



GROUNDWATER MANAGEMENT INSTITUTE

DETERMINING DEPENDENCY AND VULNERABILITY OF GROUNDWATER OF COASTAL CITIES (CAPE TOWN AND DAR ES SALAAM)

**Final Conjunctive Management
Strategic Action Plan:
Cape Town**

November 2025

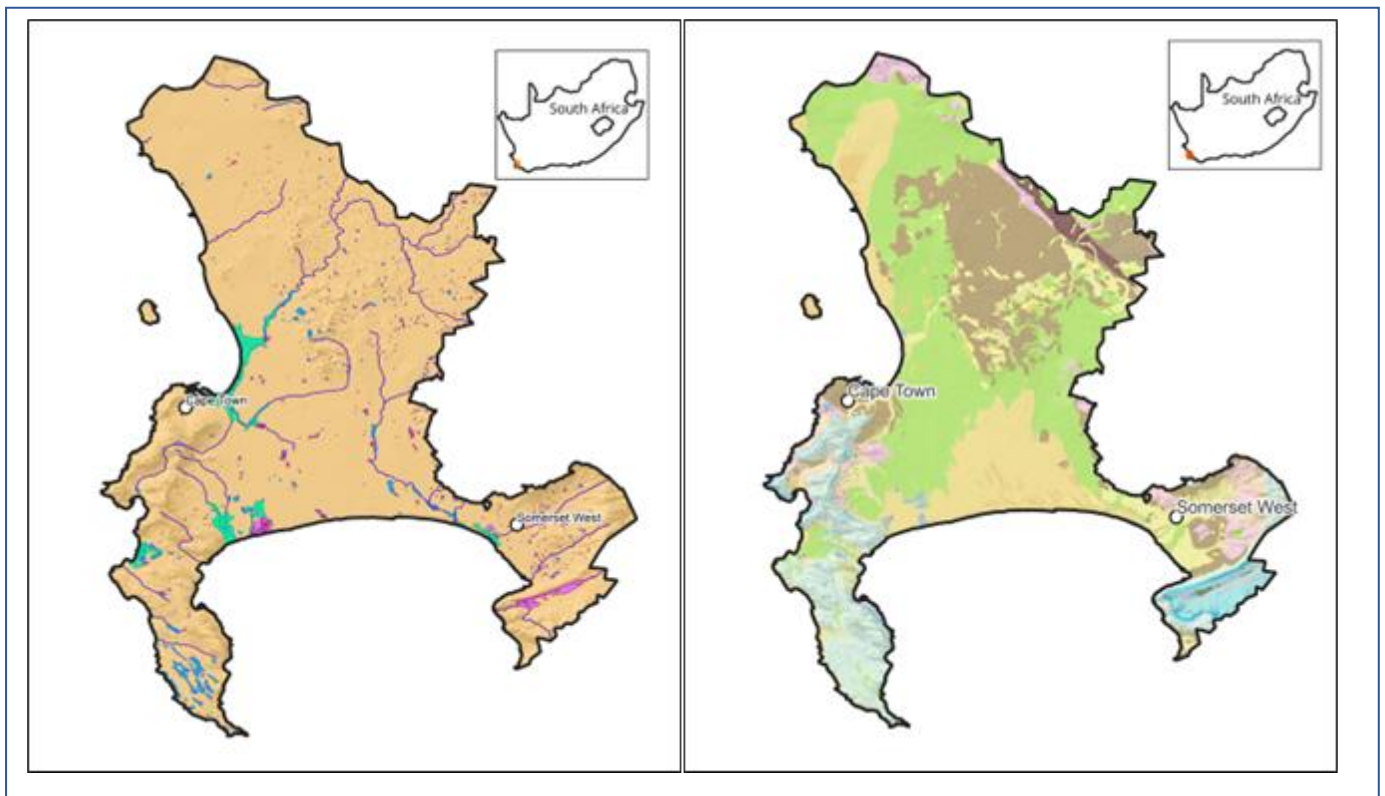


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Determining Dependency and Vulnerability of Groundwater of Coastal Cities (Cape Town and Dar es Salaam)

Final Conjunctive Management Strategic Action Plan: Cape Town



Version 1

Prepared for:
SADC-GMI



GROUNDWATER MANAGEMENT INSTITUTE

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List of Abbreviations

~	-	approximately
°	-	degrees
>	-	greater than
<	-	less than
%	-	percent
BMP	-	Best Management Practices
BSP	-	Biodiversity Spatial Plan
CBA	-	Catchment Biodiversity Area
CBD	-	Central Business District
CBO	-	Community-Based Organisations
CCRIP	-	Climate Change Response Implementation Plans
CCT	-	City of Cape Town
CCWA	-	Cross-Cutting Work Areas
CE	-	Coastal Edge
CFA	-	Cape Flats Aquifer
CFF	-	Cities Finance Facility
CMA	-	Catchment Management Agencies
CMP	-	Coastal Management Programme
CSO	-	Community Service Organisations
CSR	-	Catchment, Stormwater and Management Branch
DEA&DP	-	Department of Environmental Affairs and Development Planning
DFE	-	Department of Forestry, Fisheries and the Environment
DMA	-	Disaster Management Act
DWAF	-	Department of Water Affairs and Forestry
DWS	-	Department of Water and Sanitation
EPWP	-	Expanded Public Works Programme
ESA	-	Ecological Support Areas
GA	-	General Authorisation
GDE	-	Groundwater-Dependent Ecosystems
GINet	-	Green Infrastructure Network
GIP	-	Green Infrastructure Programme
GPZ	-	Groundwater Protection Zone
IDP	-	Integrated Development Plan
IT	-	Information Technology
IWWMP	-	Integrated Wastewater Management Plan
IWMP	-	Integrated Waste Management Plan\
IWRM	-	Integrated Water Resource Management
IWRMP	-	Integrated Water Resource Management Plan
KPI	-	Key Performance Indicators
LSMP	-	Local Stormwater Management Plan
LUW	-	Liveable Urban Waterways

MAR	-	Managed Aquifer Recharge
MRV	-	National Systems for Measurement, Reporting and Verification
MSDF	-	Municipal Spatial Development Framework
NDMF	-	National Disaster Management Framework
NEMA	-	National Environmental Management Act
NEM: ICMA	-	National Environmental Management: Integrated Coastal Management Act
NEMWA	-	National Environmental Management: Waste Act
NGO	-	Non-Governmental Organisations
NWA	-	National Water Act
NWP	-	New Water Programme
NWRS	-	National Water Resources Strategy
O&M	-	Operation and Management
PCAs	-	Potentially contaminating activities
PHA	-	Philippi Horticultural Area
POD	-	Points of Distribution
PSDF	-	Provincial Spatial Development Framework
SADC	-	South African Development Community
SADC-GMI	-	Southern African Development Community Groundwater Management Institute
SAHP	-	South Atlantic high-pressure system
SAPS	-	South African Police Service
SANDF	-	South African National Defence Force
SANS	-	South African National Standard
SAWS	-	South African Weather Service
SDG	-	Sustainable Development Goal
SDF	-	Spatial Development Framework
SFA	-	Strategic Focus Area
SPC	-	Spatial Planning Categories
SPLUMA	-	Spatial Planning and Land-Use Management Act
SMMP	-	Stormwater Management Master Plan
STA	-	Spatial Transformation Areas
SuDS	-	Sustainable Urban Drainage Systems
SWH	-	Stormwater Harvesting
TBAs	-	Transboundary Aquifers
TMG	-	Table Mountain Group
TMWSP	-	Table Mountain Water Source Partnership
UCT	-	University of Cape Town
UDE	-	Urban Development Edge
UST	-	Underground Storage Tank
WARMS	-	Water Use Authorisation and Registration Management System
WCWSS	-	Western Cape Water Supply System
WMA	-	Water Management Area
WMS	-	Water Management System
MRV	-	Measurement, reporting and verification

WSA	-	Water Services Authorities
WSI	-	Water Service Intermediary
WSP	-	Water Service Providers
WSPC	-	Water Service Provision Contract
WSPD	-	Water Services Development Plan
WSUD	-	Water Sensitive Urban Design
WUA	-	Water User Association
WUL	-	Water Use License
WWTW	-	Wastewater Treatment Works

1 Introduction

1.1 Background

Southern Africa is home to approximately thirty (30) transboundary aquifers (TBAs) and numerous national strategic aquifers that support the primary water needs and livelihoods of a significant portion of the region's population. Due to climate change, the reliance on groundwater has increased. Although there is a fair understanding of the strategic aquifers, increased data collection will enhance the capacity of institutions to sustainably manage groundwater resources. Furthermore, developing groundwater-specific data-sharing protocols among riparian states contributes to the integrated management of shared aquifers. There is a unique opportunity to establish groundwater monitoring networks and strengthen institutional frameworks for shared water management. In addition to this, strengthening institutional capacity, legislation, compliance and enforcement, stakeholder engagement, and both demand and supply-side measures remain critical elements of achieving sustainable groundwater management.

The Southern African Development Community Groundwater Management Institute (SADC-GMI), a subsidiary of the SADC Secretariat, is established as a Section 21 Not-for-Profit Company under South African law. The vision of the SADC-GMI is to ensure the equitable and sustainable use and protection of groundwater and to be a Centre of Excellence in groundwater management and management of groundwater-dependent ecosystems in the region. The role of the SADC-GMI is to:

- Promote sustainable groundwater management and provide solutions to groundwater challenges in the SADC region through building capacity, providing training, advancing research, supporting infrastructure development, and enabling dialogue and exchange of groundwater information.
- Conduct and support the SADC Member States in groundwater research, and serve as a focal interlocutor with national, regional, and international groundwater initiatives.
- Promote the sustainable conjunctive use of surface and groundwater.

As part of their programme to provide solutions to groundwater challenges, SADC-GMI embarked on a project to investigate and provide management strategies for **Groundwater Dependency and Vulnerability in the Coastal Cities of Dar es Salaam and Cape Town**.

Groundwater Dependency and Vulnerability in Coastal Cities

The dependency and vulnerability of coastal cities stem from multiple factors. Rapid urban growth and population increase drive higher water demand, often met by groundwater due to insufficient surface water sources. Many urban authorities struggle to supply water through reticulated systems, leaving informal and rural settlements reliant on shallow wells and boreholes.

Coastal cities are particularly susceptible to saltwater intrusion into aquifers, especially during dry seasons or due to excessive groundwater abstraction. Pollution from urban runoff, industrial activities, agricultural activities, and improper sanitation can degrade groundwater quality, making it unfit for consumption. Additionally, climate change has given rise to changing precipitation patterns, increasing temperatures and has affected groundwater recharge rates. These changes may increase water demand due to higher temperatures and evaporation, or reduced surface water availability, potentially leading to over-exploitation.

The urban sprawl in coastal cities, inadequate enforcement of regulations and improper management of groundwater resources can exacerbate these vulnerabilities. Given these challenges, this project aims to and develop action plans to strengthen resilience through groundwater based on an assessment of groundwater dependency and vulnerabilities in the selected coastal cities of Cape Town and Dar es Salaam in the SADC region.

1.2 Project aims and objectives

The overall objective of this project is to determine the dependency and vulnerability of groundwater in coastal cities, using Cape Town and Dar es Salaam as case studies. This will involve engaging with stakeholders, conducting high-level hydrogeological and environmental assessments, identifying gaps in the current monitoring networks, assessing vulnerability factors, evaluating the impacts of pollution and climate change, and incorporating socio-economic and gender dynamics with the ultimate goal of developing a conjunctive management strategic action plan for the City of Cape Town.

This report presents the conjunctive management strategic action plan for Cape Town, designed to build the City's resilience to climate change and environmental pressures. The strategic action plans outlined in this report provide a framework for sustainable groundwater use in Cape Town while also providing guidance for other coastal cities facing similar climate-related and environmental challenges, and other coastal cities to climate change and environmental stresses.

1.3 Methodology

1.3.1 Definition of Terms

For the context of this project, the following terms are defined and described below:

Groundwater dependency refers to the reliance on groundwater for both human consumption and aquatic ecosystems (i.e., groundwater-dependent ecosystems, GDEs).

- In coastal cities like Cape Town and Dar es Salaam, increasing urbanisation and population growth increase water demand for human consumption, resulting in an increased reliance on groundwater due to inadequate surface water sources. This is termed “human dependency on groundwater” and is usually expressed as the percentage of groundwater in total water abstraction for all human water use. This can further be specified as human dependency on groundwater for a) domestic water use, b) agricultural water use, c) industrial water use.
- Groundwater also plays a vital role in sustaining groundwater-dependent ecosystems, such as coastal wetlands and estuaries, which are crucial for maintaining biodiversity and ecological balance. Hence, groundwater-dependent ecosystems can be defined as “ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services”

Groundwater vulnerability refers to how susceptible an aquifer is to the threats affecting the groundwater resource itself, the ecosystems it supports, and its availability and suitability for human use.

- Vulnerability to the aquifer specifically refers to the physical susceptibility of the aquifer to threats/hazards such as contamination, over-abstraction, sea-level rise, and reduced recharge. This is termed “aquifer vulnerability”.
- In the context of this study, the groundwater vulnerability also includes the vulnerability of the communities that depend on the groundwater resources. This is termed “human vulnerability” and depends on aquifer vulnerability and level of groundwater dependency. E.g.:
 - Is groundwater used? How much groundwater is used? What is it used for? (e.g. domestic supply, agriculture, garden watering, etc.). What are the health implications of contamination? If surface water/soil is in contact with a contaminated aquifer, are people in direct contact with contamination?
 - Do industries/agriculture use water? Do they have alternative sources if groundwater is polluted or reduced in yield?

- If municipal water supply is disrupted as a result of contamination or reduced water availability, what other sources exist?
- Vulnerability of ecosystems can also usefully be split into three main components, sensitivity (i.e., the extent of **dependency** of an ecosystem or water users on water resources, whether ground- or surface water), adaptive capacity or **resilience** (i.e. capacity or ability to respond to shifts in drivers, such as climate or water quality, and their consequences), and exposure to stressors or **hazards** (i.e., the probability of being exposed to a certain impact) (Stuart-Hill et al., 2012; Esterhuysen et al., 2014).

Resilience or **Coping Capacity** refers to the capacity of the affected ecosystem or community to deal with an impact, to “bounce back” (i.e. persist and recover) to the status quo after a crisis or disaster, and potentially to “bounce forward” (i.e. adapt and transform) to something new that is better suited to emerging conditions.

- This includes institutional measures such as laws, regulations and by-laws, the effectiveness of their implementation, existing monitoring networks and regular data analysis, as well as the capacity of institutions, communities and individual users to cope with groundwater-related disasters. It also includes the resilience of ecosystems.

Hazards or **threats** are events or circumstances that potentially negatively impact on the groundwater resources. Key hazards include land use activities leading to water pollution, contamination, over-abstraction, climate change and seawater intrusion. The exposure to hazards is expressed in terms of probability.

The overall **Risk** of negative impact on groundwater users and the environment takes into account the likelihood of a **hazard** occurring (including severity of adverse effects on the groundwater resource, water users and receiving environment), the **vulnerability** of the receiving environment, and the **coping capacity** (or resilience).

- Key risks include contamination rendering the water quality unsuitable for the users, and reduction in water storage and discharge leading to less water available for users, seawater intrusion and degradation of groundwater-dependent ecosystems. These factors can compromise the availability and quality of groundwater for the people and ecosystems that depend on it.

Chronic stresses are underlying, ongoing pressures that weaken the functioning and resilience of a city on a day-to-day basis, such as high unemployment, inadequate infrastructure, violence, food insecurity and substance abuse.

Acute shocks are sudden, sharp events, such as droughts, floods, fires, disease outbreaks and infrastructure failures that threaten a city.

1.3.2 Approach

This Conjunctive Management Strategic Action Plan is based on findings from the Groundwater Dependency and Vulnerability Assessments, which were the key technical assessments conducted for this project.

The groundwater dependency assessment examined how municipalities, communities, industries, and groundwater-dependent ecosystems (such as wetlands, estuaries, and rivers) rely on groundwater in Cape Town. The assessment used existing information, including published literature, groundwater use volumes from the Water Authorisation and Registration Management System (WARMS), and registered boreholes and wellpoints from the City of Cape Town. By overlaying registered users with mapped GDEs, the assessment identified spatial hotspots where high levels of human dependency coincide with groundwater-dependent ecosystems. This intersection emphasised the need for integrated groundwater governance and the implementation of a conjunctive management approach.

The vulnerability assessment involved hazard and vulnerability mapping for specific threats to groundwater, including contamination from human activities, over-abstraction, reduced recharge due to climate change, and sea-level rise. A relative scoring system (1–5) was applied to individual factors such as hazard likelihood, aquifer sensitivity, and vulnerability. For mapping outputs, hazard scores indicated the probability and intensity of different groundwater threats occurring, while vulnerability scores represented the potential severity of impact on aquifers, groundwater users, and ecosystems.

Where relevant, coping capacity was incorporated descriptively as part of the qualitative assessment. Instead of formally scoring coping capacity per area, the report reflects on broad socio-economic patterns, infrastructure differences, dynamic land use, and institutional capacity across Cape Town. This approach acknowledges the wide variability in how different user groups, municipalities, and ecosystems are able to respond to groundwater risks, influenced by factors such as income levels, service provision, groundwater governance, and investment in water infrastructure.

This assessment, therefore, extends beyond hydrogeological analysis by incorporating the social, economic, and governance dimensions that shape groundwater risk exposure and vulnerability, and is aligned with international disaster risk assessment and reduction frameworks, such as INFORM (Marin-Ferrer et.al, 2017). The aim was to produce a practical decision-support tool that identifies where hazards, aquifer vulnerability, and user exposure overlap. The final risk insights are narrative and spatially descriptive, designed to highlight priority risk areas and user groups most in need of management attention.

The dependency and vulnerability assessments provided the basis for developing a Conjunctive Management Strategic Action Plan for Cape Town and Dar es Salaam by identifying high-risk and high-dependency zones where sustainable abstraction, pollution mitigation, and equitable water governance should be prioritised.

A top-down approach was used to develop the strategic action plan for conjunctive management in Cape Town. The process began with a review of the City's key strategies, many of which were developed in response to the 2015–2018 drought, to understand the broader vision for a water-sensitive city by 2040. Policies, bylaws, and supporting plans and programmes were then reviewed to determine how these strategies are being implemented in practice. This review highlighted several gaps, which informed the development of targeted action plans.

2 Cape Town

2.1 Site Overview

2.1.1 Location

Cape Town is a coastal city situated in the Western Cape Province of South Africa. It is located at the southwestern tip of the African continent, along the Atlantic Ocean and covers an area of 2,461 km² (see **Figure 2-1**). Cape Town is South Africa’s oldest city and represents the legislative capital of the country. The city is characterised by a mix of urban, residential, commercial, industrial, agricultural, and natural conservation areas. Agriculture is the largest consumer of groundwater in Cape Town, with significant use in the Philippi Horticultural Area (PHA) and at various wine farms, particularly in Durbanville and Constantia.

