CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

# KNOW YOUR COAST, 2021

Key findings from over 10 000 sample bacterial tests at 99 sites along 307 km of coastline.

Making progress possible. Together.

**Acknowledgements**

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# INTRODUCTION

Cape Town's 307 km of coastline extends from Silwerstroomstrand on the Atlantic side to Kogel Bay on the east side of False Bay. It is among the most ecologically diverse and productive coastal environments in the world and contributes significantly to the City's economy. The spectacular scenery of this coast has not only established Cape Town as a destination of choice for tourists, but it is also central to residents' identity and sense of place. Renowned for their natural beauty, Cape Town beaches offer opportunities for a wide range of recreational pastimes such as swimming, surfing, adventure sports and eco-tourism.

The *KNOW YOUR COAST, 2021* report is the third coastal water-quality report published by the City of Cape Town (hereafter referred to as 'the City') – a follow-on from the *KNOW YOUR COAST (KYC)*, *2019* and *2020* reports. The *KYC* reports provide information to the public on coastal water quality in Cape Town. This reporting also allows the City to continuously monitor cases of urban-based pollution and the effect this may have on coastal water quality. It must be noted that it is not the intent of this report to provide an advisory role in respect of public health as it relates to coastal water quality but merely to present the status and trends of coastal water quality, and the drivers of these trends, in Cape Town.



This year's report provides an overview of the 2021 results for our coastal water-quality monitoring programme, together with a summary of findings from the Blue Flag monitoring programme. It reflects the outcome of over 2 400 sample bacterial tests from 99 sites along 307 km of coastline for the 12-month reporting period commencing 1 December 2020 and ending 30 November 2021. The analysis includes all relevant and available water-quality data to generate the most accurate understanding of coastal water quality in Cape Town. This data includes results from the Blue Flag monitoring programme, whereby coastal water samples are collected and analysed by an independent and accredited scientific laboratory.

The coastal water-quality results are presented in tables for both the Atlantic coast of Cape Town (Tables 2 and 3, pg. 9) as well as for False Bay (Tables 5 and 6, pg. 15) and which illustrate sampling outcomes of the previous five-year period (2017-2021). This is key to understanding the 'bigger picture' as it relates to trends in coastal water quality for beaches in Cape Town over longer temporal scales. The intention is to help the City better understand where challenges are persistently being experienced and to identify the requisite interventions to improve water quality where necessary. Similarly, viewing the water-quality results over longer periods will illustrate success where various interventions have proven effective.

It is anticipated that this annual review, along with the biweekly data updates via our web portal, will empower residents, visitors and tourists alike with information on coastal water quality along Cape Town's coastline. Further to that, the annual KYC reports will serve as a platform for broadening an understanding of: 1) the multiple sources of coastal pollution in the context of a rapidly growing urban environment such as Cape Town, 2) the various initiatives in place to improve coastal water quality and 3) ways to help reduce the amount of pollution released into our natural environment.

The City is committed to managing and protecting its valuable coastal and marine environments. To this end, the City has initiated many programmes and strategies beyond coastal water-quality monitoring, which are geared towards addressing coastal water quality as a systemic multi-scalar challenge going far beyond the narrow marine/terrestrial interface. The City also recognises that solutions to improving coastal water quality lie with both government and civil society and their ability to work together. A number of these programmes and strategies can be found on page 3 of the *KYC, 2020* report.

# CATCHMENT TO COAST:
## KEY CONTRIBUTORS TO COASTAL WATER POLLUTION

The below factors provide a snapshot of the key contributing factors that lead to coastal water-quality challenges in Cape Town. More detail on these contributing factors may be found on pages 4-6 of the *KYC, 2020* report.

Cape Town's population has more than doubled in the last 40 years, with coastal environments becoming sites for disproportionate human population growth and urbanisation. This trend is set to continue and is a global phenomenon. The consequence is increased pressures on such areas, including increased pollution loads, both from point and non-point sources, which inevitably find their way into the receiving coastal and marine environments.

Every day, the City deals with the domestic wastewater and solid waste generated by Cape Town's four million people, and another one million bordering the city. In terms of wastewater generated, this amounts to between 485 and 618 megalitres (approximately the volume of 200 to 250 Olympic swimming pools) every day within the city; while our catchments also discharge effluent and contamination from neighbouring municipalities. The discharge of all wastewater has a significant impact on nearshore coastal water quality.

Wastewater may also enter the receiving environment through a range of other sources. For example, the City can respond to up to 400 sewer system failures each day. During the 2021 calendar year, the City's Water and Sanitation Department cleared more than 118 000 sewer blockages across Cape Town, the primary cause of which was the misuse of the system by discarding foreign items into the sewer system. More than R280 million was spent on efforts to address this chronic – yet largely avoidable – problem (see pages 62-64 of the *KYC, 2020* report). Unfortunately, and inevitably, wastewater from these incidences ultimately finds its way into the receiving environment via the stormwater system. Examples of items that have been found blocking sewerage systems include tyres, rubble, rags, fats, car parts, baby car seats, televisions, etc. (Figure 1). Sewer system failures also occur during bouts of load shedding, where pumps trip and fail to turn back on when the power returns. Because of illegal connections where rain enters the sewer system, stormwater ingress can overwhelm a pump station and cause overflow. Finally, yet importantly, there is also the risk of the unexpected failure of a pump station.

While blockages from misuse are a major issue, there are also cases of sand ingress into sewer lines, leading to blockages and leaking, which requires ongoing maintenance (more information on this can be found on pg. 17 of this report). There are also cases of damaged or collapsed pipes causing leakages into the environment. Investment into upgrades and response efficiency to address these challenges are provided in this report.

FIGURE 1: FOREIGN MATERIALS REMOVED FROM THE CITY'S SEWER SYSTEM

Stormwater drains/canals travel through the city and open into the sea. The only (legal) liquid that should flow through the stormwater system into the sea is run-off from rainfall. The problem occurs when contaminants, which are ubiquitous in urban contexts, find their way into stormwater systems from urban run-off. Stormwater systems can also provide favourable environments for bacteria to thrive under certain conditions. Common forms of contamination entering stormwater systems include agricultural run-off, run-off from household bin washing, disposal of pet waste, disposal of common household cleaning agents, disposal of FOGs (fats, oils and greases), etc.

As activities in catchments may affect coastal waters, and to better understand the water-quality dynamics more holistically in Cape Town, this report is best read in conjunction with the 2020 Inland Water Quality Report accessible via this portal that provides further information on matters relating to water quality in catchments.

# DETERMINING COASTAL WATER QUALITY

**Coastal water-quality testing is not an absolute nor precise science. The inherent variability of faecal bacteria and ocean dynamics means that two samples collected at the same time just a few metres apart may yield vastly different results. The same applies temporally, where samples taken a couple of hours to days apart can also yield very different results. For this reason, the City applies a risk-adjusted approach, whereby measurements are taken and assessed over an extended period to determine a realistic representation of water quality. This approach is internationally accepted as the most appropriate method.**

For coastal water, the microbial water quality is assessed by comparing the number of E.coli and enterococci in the water samples to limits set out in the South African Water Quality Guidelines for Coastal Marine Waters (Vol 2) (Table 1 and Box 1). These guidelines, determined by the then Department of Environmental Affairs of the Republic of South Africa, are based on research into whether people swimming in waters with different amounts of faecal indicator bacteria developed gastrointestinal illness. E. coli and enterococci serve as indicators of faecal pollution and potential presence of pathogenic micro-organisms. They are not, in themselves, necessarily bad for human health. (For more information on how global water-quality monitoring practices have been adopted and adapted for the South African context and how the results are determined, see pages 8-11 of the KYC, 2019 report.) For more information on how global water-quality monitoring practices have been adopted and adapted for the South African context and how the results are determined, see pages 8-11 of the KYC, 2020 report.

**TABLE 1: COASTAL WATER-QUALITY CATEGORIES DETERMINED BY THE SOUTH AFRICAN WATER QUALITY GUIDELINES FOR COASTAL MARINE WATERS (VOL 2)**

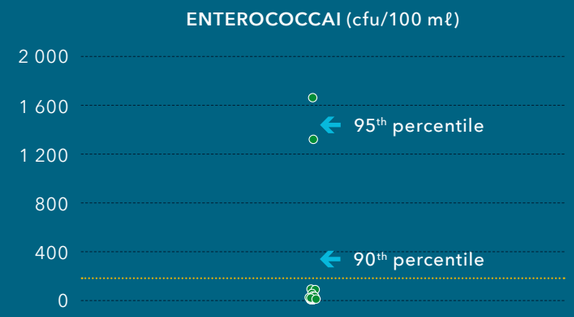
| Grade | Estimated risk of illness per exposure* | Enterococci (cfu**/100 mℓ) | *Escherichia coli* (cfu/100 mℓ) |
|---|---|---|---|
| **Excellent** | < 2,9% gastrointestinal (GI) | < 100 (95$^{th}$ percentile) | < 250 (95$^{th}$ percentile) |
| **Good** | < 5% GI illness risk | < 200 (95$^{th}$ percentile) | < 500 (95$^{th}$ percentile) |
| **Sufficient** | < 8,5% GI illness risk | < 185 (90$^{th}$ percentile) | < 500 (90$^{th}$ percentile) |
| **Poor** | > 8,5% GI illness risk | > 185 (90$^{th}$ percentile) | > 500 (90$^{th}$ percentile) |

** Exposure is defined as 10 minutes of swimming with three head immersions.* *** Colony-forming units.*

**BOX 1: WHAT DOES 'POOR' WATER QUALITY MEAN?**

Water quality is rated 'poor' if the number of enterococci bacteria colonies in water samples exceeds the targets of the South African Water-Quality Guidelines for Coastal Marine Waters. If the 95$^{th}$ percentile (calculated using the Hazen method* of the data over a specific period is ≤100, water quality is rated 'excellent'; if ≤200, it is rated 'good'; and if the 90$^{th}$ percentile over the period is ≤185, it is rated 'sufficient'. If none of these targets are met, the water quality is rated 'poor'.

