhance public awareness about the importance of maintaining clean beaches.

In conclusion, this study's findings underscore the urgent need for targeted interventions to address water quality challenges at specific beaches within the NMBM. Preserving high water quality standards is a matter of public health and a cornerstone of the region's economic vitality and environmental stewardship. Through collective action, the Nelson Mandela Bay Metropolitan Municipality can continue to uphold its status as a premier coastal destination, fostering a harmonious balance between tourism, community well-being, and ecological integrity.

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