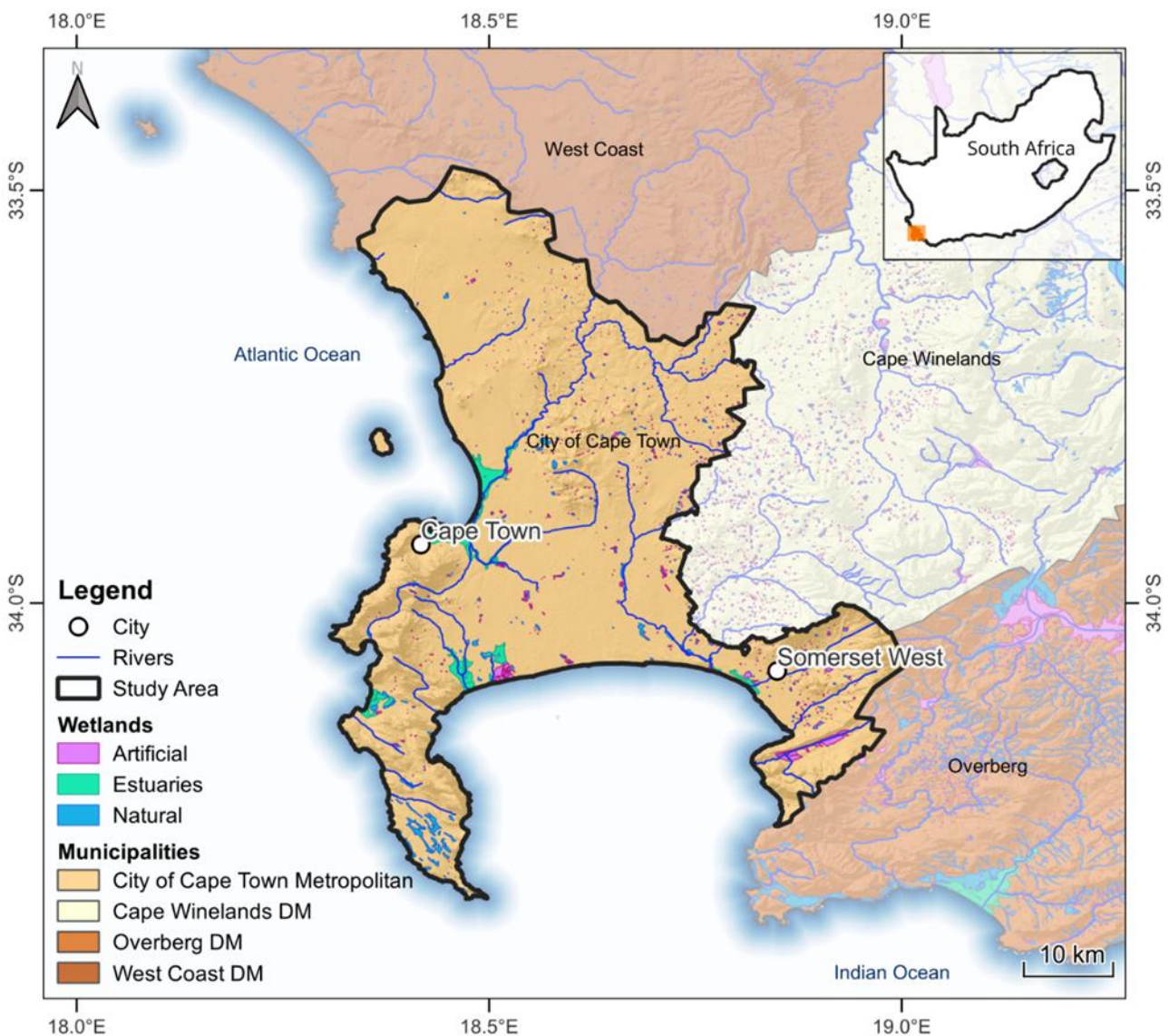


Figure 2-1 Locality map of Cape Town defining the study area within the City of Cape Town municipal boundary.

2.1.2 Demography

The City of Cape Town's (CCT's) population has been growing over the years, with an estimated annual growth rate of 1.21%. The population increased from 3,740,026 in 2011 (CCT, 2012) to a projected population of 4,772,864 in 2025. In 2011, 96.8% of the population relied on regional or local water schemes. By 2022, this reliance decreased to 96.6% (CCT, 2023d). Borehole usage increased from 0.48% (17,779) in 2011 to 1.35% (57,474) in 2022. Other minor water reliance included rainwater storage tanks. The reliance on other informal water sources decreased from 1.72% in 2011 to 0.82% in 2022, possibly due to improved access to formal water supplies.

Cape Town's economy is diverse, driven primarily by finance, tourism, agri-processing, manufacturing, and logistics (Western Cape Government, 2022). Despite its economic prominence, the city faces considerable socio-economic disparities. Income inequality is pronounced, with a Gini coefficient estimated at around 0.61, indicating deep-rooted socio-economic divides (City of Cape Town, 2022e). The unemployment rate stands at approximately 27%, with youth unemployment considerably higher, posing challenges for social and economic stability (Stats SA, 2022).

Historically entrenched spatial segregation continues to influence patterns of development, access to resources, and service delivery. Affluent suburbs enjoy reliable water infrastructure and services, whereas peripheral townships and informal settlements often face inadequate provision, limited access to reliable potable water, and increased vulnerability to water-related hazards (Turok and Scheba, 2019). According to data provided by the Department of Human Settlements (WCPP, 2022), there are currently 269,811 structures located across 806 informal settlements within the metro area. These informal settlements typically have limited basic services. Service backlogs have direct implications for groundwater quality (due to poor sanitation and pollution) and indicate the socio-economic vulnerability of a large segment of Cape Town's population.

Understanding this socio-economic context is essential when assessing groundwater vulnerability, as social disparities directly influence community resilience, adaptive capacity, and dependence on groundwater resources, especially during periods of water stress, such as the recent severe drought events (2015–2018), which highlighted the critical role of groundwater in sustaining Cape Town's water security (Ziervogel, 2019).

2.1.3 Climate and Topography

Cape Town lies within the greater region of the Western Cape, which is classified as Csb (warm, temperate, and dry), according to the Köppen and Geiger classification system (Peel et al., 2007). This Mediterranean climate regime is characterised by cold, wet winters and warm, dry summers. Precipitation is predominantly linked to frontal systems coupled with the westerly wind belt and the associated storm tracks that dominate the southwestern Cape in winter (June to August, JJA). The austral summers (December to February, DJF) are dominated by the South Atlantic high-pressure system (SAHP) – pushing the frontal systems further south, resulting in warm, dry and windy summers (du Plessis and Schloms, 2017).

Topographically, Cape Town contains several major topographical features. The Cape Peninsula mountain chain, including Table Mountain, marks the western end of the Cape Fold Mountain range, with its highest portion sitting at 1,086 m. Its main topographical feature is its 3 km plateau, which is accompanied by another plateau extending to the south. Eastward, this mountainous terrain transitions to the low-lying, flat expanse of the Cape Flats. Flat, gently sloping plains can be found throughout the region up until the base of the Hottentots Holland in the east. This portion of the Cape Fold Belt is dominated by dramatic ridges and steep slopes before transitioning into rolling hills and agricultural plains. Further north and northeast from Cape Town Central Business District (CBD) towards the northern suburbs, the landscape becomes slightly undulating as it rises into the foothills. Westwards of the northern suburbs, the elevation gradually decreases to a low-relief coastal plain, which extends north along the coast.

2.1.4 Geology and Hydrogeology

Geologically, the Cape Town Municipality is underlain by Neoproterozoic/Namibian Malmesbury Group, which is represented by shales, siltstones, graywacke and feldspathic sandstones of the Tygerberg Formation. The Late Namibian to Cambrian Cape Peninsula Batholith of the Cape Granite Suite intrudes the Tygerberg Formation and forms the basement rocks of the Cape Peninsula, with other batholiths of the Cape Granite Suite outcropping in Kuilsriver, Darling and Somerset West (see **Figure 2-2**). Basement rocks and granites generally form low-yielding weathered aquifers with poor water quality unless a particular fault/fracture is intersected with higher groundwater potential.

The erosion-resistant, high-elevation Cape Peninsula mountain chain and Hottentots Hollands mountain range comprises sandstone-dominated formations of the Ordovician to Early Devonian Table Mountain Group (TMG; forming part of the larger Cape Supergroup with the Bokkeveld and Witteberg Groups). The Cape Peninsula mountain chain comprises rocks of the Graafwater and Peninsula formations of the lower TMG. Whereas the Hottentots Hollands comprises rocks of the Peninsula, Pakhuis, Cedarberg, Goudini, Skurweberg and Rietvlei formations of the TMG (see **Figure 2-2**). The rocks of the TMG form high yielding fractured rock aquifers with good water quality, particularly the Peninsula and Nardouw (Skurweberg and Rietvlei formations) aquifers.

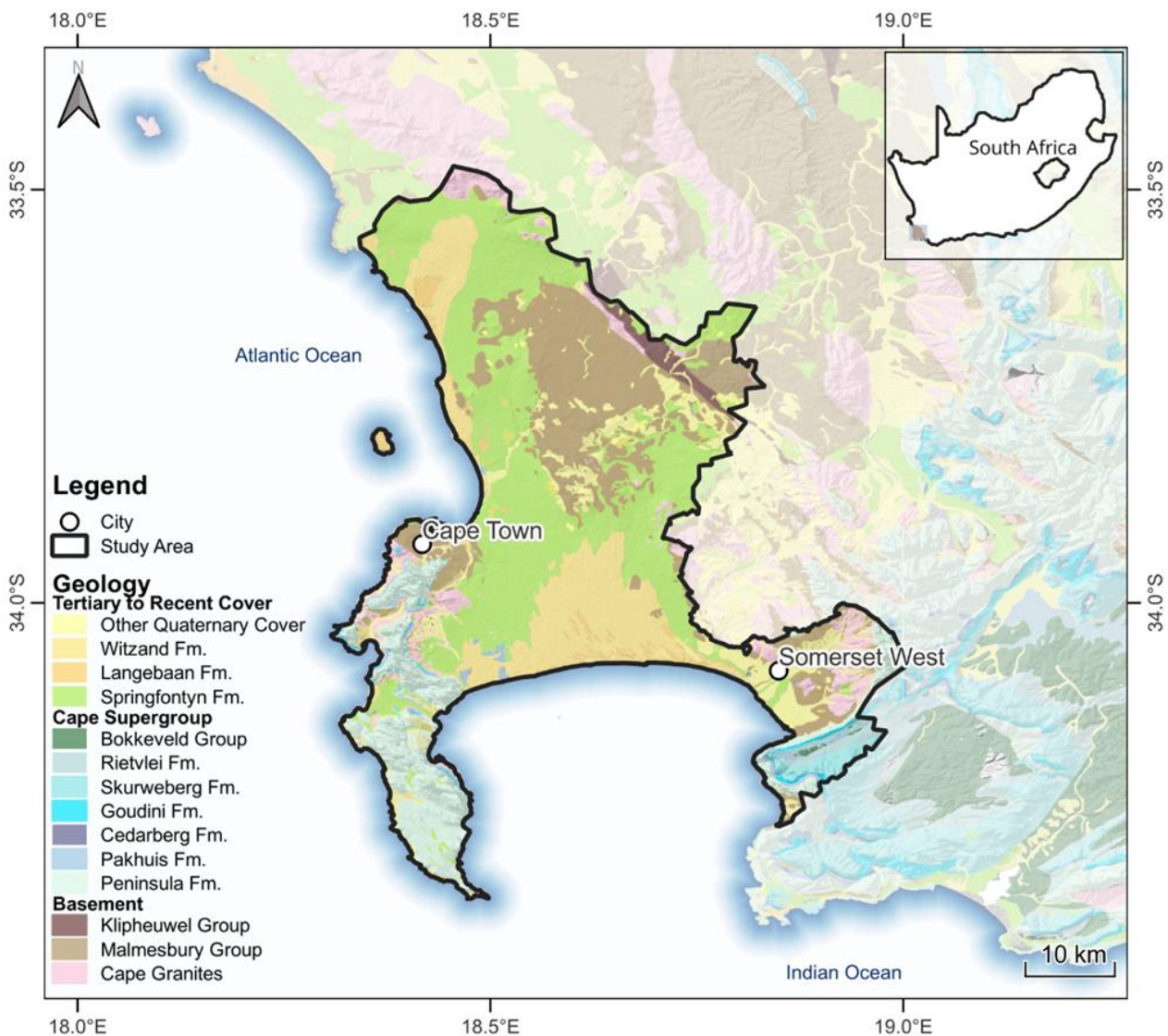


Figure 2-2 Geological map of the Cape Town study area and surrounds.

The basement Tygerberg Formation and Cape Granite Suite were structurally deformed (i.e. fractured, faulted and folded) by both the Late Namibian-Cambrian Saldanian and Permian-Triassic Cape Orogenies. Jurassic-Cretaceous break-up of the Gondwana supercontinent resulted in the re-activation and normal faulting of existing, generally NW-SE orientated structural trends within the basement rocks. Opening of the South Atlantic during Gondwana break-up also resulted in the intrusion of the ~NW-SE orientated False Bay Suite dolerite dyke swarm, which intruded both basement rocks and TMG in the Cape Town region. The overlying TMG (and Cape Supergroup as a whole) was extensively deformed by folding and transpressional (strike-slip and compressional/thrust) faulting during the Cape Orogeny, and transtensional (extensional/normal and strike-slip) faulting during Gondwana break-up.

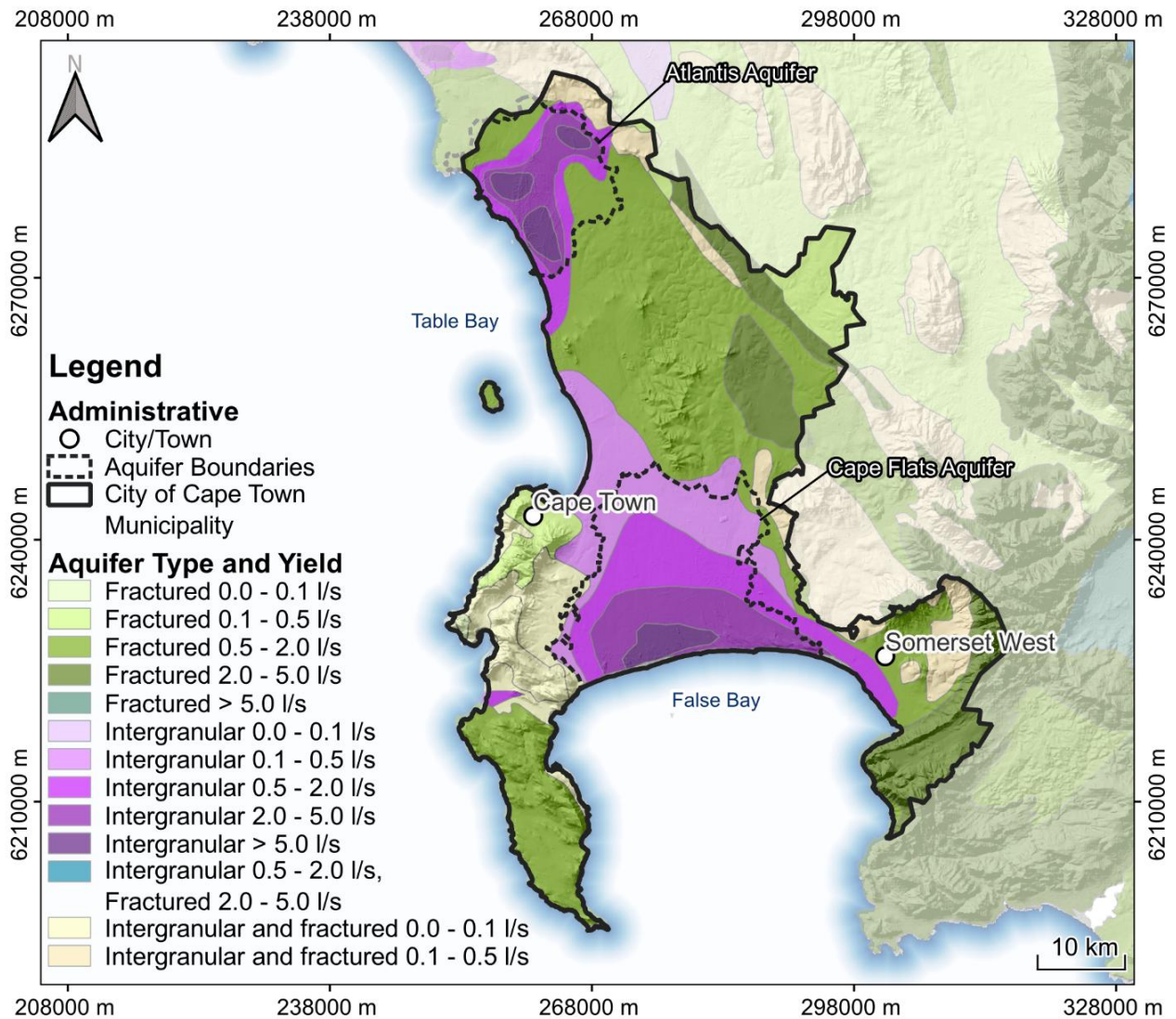


Figure 2-3 Hydrogeological map of the City of Cape Town Municipality.

Within the Cape Flats area and the west coast north of Cape Town CBD, the weathered Malmesbury Group and Cape Granite Suite basement rocks are unconformably overlain by fluvial, marine and aeolian Tertiary and Quaternary sedimentary deposits of the Sandveld Group. The sedimentary deposits are usually composed of interbedded sands, clay, clayey sand, calcrete, sandstone, coarse gravels, and peats. The Sandveld Group comprises of the Elandsfontyn, Varswater, Langebaan, Velddrif, Springfontyn and Witzand formations, though not all formations are present throughout the

study area (see **Figure 2-3**). These sediments form major primary sedimentary aquifers such as the Cape Flats Aquifer (CFA) and the Atlantis Aquifer. These primary aquifers can be high-yielding but are vulnerable to contamination due to their unconfined nature and high infiltration rates.

2.2 Overview of Vulnerability and Dependency Assessments

The dependency and vulnerability of groundwater in Cape Town were assessed to inform the development of a conjunctive management strategic action plan for the City. The assessments identified areas of high groundwater dependency and evaluated risks to groundwater quality and availability posed by contamination from human activities, over-abstraction, reduced recharge and sea level rise. These findings were used to identify high-risk areas, which form the basis for developing this conjunctive management strategic action plan aimed at guiding the sustainable use of groundwater resources in Cape Town. A summary of the key risks identified is provided below.

- **Aquifer contamination** risk in the City of Cape Town is highest in shallow unconfined aquifer systems such as the CFA and Atlantis aquifers due to high infiltration and limited natural protection. However, due to the number of potentially contaminating activities (PCAs), the CFA is the area most at risk of contamination from surface contaminants. In contrast, the deeper, confined TMG Aquifer within the Hottentots Holland Mountains and the TMG Aquifers and Cape Granite Suite basement aquifer along the Cape Peninsula generally display lower contamination risks due to their greater depth and natural confinement.
- The risk of **over-abstraction** is highest in areas with high concentrations of groundwater users, where aquifers are stressed, and where the ratio of recharge to yield is low. The CFA is particularly at risk due to large-scale private groundwater use (registered and unregistered), often concentrated in the same areas as municipal wellfields, such as the PHA. Although this part of the CFA has a low to moderate recharge-to-yield ratio and moderate stress, the concentrated and increasing water demand compounds the pressure on the resource. This stress intensifies during droughts as users increase pumping to compensate for declining surface water availability. The risk is further heightened in coastal sections of the CFA, where over-abstraction increases the potential for saline intrusion. In addition to the CFA, parts of the northern suburbs, where the basement aquifers are targeted, are also at high risk, due to a moderate stress index and a low recharge-to-yield ratio.
- The CFA is most vulnerable to **sea-level rise** due to climate change because of its shallow, unconfined nature, proximity to the coast, and low elevation relative to sea level. The Atlantis Aquifer, while also a primary coastal aquifer, is at lower risk because of the elevated position of the underlying Malmesbury geology, providing a natural barrier to seawater intrusion. Similarly, the TMG aquifers along the Cape Peninsula and in the Hottentots Holland Mountains are considered low risk due to their steep topography and confined geological settings that reduce the likelihood of saline intrusion.
- **Reduced recharge** due to climate change is a risk to groundwater availability in the City of Cape Town. Areas that already experience low recharge, like the northern suburbs, which are underlain by basement aquifers, have the highest risk. In these low recharge zones, even small declines in recharge have significant implications for long-term recharge reduction. Meanwhile, areas of relatively high recharge in the City, like the Hottentots Holland TMG aquifers, are less likely to be substantially impacted by reduced recharge. While not assessed separately in the vulnerability and dependency assessments, reduced recharge can also occur due to impermeable surfaces that often directs runoff towards oceans and increased water use/evapotranspiration from certain types of high maintenance crops that use up or prevent the replenishment of groundwater.