This does not mean that the number of bacteria colonies in the water is consistently high, however. As few as two water samples with a high number of bacteria colonies can result in a 'poor' water-quality rating in an assessment period. A good example of this is reflected for Milnerton lighthouse (figure 5) where one poor sample has resulted in the change in category from 'excellent' in 2019 to 'sufficient' in 2020. This is because of the way in which water quality is rated, as the following example illustrates:




Over 12 months, 23 water samples collected from a beach presented enterococci counts of 2, 2, 4, 4, 4, 5, 8, 9, 11, 12, 12, 13, 14, 18, 22, 29, 32, 36, 56, 89, 93, 1 350 and 1 700 per 100 mℓ (see graph above). In this example, the 95$^{th}$ percentile came to 1 473, a value between the two highest counts (i.e. 1 350 and 1 700). Therefore, water quality did not achieve 'excellent' or 'good' ratings. The 90$^{th}$ percentile came to 344, which means water quality did not meet the 'sufficient' rating either. In this example, water quality is thus rated 'poor', even though 21 of the 23 samples fell in the 'excellent' range. Of course, beach water quality might also be rated 'poor' because a large number of samples contain high numbers of enterococci bacteria colonies.

** The Hazen method of statistical analysis applied by the City is also internationally recognised and accepted as the most appropriate formula in the determination of percentiles as it relates to coastal water-quality analysis.*

In 2020, the City added 11 additional sites to its 88 coastal quality-sampling points, taking the total points monitored twice per month to 99 sites (Figure 2). These new sites were added specifically to advance our knowledge at certain locations in respect of the drivers behind poor coastal water quality. This, in turn, will aid the City in formulating appropriate management interventions towards improving coastal water quality for these areas. The detail of these new sample sites, and the rationale for choosing these sites, may be found on page 8 of the ***KYC, 2020*** report.


**FIGURE 2: SAMPLING SITE LOCATIONS**

# WATER QUALITY ALONG THE ATLANTIC COAST

Water quality along the Atlantic coast is now monitored at 28 recreational nodes and 17 coastal monitoring points. The water-quality rating for recreational nodes and monitoring points for 2020 and 2021 are illustrated in Figure 3 for comparative purposes. Tables 2 and 3 provide an overview of water quality at these sites over the previous five years (i.e. 2017-2021).

## RESULTS FOR 2021

### Recreational nodes

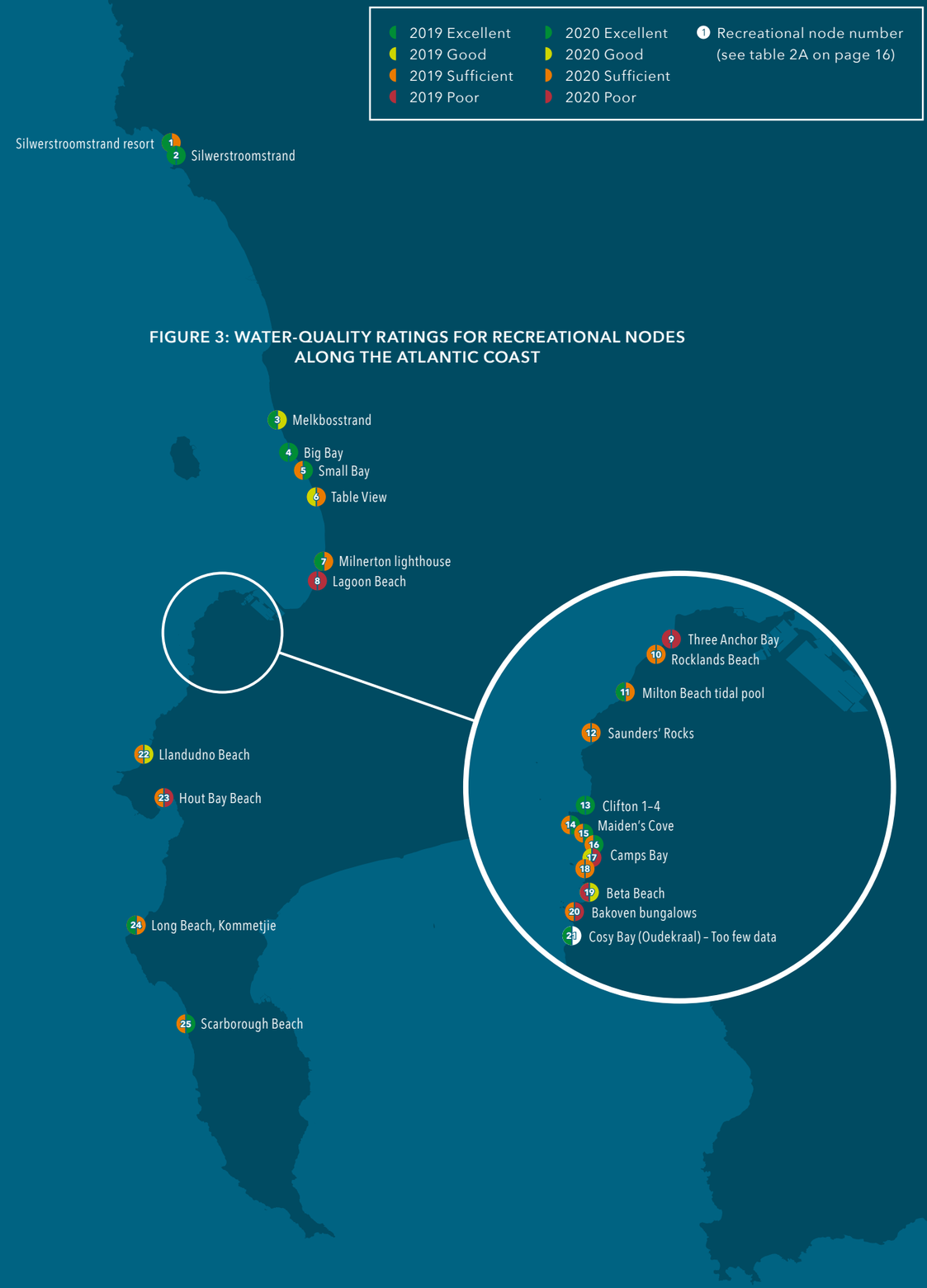
- Water quality at 20 (71%) of the recreational nodes (Figure 4) met the minimum requirement for recreational use in 2021 (eight were rated 'excellent', two 'good' and ten 'sufficient').
- Seven (25%) of the recreational nodes were rated as 'poor'. These were Lagoon Beach, Three Anchor Bay, Saunders Rocks tidal pool, Bakoven bungalows, Bakoven Beach, Hout Bay Beach and Long Beach, Kommetjie.
- Cosy Bay (Oudekraal) had insufficient data to complete an accurate analysis.

### Coastal monitoring points*

- Water quality at 15 (88%) of the monitoring points along the Atlantic coast (Figure 4) met the minimum requirement for recreational use in 2021 (six were rated 'excellent' and nine 'sufficient').
- At two (12%) of these sites, water quality was rated as 'poor'. These were the sampling sites located at Park Road (Green Point) and Saunders Rocks.

** As elaborated on in more detail in the KYC, 2019 report, sampling at coastal monitoring points is deliberately situated near potential sources of pollution. The intention is to establish the extent of the impact of these pollution sources and, as such, can be expected to reflect poorer water quality at times in these locations.*

FIGURE 3: WATER-QUALITY RATINGS FOR RECREATIONAL NODES ALONG THE ATLANTIC COAST



## COMPARISON BETWEEN 2020 AND 2021

The results for the reporting period of 2021, if compared to the last reporting period of 2020 on the Atlantic coast, reveal that:

- In 2021, 20 beaches met the minimum requirement compared to 19 beaches in 2020.
- Water quality improved at four locations. These were Silverstroom Resort, Table View, Rocklands Beach, Camps Bay tidal pool A and Llandudno Beach.
- At four locations, water quality remained 'poor'. These were Lagoon Beach, Three Anchor Bay, Bakoven bungalows and Hout Bay Beach.
- At three locations, water quality regressed to the 'poor' category. These were Saunders Rocks tidal pool, Bakoven Beach and Long Beach, Kommetjie.
- There was an increase from five beaches (21%) in 2020 to seven beaches (25%) rated as 'poor' in 2021. This indicates a slight increase of beaches not meeting coastal recreational water use guidelines.

At the coastal monitoring points, 31% of the results from the monitoring sites were classified as 'poor' in 2020. In 2021, 12% were rated as 'poor'. This is a marked improvement in water quality at coastal monitoring points.in 2019. In 2020, 31% were rated as 'poor'. This is an improvement of almost 10% from 2019.

## NOTABLE CHANGES: ATLANTIC COAST

- Table View has achieved 'excellent' status.
- While the Three Anchor Bay sites have continuously been 'poor', the additional sampling point situation at the north-west side of the bay (further away from the stormwater outlet) has consistently yielded 'excellent' results. This highlights the substantial impact that the stormwater outlet has on water quality at Three Anchor Bay.
- Camps Bay has also achieved 'excellent' status over the last two consecutive years, whereas for the period 2017-2019, it was rated as 'sufficient'. This 'excellent' status is also evident at the new sampling point in the north of Camps Bay.
- Bakoven Beach displays fluctuating results and has regressed to the 'poor' category. This is likely attributed to the Beta Road pump station that has failed multiple times during the 2021 reporting period.

**FIGURE 4A: DISTRIBUTION OF 2020WATER-QUALITY RATINGS, ATLANTIC COAST**

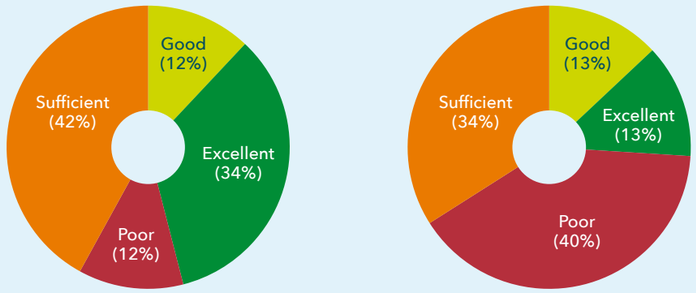
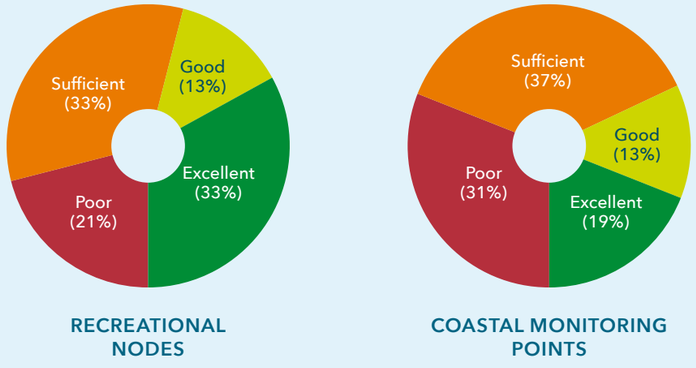



