1 Introduction

This section provides an overview of the project's location in the greater climate change discussion as well as the importance of considering climate change impacts and effects on service delivery infrastructure.

Climate change is widely recognised internationally as a reality that is having a significant impact on the natural environment. This is due, in part to global warming which has accelerated as a direct result of human activity. Extreme weather events from droughts and heat waves to cyclones and blizzards occur all too frequently, with devastating effect on human communities and the natural environment. The IPCC Sixth Assessment Report (2021) states that evidence of observed changes in extreme events has already strengthened since the 2014 report and has elevated the urgency by warning that "global warming of 1,5 °C and 2 °C will be exceeded during the 21st century unless deep reductions in carbon dioxide (CO2) and other greenhouse gas emissions occur in the coming decades." Rising temperatures lead to shifts in precipitation patterns, intensifying droughts, increased wildfires and floods in various regions.

Climate change is adding to the existing pressures on basic public services and infrastructure in South Africa. Drought and floods damage transport links, public buildings, and water and energy infrastructure, and challenge the provision of basic services.

Cities have a role to play at the forefront of climate action through civic leadership, the provision of utilities and services, regulatory powers and planning functions. Their climate actions need to both reduce emissions and minimise the negative impacts of climate change on their people, the natural and built environment, and the local economy.

According to ohnston, P. *et al.* (2023), during the water crisis that followed the 2015–2017 drought, for example, reservoirs serving 3.7 million people around Cape Town dropped to 20% of capacity, leading the government to impose water restrictions. In recent years, extreme weather has compounded South Africa's electricity crisis, with a ripple effect across the whole economy. Intense rainfall has made coal reserves too wet to use and damaged electricity distribution infrastructure. Extreme heat poses a risk to human health, adding extra pressure on the health system and reducing labour productivity.

The environmental challenges facing the City of Cape Town include the need for climate change adaptation and mitigation, conservation of unique natural landscapes or ecosystem goods and services and dealing with resource depletion.

Incorporating climate change into wastewater treatment works (WWTW) development involves addressing potential impacts and vulnerabilities. The following climate considerations must be taken into account:

- Flooding: assessment of potential flooding risks to the WWTW and surrounding areas
- Exteme weather events: Design for intenisfied rainfall, droughts and heatwaves
- Water scarcity: Consider water efficiency measures and reuse opportunities

1.1 Cape Town's climate context

Cape Town exists within a unique environmental context that makes the city particularly vulnerable to a number of climate-change related challenges. The city is located within the Cape Floristic Region – a global biodiversity hotspot – and is surrounded by 307 km of coastline. The city is also home to a large number of seasonal wetlands, freshwater bodies and watercourses. The climate of the region is

classified as “Warm-summer Mediterranean climate”; a rare climate type characterised by cold, wet winters and warm, dry summers.[1]

1.2 Risks of climate change to wastewater treatment works

Climate change poses several significant risks to wastewater treatment works, impacting their ability to function effectively and safely. This section provides a breakdown of some of the risks that are relevant to the Macassar WWTW. According to the Cape Cown Climate Change Action Plan (2018), the following key climate risks were identified based on both the likelihood of a hazard occurring, the magnitude of the hazard, and the likely impact of the hazard on vulnerable people and WWTW infrastructure:

- **Increased Flooding**
  - Infrastructure damage: Flooding potentially damage treatment facilities, leading to costly repairs and service disruptions.
  - Overflow events: Heavy rainfall can potentially cause untreated sewage to overflow into the environment.
- **Extreme weather events**
  - Storm damage: extreme rainfall weather events can cause physical damage to infrastructure and disrupt operations.
  - Power outages: extreme weather can lead to power outages affecting to continuous operation of the WWTW plant.
- **Water Scarcity**
  - Droughts can limit the availability of water for treatment processes.
- **Fire risks**
  - Increased risk of fires afftecting the natural environment and the WWTW infrastructure.

1.3 Potential Mitigation measures

Addressing the risks discussed in **Section 1.2** above requires proactive planning, investment in resilient infrastructure, and the adoption of adaptive management practices. The following adaptation strategies are proposed for the Macassar WWTW:

- **Infrastructure Resilience:**
  - Upgrade treatment plants to withstand increased precipitation and flooding, using flood-resistant materials and designs.
  - Backup systems: Installing generators and back up power supplies to ensure continuous operation during extreme weather events.
- **Green Infrastructure:**
  - Incorporate permeable pavements.
- **Water Efficiency:**
  - Reusing of treated effluent for on-site “service water” for use by mechanical equipment, cleaning of process units and flushing of toilets on site.
  - Promote water conservation practices to reduce wastewater generation.
- **Energy Efficiency:**

[1] City of Cape Town Climate Change Strategy (2020)

- The incorporation of a Combined Heat and Power (CHP) facility which allows for the conversion of biogas to energy for on-site use. Biogas is a by-product of anaerobic digestion which has the potential to yield green energy through a combined heat and power (CHP) process. This technology yields many benefits like onsite generation of green energy which will reduce overall energy costs on the WWTW as well as the reduction of greenhouse gases.
- The addition of on-site renewable energy using rooftop mounted PV panels located on the process operations, workshop and store buildings. The energy generated feeds back to the LV small power and lighting distribution boards local to these buildings to reduce the demand on mains power. The energy storage system is sized for Stage 6 loadshedding i.e. four (4) hours at any period and a total of eight (8) hours in a day.

► **Fire response plan**

By implementing these measures, wastewater treatment works can better withstand the impacts of climate change, ensuring continued protection of public health and the environment.

2 References

City of Cape Town (2020).City of Cape Town Climate Change Action Plan Available at: https://resource.capetown.gov.za/documentcentre/Documents/City%20strategies,%20plans%20and%20frameworks/CCT_Climate_Change_Action_Plan.pdf

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In diversity there is beauty and there is strength.

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