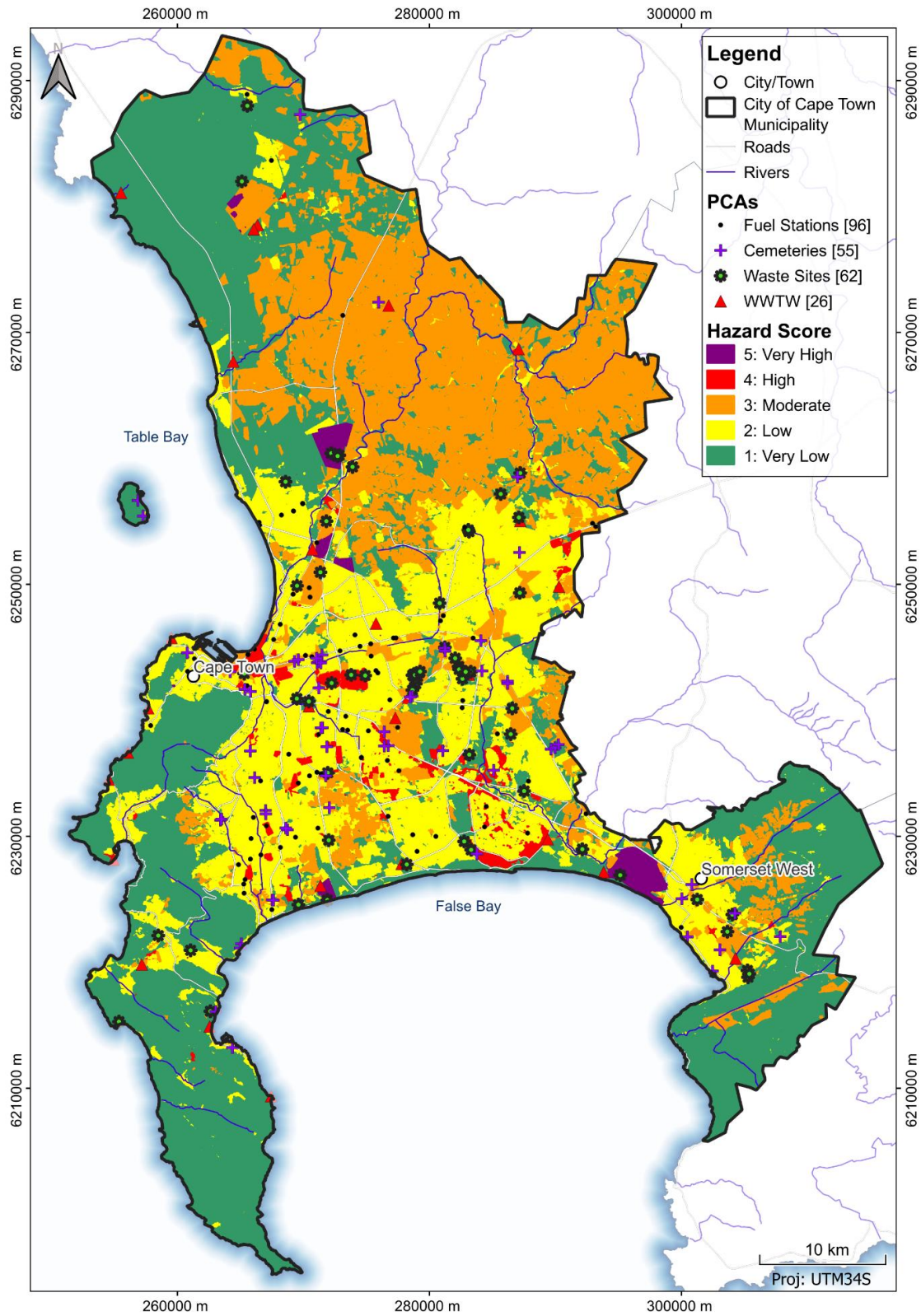


Figure 2-4 Groundwater contamination hazard map of Cape Town indicating areas of high risk to contamination and potentially polluting activities.

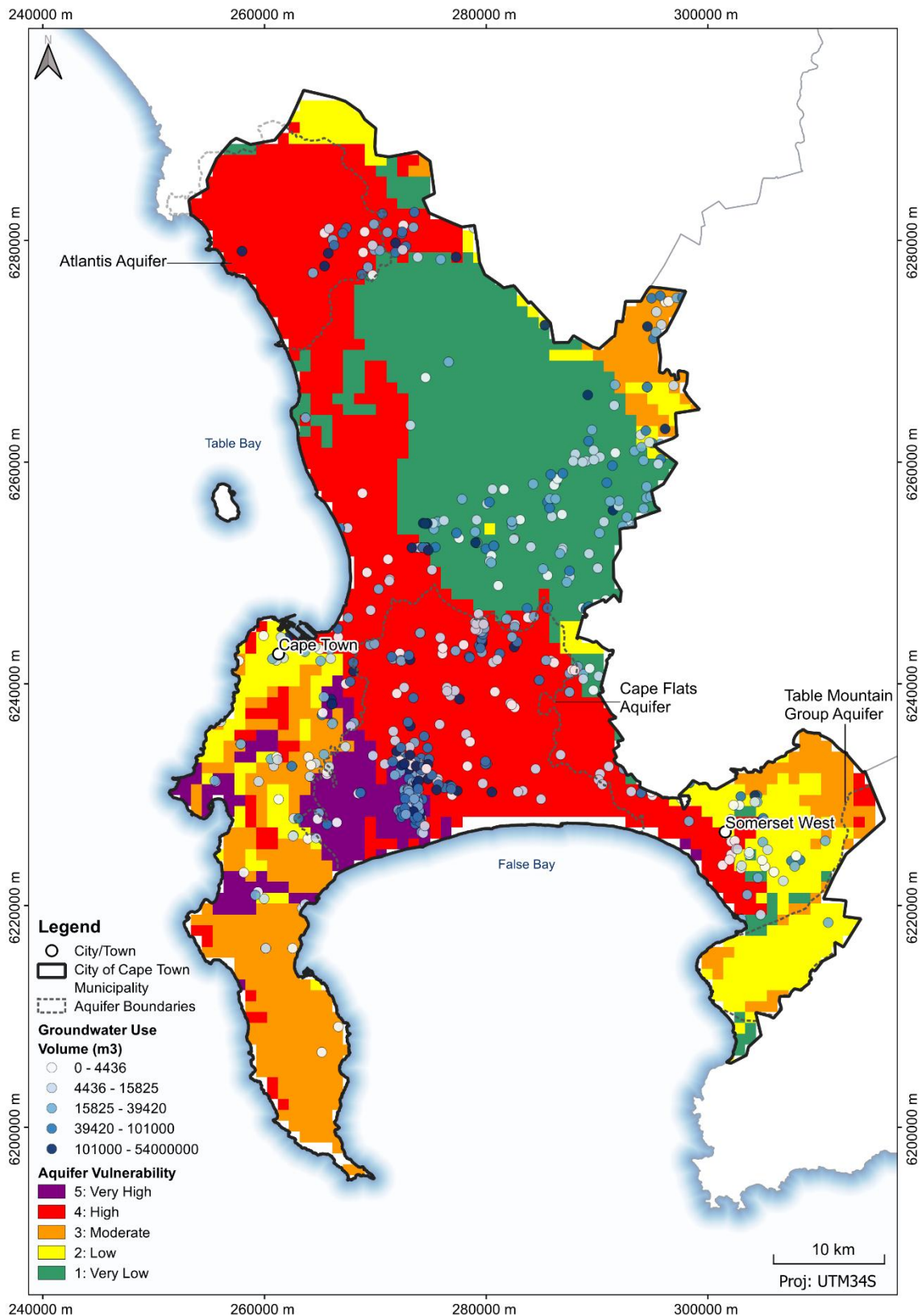


Figure 2-5 Aquifer contamination vulnerability map overlain with registered groundwater users within the City of Cape Town.

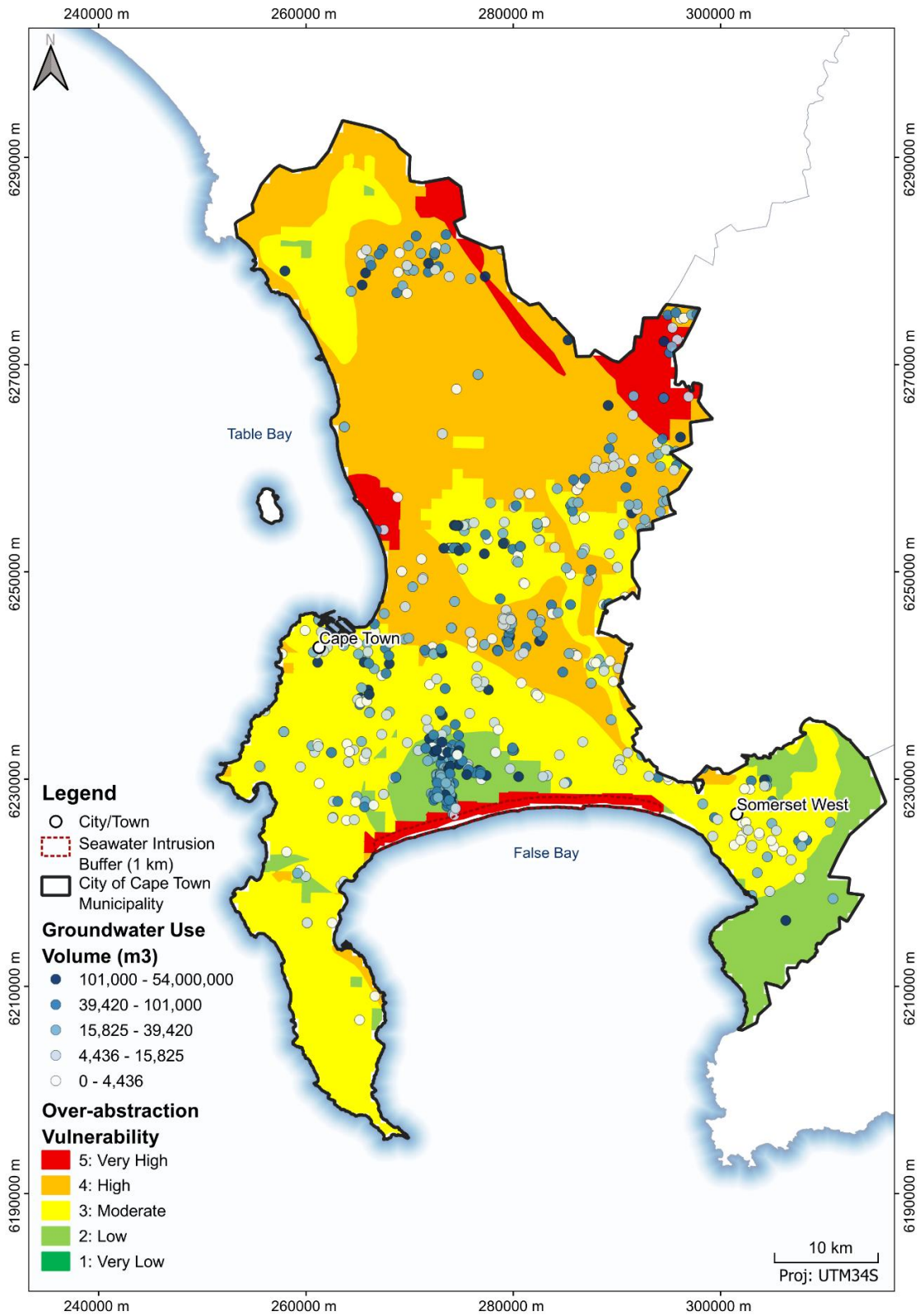


Figure 2-6 Aquifer over abstraction vulnerability map overlain with registered groundwater users highlighting areas at risk of over abstraction.

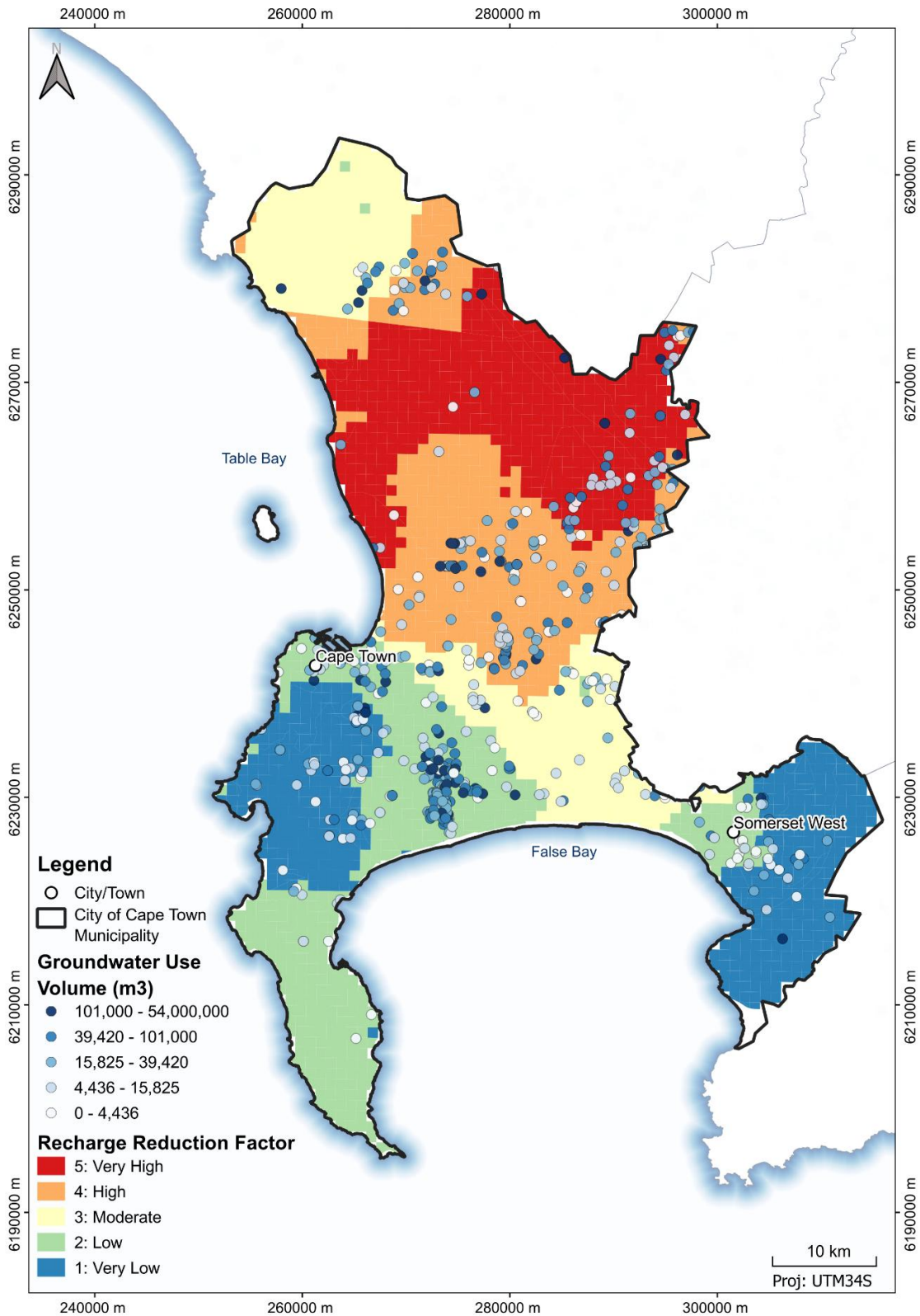


Figure 2-7 Map showing the recharge reduction factor in relation to registered groundwater users within the CCT, highlighting areas where groundwater users are at risk to reduced recharge.

The groundwater risks outlined above have serious implications for both people and the environment, particularly for **GDEs or sensitive ecosystems** (see **Figure 2-4**). Over abstraction and reduced recharge can significantly diminish the groundwater needed to sustain GDEs, leading to the shrinking or complete drying out of these systems and, as such, the loss of critical biodiversity. Additionally, GDEs are highly sensitive to groundwater contamination, which can result from human activities and saline intrusion due to sea level rise. The CFA, in particular, is the most at risk across multiple groundwater-related hazards, also placing GDEs in this region at high risk of these hazards.

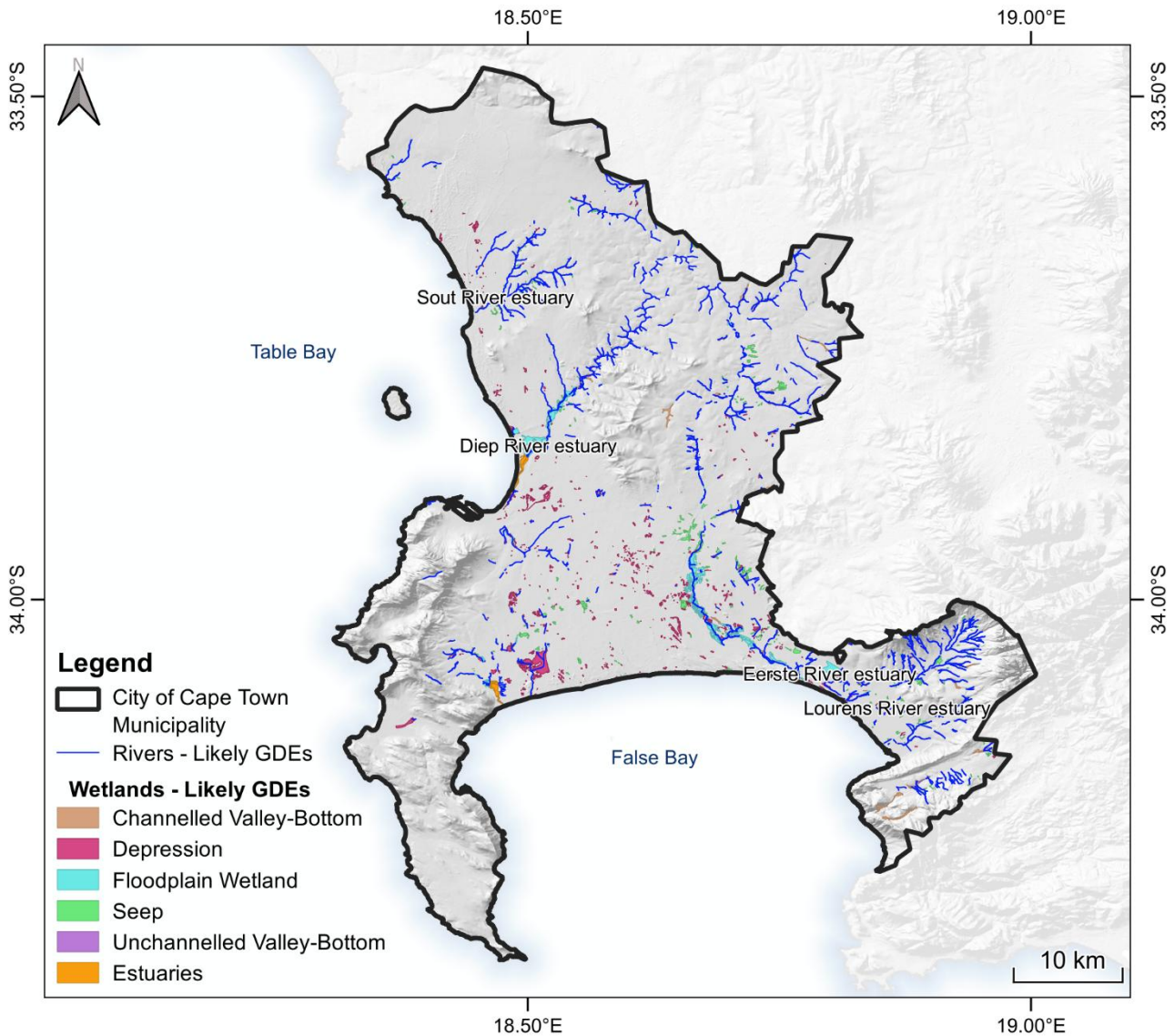


Figure 2-8 Surface water ecosystems that are likely to be GDEs.

Cape Town’s **socio-economic** vulnerability profile reveals a consistent trend: low-income communities face greater exposure and sensitivity to groundwater hazards and have far less coping capacity than high-income communities. Whether it is pollution of aquifers, unsustainable extraction, coastal impacts from sea-level rise, or climate-driven aridity, the inequalities in income, infrastructure, and social resources translate directly into unequal risk. High-income areas, with robust infrastructure, diversified water options, and financial means, generally score low on vulnerability. In contrast, low-income areas often exhibit high to very high vulnerability. This emphasises the need for targeted interventions: protecting aquifers from contamination by improving sanitation in informal settlements, regulating private over-abstraction to prevent overuse from

impacting the commons, investing in drainage and flood protection for low-lying settlements, and ensuring climate adaptation efforts prioritise the urban poor, who have the least capacity to adapt. By addressing these indicators, reducing sensitivity and increasing coping capacity in low-income areas, Cape Town can move toward more equitable groundwater resilience in the face of multiple hazards.