**FIGURE 4B: DISTRIBUTION OF 2020WATER-QUALITY RATINGS, ATLANTIC COAST**



## TABLE 2: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE ATLANTIC COAST, 2017-2021

| RECREATIONAL NODES | COASTAL WATER-QUALITY RATING | | | | |
|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| 1. Silwerstroomstrand Resort | Excellent | Excellent | Excellent | Sufficient | Excellent |
| 2. Silwerstroom | Excellent | Excellent | Excellent | Excellent | Sufficient |
| 3. Melkbosstrand | Excellent | Excellent | Excellent | Good | Good |
| 4. Big Bay | Good | Excellent | Excellent | Excellent | Sufficient |
| 5. Small Bay | Sufficient | Good | Sufficient | Excellent | Sufficient |
| 6. Table View | Sufficient | Sufficient | Good | Sufficient | Excellent |
| 7. Milnerton lighthouse | Excellent | Excellent | Excellent | Sufficient | Sufficient |
| 8. Lagoon Beach | Poor | Poor | Poor | Poor | Poor |
| 9. Three Anchor Bay | Poor | Poor | Poor | Poor | Poor |
| 10. Three Anchor Bay West | NYM* | NYM* | NYM* | TFD** | Excellent |
| 11. Rocklands Beach | Excellent | Sufficient | Sufficient | Sufficient | Excellent |
| 12. Milton Beach tidal pool | Excellent | Excellent | Excellent | Sufficient | Sufficient |
| 13. Saunders Rocks tidal pool | Sufficient | Good | Sufficient | Sufficient | Poor |
| 14. Clifton 1-4 | Sufficient | Excellent | Excellent | Excellent | Good |
| 15. Maidens Cove tidal pool 1 | Good | Sufficient | Sufficient | Excellent | Sufficient |
| 16. Maidens Cove tidal pool 2 | Excellent | Sufficient | Sufficient | Excellent | Sufficient |
| 17. Glen Beach | NYM* | NYM* | NYM* | TFD** | Sufficient |
| 18. Camps Bay North | NYM* | NYM* | NYM* | TFD** | Excellent |
| 19. Camps Bay | Sufficient | Sufficient | Sufficient | Excellent | Excellent |
| 20. Camps Bay tidal pool A | Excellent | Sufficient | Good | Poor | Sufficient |
| 21. Camps Bay tidal pool B | Poor | Sufficient | Sufficient | Sufficient | Sufficient |
| 22. Bakoven Beach | Good | Poor | Poor | Good | Poor |
| 23. Bakoven bungalows (NW rocks) | Excellent | Sufficient | Sufficient | Poor | Poor |
| 24. Cosy Bay (Oude Kraal) | Excellent | Good | Excellent | TFD** | TFD** |
| 25. Llandudno Beach | Excellent | Sufficient | Sufficient | Good | Excellent |
| 26. Hout Bay Beach | Sufficient | Sufficient | Sufficient | Poor | Poor |
| 27. Long Beach, Kommetjie | Good | Excellent | Excellent | Sufficient | Poor |
| 28. Scarborough Beach | Sufficient | Excellent | Sufficient | Excellent | Excellent |

** NYM – not yet monitored*
*** TFD – too few data*

## TABLE 3: ANNUAL WATER-QUALITY RATINGS AT COASTAL MONITORING POINTS ALONG THE ATLANTIC COAST, 2017-2021

| COASTAL MONITORING POINTS | COASTAL WATER-QUALITY RATING | | | | |
|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| 1. Big Bay near stormwater discharge | Sufficient | Excellent | Excellent | Sufficient | Sufficient |
| 2. Granger Bay | Sufficient | Excellent | Excellent | Sufficient | Sufficient |
| 3. Mouille Point | Good | Good | Sufficient | Sufficient | Sufficient |
| 4. Green Point pump station | Good | Sufficient | Good | Poor | Sufficient |
| 5. Park Road, Green Point | Poor | Poor | Poor | Good | Poor |
| 6. Rocklands | Poor | Sufficient | Sufficient | Sufficient | Sufficient |
| 7. Milton Beach tidal pool (outside) | Good | Sufficient | Sufficient | Good | Excellent |
| 8. Sunset Beach tidal pool (outside) | Poor | Sufficient | Poor | Poor | Excellent |
| 9. Saunders' Rocks | Poor | Poor | Poor | Sufficient | Poor |
| 10. Saunders' Rocks tidal pool (outside) | Poor | Excellent | Poor | Poor | Excellent |
| 11. Maiden's Cove | Sufficient | Excellent | Poor | Excellent | Excellent |
| 12. Maiden's Cove tidal pool 1 (outside) | Excellent | Sufficient | Sufficient | Poor | Excellent |
| 13. Maiden's Cove tidal pool 2 (outside) | Excellent | Sufficient | Sufficient | Excellent | Sufficient |
| 14. Camps Bay tidal pool (outside) | Sufficient | Good | Sufficient | Excellent | Sufficient |
| 15. Horne Bay Beach | Sufficient | Excellent | Good | Poor | Sufficient |
| 16. Noordhoek South | NYM* | NYM* | NYM* | TFD** | Excellent |
| 17. The Kom | Poor | Poor | Poor | Sufficient | Sufficient |

** NYM – not yet monitored*
*** TFD – too few data*

# A CLOSER LOOK: CASE STUDY

## LONG BEACH, KOMMETJIE

It was interesting to note that Long Beach, Kommetjie, regressed from three years of generally excellent water quality to a 'sufficient' rating in 2020 and a 'poor' rating in 2021. Over the sampling period from 1 December 2020 to 30 November 2021, there were two enterococci results greater than 100 cfu/mℓ, while the remaining results were all excellent (all results < 100 cfu/100 mℓ yield an overall 'excellent' rating). The 'poor' rating direct results from these two high counts of enterococci recorded on 27 January and 6 October 2021 (Table 4). These two readings resulted in a Hazen method calculation value of 259 cfu/100 mℓ, which is above the bounds for a poor result (a result higher than 185 cfu/100 mℓ necessitates a 'poor' result; Table 1).

It is difficult to determine the causes for the high enterococci results, as this beach has mostly yielded excellent water quality, and there are no common sources of pollution nearby. Discrete 'spikes' in enterococci readings can result from multiple factors, including a pollution incident that may have taken place in the Bokramspruit, an intermittent stream that flows onto the beach adjacent to Pelican Place. Additional sources may include the possibility of animal (dog, seal, etc.) excreta influences in the vicinity of where the sample was taken or even from bacteria overgrowth between the time the sample was taken and analysed.

The water quality at the nearby Waste Water Treatment Work (WWTW) outlet (Noordhoek South) is well within the 'excellent' category and unlikely to be causing an impact on Long Beach. The results from the nearby site, The Kom, have improved from 'poor' to 'sufficient' and had only one 'spike' during the reporting period. This was an enterococci reading of 300 cfu/100 mℓ on 27 January 2021.

Often a rainfall event can affect a nearby sample site, as bacteria, dog excrement, run-off from the washing of waste bins and other waste may have accumulated in stormwater gutters and drains. Rainfall was recorded at the nearby gauge (located at the WWTW) on 21 and 22 of January and on 2 October (both a few days before the spikes). The rainfall may have flushed the system, causing a spike in bacteria at adjacent sites. This is not guaranteed to be the cause of the spike, as there is intermittent rainfall throughout the year, and we do not continuously see poor results in this area. However, it may have been a flush of the system after a dry period.

Notwithstanding this, Long Beach will continue to be closely monitored to determine if there are any infrastructural issues leading to these discrete spikes.

## WORKING TOWARDS IMPROVED COASTAL WATER QUALITY:

# UPGRADES AND INITIATIVES ALONG THE ATLANTIC COASTLINE

The following infrastructure upgrades and initiatives are currently underway and are anticipated to improve coastal water quality on the Atlantic seaboard, specifically in the Milnerton area:



Combating pollution in the Diep River catchment: major infrastructure projects currently underway:

- The Potsdam WWTW upgrade project, at a total estimated value of R2,2 billion, will progressively provide new technology and additional treatment capacity between now and the estimated completion in August 2025.
- Stormwater to sewer diversions to address the impact of unlawful land occupations in Dunoon/ Doornbach are being designed for completion in 2023. A Dunoon Bulk Sewer Upgrade was completed in June 2020.
- Upgrade of Koeberg Road pump station (including construction of stormwater to sewer diversions in Montague Gardens) is to be completed in July 2022.
- Montague Gardens Bulk Sewer Upgrade: The size of this bulk sewer pipeline is being increased.

# WATER QUALITY ALONG THE FALSE BAY COAST

Along the False Bay coast, water quality is now monitored at 33 recreational nodes and 21 coastal monitoring points (Figure 2). Figure 5 presents the locations and overall categories for both recreational nodes and monitoring points for 2020 and 2021, respectively. Tables 5 and 6 provide an overview of annual water-quality ratings at these sites over a five-year period (i.e. 2017-2021). In this section, the results of 2021 are reported first, followed by a comparison of the results between 2021 and the preceding year (2020). Finally, it provides a closer look at a section of the coastline that proved to be an interesting case study.

## RESULTS FOR 2021

### Recreational nodes

- At 22 (67%) of the recreational nodes along the False Bay coast, water quality complied with the minimum requirement for recreational use (11 tested 'excellent', 2 'good' and 9 'sufficient'; Figure 6).
- Beaches at 11 (33%) of the recreational nodes were rated 'poor' (Figure 6). These were Seaforth Beach, Simon's Town Long Beach, Clovelly, Muizenberg station, Muizenberg Pavilion, Sunrise Beach, Monwabisi Beach, Strand Murray Street, Strand Pavilion jetty, Gordon's Bay and Gordon's Bay Milkwood.

### Coastal monitoring points*

- Water quality at eight (38%) of the points in False Bay met the minimum requirement for recreational use in 2021 (three were rated 'excellent' and five 'sufficient') (Figure 6).
- At 13 (62%) of these sites, water quality was rated as 'poor'.

** As elaborated on in more detail in the **KYC, 2019** report, sampling at coastal monitoring points is deliberately situated near potential sources of pollution. The intention is to establish the extent of the impact of these pollution sources and, as such, can be expected to reflect poorer water quality at times in these locations.*




**FIGURE 5: WATER-QUALITY RATINGS FOR RECREATIONAL NODES ALONG THE FALSE BAY COAST FOR 2020 AND 2021**

## COMPARISON BETWEEN 2020 AND 2021

The results of the recreational nodes for the reporting period of 2021, if compared to the last reporting period of 2020 (Table 5), reveal that:

- In 2021, 22 (67%) beaches met the minimum requirement compared to 15 (56%) beaches in 2020.
- At nine locations, water quality improved. These were Boulders Beach, Fish Hoek Beach, Dalebrook tidal pool, Mnandi Beach West, Mnandi Beach East, Macassar Beach, Strand Beach, Strand Harmony Park and Bikini Beach.
- At five locations, water quality remained in the 'poor' category. These were Clovelly, Muizenberg Pavilion, Sunrise Beach, Monwabisi Beach and Strand Pavilion jetty.
- At four locations, water quality regressed to the 'poor' category. These were Seaforth Beach, Simon's Town Long Beach, Muizenberg Station and Gordon's Bay.
- Four of the six additional recreational sampling sites were rated 'good' or 'excellent'. Those that did not were Strand Murray Street and Gordon's Bay Milkwood, which both yielded 'poor' results.

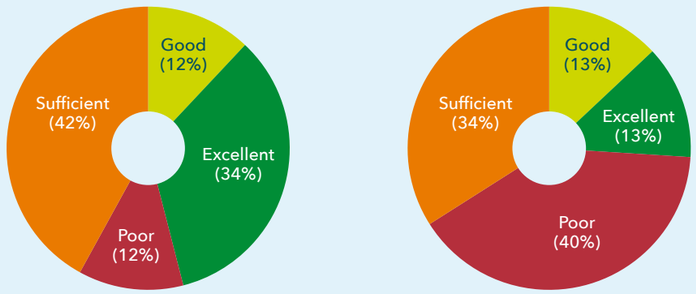
At recreational nodes, 44% of beaches were classified as 'poor' in 2020. In 2021, 33% of recreational nodes were rated as 'poor', indicating an increase in recreational beaches that met the requirements along the False Bay coast.

At the coastal monitoring points for 2020, 75% of the results from the monitoring sites were classified as 'poor'. In 2021, 62% were rated as 'poor'. This also indicates an increase in monitoring points that met the requirements from 2020 to 2021.

## NOTABLE CHANGES: FALSE BAY COAST

- While Fish Hoek Beach has yielded an 'excellent' result only once in the last four years, it is useful to note that the additional site located in the popular bathing area, adjacent to Galley Restaurant and close to Jager's Walk, has yielded consistently excellent results since inception and, as such, is rated 'excellent'. This again highlights the impact of stormwater outlets on coastal water quality as reflected in water-quality results at those sample sites located next to such outlets.
- While in previous years Macassar Beach, Strand Beach and Strand Harmony Park have consistently been rated 'poor', these locations all showed a marked improvement in 2021.
- On another positive note, two of the three additional sampling points helped to gain a better understanding of water quality in Strand (Strand water slides and Strand pedestrian crossing were classified as 'excellent' in the 2021 reporting year). This means that, of the six sampling sites in Strand, four are rated 'excellent'. As with the additional sampling site in Fish Hoek (adjacent to the Galley Restaurant), these sample sites are located further away from stormwater outlets, which again highlights the negative (yet usually localised) impact that such outlets can have on coastal water quality.

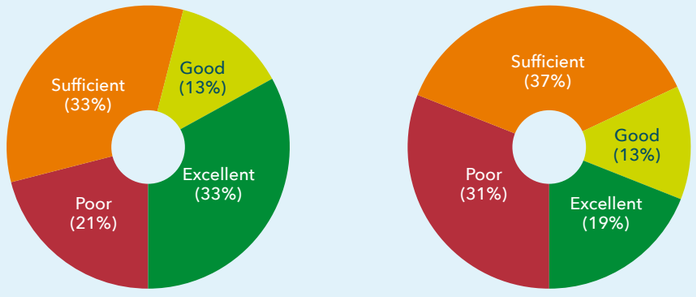
**FIGURE 6A: DISTRIBUTION OF 2020 COASTAL WATER-QUALITY RATINGS, FALSE BAY COAST**




RECREATIONAL NODES

COASTAL MONITORING POINTS

**FIGURE 6B: DISTRIBUTION OF 2021 COASTAL WATER-QUALITY RATINGS, FALSE BAY COAST**




RECREATIONAL NODES

COASTAL MONITORING POINTS

## TABLE 5: ANNUAL WATER-QUALITY RATINGS AT RECREATIONAL NODES ALONG THE FALSE BAY COAST, 2017-2021

| RECREATIONAL NODES | COASTAL WATER-QUALITY RATING | | | | |
|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 |
| 1. Frank's Bay | Good | Excellent | Excellent | Good | Excellent |
| 2. Seaforth Beach | Sufficient | Excellent | Excellent | Sufficient | Sufficient |
| 3. Boulders Beach | Sufficient | Sufficient | Sufficient | Sufficient | Poor |
| 4. Simon's Town Long Beach | Poor | Sufficient | Poor | Poor | Sufficient |
| 5. Glencairn Beach | Good | Sufficient | Excellent | Excellent | Excellent |
| 6. Fish Hoek Beach | Poor | Poor | Excellent | Poor | Poor |
| 7. Clovelly | Sufficient | Poor | Poor | Excellent | Poor |
| 8. Kalk Bay harbour beach | Poor | Poor | Poor | Sufficient | Sufficient |
| 9. Kalk Bay tidal pool | Poor | Sufficient | Excellent | Excellent | Good |
| 10. Dalebrook tidal pool | Good | Excellent | Excellent | Sufficient | Sufficient |
| 11. St James tidal pool | Excellent | Excellent | Excellent | Good | Excellent |
| 12. Muizenberg Station | Poor | Sufficient | Sufficient | Poor | Sufficient |
| 13. Muizenberg Pavilion | Sufficient | Sufficient | Sufficient | Poor | Poor |
| 14. Sunrise Beach | Poor | Poor | Sufficient | Poor | Poor |
| 15. Strandfontein | Sufficient | Excellent | Excellent | Sufficient | Sufficient |
| 16. Strandfontein tidal pool | Sufficient | Good | Excellent | Poor | Excellent |
| 17. Mnandi Beach west | Excellent | Sufficient | Excellent | Sufficient | Poor |
| 18. Mnandi Beach east | Sufficient | Sufficient | Excellent | Sufficient | Poor |
| 19. Monwabisi tidal pool | Good | Poor | Excellent | Excellent | Excellent |
| 20. Monwabisi Beach | Poor | Poor | Poor | Poor | Poor |
| 21. Macassar Beach | Sufficient | Poor | Poor | Poor | Poor |
| 22. Strand Beach | Excellent | Poor | Poor | Poor | Poor |
| 23. Strand Pavilion jetty | Good | Poor | Poor | Poor | Poor |
| 24. Strand Harmony Park | Excellent | Poor | Poor | Poor | Poor |
| 25. Gordon's Bay | Excellent | Poor | Sufficient | Poor | Sufficient |
| 26. Bikini Beach | Excellent | Poor | Excellent | Excellent | Sufficient |
| 27. Kogel Bay | Good | Poor | Excellent | Excellent | Excellent |

** NYM – not yet monitored*
*** TFD – too few data*

## TABLE 6: ANNUAL WATER-QUALITY RATINGS AT COASTAL MONITORING POINTS ALONG THE FALSE BAY COAST, 2017-2021

| COASTAL MONITORING POINTS | COASTAL WATER-QUALITY RATING | | | | |
|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | 2020 |
| Miller's Point | Excellent | Excellent | Excellent | Sufficient | Excellent |
| Simon's Town harbour | Excellent | Sufficient | Sufficient | Excellent | Excellent |
| Simon's Town diving school | Excellent | Good | Good | Excellent | Excellent |
| Kalk Bay rocks | Excellent | Sufficient | Excellent | Sufficient | Excellent |
| Ex Sandown Hotel site | Excellent | Excellent | Good | Good | Poor |
| Lifebox 21 | Poor | Poor | Poor | Poor | Poor |
| Lifebox 23 | Poor | Poor | Poor | Poor | Poor |
| Sonwabe | Poor | Poor | Poor | Poor | Poor |
| Ribbon parking area | Poor | Poor | Poor | Sufficient | Poor |
| Lifebox 30 | Poor | Poor | Poor | Poor | Poor |
| Lukannon Drive wastewater pump station | Sufficient | Sufficient | Good | Sufficient | Poor |
| Mitchells Plain wastewater effluent discharge | Poor | Poor | Good | Poor | Sufficient |
| Mitchells Plain stormwater west discharge (East) | Poor | Poor | Poor | Poor | Poor |
| Mitchells Plain stormwater west discharge (West) | Poor | Poor | Poor | Poor | Poor |
| Mitchells Plain stormwater east discharge (East)[2] | Poor | Poor | Poor | TFD* | TFD* |
| Mitchells Plain stormwater east discharge (West) | Poor | Poor | Poor | TFD* | TFD* |
| Strand opp. Woltemade St | Excellent | Poor | Poor | Poor | Poor |
| Strand near Lourens River mouth | Excellent | Poor | Poor | Poor | Poor |
| Gordon's Bay wastewater treatment works | Poor | Poor | Poor | Poor | Poor |
| Gordon's Bay harbour island | Poor | Poor | Good | Good | Poor |
| Gordon's Bay harbour | Sufficient | Poor | Sufficient | Sufficient | Poor |
| Near Sir Lowry's Pass River | Poor | Poor | Poor | Poor | Poor |

** NYM – not yet monitored*
*** TFD – too few data*

# A CLOSER LOOK: CASE STUDY

## STRAND BEACH

There are now nine monitoring points in the Strand area. Five of these sites, namely Strand MPA, Strand water slides, Strand Beach pedestrian crossing, Strand Murray Street and Gordon's Bay Milkwood, are new sampling locations that have been added. Across the nine sites, results indicate a highly variable environment where four of the nine sites (three of which are at recreational nodes) are categorised as 'excellent'. The sites rated as 'excellent' are located further away from stormwater outlets. The Strand MPA sample site is rated as 'poor'. While this site is located within an MPA, there are a number of nearby sources that may be contributing to poor water quality. These include a stormwater outlet approximately 100 m east of the sample location and the nearby Eerste River mouth. Given that the highest enterococci readings at this site were recorded between March and May, as well as August, and November (winter and spring rainfall), with the lowest readings being recorded in December (summer, with low rainfall), the 'poor' water quality at this location is likely a result of these rivers and stormwater outlet. Notwithstanding this, it is interesting to note that while river systems and their discharges are known to contribute to poor coastal water quality, the sample site near the Lourens River mouth had enterococci readings consistently < 100 cfu/100 mℓ with only one spike during the monitoring period (January), which is considered unusual.