2.3 Cape Town's Vision

Cape Town's vision of becoming a water-sensitive city by 2040 is rooted in the City's Water Strategy (CCT, 2019a), developed primarily in response to the severe 2015-2018 drought, which brought the city to the brink of "Day Zero", a scenario where municipal water supply would have been shut off due to critically low surface water availability. This crisis exposed vulnerabilities in the City's water system and highlighted the urgent need for long-term resilience against climate change, urbanisation, and population growth.

In response, several strategies, policies and programmes have been implemented across the City to improve the region's resilience to climate change and ensure its water infrastructure and supply are optimally developed and managed to mitigate the risks of severe drought and other impacts of climate change on its inhabitants (CCT, 2019a; CCT, 2019b).

Cape Town's vision of becoming a water-sensitive city involves these key elements:

Diverse water sources: The City is developing new, diverse water supplies, including groundwater, water reuse, and desalinated water, through its New Water Programme to create a city that is resilient to climate change. The City of Cape Town's Water Strategy (CCT, 2019a) now projects about 7% of its bulk water supply to come from groundwater by 2040 through the fast-tracked development of wellfields in the Table Mountain Group and Cape Flats aquifers and the refurbishment of the Atlantis Water Management Scheme.

Diversified infrastructure: This involves the CCT investing in both traditional and new infrastructure. A key component is water-sensitive urban design (WSUD), which integrates the urban water cycle (including stormwater, groundwater and surface water) into urban planning and design. WSUD incorporates features such as permeable paving, bio-swales, rain gardens, retention and detention ponds to enhance infiltration, reduce runoff and improve water quality. Together with green infrastructure initiatives, these interventions can be achieved through the Green Infrastructure Programme (GIP).

Healthy waterways and rivers: This ensures that rivers and wetlands function ecologically with improved water quality and biodiversity. Waterways should also allow for flood control, aquifer recharge, water reuse and recreation. The CCT aims to achieve this through the Liveable Urban Waterways Programme.

These elements are essential for diversifying the City's water supply while protecting vulnerable aquifers from additional stress.

3 Legislation and Regulations

3.1 Role of Local Government in Groundwater Management





South Africa's legislative framework divides water governance between national resource management and local service provision. The National Water Act (NWA) designates the national Department of Water and Sanitation and Catchment Management Agencies as custodians of water resources (including groundwater), while the Water Services Act (1997) tasks local governments (municipal Water Services Authorities, WSAs) with providing water services to communities.

3.1.1 Governance Structure

The NWA and the Water Services Act (Act No.108 of 1997) outline the authorities responsible for water management in South Africa. The main authorities involved in groundwater management and associated groundwater data collection are listed below (WRC, 2011; CCT, 2025):

- **National Government** – The role of the National Government is to draft and gazette water regulatory policies and laws.
- **Department of Water and Sanitation (DWS)** – is responsible for national legislation, planning the development of national groundwater resource policy, regulation and monitoring. DWS regional offices act as the effective proto-CMAs.
- **Catchment Management Agencies (CMAs)** are responsible for water resource management within their Water Management Area (WMA). They were established to address local water needs more effectively and develop tailored water management strategies specific to their WMAs. Their primary goal is to achieve integrated management within the catchment and facilitate stakeholder participation in decision-making and water resource management. Initially, nineteen (19) WMAs were defined with the intent for a CMA to be established within each WMA. However, delays in establishing these agencies led to a reduction first to nine WMAs and CMAs, which were later consolidated to just six. The City of Cape Town currently falls within the Breede-Olifants Water Management Area and is managed by the Breede-Olifants Catchment Management Agency since 2024, following its expansion from the Breede-Gouritz Catchment Management Agency established in 2013.
- **Water User Associations (WUAs)** are responsible for functioning at a local level, representing individual water users and providing vehicles for public participation to the CMA. They operate at a restricted localised level and are co-operative associations of individual water users who wish to undertake water-related activities for their mutual benefit (National Water Act 36 of 1998). WUAs are well placed to implement and manage conjunctive use of groundwater and surface water resources and the artificial recharge of local aquifers, reduce or prevent over-exploitation and degradation of the groundwater resource, implement water conservation measures and create awareness on resource availability and sustainability.
- **Water Boards** – The eight (8) government-owned water boards play a key role in resource management in the water sector of South Africa. The water boards operate bulk water supply infrastructure, wastewater systems, dams and supply infrastructure. Water boards which provide access to water service are referred to as Water Service Providers (WSP).
- **Water Service Authorities** are the designated municipal institutions responsible for ensuring water and sanitation services within their jurisdiction. Their duties include planning of water supply services, ensuring the operation and maintenance (O&M) of infrastructure, monitoring **water resources**, including **water levels, quantity, and quality**, and **analysing this data** to advise the WSP on necessary improvements. Some of these duties might be delegated to the WSP under a service provision contract (WSPC). WSAs are also required to submit regular compliance reports to the CMA and DWS, including monitoring data (water level,

water quality and quantity) and abstraction volumes. To support these functions, WSAs can make use of external organisations to assist in monitoring and reporting.

	MUNICIPALITY	PROVINCIAL GOVERNMENT	CATCHMENT MANAGEMENT AGENCY* <small>*National if no CMA in place</small>	NATIONAL GOVERNMENT
Groundwater abstraction and use 	<ul style="list-style-type: none"> •Often a key user of groundwater as part of bulk supply •May regulate water services intermediaries •Control over any connections to water supply infrastructure 	-None-	<ul style="list-style-type: none"> •Licensing authority for groundwater use •May issue general authorisations •May restrict use when supply is limited 	<ul style="list-style-type: none"> •Custodian of all water resources •Assigns powers to CMAs •Establishes CMAs, advisory committees, and delegates powers
Provision of water service 	<ul style="list-style-type: none"> •Implementer as water services authority / water services provider for provision of water services to all users. (may include groundwater use) 	<ul style="list-style-type: none"> •Monitoring and oversight over water services authorities •May intervene at municipal level if required 	-None-	<ul style="list-style-type: none"> •Monitoring and oversight over water services authorities •Regulates by setting national standards •May intervene at municipal level •Creates national information system
Regulation of land use 	<ul style="list-style-type: none"> •Regulator of land use through zoning and building development management 	<ul style="list-style-type: none"> •Regulator of certain land uses including those that impact on surface water and certain specified industrial, waste management and other polluting activities 	<ul style="list-style-type: none"> •Regulator of land uses related to surface water (impacts on watercourses, discharge of waste) 	<ul style="list-style-type: none"> •Regulator of mining (Department of Mineral Resources and Energy [DMRE]), energy (Department of Forestry, Fisheries and the Environment [DFFE]) and certain other listed activities
Pollution control and response 	<ul style="list-style-type: none"> •Enforcement and response in terms of ECA and local by-laws 	<ul style="list-style-type: none"> •Enforcement and response in terms of NEMA (Western Cape Department of Environmental Affairs and Development Planning [DEA&DP]) •Contaminated land regulator in terms of NEMWA 	<ul style="list-style-type: none"> •Enforcement and response in terms of NWA 	<ul style="list-style-type: none"> •Enforcement and response in terms of NEMA (DFFE), NWA (DWS) and MPRDA (DMRE) •Contaminated land regulator in terms of NEMWA

CMA* Catchment Management Agency, DWS* Department of Water and Sanitation, ECA* Environmental Conservation Areas, NEMA* National Environmental Management Act, NEMWA* National Environmental Management: Waste Act, NWA* National Water Act.

Figure 3-1 Powers and competencies of spheres of government (CCT, 2025).

- **Water Service Providers** are appointed to provide water supply and sanitation services on behalf of the WSA. This also includes operating and maintaining infrastructure, monitoring (e.g., collecting, capturing, interpreting and analysing groundwater data) and submitting compliance reports to the WSA. The City of Cape Town Municipality functions as both a WSA and a WSP.

3.1.2 Local Government Function

Metropolitan municipalities, as WSAs, are responsible for delivering potable water, sanitation, and related infrastructure, but they have no explicit mandate for groundwater resource management under current law (Faragher and Carden, 2023). In practice, this means metros historically focused on distributing surface water supplied from regional dams, with groundwater governance largely left to national authorities.

Despite this division, municipal functions intersect with groundwater governance. Local authorities control land use planning, stormwater management, and pollution control, all of which affect aquifer recharge and quality (Faragher and Carden, 2023). Moreover, municipalities themselves may become significant groundwater users during droughts or as cities expand. The National Groundwater Strategy (DWS, 2016) recognises the need for a “bottom-up” co-management approach with local stakeholders (DWS, 2016), but it provides little practical guidance on how local governments should engage in groundwater management (DWS, 2016; Faragher and Carden, 2023). This gap has resulted in a mismatch between policy and practice: local governments have traditionally not planned or budgeted for groundwater management, even as urban aquifers are increasingly tapped by residents and businesses. Current Practices in Metropolitan Municipalities include:

Historically limited use and oversight: In South Africa’s metropolitan municipalities, groundwater use has generally been a small fraction of the total urban water supply. Nationally, only about 15% of the country’s water supply comes from groundwater (DWS, 2016; Riemann et al., 2012). Large metros like The CCT, Johannesburg, eThekweni (Durban), and Tshwane (Pretoria) have relied overwhelmingly on surface water from regional bulk suppliers, giving groundwater a peripheral role. As a result, most metros did not develop dedicated groundwater units or monitoring programmes. Very few cities employed hydrogeologists or maintained comprehensive borehole registers until recently. Groundwater was often seen as an “emergency” or supplementary source rather than part of the core supply mix (Riemann et al., 2012). This attitude is reflected in metropolitan water plans that, until the mid-2010s, made little mention of local aquifers.

Growing municipal groundwater use: In recent years, climate change and drought stresses have prompted some metros to reconsider groundwater. The severe 2015–2018 drought in the Western Cape was a turning point, especially for Cape Town, which relied mainly on surface water. CCT’s Water Strategy (2019a) now projects about 7% of its bulk water supply to come from groundwater by 2040 (City of Cape Town, 2019a). During the 2015–2018 drought, Cape Town fast-tracked the development of wellfields in the Table Mountain Group and Cape Flats aquifers to supplement its strained dams. Other metros have also begun modest groundwater initiatives, for instance, Mangaung (Bloemfontein) has developed wellfields to support its supply during dry periods, and Nelson Mandela Bay metro drilled emergency boreholes in the 2019–2020 drought. These efforts indicate a shift toward conjunctive use of surface and groundwater in cities. However, they remain the exception rather than the norm. Many metropolitan municipalities still have limited internal operational experience or capacity in groundwater development and management, and expertise is thus sourced from external specialists as needed.

Private groundwater use in cities: A significant aspect of current practice is that much urban groundwater use occurs outside the municipal supply system. In metropolitan areas, private individuals, industries, and other entities abstract groundwater via boreholes and wellpoints, often without active oversight by local government. For instance, in Cape Town, the majority of registered groundwater use (by volume) is by agriculture (irrigation on the urban fringe) and industry, rather than the municipal utility (DWS, 2016). Most metros require permits or registration for private

boreholes in theory, but enforcement is inconsistent. Typically, these registrations are intended to prevent cross-connection with municipal water and to promote safety, rather than to actively monitor usage volumes. Monitoring of private abstractions is largely voluntary and compliance with reporting to the national WARMS database is low.

Consequently, metropolitan municipalities today face a situation where significant groundwater abstraction is happening within their boundaries, with minimal data available at the local level. This poses challenges for integrated water resource management, as decision-makers may be unaware of the stress on underlying aquifers.

Additional Responsibilities of Local Government

The key responsibilities of the local authorities, in terms of the constitution and water legislation that relate to Integrated Water Resource Management (IWRM), include ensuring provision of municipal services, municipal spatial development (land use), infrastructure planning and environmental management, including stormwater management, pollution control and waste management.

Local authority functions, such as environment, water services and air quality, should be dealt with as part of the **Integrated Development Plan (IDP)** process where they are relevant to the local priority issues. The **Water Services Development Plan (WSDP)** is seen as the water services component of the IDP. In addition, local authorities must set key performance indicators (KPIs) and targets related to their IDPs. The WSDP must be aligned with the Catchment Management Strategy (CMS) of the CMA, if in existence, or with the Internal Strategic Perspective (ISP).

The **Integrated Waste Management Plans (IWMP)** are considered the waste management component of the IDP. It must include all streams of waste, solid and liquid, and provide for waste reduction, treatment and long-term disposal.

The **Municipal Spatial Development Framework (MSDF)** deals with the growth and development scenarios of the municipality and the related spatial development and land use. The local SDFs feed into the Provincial Growth and Development Framework and, in turn, must be aligned with its guiding principles. The SDF must also be aligned with the Provincial and National Spatial Development Frameworks and all other requirements set out for municipalities as required by the Spatial Planning and Land Use Management Act (SPLUMA).

The legally required sectoral plans, namely IWMP and WSDP, have IWRM gaps, which must be filled if a local authority is to simultaneously comply with its constitutional obligations for sustainable service delivery, socio-economic development and a safe and healthy environment. Hence, the local authority has to develop an **Integrated Water Resource Management Plan (IWRMP)** to facilitate the water use authorisation application process and local implementation of IWRM.

3.2 Overview of Water-Related Legislation

Groundwater development and use within the City's future water supply programme is governed by a set of complementary legislative and regulatory instruments, primarily the NWA, the Water Services Act and the SANS 241 Drinking Water Standard. Together, these frameworks regulate how groundwater may be abstracted, treated, managed, and supplied as part of the municipal water system, ensuring both resource sustainability and public health protection.

The NWA, Act 36 of 1998, is South Africa's primary legal framework for the protection, use, development, conservation, management, and control of all water resources, including groundwater. The Act establishes groundwater as a national resource and regulates activities such as abstraction, storage, and potential pollution through water-use authorisation under Section 21. It mandates the registration and monitoring of groundwater use to ensure accurate national data for assessing aquifer status, determining the Reserve, and informing equitable and sustainable groundwater allocation by the DWS or an appointed regulator.

SANS 241 drinking water quality standards provide the national benchmark for water quality, ensuring that all water introduced into Cape Town's bulk supply system is safe and acceptable for human consumption. As the City diversifies its bulk water sources, reducing reliance on surface water through the incorporation of water reuse, desalination, and groundwater augmentation (including managed aquifer recharge (MAR) using highly treated effluent), all blended water must comply with SANS 241 limits prior to entering the City's distribution network to safeguard public health, and guide the treatment, monitoring, and validation of all new and existing water sources within the system.

The Water Services Act (Act 108 of 1997), which governs the provision of water supply and sanitation services, becomes directly relevant to groundwater when it is incorporated into the municipal drinking water system, as planned by the City. Once groundwater is integrated into the supply network, the Act obligates authorities to plan, operate, monitor and maintain the groundwater resources within their supply networks, also ensuring that the water delivered to the public (including groundwater) meets SANS 241 drinking water standards.

The above-mentioned water-related legislation is described in more detail in **Appendix A – Legislation and Regulations**.

3.3 Overview of Environmental Legislation

The National Environmental Management Act (NEMA) sets core principles for environmental governance. It requires sustainable development and protection for vulnerable environments and ecosystems. This act mandates environmental impact assessments for new activities or developments that among various environments, effects groundwater. It directly protects aquifers from over-exploitation, aquifer contamination and in some instances reduced recharge, ensuring important recharge areas are not affected by impermeable surfaces.

The National Environmental Management: Biodiversity Act protects South Africa's species and ecosystems. Often these ecosystems are dependent on groundwater, the act therefore ensures that the use of ecological resources does not harm the groundwater systems that sustain them.

The National Environmental Management: Waste Act regulates waste management to prevent polluted waste from reaching the environment. It holds the polluter responsible for contamination and provides rules on hazardous waste and dumping to help prevent contamination at its source. The act protects groundwater environments from contamination from leachate or sewerage.

SPLUMA is a piece of legislation that guides land use and spatial development at the municipal level. The act's primary purpose is to ensure that planning and development are socially equitable, economically efficient and environmentally sustainable. Part of the act's mandate is to integrate environmental protection into spatial planning through spatial development frameworks and zoning schemes. From a groundwater perspective, this allows the government to control development on groundwater recharge zones, designate groundwater protection areas with usage restrictions and safeguard GDEs. Through the management of land use, the act serves as a preventative tool that complements water laws to protect groundwater from contamination and over-exploitation.

The above-mentioned environmental-related legislation is described in more detail in **Appendix A – Legislation and Regulations**.

3.4 Overview of Climate Change and Spatial Planning Legislation

Legislation in South Africa creates an integrated legal framework that compels municipalities to manage groundwater for climate resilience. This framework combines long-term planning with emergency response, transitioning governance from reactive crisis management to proactive risk reduction.

The Climate Change Act, 2024, provides a proactive planning framework that mandates municipalities to conduct climate risk assessments and develop CCRIPS. For groundwater, this

means integrating aquifer data (water levels and quality) into these plans as key climate indicators. The act enables the use of predefined thresholds that trigger automatic drought responses or MAR, ensuring a swift, data-driven reaction to protect groundwater resources.

Complementing this, the Disaster Management Act, 2002, provides the emergency response framework. It treats drought as a “slow onset disaster” and requires municipalities to prepare disaster plans that address groundwater risks like contamination and saline intrusion. The Act empowers authorities with early warning systems based on reductions in groundwater storage (declining water levels) and provides the government with additional power and ability to implement emergency measures. Examples include the expediting of borehole drilling during drought or enforcing water restrictions to reduce demand and secure water supply.

These two acts are ultimately intended to work together to mitigate the impacts of climate change on groundwater and the users who depend on it. The Climate Change Act identifies long-term risks and embeds groundwater in development strategy, while the Disaster Management Act provides the legal tools for emergency action. Supported by SPLUMA, which safeguards wellfields spatially, this integrated approach is an improvement towards securing South Africa’s groundwater in a climate variable future.

The above-mentioned climate change and spatial planning legislation are described in more detail in **Appendix A – Legislation and Regulations**.

3.5 Overview of Provincial Planning Laws

The Western Cape Land Use Planning Act, 2014 (Act 3 of 2014), provides an important framework for integrating groundwater considerations into land use decision-making. While not a water law itself, the Act requires municipalities to prepare spatial development frameworks (SDFs) and zoning schemes that guide where development may occur, and to apply sustainability principles in all land use planning. The Western Cape Province, in response to the Act, developed the Western Cape Provincial Spatial Development Framework (2014). The development of SDFs creates an opportunity to identify and protect aquifer recharge zones, groundwater-dependent ecosystems, and areas of high groundwater vulnerability from inappropriate land uses that could lead to contamination or reduced recharge. By regulating the effect of land development on agriculture, the Act also indirectly safeguards sectors and communities that are highly groundwater-dependent, particularly in rural and drought-prone areas. At a provincial level, the requirement to align planning with broader priorities such as climate change adaptation, biodiversity conservation, and water security ensures that groundwater vulnerability and dependency are explicitly considered in development management. In this way, the Act serves as a critical tool to promote land use planning that both protects groundwater resources and recognises the reliance of people, ecosystems, and economies on their sustainable use.

The Western Cape Biodiversity Act (2021) does not regulate groundwater directly, but it is closely linked to groundwater management because many of the ecosystems, ecological infrastructure, and biodiversity features it seeks to protect are groundwater-dependent. The Act requires the conservation of ecosystems, ecological infrastructure, and ecosystem services, many of which rely on sustained groundwater levels, aquifer recharge, baseflow, and groundwater discharge via springs and seeps. Through systematic biodiversity planning, the identification of Critical Biodiversity Areas and Ecological Support Areas, and the regulation of activities affecting ecological integrity, the Act supports the protection of groundwater-dependent ecosystems and the recharge areas that maintain them. It therefore complements the NWA and NEMA by embedding groundwater considerations into provincial biodiversity planning and land-use decision-making, promoting the long-term ecological sustainability of groundwater-linked systems.

The above-mentioned provincial planning laws are described in more detail in **Appendix A – Legislation and Regulations**.

4 City of Cape Town Strategies, Policies and By-laws

Strategies provide the framework for the conjunctive management of water resources. Their implementation, monitoring and enforcement help balance supply and demand, mitigate risks such as over-abstraction, aquifer contamination and reductions in recharge, and enhance resilience against climate variability. By combining regulatory measures, technological innovations, and community engagement, conjunctive management optimises resource allocation, protects ecosystems and secures long-term water availability. Groundwater, as a vital resource, is often utilised to mitigate against drought, which requires strategic planning to maintain its reliability and sustainable use. To reduce the potential impacts on groundwater resources, well-designed and integrated strategies and policies are essential for holistic water security.

As part of the City of Cape Town's vision of transitioning into a water-sensitive city by 2040, several strategies, policies and programmes have been implemented or are ongoing across the regional municipality to improve the region's resilience to climate change and ensure its water infrastructure and supply are optimally developed and managed to mitigate the risks of severe drought and other impacts of climate change on its inhabitants. While the development of these plans is welcomed, it is recommended that progress on their actions be monitored and evaluated annually. At present, reporting is fragmented and inconsistent across sectors. Consolidating progress into a single report would provide a more comprehensive overview.

The strategies described below and further detailed in **Appendix B – City of Cape Town Strategies** are existing strategies that align with the proposed action plans and support overall groundwater management. They are supported and enforced by key polices and by-laws relating to water and sanitation, stormwater management, municipal and spatial planning, the environment and climate change. Policies form the first layer of implementation by establishing the principles and overall direction of each strategy. By-laws then translate these principles into enforceable legal rules and standards, ensuring compliance and providing the regulatory foundation required for effective implementation of the strategies. A detailed overview of the policies and bylaws outlined in this section is presented in **Appendix C – Policies and By-laws**.

4.1 Strategies

4.1.1 Water Strategy (2019)

In 2019, the CCT developed and adopted its “Our Shared Water Future” strategy to support its vision of becoming a water-sensitive city by 2040 that optimises and integrates the management of water resources, to improve resilience, competitiveness and liveability for the prosperity of its people (CCT, 2019a). The Strategy highlights the following commitments:

1. Safe Access to Water and Sanitation

This commitment focuses on ensuring safe and reliable access to water and sanitation for all residents, in line with well-defined minimum standards. A key emphasis is on working with informal settlements and relevant stakeholders to enhance daily water and sanitation services. These improvements directly support groundwater protection, particularly in shallow unconfined aquifers such as the CFA, by reducing the risk of contamination from inadequate sanitation infrastructure. Through these efforts, the City aims to foster trust and improve community safety.

2. Wise use of water

The City commits to promoting wise water use amongst all of its users. This primarily includes promoting and emphasising responsible water conservation behaviour through several measures, which include;

- a) pricing water in line with the cost of providing additional supply, while maintaining a basic

free allocation for households unable to afford it. It is recommended that these prices should take into account annual household income to not make already vulnerable groups even more vulnerable.

- b) revising by-laws and planning requirements, and including incentives which support water efficiency, treatment, and reuse.
- c) improving customer management and engagement to support active citizenship, and
- d) reducing water supply losses and non-revenue water through the effective management of the city's water network.

Reducing overall demand through these initiatives forms part of sustainable groundwater management, as it reduces stress on groundwater abstractions.

3. Sufficient, reliable water from diverse sources

Increasing water supply capacity through diversification of its water supply network, which includes developing new supplies from groundwater schemes, water reuse and the desalination of water in a cost-effective and timely manner, to increase resilience and reduce the likelihood of severe water restrictions in the future. Through this strategy, the CCT is aiming to grow water supply capacity by 300 million litres per day over the next ten years. Where necessary, suitable increments in a way which is adaptable and robust to changes in circumstances will be developed.

4. Shared benefits from regional water resources

Collaboratively optimising the economic, social and ecological benefits of regional water resources and reducing their associated risks. The goal is to work with water users and relevant stakeholders to reduce the risk of contamination and over-exploitation for Cape Town's shared water resources, while simultaneously optimising the economic, social and ecological benefits through its use. CCT is especially interested in working with urban and agricultural water users, government and other key stakeholders to maximise these benefits. The use of springs is an example of what the CCT is trying to achieve, as they offer ecological benefits, are communal points that offer relief to society during times of drought and have historically been used for various economic benefits, particularly in the brewing industry. Through improved management and infrastructural upgrades, these water sources could be sustainably utilised to optimise these benefits, while ensuring they are protected from over-exploitation and contamination.

5. A water-sensitive city

Actively facilitating the transition of Cape Town to a water-sensitive city, supported by diverse water sources, resilient infrastructure, and the efficient use of stormwater and urban waterways. This approach will enhance flood management, groundwater recharge, water reuse and recreation while considering sustainable ecological principles. The CCT aims to achieve this through new incentives, regulatory mechanisms and the way in which the CCT invests in new infrastructure.

To achieve the commitments outlined in the Water Strategy, the CCT has developed a Water Transition Plan, which is implemented through the **New Water Programme (NWP)**. The purpose of the New Water Programme is to ensure that the city has a reliable, diversified and climate-resilient water supply that can meet future demand, while reducing the risk of another "Day Zero" scenario in Cape Town. The programme specifically focuses on transitioning from a reliance on rain-fed dams to a mix of water sources. The City plans to increase supply by more than 300 million litres per day by 2030, with a significant portion expected from groundwater abstraction and MAR to maintain groundwater levels, linking groundwater directly to drought resilience, climate adaptation, regional cooperation, ecological sustainability, and long-term water security.

Besides the augmentation of groundwater, other initiatives such as water reuse, desalination and the clearing of invasive vegetation are currently ongoing or planned. However, due to delays in implementing parts of the NWP and continued growth in water demand, timelines for these initiatives may need to be moved forward and targeted supply assurances and climate change allowances may need to be adjusted to reach the NWP's 2030 goal (CCT, 2024b).

To support Cape Town's goal of transitioning into a water-sensitive city as stipulated in the Water Strategy, the CCT has also implemented the **LUW Programme** and the **GIP**, which are discussed in the following sections of this report.

4.1.2 Resilience Strategy (2019)

Cape Town's resilience strategy, adopted in August 2019 provides an innovative roadmap to strengthen the City's adaptive capacity against a range of potential sudden **shocks** in the future (e.g., storm surges, droughts, flooding and heat waves), while addressing existing underlying **chronic stress** (e.g. climate change, informal settlement, poverty, crime, substance abuse and a lack of social cohesion) that affects the CCT's ability to respond to sudden shocks effectively (CCT, 2019b). A central focus of the Strategy is the need to partner across all sectors, including the government, businesses, community organisations, academia and households, to build collective resilience to shocks and stresses.

The Strategy strengthens the role of groundwater in building long-term water security and reducing vulnerability to future droughts. The strategy recognises that the city's heavy dependence on surface water makes it highly exposed to climate-driven shocks, and therefore prioritises both the diversification and protection of groundwater resources. Key actions include protecting water sources through MAR to ensure the long-term health and sustainability of the city's major aquifers, as well as promoting enhanced recharge through catchment restoration under the Greater Cape Town Water Fund. The Strategy also encourages responsible private groundwater use through improved data capture and user awareness, and emphasises stronger data, monitoring and scenario planning to support evidence-based decisions on groundwater and overall water resilience.

Cape Town's Resilience Strategy is structured around 5 resilience pillars, 20 goals and 75 actions with the following pillars being relevant to the project (see **Appendix B** for further details):

- Pillar 2 (**Collectively, Shock-related City**),
- Pillar 4 (**Collaborative, Forward-looking City**) and
- Pillar 5 (**Connected, Climate-adaptive City**).

Some actions detailed in the Resilience Strategy are new, while others are pre-existing but require further reframing, upscaling and support to increase the city's resilience. It is also important to note that several actions, either already implemented or in the process of implementation, may be aligned with those described in the Climate Change Strategy described in **Section 4.1.3**.

4.1.3 Climate Change Strategy and Climate Change Action Plan (2021)

The vision behind Cape Town's Climate Change Strategy is to become a climate-resilient, resource-efficient, and carbon-neutral city that enables inclusive economic development and healthy, thriving communities and ecosystems (CCT, 2021a). This strategy also aims to contribute towards achieving the city's goal of transitioning into a water-sensitive city by 2040.

A critical component of the strategy is groundwater management due to its role in the adaptive capacity to droughts. The plan emphasises sustainable groundwater use to prevent over-abstraction and aquifer contamination. Moreover, the strategy plans to diversify and augment water supply, enhance artificial recharge measures and integrate groundwater with surface water systems for greater reliability and availability.

The Strategy shifts Cape Town towards greater climate resilience, through key concepts such as:

- **Adaptive planning** – preparing for water scarcity, extreme weather events and extreme heat
- **Mitigation efforts** – reducing emissions via renewable energy and sustainable transport
- **Integrated resource management** – ensuring water, energy and food security
- **Community engagement** – empowering citizens and businesses in climate action

The Climate Change Strategy is based on the following principles:

1. Resilience
2. Economic inclusiveness
3. Embedded sustainability
4. Carbon Neutrality
5. Health and well-being
6. Collaboration and integration
7. Climate-responsive urban development
8. Equitable and inclusive service delivery
9. Precautionary principle
10. Innovation and transformational planning

By addressing both intermediate and long-term sustainability, Cape Town's Climate Change Strategy is essential for ensuring the city remains liveable, economically stable, and environmentally secure.

Within the strategy's existing action plan framework, actions are organised into strategic focus areas (SFAs) and cross-cutting work areas (CCWAs). Each SFA and CCWA supports the achievement of the strategy's goals while aligning with its guiding principles, and together they contribute to the pathways that deliver its vision, principles and desired outcomes. For the purposes of this study, only action plans related to water management are considered. These are strategic focus areas 2 and 3, which deal specifically with water security, drought-readiness, water sensitivity, flood readiness and storm management, all of which are relevant to groundwater management given the critical role groundwater can play in achieving water security, whilst also acknowledging the relationship between storm and flood management on the health of aquifers in terms of recharge and contamination.

Climate Change Strategy SFA 2: Water Security and drought-readiness is aimed at **developing water security and drought readiness**, one of the most impactful climate change challenges faced by the city. The Water Strategy and Resilience Strategy are key overarching strategies that align actions and measures to achieve this goal. The drought Cape Town experienced, from 2015 to 2018, expedited the formulation and establishment of these plans to ensure the water sector is protected against the threats of climate change. The actions covered in this SFA are therefore focused on adapting to the impacts of reduced rainfall, drought and increased water scarcity.

SFA 3 of the Climate Change Strategy deals with **water sensitivity, flood readiness and storm management**. Climate modelling suggests Cape Town will experience less rainfall but at higher intensities in its future. Each year, Cape Town experiences flooding and gale-force winds that cause damage to properties and leave residents highly vulnerable. Flooding, in particular, is an issue faced by many residents of the city, and is often less about the intensity of the rainfall and more about geographical location and economic vulnerability. From a groundwater perspective, flooding can introduce poor-quality water into the aquifer and alter its condition. Part of addressing flood readiness and water sensitivity is covered in the City of Cape Town's Water Strategy. Therefore, many of the actions covered in this SFA are aligned with the CCT Water Strategy.

4.1.4 Environmental Strategy (2017)

The CCT's Environmental Strategy was approved by Council in August 2017 (CCT, 2017). The vision of the Strategy is "To enhance, protect and manage Cape Town's natural and cultural resources for long-term prosperity, in a way that promotes access and social wellbeing, and optimises economic opportunities." A core principle of the Strategy is that the City's environment is a shared public asset, and its protection is the collective responsibility of all municipal departments.

At its core, the Environmental Strategy aims to build a resilient city that can withstand environmental shocks, especially climate-induced droughts. By prioritising environmental protection, it seeks to safeguard all water resources from contamination and unsustainable use, both of which directly affect ecosystems as well as surface and groundwater environments. The Strategy reinforces principles of Integrated Water Resource Management, sustainable resource use, climate change adaptation, and the protection of biodiversity and ecological systems.

Implementation of the Strategy depends on partnerships and management approaches that share responsibilities and decision-making across line departments. The Environmental Strategy identifies 11 principles to collectively enable the CCT to achieve its vision of long-term sustainability, and each principle is associated with a directive that gives effect to the principle.

- Long-term approach
- Equity and accessibility
- Economic and social benefits
- Resilience
- Ecosystems approach
- Preventing, minimising and mitigating environmental impacts
- Resource efficiency
- Environmentally sensitive and low-impact urban design
- Educated and empowered citizens
- Protected natural heritage
- Protected cultural heritage

4.1.5 Catchment, Stormwater and River Management Strategy (2002-2007)

The CCT’s Catchment, Stormwater and River Management Strategy (2002-2007) transitions from prioritising basic drainage to integrated catchment management, addressing growth, development impacts, and rising community demands for flood safety and ecological health. Its goal is to provide effective stormwater systems while ensuring safe rivers and improved water quality in rivers, wetlands, and coastal areas for residents.

This framework is built upon six strategic focus areas:

1. Holistic Planning and Management to balance societal needs with environmental requirements through catchment-level plans.
2. System Development, Upgrading, and Maintenance using a risk-based approach and environmentally sensitive methods.
3. Public Safety and Environmental Protection through flood disaster mitigation and water pollution reduction.
4. Information Management to create robust data systems for monitoring and planning.
5. Regulatory actions, including new by-laws and development controls to protect watercourses.
6. Relationship Management to ensure cooperation between city departments and foster public partnerships and education.

The strategy is based on principles including sustainability, customer focus, co-operative governance, and ongoing improvement. The document outlines programs, timelines, and performance indicators for each focus area, with the intention of establishing a multi-functional urban water system. These strategic focus areas and their supporting programmes have been summarised in **Table 4-1**.

Table 4-1 Summary of Strategic Focus Areas and Supporting Programmes.

Strategic Focus Areas	Supporting Programmes
Holistic Planning and Management	<ol style="list-style-type: none"> 1. Catchment, Stormwater and River Planning 2. Integrated Urban Water Management
System Development, Upgrading, and Maintenance	<ol style="list-style-type: none"> 1. Stormwater Management Guidelines and Design Criteria for New Developments 2. Risk-Based Approach to Upgrading and Maintenance 3. Infrastructure Management System 4. Environmentally Sensitive River Maintenance
Public Safety and Environmental Protection	<ol style="list-style-type: none"> 1. Flood Disaster Mitigation 2. Water Pollution Abatement
Information Management	<ol style="list-style-type: none"> 1. Information Systems 2. Data Bureau Services
Regulatory	<ol style="list-style-type: none"> 1. Control of Development near Watercourses 2. By-Laws 3. Tariff Funding Options
Relationship Management	<ol style="list-style-type: none"> 1. Management Integration Mechanisms 2. Customer Care 3. Staff Development 4. General Education Initiatives 5. Partnership Development

The CCT’s Catchment, Stormwater and River Management Strategy (2002-2007) represents a fundamental shift from basic drainage to an integrated, sustainable approach that manages entire catchments to balance flood safety, ecological health and water quality. Based on holistic planning, risk-based infrastructure maintenance, pollution reduction, and strong regulatory controls, the strategy is implemented across spatial scales, setting broad objectives from high-level catchment and river management plans down to local stormwater management plans for specific developments. The strategy focuses on pollution reduction at the source and the use of regulatory controls to prevent contamination in rivers and wetlands that ultimately replenish groundwater systems. Moreover, by maintaining the natural function of watercourses and promoting environmentally sensitive design, the strategy sets out to ensure stormwater becomes a source of water for groundwater recharge.

4.2 Policies

4.2.1 Water and Sanitation Services Policy

The City of Cape Town's Water and Sanitation Services Policy (2023), is a legal instrument that supports the City's vision of transitioning into a water-sensitive city by 2040, by providing principles for how Cape Town will deliver water and sanitation services in a way that is sustainable, equitable, and aligned with broader city strategies such as the Water Strategy, Resilience Strategy and Climate Change Strategy discussed in previous sections of this report (CCT, 2023b). This policy promotes a transversal approach that fosters coordination and partnerships with all stakeholders to ensure sustainable water supply and the provision of sanitation services.

The policy also emphasises the need to move beyond the conventional approach by mandating principles of sustainability, equity, and climate resilience and promotes Water Sensitive Urban Design and Green Infrastructure. The policy is implemented through directives focused on comprehensive service provision, integrated resource management, good governance, innovation partnerships, and safety.

The policy closely aligns with other City initiatives, particularly the Excellence in Water and Sanitation Services Delivery Programme, which aims to improve infrastructure and improve service in informal settlements through initiatives and projects such as the Reticulation Network Modernisation Initiative, Wastewater Treatment Project and the Sewer and Pump Station Maintenance Project. The policy also aligns with the New Water Programme (described in **Section 5.1**), which aims to diversify water sources in the city (which involves water reuse, desalination and augmentation of groundwater).

The relevance of the policy to groundwater is centred around both the improvements of existing infrastructure and the diversification of the City's water resources. The improvement and maintenance of existing infrastructure is expected to reduce water supply losses and protect groundwater systems from leaking sewer lines. These policy outcomes therefore contribute to protecting aquifers and ensuring that available water resources are not wasted. In addition, the policy supports the diversification of Cape Town's water supply, helping the City meet increasing demand as its population grows and as climate change places greater pressure on surface water systems.

4.2.2 Critical Water Shortages Disaster Plan/ Drought Response (2018)

The Critical Water Shortages Disaster Plan/ Drought Response (2018) outlines Cape Town's emergency strategy for a multi-year drought, aiming to safeguard public health and maintain a basic water supply during a crisis. It combines supply augmentation with phased disaster response mechanisms.

Through the augmentation program, the various sources of water available to the city have significantly increased. Through the development of temporary and permanent projects, the City has looked to improve its water supply by means of groundwater, desalination and water reuse. The response to disaster is triggered by dam levels, escalating from severe water restrictions in Phase 1 to a "Day Zero" scenario. In Phase 2, the municipal reticulation is largely shut down, and water is distributed from roughly 200 designated points of distribution. A key recommendation to improve on this plan is to strengthen governance for both municipal and private groundwater use during disasters to prevent over-exploitation during times of drought.

4.2.3 Management of Urban Stormwater Impacts Policy (2009)

The CCT's Management of Urban Stormwater Impacts Policy (2009) establishes a framework to minimise the negative effects of urban development on water bodies by mandating Water Sensitive Urban Design and Sustainable Urban Drainage Systems (SuDS). Its core objectives are to improve the quality of stormwater runoff, control its quantity and rate, and promote natural groundwater

recharge. The policy requires new developments to integrate SuDS and encourages the implementation of SuDS in existing areas. It promotes a suite of best management practices that fall under either structural mechanisms or non-structural controls to achieve its objectives. By treating stormwater as a resource and reducing pollutant loads, this policy supports aquifer protection and looks to enhance groundwater recharge, effectively contributing to the City’s broader water resilience goals.

4.2.4 Floodplain and River Corridor Management Policy (2009)

The Floodplain and River Corridor Management Policy (2009) provides a framework for managing development and land use around rivers, wetlands, and floodplains. The primary objectives of the policy are to reduce flood risk to people and property, protect the natural water storage capacity of ecosystems, and enhance their ecological and recreational value. A key mechanism for achieving this is the establishment of ecological buffers around sensitive aquatic areas (see **Figure 4-1**). These buffers provide several benefits, including protecting water quality, providing wildlife corridors, reducing erosion and creating space for Water Sensitive Urban Design. Through safeguarding the health of these surface ecosystems, the policy indirectly protects groundwater quality and promotes recharge, further integrating the management of surface and groundwater resources.