Strand Beach has improved significantly from being 'poor' in 2020 to 'excellent' in 2021. Of particular interest is that water quality has consistently been rated 'poor' at this recreational node over the previous four reporting years from 2017 to 2020. The same significant shift in trend is evident for the Strand Harmony Park site, which has been consistently poor in the past, but for the 2021 reporting year, it is rated 'excellent'. The only time that enterococci were recorded at > 100 cfu/100 mℓ for this site was in March. Otherwise, all other readings were < 100 cfu/100 mℓ. For both sites, this significant shift in the category is difficult to explain, given the historical trend of consistently poor water quality in this area. Systemic challenges of pollutants arising from numerous pollution sources in this area, as well as poor circulation on the eastern side of False Bay, are attributed to the generally poor water quality (for further detail on this, see pg. 28, 29 and 48 of the KYC, 2019 report). Results from 2017 to 2021, and as indicated in Tables 5 and 6, indicate that water quality is by and large poor for this section of the coast and remains a major concern for the City. The results for these two specific locations tell us is that coastal water quality, and what influences it, is extraordinarily complex and highly variable.

Also, on a positive note, the two new recreational monitoring sites, namely Strand pedestrian crossing and Strand water slides, have achieved 'excellent' status for the 2021 reporting year.

# WORKING TOWARDS IMPROVED COASTAL WATER QUALITY:

# UPGRADES AND INITIATIVES ALONG THE FALSE BAY COAST

In the *KYC, 2020* report (pg. 49), the City listed a number of short- to medium-term interventions as a means to improve coastal water quality in False Bay. In addition to these initiatives, the City has initiated a number of infrastructure upgrades to improve water quality in False Bay. The following pages provide a status update.



## EASTERN FALSE BAY

- **Zandvliet WWTW** upgrades are on track, with almost 80% of the total mechanical installations complete. The Zandvliet WWTW serves one of the fastest-growing catchments in the City – including Delft, Mfuleni, Blue Downs and Khayelitsha. At an estimated cost of R1,9 billion, this state-of-the-art upgrade is one of the biggest capital projects on the City's budget. The project is on track for completion by the scheduled date of August 2023. In addition to the increased capacity, a new primary treatment process and upgrade of the existing treatment modules will ensure that treated effluent of high quality is discharged, meeting or exceeding all licence requirements as laid out by the National Department of Water and Sanitation.
- **Mitchells Plain WWTW** is undergoing a R160 million refurbishment and was scheduled for completion in February 2022. The upgrades include increasing capacity, refurbishment and construction of new inlet works, and replacing various other mechanical equipment. The plant was subject to significant cable theft and vandalism, and the addition of a perimeter security wall has mitigated the impact of theft.
- **Macassar WWTW** construction upgrades are set to begin in the 2023/24 financial year, with the project value totalling R1,5 billion.
- Two of the **bulk sewer lines in the Cape Flats** are being refurbished at an estimated cost of R539 million. This entails refurbishing a total of 28 km of pipeline, four metres below ground, and is the largest project of its kind undertaken in South Africa. Before the work on the pipes could commence, the sewage flowing through the lines had to be diverted to allow teams to clean the system of built-up materials. During four months of cleaning a section of about 2 km, more than 600 tons (the weight of roughly 90 adult African elephants) of rags, silt, sand, grease, bricks, cutlery, animal carcasses and more were removed. It is illegal to dispose of these items in the sewers, and they all contribute to blockages and overflows.
- In June 2021, the City launched the **new Retreat pump station**, which boasts state-of-the-art design and equipment, including a screening mechanism to stop dumped objects and materials from blocking the system and creating sewer overflows/spills. In a single month, six cubic metres of rags were removed from the wastewater entering the pump station.

## WESTERN FALSE BAY

Between July 2019 and June 2021, the City allocated approximately R350 million towards upgrading and rehabilitating the sewage network. These included the following locations:

- Muizenberg sewer relining – R4 500 000
- Albertyn Road sewer cleaning – R50 000
- Axminster Road and Clifton Road sewer cleaning – R1 200 000
- New pump station in Military Road, Retreat Main refurbishment and relining of sewers – R82 000 000

In some coastal areas, sewer infrastructure has been exposed to sand ingress resulting in blockages of sewer lines. The City has embarked on a process to clear affected lines and reline sewer pipelines with a special resin. This method has a warranty of 50 years. However, the true lifespan can significantly exceed that. In May 2021, the City cleaned approximately 50 km of pipeline in the Lotus River and has since commenced cleaning pipes in Ocean View, Seawinds, Lavender Hill and Vrygrond.

Do we have a pic of any of the above projects/areas?

## ADDITIONAL EFFORTS TO IMPROVE THE HEALTH OF WATERWAYS

Efforts to improve the waterway health in the Sand River catchment, of which Zandvlei is part, include the following:

- The Liveable Urban Waterway Programme is well underway and aims to rehabilitate our waterways using nature-based solutions, green infrastructure and water-sensitive design approaches. Five projects, totalling some R50 million, are underway in the Sand River catchment that will collectively contribute to an improvement in ecosystem health, reduction in flood risk, improved access and amenity use of the waterways, and better water quality in Zandvlei. This is the start of a long-term programme of projects to rehabilitate other waterways across Cape Town so that it will become a water-sensitive city.
- In addition to a number of existing litter fences, litter booms and litter traps, it is envisaged to roll out additional waste intercepting structures in the Sand River catchment in the next five years as part of the citywide waste interceptors project.
- Ongoing transversal inroads with partners, including the Sand River Catchment Forum and the Zandvlei Protected Areas Advisory Committee, are being forged to communicate more widely with stakeholders about the impact of pollution on the City's waterways.

# SUMMARY OF KEY FINDINGS FOR THE 2021 REPORTING PERIOD

Reflecting on the City's coastal water-quality monitoring programme, the following key findings emerge from the 2021 reporting year:

**On the Atlantic coast:**

- For the last two reporting years, Milnerton lighthouse has remained 'sufficient'.
- Table View improved from 'sufficient' in 2020 to 'excellent' in 2021.
- Recreational nodes from Rocklands Beach right through to Camps Bay tidal pool (except for Saunders Rocks tidal pool) met the minimum requirements for recreational water quality.
- Three Anchor Bay remains a challenge. It has been highlighted that the sampling point is adjacent to a stormwater outlet. However, it is promising to note that the additional sampling point at Three Anchor Bay (Three Anchor Bay west, situated on the other side of the bay) is rated 'excellent'.
- Saunders Rocks tidal pool declined from 'sufficient' to 'poor'. This was because of two samples recording > 100 cfu/100 mℓ enterococci (all readings > 100 cfu/100 mℓ result in an 'excellent' rating).
- Llandudno showed an improvement from 'sufficient' to 'good' in 2020 and from 'good' to 'excellent' in 2021.
- Hout Bay remained 'poor' for the second year (there were four results > 100 cfu/100 mℓ).
- Bakoven Beach continues to demonstrate high variations in water quality, changing from 'good' in 2020 to 'poor' in 2021. Five samples had enterococci readings of > 100 cfu/mℓ in the reporting period. There were a number of pump station failures at Bakoven Beach because of load shedding, which resulted in high enterococci readings over a number of days.
- Long Beach, Kommetjie, regressed from 'sufficient' to 'poor'. Closer inspection of the water-quality results indicated that the 'poor' classification resulted from two samples recording > 100 cfu/mℓ of enterococci.

**While on the False Bay coast:**

- Seaforth Beach declined from 'sufficient' to 'poor'. There were six results recording levels of enterococci > 100 cfu/mℓ.
- Boulders Beach improved from 'poor' to 'excellent'.
- Fish Hoek Beach improved from 'poor' to 'sufficient', and the sampling point at the south of the beach was rated 'excellent'.
- Clovelly Beach remained 'poor' for the second year.
- Dalebrook tidal pool improved to 'excellent' after two years of 'sufficient' rating.
- Readings for Muizenberg station and Muizenberg Pavilion were rated 'poor'. The poor results for these areas are likely attributed to stormwater discharge and sewage spills into Zandvlei, which discharge to the east of these sampling points. Despite poor results at both ends of Muizenberg Beach, a new sampling point (Muizenberg central) located in front of the ablutions/Shark Spotters building is rated 'good'. This sampling point was chosen as it is a popular recreational area. The Muizenberg area has also undergone extensive upgrades in the last 18 months, and the effects should become apparent in the following reporting period.
- Both sides of Mnandi Beach improved from 'poor' to 'sufficient'.
- Monwabisi Beach has remained 'poor' for the last five years and remains a major challenge for the City.
- Macassar Beach improved from being consistently 'poor' to being rated 'good' in 2021.
- Out of the six recreational nodes along the stretch from Strand water slides to Strand Harmony Park, two were rated 'poor', and the other four were 'excellent'.
- Two of the three recreational nodes monitored in Gordon's Bay are rated 'poor'. The third, Bikini Beach, is rated 'excellent', which is an improvement from 'sufficient' in 2020.

The City is determined to improve water quality in areas where it remains a persistent challenge and will implement various interventions to drive an incremental improvement of the water quality along the False Bay coastline in particular.

# CAPE TOWN'S BLUE FLAG BEACHES

The Blue Flag Programme, a world-renowned ecolabel established in 1987, is operated under the auspices of the Foundation for Environmental Education headquartered in Copenhagen, Denmark. The programme aims to promote the sustainable growth and development of tourism in coastal areas. About 47 countries participate in the programme, and South Africa is the first country outside Europe to have been awarded Blue Flag accreditation. To qualify for this prestigious annual award, a series of stringent environmental, educational, and safety- and access-related criteria must be met.

Despite the challenge of sewage spills, all Blue Flag beaches managed to maintain their status. The City currently has 10 Blue Flag beaches, with five each on the Atlantic and False Bay coastlines (Table 7 and Figure 7).

For the 2020/21 Blue Flag season, False Bay's results were not as good as the Atlantic side of Cape Town. This is not surprising, given the water-quality challenges evident in False Bay, which this report has demonstrated more clearly. Because of the use of the 95th percentile and the rolling-over effect over a four-year sampling period, there was a slight risk of Mnandi dropping off the programme unless results in the 2021/22 season improved. The water quality at both nodes of Mnandi did improve, and it has remained on the Blue Flag list for its 18th year.