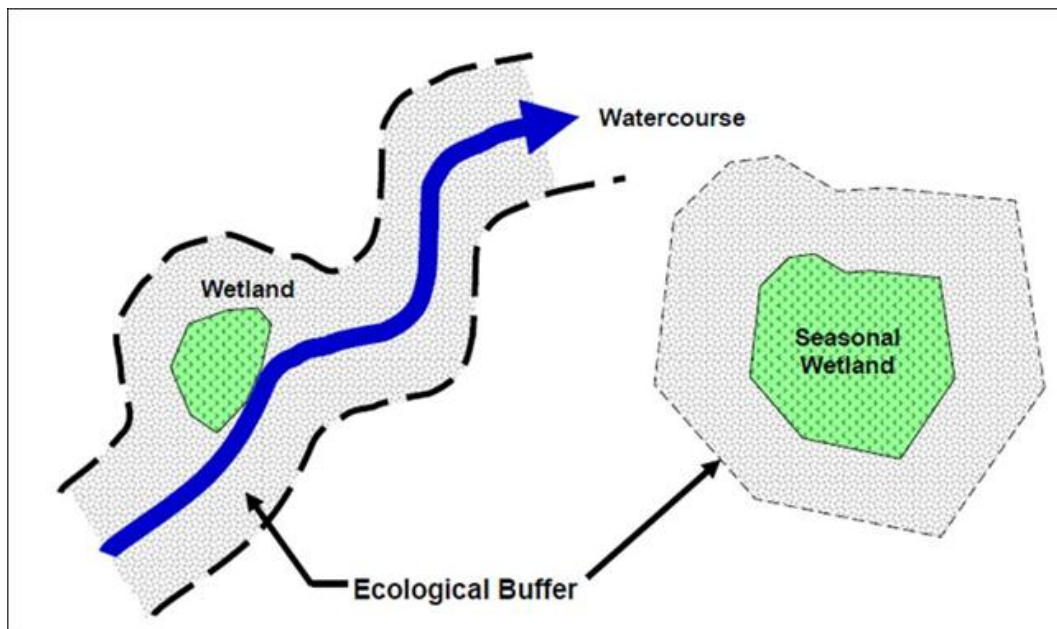


Figure 4-1 Schematic representation of the concept of an ecological buffer designed for the protection of rivers, wetlands, riparian areas and floodplains.

4.2.5 Urban Watercourses Guide

The Urban Watercourse Guide was developed by the GIP to provide best practice guidelines for managing, protecting, and enhancing Green Infrastructure. It aims to create Liveable Urban Waterways by guiding stakeholders on responsible alterations, pollution prevention, and improving water quality, ecological function and amenity value of urban watercourses. The guidelines are a key implementation tool for the City’s broader water, climate, resilience and environmental strategies. The main groundwater relevance of this guideline is the promotion of recharge-enhancing features and landscaping, which contribute to improving groundwater availability and building resilience against droughts.

4.3 By-laws

4.3.1 Integrated Waste Management By-law (2009)

The Integrated Waste Management By-law (2009) serves as a legal safeguard for protecting the environment from the impacts of waste through effective regulation of waste generation, handling and disposal. By requiring that waste be managed in ways that prevent contamination, and by prioritising waste reduction and recycling, the by-law helps minimise pollutants that could infiltrate soils and contaminate the City's aquifers.

This by-law is a key implementation mechanism for the City's overarching strategies, policies and frameworks. It establishes the legal framework and enforcement tools needed to achieve the targets of the IWMP, directly supporting the IDP vision of a safe and sustainable city. It also contributes to the Climate Change Strategy by diverting waste from landfills and thereby reducing greenhouse gas emissions. Furthermore, it underpins the Water Strategy and urban management policies through its direct protection of water resources and public health. Without effective waste management, illegal dumping and poorly managed waste facilities can lead to soil and water pollution through leachate contaminating groundwater and or stormwater runoff transporting contaminants into receiving water bodies.

4.3.2 Water By-law (2010 as amended in 2018)

The Water By-law (2010 as amended in 2018) establishes a legal framework to ensure a safe, reliable water supply, while promoting water conservation. It does so by protecting water infrastructure from contamination, regulating plumbing installations, preventing unauthorised use and wastage, and managing alternative water sources, such as boreholes and wellpoints, through compulsory registration. This registration requirement enables the City to better account for private groundwater use; however, the by-law does not currently provide for the regulation of groundwater abstraction itself.

While the by-law ensures that proper procedure is followed for the installation or establishment of borehole infrastructure to protect the aquifer from contamination and inefficient use, it does not mandate ongoing monitoring or reporting by private users. As a result, private groundwater abstraction remains largely unregulated. Strengthening the by-law by introducing provisions for the regulation of groundwater use, as well as requiring regular reporting of abstraction volumes, would significantly enhance groundwater governance. Such amendments would also allow City officials to use these installations for monitoring purposes, supporting improved management of Cape Town's groundwater resources and promoting their sustainable use.

4.3.3 Wastewater and Industrial Effluent By-law (2013)

The City's Wastewater and Industrial Effluent By-law (2013) is a regulatory tool for protecting the environment from contamination caused by industrial effluent and wastewater. This by-law regulates both the quality and quantity of all discharges into municipal sewer systems. It prohibits a list of harmful substances, sets effluent standards and enforces pre-treatment requirements to prevent corrosion, blockages and infrastructure failures that cause severe overflows and leaks. Overflow events can often release raw, contaminated wastewater directly into the soil and surface water, which can lead to the pollution of underlying aquifers. The Wastewater and Industrial Effluent by-law essentially safeguards the City's infrastructure from hazardous discharges, acting as the primary defence against source pollution, which may impact groundwater quality.

4.3.4 Stormwater Management By-law (2005)

The Stormwater Management By-law (2005) is a measure used by the City to protect the urban environment by regulating the City's stormwater system, which includes natural features and constructed channels to control flooding and prevent pollution. It achieves this by strictly prohibiting any discharge into the system other than clean rainwater without council consent, banning activities that damage or obstruct the system. The by-law holds property owners responsible for pollution cleanup and the maintenance of private drains.

These measures directly protect groundwater quality by preventing contaminated runoff from entering the system and infiltrating into the subsurface, where it can pollute the City's aquifer systems. Where natural stormwater features are included, they are designed to reduce flooding and attenuate the movement of contaminants into the City's underlying aquifers.

4.3.5 Municipal Planning By-law (2015)

The City's Municipal Planning By-law (2015) guides land development to implement the City's spatial vision, balancing private development rights with public and environmental interests. It protects groundwater by integrating environmental safeguards into the approval process, requiring developers to consider environmental characteristics and limitations. This ensures that construction is managed with the environment in mind. In so doing, the by-law helps protect groundwater resources by preventing high-risk land uses in sensitive areas, safeguarding groundwater quality and groundwater recharge zones from activities that could lead to groundwater contamination.

4.3.6 Recreational Water-Use By-law (2018)

The Recreational Water-Use By-law (2018) regulates activities on inland public waterways to ensure public safety and protect aquatic environments. It achieves this by prohibiting the discharge of pollutants, designating specific usage zones and requiring permits for the use of motorised vessels. This by-law assists groundwater management by preventing source contamination introduced by recreational users, which could feed into underlying groundwater systems.

5 Status of Relevant Programmes and Plans

This section of the report discusses the programmes and plans implemented by the CCT to support the overarching strategies discussed in **Section 4**, developed to build the city's resilience and adaptive capacity to future shocks. This section also aims to identify gaps in the implementation of these programs, which will inform the basis of the action plans recommended.

5.1 New Water Programme

5.1.1 Background

Most of the water used by the CCT (96%) is currently supplied by the WCWSS. This interconnected water supply network supplies water from six main dams (Theewaterskloof Dam, Voëlvlei Dam, Berg River Dam, Wemmershoek Dam and Steenbras Upper and Lower Dams) that have a total storage of approximately 900 million kilolitres (Mauck & Winter, 2021; CCT, 2023a). Cape Town's Water Strategy highlights the need to reduce the city's reliance on rainfed dams. Groundwater currently only contributes 4% (**Figure 5-1**) to the city's water supply. However, this is expected to increase to 7% through the implementation of this strategy.

As part of fulfilling commitment 3 of Cape Town's Water Strategy (sufficient, reliable water from diverse sources), the city developed the **NWP**. This programme is structured in two phases, namely the **committed programme** and the **adaptable programme** (**Figure 5-2**). Through the New Water Programme, the city aims to diversify water sources by 25% which amounts to approximately 300 M/L per day (**Figure 5-1**) through the augmentation of groundwater (7% - 84 M/L per day), water reuse (7% - 84 M/L per day) and desalination (11% - 132 M/L per day) by the year 2040 (CCT, 2023a). According to the City of Cape Town Infrastructure Report (CCT, 2023c), the city remains on track with this commitment to deliver 300 million litres per day by 2030.

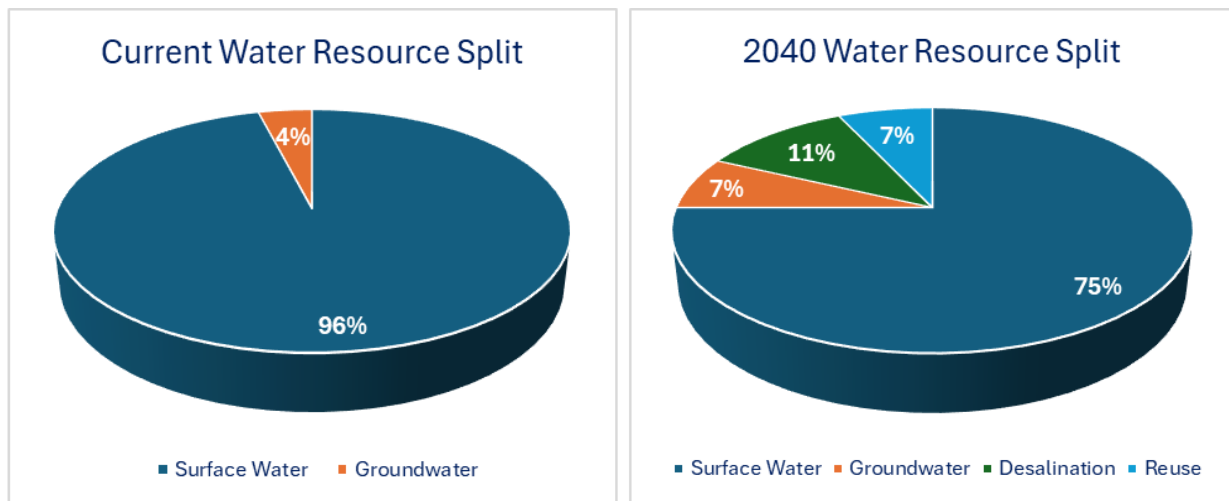


Figure 5-1 The shift from the current water resource split to that planned by the City of Cape Town by 2040, through the implementation of the New Water Programme (CCT, 2022b).

The NWP plan currently in place was implemented to cater for the water demand of the city until 2030. **The Adaptable Programme** has been initiated to plan for water demand beyond 2030, as Phase 2 of the current New Water Programme. However, this programme is still in the planning phase and has not been implemented yet. **Figure 5-2** shows how the Adaptable Programme fits into the overall Water Strategy and the NWP.

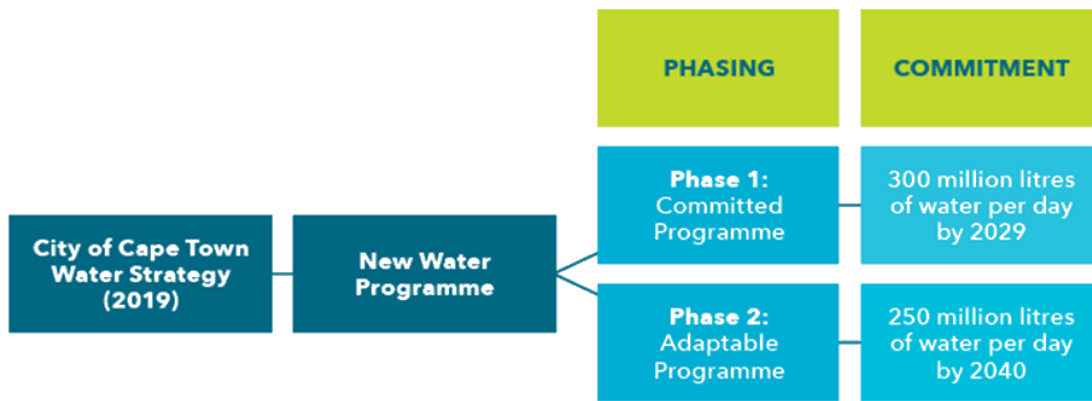


Figure 5-2 Phasing and water supply commitments of the City of Cape Town’s New Water Programme under the 2019 Water Strategy (CCT, 2019a).

5.1.2 NWP Projects and Progress

This section describes the projects implemented under the NWP that aim to diversify the City’s water resources. The development of the desalination plant, water reuse, alien invasive species clearing and infrastructure refurbishment and maintenance, although not directly related to groundwater, are all relevant to the current project as they aim to increase water supply, which will reduce the reliance on groundwater and limit the risk of over-abstraction.

Groundwater Development

The CCT is developing three groundwater schemes to supplement the bulk water supply, namely the Cape Flats Aquifer Management Scheme, the Table Mountain Group Aquifers Management Scheme and the Atlantis Water Management Scheme (this scheme has been operational for the past 40 years but is undergoing refurbishment and expansion) (see **Figure 5-3** and **Figure 5-4**). A key component of this scheme is MAR, where highly treated wastewater is injected into aquifers to replenish them and limit the possibility of seawater intrusion. Upon completion, the Cape Flats Aquifer is expected to produce between 50 - 60 million litres of water a day, the TMG aquifer approximately 20-25 million litres per day and the Atlantis Aquifer around 25 million litres per day after the planned upgrades and refurbishment of the scheme (see **Figure 5-3**).

Desalination Plant Development

Feasibility studies to explore the implementation and operation of the city’s first seawater reverse osmosis desalination plant to be constructed in Paarden Eiland are in progress (see **Figure 5-4**). International and local desalination experts have formed an advisory panel to guide the project, and an Environmental Impact Assessment for the project is in progress. This desalination plant is a key component of the New Water Programme. It is expected to add between 50 to 70 million litres of water per day by 2030. Since the brine generated from the process is to be discharged back into the ocean, a common disposal method for coastal desalination plants, the risk of groundwater contamination is minimal.

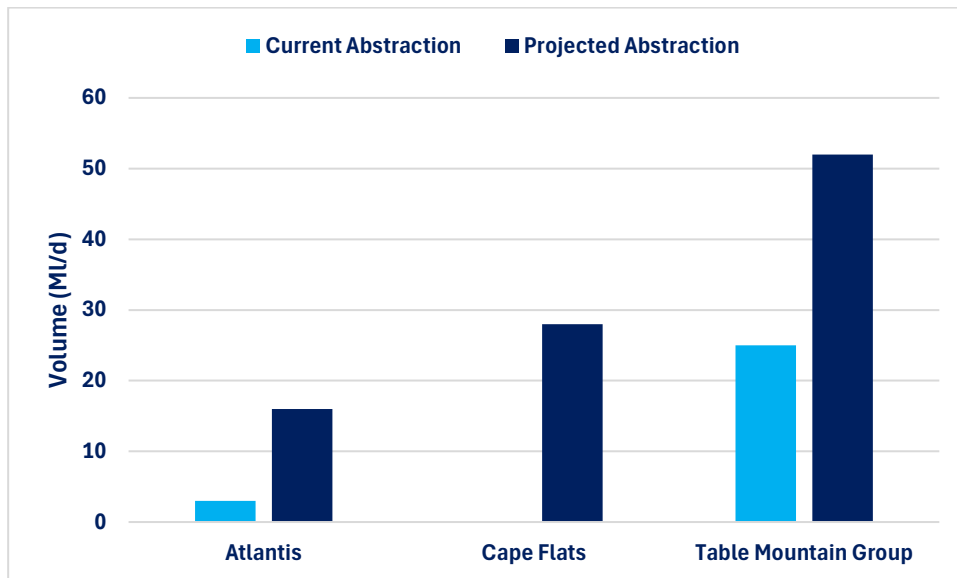


Figure 5-3 Current vs project abstraction volumes for the City of Cape Town’s groundwater schemes.

Water Reuse

The Faure New Water Scheme is an advanced water reuse initiative currently in the design and planning phase. It aims to augment and diversify the city's drinking water supply by up to 100 million litres per day. In this scheme, treated wastewater will be purified through new advanced water purification technology to a standard that is fit for consumption and in line with drinking water quality standards. The CCT has conducted feasibility studies to investigate the most suitable options for the construction and operation of the scheme. Besides reducing groundwater reliance and as such the risk of over-abstraction, the additional supply capacity from water reuse would also reduce the risk of groundwater contamination from wastewater, as this water would be recycled for reuse. Provided water is still available to maintain hydrological and ecological functions, water reuse offers several benefits.

Clearing of Alien Invasive Species

The clearing of alien invasive vegetation in the catchments of major dams is a key component of the NWP, which aims to add 55 billion litres of water per year to Cape Town’s supply network by 2026. To date, the programme has already contributed more than 44 million litres of additional water per day. Ongoing clearing efforts in the Wemmershoek, Steenbras, Berg River and Atlantis catchments are designed to improve runoff and enhance the volume of water reaching major dams (see **Figure 5-4**).

Alien vegetation clearing also plays an important role in supporting groundwater sustainability. Many invasive species have significantly higher water-use rates than indigenous vegetation, reducing infiltration and limiting aquifer recharge. Their removal helps restore natural hydrological processes, increases recharge, and improves baseflows in connected rivers and streams. Clearing further reduces erosion and sedimentation risks that can degrade groundwater quality. As such, alien vegetation management is a critical climate-adaptation measure that protects both surface and groundwater resources and contributes to long-term water security for the City.

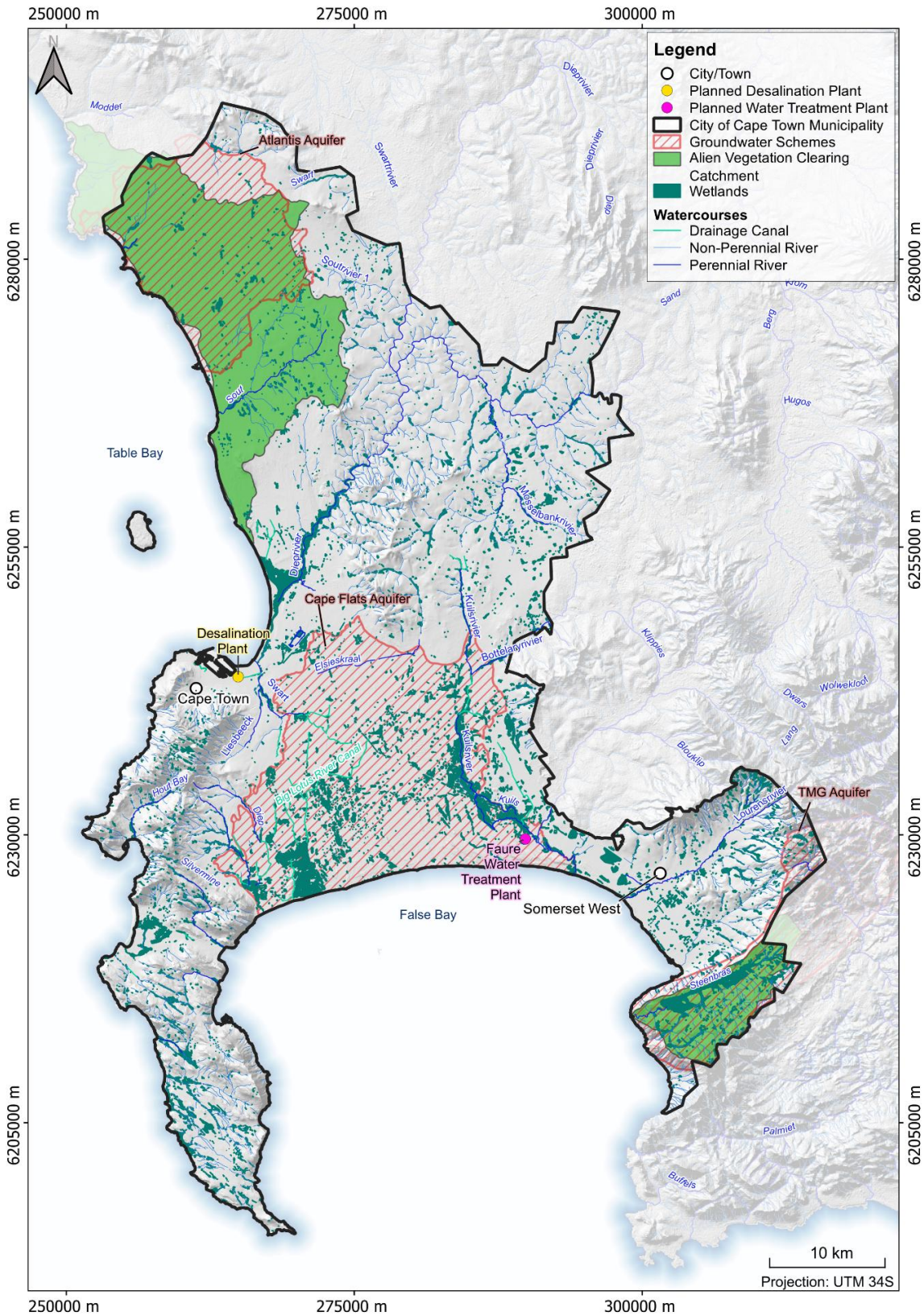


Figure 5-4 New Water Programme's efforts to diversify water sources through the development of groundwater schemes, a desalination plant, alien vegetation clearing and water reuse.

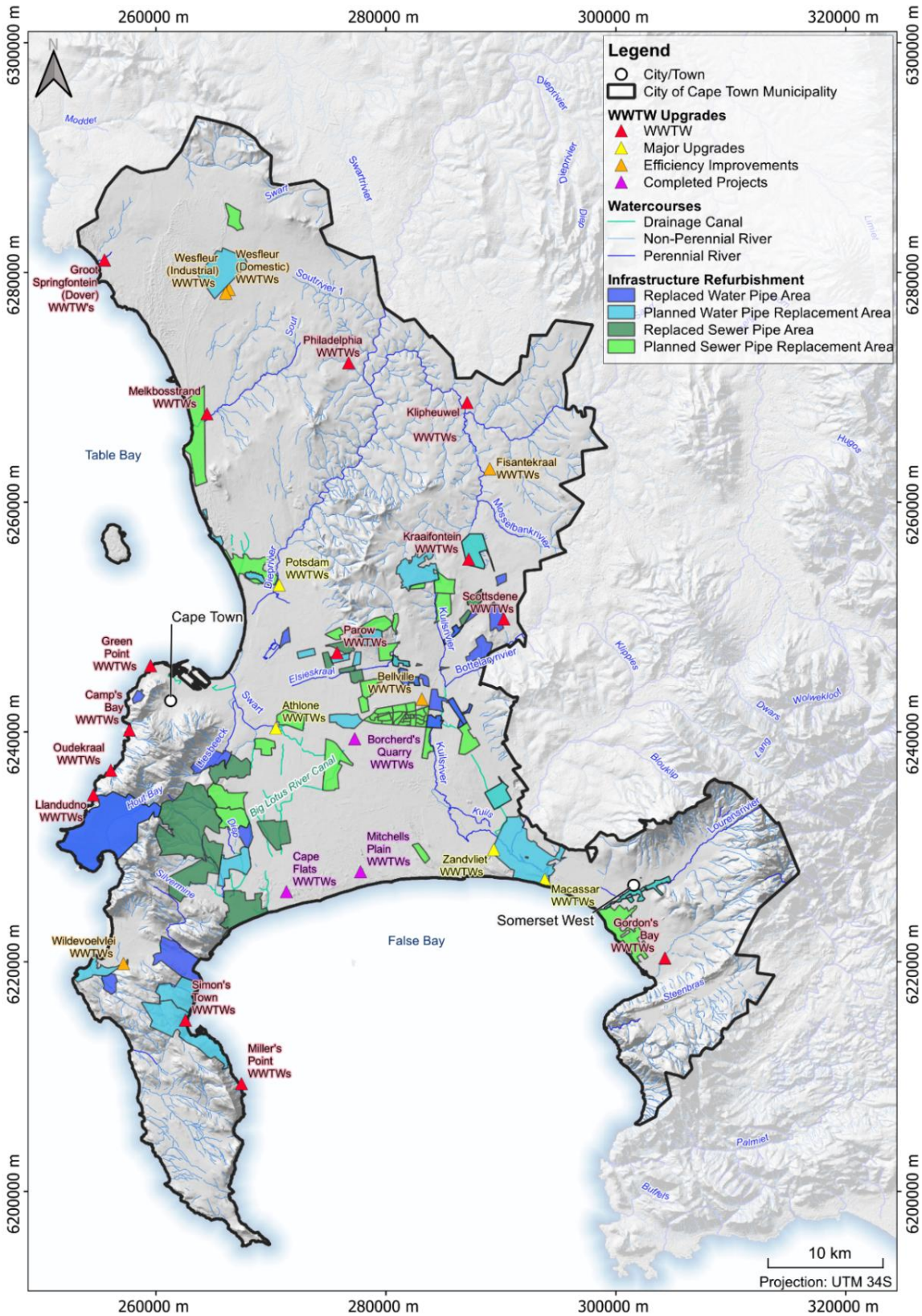


Figure 5-5 Upgrades of WWTWS and infrastructure refurbishment as part of the City’s New Water Programme.

Infrastructure Refurbishment and Maintenance

Another key component of the NWP is the refurbishment and maintenance of existing infrastructure through the replacement of water and sewer pipelines and the upgrade of existing wastewater treatment facilities (**Figure 5-5**). This reduces system losses and improves groundwater quality by preventing contamination from leaking sewage. Improvements in reliability and increased capacity may encourage users to use less groundwater, thereby reducing the impact on groundwater levels and availability. To achieve this, the CCT developed a proactive infrastructure maintenance and upgrade programme that was aimed at replacing 50 km of water pipes and 100 km of sewer pipes by May 2024 (CCT, 2024a). By the end of May 2024, the CCT had successfully replaced 97% of water pipes and 78% of sewer pipes in several communities, such as Hout Bay, Fish Hoek, Bellville South and Kuils River (see **Figure 5-5**).

5.2 Liveable Urban Waterways (LUW) Programme 2021

5.2.1 Background

Cape Town has many rivers, lakes and wetlands, many of which are found within the Cape Flats, such as Zandvlei, Rondevlei, Zeekoevlei, Princessvlei, Zoarvlei, Paardevlei, Wildevoëlvlei and many others. However, most of these ecosystems are in a bad state due to urbanisation, land use changes and pollution. During development projects, many wetlands are drained, and rivers are converted into concrete canals, resulting in the loss of biodiversity, while also affecting the river-wetland-aquifer continuum, which alters the water cycle. Furthermore, many waterways are polluted, resulting in elevated nutrient levels and the rapid growth of algae, which depletes the oxygen required by aquatic plants and animals for survival. Invasive alien vegetation present in these environments also soaks up water and clogs these systems. The restoration of such waterways is a necessary step that will allow these waterways to function more naturally.

The LUW Programme launched in 2018 is a City of Cape Town initiative focused on protecting, rehabilitating and restoring rivers, streams, ponds, wetlands and canals through water-sensitive design, nature-based solutions and green infrastructure to create a more liveable and climate-resilient city (CCT, 2021a). The programme optimises the use of stormwater and urban waterways for flood control, aquifer recharge, water reuse, conservation and recreation. By naturalising channels, improving water quality and rehabilitating riparian and wetland systems, the programme not only restores healthy surface water functioning but also enhances groundwater recharge, strengthens surface-groundwater interactions and reduces erosion and pollution risks that can affect aquifer quality. Overall, it improves the connectivity between surface water and groundwater systems, supporting long-term aquifer sustainability and resilience.

This programme was developed in response to the Water Strategy, Climate Change Strategy, Resilience Strategy and the Environmental Strategy. In these strategies, the CCT committed to transitioning to a water-sensitive city by creating liveable waterways (CCT, 2024a). This is a key step towards meeting Cape Town's goal of becoming a water-sensitive city with waterways that are healthy, accessible and safe by 2040.

A liveable waterway is a waterway that has the following elements:

1. **Water quality:** A liveable urban waterway should maintain acceptable water quality that can support aquatic life.
2. **Flood Management:** These waterways should reduce flood risk by absorbing and gradually releasing stormwater.
3. **Ecological Functioning:** Liveable waterways should provide a healthy and diverse habitat structure that supports aquatic life. They should also have connectivity for the movement of plants and animals.

4. **Connectivity to the Water Table and Floodplain:** These waterways are hydraulically connected to aquifers, floodplains and wetlands, which allows water to move naturally, recharge groundwater and maintain wetlands.
5. **Community Engagement:** These waterways should be used and enjoyed by communities, connecting communities around them.
6. **Ecosystem Services and Economic and Social Benefits:** These waterways should provide a range of ecosystem services, such as naturally treating water, reducing flood risk, enhancing biodiversity, trapping sediments, recycling nutrients, capturing and storing carbon dioxide and reducing heat. They should also provide economic benefits (e.g., job creation and property value boost) and social benefits (e.g., improved public spaces).

The waterways in Cape Town have varying elements of liveability, hence the Liveable Waterways Programme aims to enhance existing elements, while restoring those that have been lost. To achieve this, the CCT is:

- Creating new wetlands and rehabilitating and extending existing ones.
- Upgrading stormwater systems to prevent flooding.
- Conducting canal rehabilitation, removal, and renaturalisation.
- Removing invasive alien vegetation and replacing it with appropriate plants.
- Rehabilitating where there is erosion.
- Creating more natural-looking banks.
- Upgrading the area around waterways.
- Installing hard and soft landscaping.
- Creating small parks next to the waterway.
- Improving footpaths, bridges and signage.
- Developing educational spaces and programs.
- Making provision for recreational opportunities.

5.2.2 Implemented Projects and Progress

Figure 5-6 shows locations where the LUW Programme has been implemented in the city. Projects to rehabilitate waterways under the LUW Programme are currently ongoing, mostly within the Sand Catchment, with planned expansion into the Zeekoe Catchment through the C40 Cities Finance Facility (CFF) Project. The LUW Programme will continue to expand by identifying potential future waterways that require rehabilitation.

Before the commencement of this programme, efforts to restore and rehabilitate waterways were already ongoing in several parts of the city. These river and wetland rehabilitation efforts conducted before 2018 have led to the improved liveability of several waterways in Cape Town. These include:

- Century City Canals and Intaka Island;
- Edith Stephens Nature Reserve;
- Silvermine Wetlands;
- Upper Liesbeek River; and
- Zandvlei Estuary Nature Reserve.

According to the City of Cape Town, these waterways are safe, attractive and provide several ecosystem services and benefits and bring people together.

5.3 Green Infrastructure Programme

5.3.1 Background

Still in development, the GIP looks to improve the city's natural assets and aid in the planning and development of new green and sustainable features. Green Infrastructure refers to nature-based systems designed to manage water, reduce pollution, enhance biodiversity and improve urban resilience. As a concept, green infrastructure advocates for the designed network of natural and semi-natural systems that integrate hydrological functions with ecological and social benefits, this therefore inherently includes Blue Infrastructure. Currently, many of Cape Town's waterways and infrastructure follow what is referred to as "grey" infrastructure, where concrete pipes, canals and drainage systems are the preferred mechanisms. This programme is closely aligned with the CCT's **Liveable Urban Waterways Programme**, and is often incorporated in projects in conjunction with each other, especially those which would fall under actions of the **Climate Change Strategy**, **Resilience Strategy**, **Environmental Strategy** and **Water Strategy**.

The CCT has made it clear that integrating components of the hydrological cycle into spatial planning is a priority, and urban water courses are an important component of their Green Infrastructure. During the programme's life cycle, a Green Infrastructure Network (GINet) and toolkit have been developed to aid in the implementation of actions and projects. The GINet is a spatial tool that illustrates the total value of green spaces across the Cape Town Municipality. The calculated value was determined through an assessment of each area's infrastructural function, ecological function and social function. Through this, users can determine which areas require improvement (CCT, 2022c). In addition to this spatial component, a toolkit comprising of policies, bylaws and a series of best practice guidelines has been compiled to guide stakeholders in regulating, managing and improving green infrastructure collectively, and sustainably to achieve the balanced, safe and integrated environments envisioned for the city. The guidelines, which have been released primarily address Trees, Urban Green and Urban Watercourses (CCT, 2020; CCT, 2022d; CCT, 2024c).

5.3.2 Implemented Projects and Progress

Since the formal inception of the GIP in 2021, the programme has been a part of:

- Developing detailed policy and guidelines
- Integrating Green Infrastructure requirements into urban planning processes
- Informing new and target Green Infrastructure projects, specifically designed for climate adaptation (e.g. managing flood risk and improving recharge capabilities)

In addition to the three best practice guidelines, the GIP has been integrated into a range of existing and evolving policies, by-laws and strategic frameworks. Initially, the programme was developed as a response to the Climate Change Strategy, and is therefore a crucial element of achieving its goal. The GIP has also been utilised in or incorporated as a part of:

- The Cape Town Spatial Development Framework in the Integrated Development Plan
- Water By-law
- Municipal Planning By-law



Figure 5-7 Example of Green Infrastructure in the City of Cape Town and the elements it addresses (CCT, 2022a).

Before its inception, Green Infrastructure principles were already applied to several spaces and projects throughout Cape Town over the past two decades. Examples of current and past projects include:

- Green Point Urban Park
- Century City Canals and Intaka Island
- Zandvlei Nature Reserve
- Khayelitsha Wetland Park
- Diep River Alphen greenbelt
- Kirstenhof Wetland
- Silvermine Wetland
- Edith Stephens Nature Reserve
- Asanda Village Wetlands
- Vygekraal River
- Liveable Urban Waterways
- Source to Sea

Several projects are still in the pipeline, but a major goal of the CCT is to develop a Green Infrastructure, waterway rehabilitation and nature-based solutions masterplan along with these projects. A key aspect of this is developing an implementation framework for use across projects and sectors. The implementation of these projects within high-risk areas to contamination and over-abstraction would aid in mitigating vulnerability through the benefits of additional recharge-enhancing measures and the associated water quality attenuation benefits of natural systems.

Areas with high GI value such as the TMG Aquifer in Steenbras, southern portion of the CFA, and in Atlantis suggest the groundwater systems in these areas would benefit from development under the GIP. Recharge-enhancing measures and water quality improvements would reduce their vulnerability and risk. Conversely, areas above these aquifers with moderate to low GI values, indicate potential for improvement. This is especially true in the CFA, where most of its extent is categorised as having a low GI value, and the vulnerability of the aquifer is relatively high.

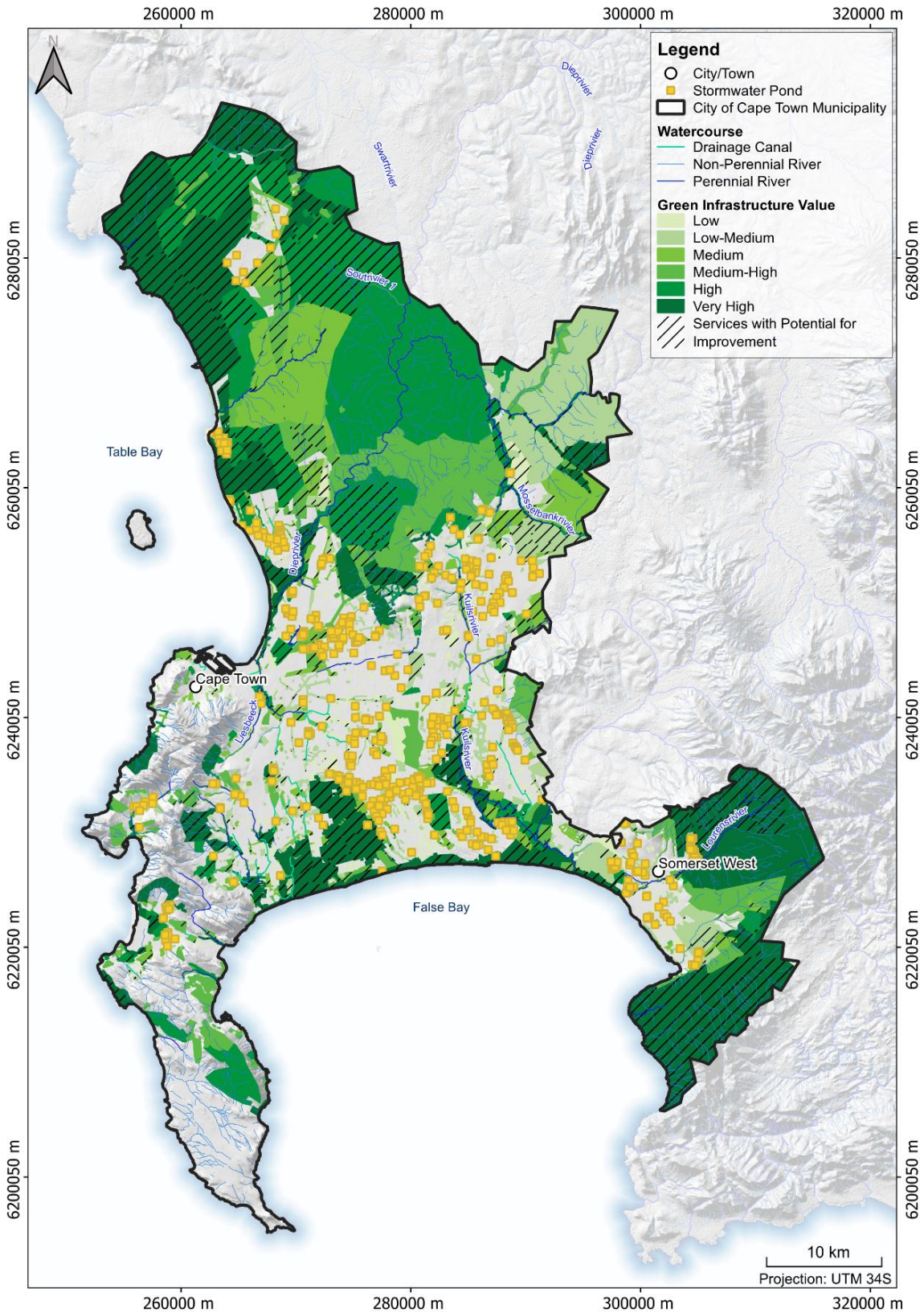


Figure 5-8 City of Cape Town’s GINet indicating total Green Infrastructure value and its green corridors.

5.4 Groundwater Management Framework

5.4.1 Background

The development and implementation of the CCT Groundwater Management Framework Policy Brief (CCT, 2025) is an ongoing attempt to establish an effective approach to protecting the quality and quantity of groundwater resources within the CCT. The initiative is a direct response to various pressures and exposure of vulnerability during the 2015 – 2018 drought experienced by the city. This event was the primary catalyst which highlighted the extreme vulnerability of Cape Town's water supply. The drought accelerated the city's urgent need to diversify its water resource portfolio and reduce its reliance on rainfall-fed dams. The document highlights contamination and over-abstraction as two major threats to the city's aquifers, as well as a complex and fragmented governance landscape.

To improve its resilience and reduce its reliance on susceptible surface water, the CCT has significantly increased its investment in alternative water sources, with groundwater being a major component. This strategic shift from seeing groundwater as a marginal resource to a key pillar of the city's future water security created an immediate need for a robust management system to ensure these resources are used sustainably and protected from contamination.

This initiative is a direct response to the Water Strategy, acting as a structure which expands on alternative water sources and improves the management and capacity of the city's groundwater schemes. Consequently, this improves resilience to climate change and, therefore, is interlinked with both the Resilience and Climate Change Strategies.

5.4.2 Implemented Projects and Progress

Part of the strategic shift to groundwater has seen the CCT develop its groundwater abstraction schemes, which target the CFA, Atlantis Aquifer and the TMG Aquifer (CCT, 2019a). Groundwater Protection Zones (GPZs) have also been developed to protect the quality of water near these schemes (CCT, 2025). Additionally, the ongoing management and development of MAR in Atlantis and the establishment of a new MAR scheme in the Cape Flats have been a priority of the CCT to build resilience for times of water scarcity (CCT, 2023a).

As of 2025, a formalised attempt to develop a framework and identify gaps and deficiencies in the current management of the city's groundwater schemes was undertaken, preparing a policy brief report titled "Towards A Groundwater Framework for the City of Cape Town" (CCT, 2025). It listed confusion amongst the general public as to who is responsible for the management of the city's aquifers, capacity constraints within the DWS and gaps in coordination between different spheres of government as major challenges to overcome. Through a series of workshops with regulators, industry professionals and users, critical gaps were also identified, these include:

- Unregulated groundwater development and poor drilling practices,
- Lack of protection for crucial aquifer recharge zones from polluting land uses,
- Fragmented, inaccessible, and unusable groundwater data,
- Poor public awareness and understanding of groundwater issues.

Based on these identified gaps, recommendations were made in 4 key focus areas, which include:

A: Managing land-use and contamination

- Groundwater Protection Zones should be incorporated in the National Environmental Screening Tool,
- Introduce a development life-cycle approach into the stormwater management and pollution prevention and control process,
- Identify appropriate stormwater management measures for each groundwater protection zone and each stage of development,
- Categorise different land-uses and operational activities as high, medium and low-risk to the aquifer water quality,
- Develop a pollution prevention control action plan for future and existing developments within the GPZ,
- Incorporate groundwater protection measures into the municipal planning by-law,
 - Phase 1: Prescription
 - Phase 2: Overlay Zoning.