Water quality is important for a Blue Flag beach. Yet, it is not the only criterion. The Blue Flag Programme is divided into four pillars: Environmental Education, Environmental Management, Safety and Security Services, and Water Quality. These categories, in turn, comprise 33 different criteria, ranging from the provision of interpretive signage to the control of domestic animals on the beach.

The programme is very useful to a participating municipality, in that it serves as a coastal management tool, covering a range of standards that have to be managed. Water quality is certainly one of the most difficult to manage, though, as much of what enters the water is unknown or uncontrolled. In accordance with the International Blue Flag Standards, each beach has to submit at least five samples per season, no more than 30 days apart. It is very important to note that the Blue Flag season is only from 1 December to 31 January for most of the beaches, which means that there is a very small and specific sampling window. The more frequented beaches of Camps Bay, Muizenberg and Strandfontein have a four-month season, ending on 31 March. However, the City exceeds the minimum sampling regime, as we obtain weekly or biweekly samples. This can have both positive and negative consequences: on the one hand, there is less cost and less effort required for just five samples; yet the negative aspect of this is that one failed sample is going to have a far greater impact on a small data set. Whereas many samples provide a clearer indication of water quality, a failed sample will be countered by numerous good samples, as is the nature of the 95th percentile.

The sampling dates are set at least six months before they take place. The municipality must submit a sampling calendar in conjunction with the annual Blue Flag applications, usually in April or May, and sampling must occur within four days of the dates submitted.

More information on the management and monitoring of Blue Flag beaches and the comparison to the City's year-round monitoring can be found on pages 56-58 of the ***KYC, 2020*** report.


FIGURE 7: CAPE TOWN'S BLUE FLAG BEACHES

**TABLE 7: HISTORICAL OVERVIEW OF THE STATUS OF BLUE FLAG BEACHES ALONG CAPE TOWN'S COAST**

| BEACH | YEARS IN PROGRAMME | BLUE FLAG STATUS AWARDED | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 |
| Silwerstroomstrand | 10 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Melkbosstrand | 6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Clifton 4th Beach | 19 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Camps Bay Beach | 15 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Llandudno Beach | 12 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Fish Hoek Beach | 6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Muizenberg Beach | 17 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Strandfontein Beach | 14 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mnandi Beach | 18 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Bikini Beach | 18 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |



# A BRIEF HISTORY OF URBAN STORMWATER DRAINAGE SYSTEMS – WITH IMPLICATIONS FOR HOMEOWNERS

– Neil Armitage, PrEng, PhD



**Ever since there have been cities, there has been a need to remove excess rainwater, which is called 'stormwater' once it has reached the ground. An associated problem is the removal of wastewater, which usually emanates from clean water brought into the settlement to supply the drinking, washing, commercial and industrial needs of the population and is subsequently contaminated to the point where it is no longer fit for use.**

The earliest evidence of urban drainage systems comes from Crete and the civilisations of the Indus Valley (modern Afghanistan, Pakistan and north-west India), where surplus water was drained in stone channels dating from as long as 5 000 years ago (De Feo et al., 2014; Burian & Edwards, 2002). The Romans (roughly 2 000 years ago) had particularly well-designed drainage systems, which can still be clearly seen at historical sites such as Hadrian's Wall (northern England) and Pompei (near Naples, Italy). In the case of the latter, rainwater was harvested off roofs for later use, while surplus water ran down the cobbled streets and out of the settlement. Stepping stones were placed at intersections to allow pedestrians to walk across the flooded streets, while openings between the stones allowed passage for wheeled vehicles, such as carts bringing goods in and out of the city.

The fall of the Roman Empire saw the end of major cities in Europe, and in the long period of political instability that followed, most urban areas were small towns serviced by earth-lined ditches (Butler et al., 2018). This is how urban drainage remained until the Industrial Age resulted in the rapid growth of large, dense cities where the question of what to do with liquid waste suddenly became very pressing. Population density impacts urban drainage in several very significant ways: large parts of the ground surface are made impermeable through the construction of buildings, roads, parking areas and the like, resulting in a huge increase in the stormwater volumes and flow rates; groundwater tables drop as recharge rates drop while more people pump underground aquifers as a supplementary source of water; the quantity of wastewater is massively increased; and, finally, the space to cope with liquid waste streams is reduced.

The urban drainage problem came to a head in what was then the world's largest city, London, in the middle of the 19th century when its population exceeded one million people crammed into a relatively small area. Human waste was discharged to cesspools located in any available open space and stormwater ran down the street to the Thames and its tributaries. To make matters worse, the streets were full of horse manure, as this was the era before motor vehicles! Unsurprisingly, frequent outbreaks of water-borne diseases, such as cholera, killed thousands of people. Something had to be done. So a plan devised by the civil engineer Joseph Bazalgette was completed in 1875. This saw all liquid 'wastes', including stormwater, collected into one system of underground tunnels, technically called 'combined sewerage', and discharged into the Thames River downstream of the city. It is still in use today (Butler et al., 2018).

Although the new London sewer system saw an immediate improvement in the quality of living in London – including a substantial increase in life expectancy – it created new problems. The lower Thames was now heavily polluted, and it proved impossible to stop this water from being brought back into the city by the tide – let alone reduce its impact on the people living downstream. Treatment was clearly required before discharge, but it was impossible to treat all the water. So, pragmatic engineers focused on treating the baseflows – between storms – while hoping that surplus rainwater would adequately dilute the rest of the pollutants before their overflow into the river. They were given unexpected help by the shift from horse-drawn transport to motor vehicles, which helped to reduce the organic loads.

By the end of the Second World War, it had become apparent that wastewater – including human waste – needed to be kept separate from stormwater, so 'separate sewerage', with a 'foul' sewer for wastewater and a 'storm' sewer for stormwater, became popular throughout the developed world. The foul sewers transported wastewater and sewage (from flush toilets) to wastewater treatment works. Because stormwater was now considered relatively clean (no horses!) – and was clearly expensive to treat – it was discharged directly into watercourses without intervention. This approach rapidly became established practice in South Africa – even being enshrined into law. It is still the dominant practice in this country.

There are three major problems with this approach. Firstly, the very efficiency with which stormwater flows from roofs and parking areas onto asphalt roads drained by concrete pipes results in huge increases in the flow rates that cause massive erosion and subsequent deposition of river bank material. In response, engineers began to construct 'detention' ponds to temporarily store surplus water from the height of the storm for slow release downstream from the 1970s onwards. Many of Cape Town's 800+ ponds date from the latter part of the 20th century as the City attempted to control stormwater flows in this manner.

Secondly, the premise that stormwater was relatively clean turned out to be a dangerous delusion. Without the intervention of green open spaces, stormwater rapidly becomes contaminated with a huge variety of pollutants, including heavy metals (e.g. from car brake linings, industrial emissions, corroding metals); hydrocarbons (exhaust emissions, deteriorating asphalt surfaces); nutrients (fertilisers, faecal matter – both animal and human); trash (particularly plastic packaging); illegal industrial discharges; and pathogenic (disease-causing) organisms.



Thirdly, it proved almost impossible to keep the two streams separate, with rain/stormwater getting into the foul sewers (causing overloading at the wastewater treatment works) and sewage getting into the storm sewers.

The problem of polluted stormwater grew internationally until the passage of the Clean Water Act in 1972 (Health and Environment, 2022). This soon prompted similar legislation elsewhere in the world – including South Africa. However, it took until around 1990 before stormwater engineers and associated professionals had fully figured out better ways of managing stormwater. The new approach (over 30 years old now!) has different names depending on what part of the world you live in, but in South Africa – as in the UK – it is called Sustainable Drainage Systems (SuDS).

SuDS aim to provide a holistic solution to stormwater management by mimicking the natural processes as far as is reasonably possible. It has four main objectives: controlling stormwater flows, improving water quality, providing amenities (recreation space) and preserving biodiversity. There are at least 12 different options open to engineers. Although some involve 'blue-green' areas such as ponds, others are effectively invisible, such as permeable pavements that are roads and parking areas designed to soak up the rainwater rather than spill it. Some of the most effective options involve interventions as simple as ensuring that all rainwater is allowed to temporarily puddle on the property – and infiltrate into the ground – or forced to travel over vegetated areas such as gardens or grass verges (removing the worst of the pollutants and some of the liquid) before entering the formal drainage system. Grass-lined ditches – technically called 'swales' – are preferred to concrete pipes. In many cases, SuDS are cheaper to construct and maintain than separated sewerage – particularly if one considers the cost of the downstream damage.

The SuDS approach has made a huge difference wherever it is applied. For example, children can now safely swim in the canals of the Netherlands and Denmark, which would have been unthinkable a few decades ago! South Africa has also gradually been adopting SuDS. The City made it mandatory for new developments with their *Management of Urban Stormwater Impacts Policy* published in 2009 (CCT, 2009), while *The South African Guidelines for Sustainable Drainage Systems* was published in 2013 (Armitage et al., 2013). However, take-up has been slow as town planners, engineers and landscape architects have struggled to come to grips with the new approach – particularly in established areas with old-fashioned road and stormwater systems that are expensive to retrofit.

**While the municipality has work to do with improving infrastructure, residents also have a part to play in improving the health of waterways:**

- Do not allow your roof water to be channelled directly to the road. Rather direct it into your flowerbeds or onto your lawn – or collect it in rainwater tanks for later use. If you are space-limited, you may still be able to dig a ditch and line it with stones placed on top of a geotextile (a product available from hardware stores designed to prevent soil and stones from mixing) to create a 'French drain', i.e. a structure designed to infiltrate water into the ground.
- Do not overfertilise and/or overwater your garden, as nutrient-laden water will find its way onto the road and into the drainage system.
- Do not discharge surplus swimming pool water – with its chlorine and dirt load – into the road (it is illegal in any case). Rather find an alternative place on your property where it can at least be filtered as it infiltrates into the ground.
- Ensure that litter is placed in litter bins – or, preferably, recycled – and properly removed. With the best intentions in the world, it is unreasonable to expect the municipal rubbish removal personnel to account for every last packet when they come and empty your wheelie bins – particularly after the vagrants have picked their way through them. You will likely need to clean up after everyone has gone.
- Ensure that you never put anything down the toilet that will not immediately disintegrate. Stockings, for example, are incredibly strong when twisted – and can stop a sewer pump with ease, risking a sewer overflow into the drainage system.
- Take care to ensure that any contractors working for you – perhaps on a new extension to your home – take the construction rubble to approved disposal sites. You would be shocked to know how often construction rubble simply gets dumped in open fields – or sometimes even directly in open canals and streams – as the contractor tries to save money for themselves at the cost of the environment.
- Ensure that your workplace also takes responsibility for stormwater drainage. Every year, the City battles with multiple illegal discharges of highly polluting liquids from companies unwilling to pay the price of having their waste properly treated and removed.

## DID YOU KNOW?

A study by Kole et al. (2017) in the Netherlands has revealed the significant contribution that vehicle tyre 'wear and tear' has in terms of releasing microplastics into the environment. The study estimated that the per capita emission of microplastics from tyre wear and tear ranges from 0,23 to 4,7 kg/year, with a global average of 0,81 kg/year. The relative contribution of microplastics from tyre wear and tear to the total global amount of plastics in our oceans is estimated to be 5-10%. The study also revealed that due to the chemical makeup of microplastics, it has the ability to enter the food chain, which has a potential to impact human health. This still requires further research. The study may be accessed from the following links:

- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5664766/**
- **https://www.theguardian.com/environment/2022/mar/24/microplastics-found-in-human-blood-for-first-time**

# KEY CITY INITIATIVES TOWARDS IMPROVING COASTAL WATER QUALITY IN CAPE TOWN

The City has tabled its draft budget for 2022/23. There have been major allocations to the water and sanitation infrastructure, as there is a commitment to improving the quality and accessibility of sanitation services for all Cape Town residents. Reflecting this commitment, the City has quadrupled its investment in sewer pipeline replacement as a key initiative to reduce sewage spills in Cape Town. The following projects have been initiated with the intent to improve coastal water quality in Cape Town:



## NEW WATER ADVISORY COMMITTEE

An advisory committee will be formed to focus on the quality and cleanliness of Cape Town's rivers, vleis and waterways. The new advisory committee is called The Water Quality in Wetlands and Waterways Advisory Committee and was approved by Council in April 2022. The committee will be chaired by the Mayor of Cape Town, and the committee intends to bring water activists and experts from across the city together to recommend strategies to mitigate water pollution and ensure the long-term protection and restoration of wetlands and waterways in Cape Town.

## DIEP RIVER ESTUARY MANAGEMENT PLAN

The City is in the process of reviewing the Diep River Estuary Management Plan (EMP). This is the fourth review of the plan and is a legal requirement in terms of the National Estuarine Management Protocol of 2021. The 2021 revision intends to identify interventions that are pragmatic and realistic to improve the state of the Diep River estuary, given the many pressures it is facing. The water quality of the Diep River estuary has been declining over time, with pollutants including agricultural run-off, effluent from the Potsdam WWTW, illegal disposal of substances in the local stormwater system from formal and informal residential areas, stormwater run-off from industrial areas, litter, and so forth.

The revised plan includes new information and recommendations and was workshopped with external experts and independent scientists in the field of coastal and estuarine science. The draft management plan divides the Diep River estuary into six distinct zones with various objectives and priority actions developed that are specific and tailored for each zone, but which also simultaneously recognise the interlinkages and dependencies between these zones. It also outlines a number of capital-intensive projects to address the current challenges, among which are the planned upgrade of the Potsdam WWTW to improve the quality of effluent and upgrades to bulk sewerage infrastructure and the construction of treatment wetlands.

The next step is to take the EMP through a public commenting period, upon which the EMP will be reviewed and adopted by Council.

## SEWER SPILL REDUCTION PLAN

The City's Water and Sanitation Department has launched a Sewer Spill Reduction Plan to help contend with more than 300 sewer blockages and overflows in the city every day. The plan targets a 50% reduction in sewage spill events by 2030 through a combination of strategic upgrades, intensified proactive maintenance, more efficient use of resources, and, importantly, community education. Key to achieving this target will be the reduction of foreign objects being disposed of illegally in the City's sewers through education, increased proactive cleaning, and improved coordination and synergy with other City directorates.

## LONG-TERM PLANS TO ADDRESS POLLUTION IN OUR WATERWAYS/COASTAL ENVIRONMENT

- The City projects a minimum investment of R8 billion for major WWTW upgrades over the next 10 years.
- There are plans to invest approximately R426 million in the upgrading of sewage pump stations and related sewer infrastructure over the next 10 years.
- The City will invest R65,2 million from 2022 until June 2026 on capital projects to improve the health of vleis in Cape Town. This will be spent on, among others, acquiring weed harvesters, a vessel for Zandvlei and the lowering of the Zeekoevlei weir. And a further R300 million will be spent on operations over the next five years, until 2027, demonstrating the City's commitment to addressing the water quality of these inland waterbodies.

## ALLOCATIONS TO BUDGET FOR 2022/23 TO 2024/25

Over the next three years, more than R10 billion of the City's R29 billion capital expenditure plan will be invested in water and sanitation infrastructure to support sustainable development, of which R1,6 billion is specifically for conveying sewage. This includes:

- R755 million to quadruple sewer pipe replacement from 25 km to 100 km per year
- R112 million additional toilets and taps in informal settlements
- R529 million for sewer pump station upgrades and repairs
- R3,3 billion on WWTW upgrades and extensions to Potsdam, Zandvliet, Athlone, Macassar, and the refurbishment of Bellville WWTW
- R860 million for major sewer upgrades, including the Cape Flats, Milnerton, Philippi, and Gordon's Bay bulk sewers
- R57,8 million for infrastructure upgrades linked to vlei rehabilitation, including the Sand/Langvlei Canal, Zandvlei Canal, and Bayside Canal at Rietvlei
- R2 billion New Water Programme including major aquifer and resilience projects

## OPEN DATA PORTAL

The City's water inland quality data is now available publicly on an Open Data Portal, while the City's coastal water-quality data, which now includes the latest sample results, is available here.

## SHORT-TERM IMPROVEMENT STRATEGY

Alongside the Sewer Spill Reduction Plan, the City's Water and Sanitation Department is currently determining a short-term improvement plan to enable more efficient responses to overflows and clearing of blockages in sewer pipelines. This short-term strategy also includes major sewer projects that have been initiated in recent months, with work being undertaken in Gugulethu, Khayelitsha, Gatesville/Rylands and Camps Bay. The short-term plan includes building capacity in the Water and Sanitation Department, improved integration between directorates, reduction of abuse of the sewer system by the public and industry, river maintenance implementation, litter-boom project partnerships, and regular infrastructure assessments, repairs and improvements.

Action items and budget reallocations in the short-term improvement strategy:

- R85,5 million is budgeted for the 2021/2022 financial year for the Sewer Pipe Replacement Programme. The target is to replace 26 km of sewer pipeline by the end of June 2022.
- By-law enforcement teams shall have a greater presence and take action against those contributing to pollution.
- R30 million has been allocated to procure new vehicles for fleet expansion. This includes six 10 ton tippers with crane and grab, four combination (vacuum and jet combined) units, jet trucks and one vacuum tanker. These vehicles will aid in the prompt clearing of sewer blockages.
- R20 million has been added to the budget for pump stations to ensure these facilities receive necessary security upgrades and replacement of electrical components.
- R41 million is budgeted to replace additional sewer and water pipes.
- R23 million will be added to the ongoing improvement works at the Cape Flats WWTW.

## ADDRESSING THE SCOURGE OF VANDALISM

Over five months, from July to November 2021, the City spent R1,9 million on replacing more than 2 293 missing or stolen manhole covers across the city. Missing manhole covers mean that foreign items can fall into or be dumped into the sewer system. It also poses a significant danger of a person falling in. In addition, 33 sewage pump stations were vandalised or impacted by theft between July 2020 and November 2021. This results in an inability to pump sewage to WWTWs and sewage overflows across the city. In April 2021, it was estimated that these operating costs, including repairs and hiring of mobile equipment to minimise sewer overflows, cost residents approximately R30 million. The worst case was in February 2021 when Site B pump station in Khayelitsha was vandalised. It cost the City R6 million to reconstruct the pump station. This sewage pump station services about 8 000 households in Site C and a part of Site B in Khayelitsha. The total destruction of this pump station resulted in major overflows and blockages in the network.

The City of Cape Town Water and Sanitation Department is plagued by vandalism and theft of critical infrastructure commensurate with threats to frontline staff. A reward of up to R5 000 is being offered to any resident who helps to report any incident or information related to theft and vandalism of water and sanitation infrastructure that leads to a successful arrest or recovery of stolen infrastructure.

**All witnessed or potential incidents must be reported immediately to the City's public emergency call centre:**

- 107 from a landline
- 021 480 7700 from a cellphone

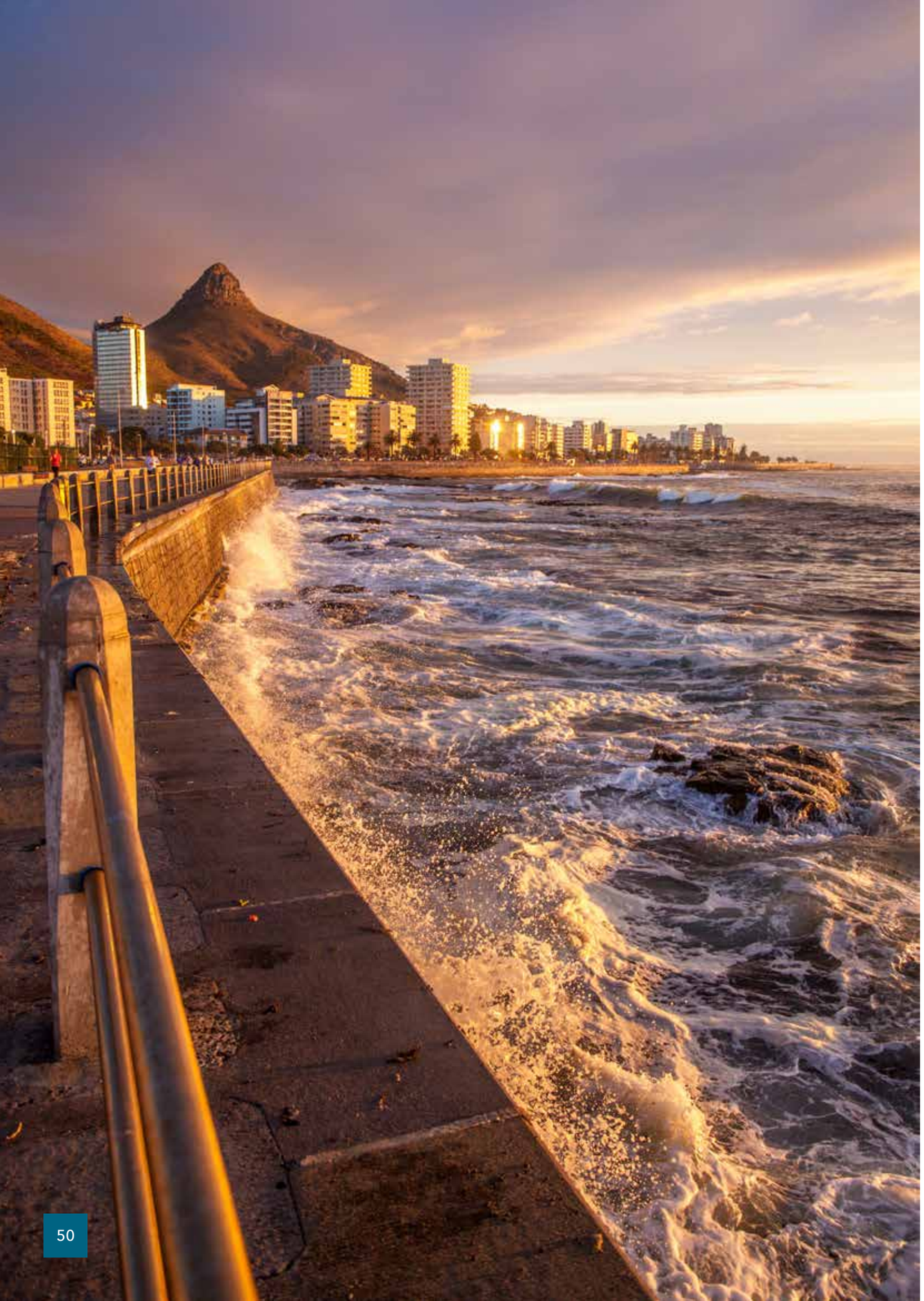
## EDUCATION AND AWARENESS CAMPAIGNS TO IMPROVE COASTAL WATER QUALITY

### Sewer education campaigns

The City's Solid Waste Management Department, Water and Sanitation Department, local ward councillors and subcouncils are driving awareness of the correct use of the sewer system. This involves media campaigns and door-to-door activations to educate community members on how they can prevent illegal dumping, sewer blockages and sewer spills. This clip, for example, provides a graphic representation of the challenges the City faces in respect of foreign items blocking sewer systems, and this clip provides information to the public on how to report blockages, overflows and illegal discharge of foreign items into the sewer system. For further information on this campaign, please visit the following link: Bin it, Don't Block It

### Stormwater education campaigns

As with the sewer educational campaigns, the City's Transport Directorate is raising awareness of the importance of keeping pollution out of the stormwater infrastructure. Stormwater systems may also overflow when waste and objects are dumped into the stormwater drains, causing localised flooding. The City is developing educational programmes on how stormwater drains and catch pits function as part of its waterways and how to prevent pollution from entering these systems.



# COASTAL WATER QUALITY: HOW YOU CAN HELP MAKE A DIFFERENCE

## ILLEGAL DISCHARGE INTO THE SEWER SYSTEM

Cape Town's sewer reticulation system operates under tremendous stress because of the illegal discharge of foreign items into the sewer system. The sewer reticulation system is only geared to accept toilet waste (urine, excrement and toilet paper) and sink/basin/bath waste (water, washing liquid and soap). Anything other than this harms the systems and ultimately causes blockages. Where such overflows take place close to the coast, it enters the stormwater system and discharges into the receiving marine and coastal environments.

**Members of the public can contribute to limiting sewage blockages and subsequent spills into the receiving environment by doing the following:**

- Flush only human waste, toilet paper, and cleaning detergent down the toilet. Everything else, such as rags, cooking oil/fats, newspapers, feminine hygiene products, condoms, nappies, wet wipes and building materials, need to be disposed of via the appropriate solid waste services that the City provides. Flushing anything apart from human waste and toilet paper is illegal in terms of the Wastewater and Industrial Effluent By-law, 2013.
- Install and properly maintain a grease trap if you run a restaurant or are involved in food preparation.
- Put a strainer in the sink to catch food, and do not wash food scraps down the drain. Throw these in the rubbish bin. Do not install a food grinder in your sink.
- Manholes must not be used for dumping/waste disposal. These should remain closed, as they are only used for inspection and maintenance purposes.
- Report missing manhole covers to the City. Manhole covers prevent objects like sand, stones and discarded items from falling into our sewers. They are also important for safety and prevent bad smells and cockroaches from leaving the system. Missing manhole covers and any other faults may be reported to the City here.
- Check that tree roots are not growing into your sewer system.
- Ensure that your drains are fitted with suitable covers to prevent sand, leaves and other foreign material from entering the sewer system.
- Sweep sand away from drains and dispose of it in small amounts in the normal household bin or at your local drop-off site.
- Ensure that rain gutters, downpipes, and surface run-off on your property flow into stormwater drains in the street rather than sewers. Illegal discharge of stormwater (i.e. from rain gutters) into sewers contributes to overflows by overloading the capacity of the pipes, particularly during heavy rainfall. The City conducts smoke testing and door-to-door inspections to determine illegal connections. It is helpful if residents check their property to ensure rain run-off does not enter the sewer system.
- Call a qualified, registered plumber to unblock sewers on your private property. Call our Technical Operation Centre if the blockage is in the street or on public land.

For further information, refer to the Bin it, Don't Block It Campaign.

## HELP PREVENT OCEAN POLLUTION IN CAPE TOWN

Cape Town is experiencing pollution incidents caused by the disposal of unwanted materials and substances into the stormwater system, which flows directly into the sea. In terms of various City by-laws, it is illegal to discharge any substance that may harm the quality of the water in the stormwater system and/or poses a threat to the health of people and our natural environment. The stormwater system links our homes, businesses and streets to the natural environment, including the sea. It is not for waste disposal.

We all share the responsibility of taking as many steps as possible to prevent pollution from entering our ocean. The coastline is one of our most important socio-economic, cultural and environmental assets, and we need to do everything possible to protect it as a shared space. It is very difficult to trace the source of pollution in stormwater, so it helps if people inform the City if they are aware of waste dumping or discharging of substances into the stormwater system.

**PLEASE REPORT the following using the contact details provided:**

| **Blocked drains and waste substances being illegally discharged into the stormwater system** | |
|---|---|
| **Online** | www.capetown.gov.za/servicerequests |
| **WhatsApp** | 063 407 3699 |
| **Email** | water@capetown.gov.za |
| **SMS** | 31373 (max 160 characters) |
| **Call** | 0860 103 089 |
| **Visit** | City walk-in centres: www.capetown.gov.za/facilities |

| **Illegal dumping** | |
|---|---|
| **Call** | 021 444 6231/6224/3 |
| **Email** | solidwaste.bylaw@capetown.gov.za |

| **Informal settlement waste** | |
|---|---|
| **SMS** | 32772 (max 160 characters) |

| **Removal of dead animals** | |
|---|---|
| **WhatsApp** | 082 563 2712 |

| **Other waste-related queries** | |
|---|---|
| **Call** | 0860 103 089 |
| **Email** | wastewise.user@capetown.gov.za |



## WHERE TO SAFELY DISPOSE OF HAZARDOUS/ DANGEROUS SUBSTANCES

| **Athlone Household Hazardous Waste Drop-off and Bellville Integrated Waste Management Facility[3]** |
|---|
| – Paint or substances used to dissolve paint<br>– Anti-freeze and other waste products from cars<br>– Household cleaning products<br>– Fertilisers, insecticides and herbicides |
| **Vissershok Landfill Facility – special waste** |
| – Blood and animal by-products (permit or prior approval needed) |
| **Sewer system on your property** |
| – Detergents used to wash refuse bins and the contaminated water from bin washing<br>– Detergents from car washing and engine cleaners<br>– Hygienic detergents used in portable toilets<br>– Animal/bird faeces<br>– Building site run-off |
| **Disposed as general/recyclable waste (in own or nearest bin) or at City drop-off sites** |
| – Litter, such as plastic bags, bottle tops and cigarette butts<br>– Household cooking oil (rather than in the sewer or stormwater system)<br>– Hygiene products (wet wipes, earbuds, feminine hygiene products, nappies, disposable face masks)<br>– Engine oil (City drop-offs) |
| **Solid Waste Management Department** |
| – Dead animals – please send a **WhatsApp** to **082 563 2712** |

| **Disposal details** | |
|---|---|
| **Athlone Refuse Transfer Station**<br>Note: Only small volumes are accepted | Off Bhunga Avenue, Settlers Way, Athlone |
| **Bellville Integrated Waste Management Facility**<br>Note: Only small volumes are accepted | Sacks Circle, Bellville |
| **Vissershok (special waste)** | Off N7, Frankdale Road, near Table View |

For more information, search for 'Household hazardous waste drop-off' at **www.capetown.gov.za**

| **Enquiries** | |
|---|---|
| **City solid waste drop-off sites** | **0860 103 089** for more information or search for 'Drop off your waste' at **www.capetown.gov.za** |
| **Sewer** | For more information, email **water@capetown.gov.za** |
| **Solid Waste Management** | For assistance, contact **0860 103 089** (option 1) or email **wastewise.user@capetown.gov.za** |

[3] *Waste of residential origin ONLY in a vehicle with a carrying capacity of less than 1,5 tonnes. Waste from other sources (non-residential) to be disposed at Vissershok Landfill Facility with the relevant permit.*

# LIST OF TABLES AND FIGURES

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# ACRONYMS

| | |
|---|---|
| **CCTV** | closed-circuit television |
| **cfu** | colony-forming units |
| **Covid** | coronavirus disease |
| **CSRM** | Catchment, Stormwater and River Management |
| **GDP** | gross domestic product |
| **IY** | Imizamo Yethu |
| **MPA** | Marine Protected Area |
| **SABS** | South African Bureau of Standards |
| **TFD** | too few data |
| **UV** | ultraviolet |
| **WWTW** | wastewater treatment works |



**This report can be found online at:**
www.capetown.gov.za

**Information on Cape Town's coastline, beaches and coastal amenities is available on the City's website.**

**If you wish to report a pollution incident, please visit:** www.capetown.gov.za/ServiceRequests

**If you see pollution or witness it being discharged into the stormwater system:**

| | |
|---|---|
| Emergencies: | Call 107 from a landline, 112 toll free or 021 480 7700 from a cellphone |
| Water and Sanitation: | Call 0860 103 089, select option 2 (24 hours) |
| SMS: | 31373 (max 160 characters) |
| Email: | waterTOC@capetown.gov.za |

**Please help us keep our oceans clean and safe.**

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Making progress possible. Together.