B: Municipal control of groundwater development and use

- Require driller accreditation and submission of drill logs and testing data,
- Enforce SANS standards,
- Registration of schedule 1 users,

C: Improving data and monitoring

- Monitoring level and volume data,
- Extend monitoring borehole network,
- Develop an effective groundwater monitoring database and ensure feedback to inform governance and management.

D: Coordination and Governance

- Establish aquifer advisory forum(s),
- Education and awareness campaign on groundwater issues.

These actions were organised according to their potential impact, their cost and resources to implement and the overall level of readiness for their implementation (see **Figure 5-9**).

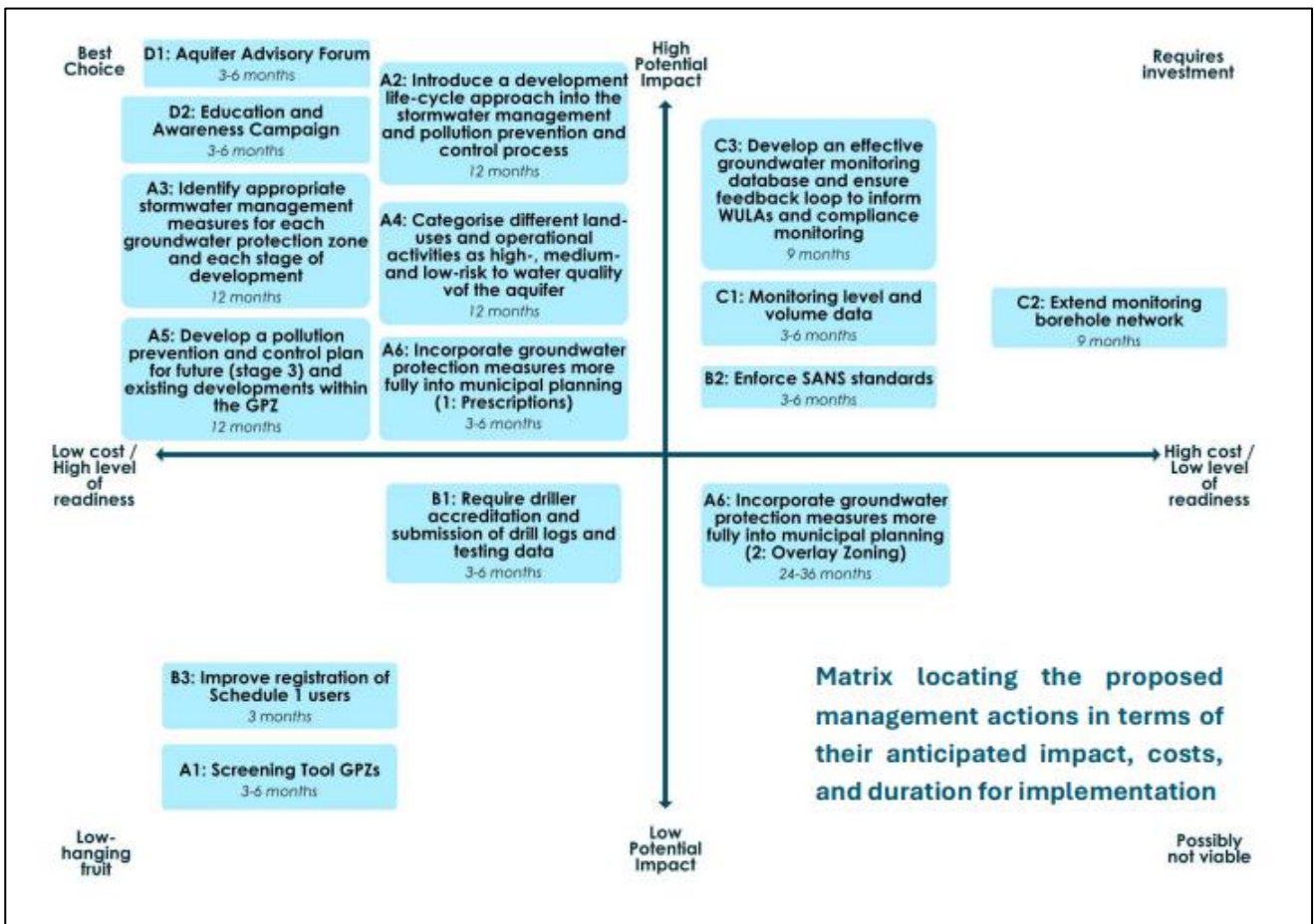


Figure 5-9 Matrix locating the proposed management actions in terms of their anticipated impact, costs, and duration for implementation (CCT, 2025).

5.5 Spatial Development Framework

The MSDF is a statutory spatial plan that underpins the City’s IDP (2022–2027) and sets “where, when and how” land-use development should be facilitated, linking spatial priorities to capital budgeting via Spatial Transformation Areas (STAs) and an inward-growth approach to address efficiency, resilience and equity objectives. The framework recognises Cape Town’s natural/biophysical assets such as biodiversity, rivers, wetlands and the coastline, as structuring elements. It explicitly treats them as green infrastructure that delivers ecosystem services.

Climate adaptation and resource security are embedded through SFAs, including “Water security and drought readiness” (implementing the Water Strategy and working towards a water-sensitive city) and “Water sensitivity, flood readiness and storm management,” alongside coastal resilience measures tied to the coastal development edge.

The following components are relevant to groundwater management & WSUD:

Green Infrastructure Network (GINet)

The City’s GIP maps green open spaces and ecological corridors, rivers, floodplains and wetlands into the GINet to guide development decisions that protect and enhance ecosystem-service provision. This is foundational for WSUD (e.g., detention, infiltration, riparian buffers) and for protecting the hydro-ecological functions linked to aquifer recharge zones.

Strategic Focus Areas on water and resilience

SFA 2 (“Water security and drought readiness”) commits to implementing the Water Strategy to build a resilient supply and move toward a water-sensitive city; SFA 3 (“Water sensitivity, flood readiness and storm management”) frames tools for stormwater and flood risk, which align with WSUD practices (nature-based drainage, attenuation, infiltration) across precincts.

Urban Development Edge (UDE) and Coastal Edge (CE): development directives

Development assessments must consider the urban and coastal edges; rivers and wetlands; and “areas containing unique agricultural land and aquifers.” This links spatial decisions directly to aquifer protection. The CE buffers infrastructure from coastal processes (erosion, surge, inundation) and protects sensitive coastal ecosystems; urban development is precluded seaward of the edge where such risks/ecosystems are the primary informants. For the UDE, directives include limiting uncontrolled sprawl, optimising vacant/underutilised land, and enabling expansion “away from risk regions,” collectively supporting risk-averse, sustainable, resilient development, which is an important control for safeguarding recharge areas and water resources.

Spatial strategies on growth management and environmental protection

Spatial Strategy 2 emphasises directing growth away from risk areas, managing development impacts on natural resources, and appropriately protecting citizens from risk-prone activities, principles that dovetail with groundwater source protection (e.g., avoiding intensification in floodplains/sinkhole-prone or pollution-risk areas).

Integration with infrastructure and resource planning

The MSDF explicitly aligns spatial prioritisation with infrastructure sequencing and recognises resource challenges, including water. It embeds resilience and climate-adaptation approaches and uses spatial targeting and assessment tools to inform capital pipeline mechanisms that enable WSUD retrofits and groundwater-sensitive investments to be budget-aligned.

What this means for groundwater & WSUD practice in the CCT.

- **Groundwater safeguards in spatial screening:** The MSDF requires that aquifers and hydrologically sensitive areas be explicit inputs in development decisions, creating a spatial check against pollution or inappropriate hardening that could reduce recharge.
- **WSUD as the default urban drainage paradigm:** Through SFAs focused on water security and sensitivity, the MSDF endorses measures that store, infiltrate and treat runoff within the urban fabric—key to sustaining baseflows and protecting connected aquifer–surface water systems.
- **Edge policies reduce hydro-climatic exposure:** The UDE and CE limit risky encroachment, maintain buffers, and preserve ecological function, which in turn helps protect recharge zones and reduces saline intrusion risks at the coast.
- **GINet operationalises nature-based planning:** By mapping rivers, floodplains and wetlands as green infrastructure, the City has a platform to embed WSUD and catchment-scale restoration into precinct planning and approvals.

5.6 Stormwater Management Plan

The CCT Stormwater Management Plan describes the intention to transition Cape Town into a water-sensitive city by altering how stormwater is managed. It intends to reshape how stormwater is viewed and managed, and change its perception from a waste product to a valuable resource that can enhance the city's water security and improve the urban environment.

WSUD involves integrated management of water supply, sewerage, and stormwater in cities and towns. It marks a major change in urban planning by prioritising environmental resources and water infrastructure at all scales. While "water-sensitive urban design" describes the process, "water-sensitive city" is the intended goal (Fletcher et al., 2014).

Per Cape Town's 2019 Water Strategy, the CCT aims to become a water-sensitive city and undertakes to "actively facilitate the transition of Cape Town over time into a water-sensitive city with diverse water resources, diversified infrastructure and one that makes optimal use of stormwater and urban waterways for the purposes of flood control, aquifer recharge, water reuse and recreation, and that is based on sound ecological principles. This will be done through new incentives and regulatory mechanisms as well as through the way the CCT invests in new infrastructure".

In considering the above, the optimisation of aquifer recharge ties into the groundwater focus of this report.

Passive aquifer recharge (excluding direct measures such as groundwater injection) can occur from either distributed infiltration, which occurs during a rainfall event, or the concentration of subsequent runoff or alternative sources of effluent (e.g., from WWTW). While increasing hardstanding (from advancing urbanisation) decreases the potential for distributed infiltration, there remain measures available to improve recharge, including:

- Increasing watercourse and groundwater connectivity by firstly removing impermeable lining, and secondly decanalising rivers (enabling a more natural response)
- Supplementing river flow and thereby increasing aquifer recharge potential (particularly in the dry season where natural flows are muted) through discharge of suitable effluent (e.g., treated wastewater) into watercourses.
- Adopting MAR through the retrofitting of stormwater systems (in particular ponds/basins) or through the use of infiltration basins attached to WWTWs.

The nature of the receiving aquifer and its overlying soils has a bearing on the effectiveness of the above, with an unconfined, intergranular aquifer with sandy soils (as represented by the CFA) well suited to recharge through surface.

UCT's Future Water has been investigating the potential benefits and challenges of utilising large-scale stormwater harvesting (SWH), focusing on two main storage methods of surface water storage and groundwater storage (enabled by MAR).

The application of SWH for MAR has been tested by Okedi (2019), wherein the 89 km² Zeekoe Catchment to the south of Cape Town was selected as a case study. In the study area, a simulation of 61 stormwater ponds was undertaken to improve surface-to-groundwater transfer through the use of bio-retention cells. As a result, the mean annual infiltration increased groundwater resources to 29–33 Mm³. The additional groundwater derived from stormwater infiltration was 9–12 Mm³ (above the status quo), representing an approximately 30% increase. Furthermore, the use of bio-retention in the study was aimed at improving the quality of infiltrated water, enhancing the existing water quality benefit of the recharge through the sandy CFA.

Tanyanyiwa et al. (2025) undertook a more site-specific investigation involving the retrofitting and simulation of the performance of a stormwater detention pond, including an investigation into the influence of groundwater levels. The finding of this report was that a 118% increase in recharge volume was possible for a retrofitted pond, with an increase in recharge potential of up to 290% when the water table was lowered (possible through a groundwater abstraction scheme).

Both of the above studies pointed to climate change and the anticipated reduction in rainfall in the CCT, reducing the potential volumes of recharge from rainfall.

Beyond the gravity-fed (passive) MAR mentioned above, the Cape Flats Aquifer Management Scheme seeks to use active injection-based recharge, including a saline intrusion injection curtain along the CFA's coastal edge (McGibbon, 2025). The use of treated effluent for active recharge would compete with the availability of water for both passive recharge and generalised discharge.

5.7 Biodiversity Spatial Plan

The Cape Town Biodiversity Spatial Plan (BSP) was adopted on 30th July 2025. The BSP comprises a biodiversity profile for the city, the Cape Town Biodiversity Network or BioNet, and associated management guidelines. The purpose of the BSP is to inform and guide environmental and development planning, environmental assessment and natural resource management. The Plan applies to a range of sectors whose decisions and actions can and do impact on biodiversity, and it encourages the alignment of environmental responsibilities across these sectors, in order to reduce conflict, facilitate sustainable development and protect biodiversity.

6 Proposed Conjunctive Management Strategic Action Plans

Based on the groundwater dependency and vulnerability assessments conducted, together with a review of relevant legal instruments and implementation programmes, a Conjunctive Management Strategy for Cape Town is proposed to strengthen the City's resilience to climate change and increasing environmental pressures.

This strategy outlines broad recommendations towards groundwater management, sustainable groundwater development and climate-responsive management (**Section 6.1**), followed by an overview of the methodology used to develop the action plans (**Section 6.2**), and the detailed set of proposed action plans (**Section 6.3**).

6.1 Recommendations for a Conjunctive Management Strategy

6.1.1 Groundwater Management

The City of Cape Town recently developed a groundwater policy brief (CCT, 2025) with proposed solutions and actions to enhance groundwater governance and management within the municipal framework. These are grouped into four focus areas:

- **Managing Landuse Contamination:** The urban context presents a multitude of potential contaminant sources which pose a risk to groundwater quality. Spatial and land use planning can assist in limiting the potential for future contamination in areas of strategic groundwater importance, and as such, solutions are proposed to this end. The prevalence of groundwater use across the CCT Municipal area, as well as the presence of existing land use practices and the occurrence of informal settlements, means that future land use planning initiatives will not solely address the risks of groundwater contamination. As such, mitigation measures are proposed for potential contaminating activities and stormwater handling.
- **Municipal Control of Groundwater Development and Use:** The National DWS is the custodian of the country's water resources, which includes the groundwater in Cape Town. CCT, as a groundwater user and WSA, recognizes it has a role to play in the protection and management of groundwater within its area of responsibility, but that it cannot enact legislation from a water resource management perspective.
- **Improved Data and Monitoring:** Groundwater data collection is currently mandated for groundwater users with Water Use Licenses (WULs), as well as for those with Water Services Intermediary (WSI) Agreements. Whilst less explicit, Schedule 1 users are also mandated to monitor. Awareness and clarity in terms of the monitoring mandate, as well as the relevant supporting information technology (IT) infrastructure, is needed to ensure data is used to inform future management of the resource by DWS.
- **Coordination and Governance:** DWS, as the regulator of groundwater, have the mandate to protect and govern groundwater within the CCT. However, DWS is known to have capacity and resource constraints, which in addition to the scale at which they are managing the resources (Water Management Area extent), limits the degree to which they are able to deliver the level of groundwater governance and management that the CCT desires. A prominent solution is the establishment of an aquifer advisory forum, which can allow for stakeholder involvement. A forum of this nature would enable CCT to exercise its agency, influence and resources to support DWS in achieving its mandate.

It is recommended that these proposed solutions be included in the strategic action plan and implemented as per the Groundwater Policy Brief.

6.1.2 Sustainable Groundwater Development

The CCT currently develops three of the main aquifers for groundwater use to diversify the water sources for the City's water supply portfolio as part of the Water Strategy. It is recommended that this continue with an emphasis on:

- Implement and expand MAR schemes, such as the Atlantis Water Resource Management Scheme and the Cape Flats Aquifer Management Scheme.
- Upgrade and optimise existing groundwater schemes such as the Atlantis Water Resource Management Scheme.
- Continue strategic development of additional wellfields, especially within the CFA and the TMG Aquifer.
- Enhance groundwater monitoring, modelling and governance across all schemes, including the more localised supply from springs.

6.1.3 Climate-Responsive Management

The City's 2019 Water Strategy and Climate Change Policy embed the lessons of the recent drought, emphasising ongoing water conservation, the protection of ecological infrastructure, and proactive adaptation to climate risks. It is recommended to incorporate relevant aspects of the Climate Change Policy into the strategic action plans with special emphasis on:

- Integration of groundwater into climate-adaptive strategies.
- Incorporation of climate change projections into groundwater planning and management strategies.
- Improved regulation of private groundwater abstractions.
- Strengthening of drought preparedness and response.

6.1.4 Green-Blue Infrastructure

Moving towards a conjunctive management strategy, it is recommended that a Green-Blue Infrastructure approach be adopted. Green-Blue infrastructure refers to a strategically designed network of natural and semi-natural systems that integrate hydrological functions with ecological and social benefits. Currently, many of Cape Town's waterways and infrastructure follow what is referred to as "grey" infrastructure, where concrete pipes, canals and drainage systems are the preferred mechanisms. Green-Blue Infrastructure, in contrast, utilises vegetation, soils, wetlands, rivers and urban water features to manage stormwater, enhance groundwater recharge, reduce flooding and improve water quality. This strategy attempts to mimic natural water cycles to support climate resilience, biodiversity and sustainable urban development. Ultimately, Green-Blue Infrastructure attempts to address the challenges of water scarcity and water pollution in a cost-effective and multifunctional approach as an alternative to traditional water management systems.

Hence, the Liveable Urban Waterways programme should be rolled out across the whole of the City. In addition, the concept should be expanded to include Green-Blue Infrastructure elements, SuDS, green architecture, rainwater harvesting, localised infiltration, localised bioretention treatment, water re-use, etc.

6.2 Conjunctive Management Strategy Methodology

The dependency and vulnerability assessments described in **Section 2.2** provided the basis for developing a Conjunctive Management Strategic Action Plan for Cape Town by identifying high-risk and high-dependency zones where sustainable abstraction, pollution mitigation, and equitable water governance should be prioritised. The approach used during these assessments is described in detail in **Section 1.3**.

A top-down approach was used to develop the strategic action plan for conjunctive management in Cape Town. The process began with a review of the City's key strategies, many of which were developed in response to the 2015–2018 drought, to understand the broader vision for a water-sensitive city by 2040. Policies, bylaws, and supporting plans and programmes were then reviewed to determine how these strategies are being implemented in practice. This review highlighted several gaps, which informed the development of targeted action plans.

6.3 Action Plans

The proposed action plans outlined below are organised into four main categories: governance, urban planning, data acquisition and management, outreach and education. Proposed action plans outlined in the **Draft Groundwater Management Framework Policy Brief Report (CCT, 2025)**, which are yet to be implemented, have been included in this section. While presented separately, many of the actions are cross-cutting. In particular, the management and protection of springs require coordinated efforts in governance, monitoring, urban planning and outreach, and are therefore highlighted under a dedicated cross-cutting category.

The rationale, key objectives, priority areas, implementing organisations, timelines, priority level, and budget class are outlined for each action plan under all categories. The budget class for each action plan was determined according to the anticipated level of investment required for implementation. Actions involving infrastructure development or physical construction, typically the most high-cost activities, were classified as high-budget. Actions that do not involve infrastructure but still require additional resources beyond existing resources, such as staff training or the development of new operational processes, were assigned a medium budget. Actions that can be implemented largely through existing avenues and staff capacity, supported by minimal materials or routine outreach resources, were classified as low budget.

The priority level of each action plan was determined by assessing whether it directly addresses groundwater-related hazards or strengthens the City's coping capacity. Priority setting also considered the logical phasing of actions and the dependencies between them, recognising that certain actions must be implemented before others can proceed. Meanwhile, the activities and timelines stipulated for each action plan are based on the expert knowledge of the project team.

6.3.1 Improved Governance

6.3.1.1 Establishment of an internal groundwater steering committee

The management of groundwater resources can often be hampered by poor coordination between the CCT branches. As a result, these entities will pursue activities that meet their own objectives without fully considering the repercussions for groundwater and its management. To reduce these inefficiencies and the impacts on groundwater systems, it is proposed that an internal groundwater steering committee be established. The committee would serve as a transversal forum or build on existing multidisciplinary forums to discuss matters relating to groundwater management and ultimately support the coordination and governance focus area of the CCT's Draft Groundwater Management Framework.

Regular information sharing through such a forum would enable departments to better anticipate and prevent impacts on groundwater, supporting more sustainable and integrated resource management. While the concept of an integrated groundwater committee has been raised previously, it has not yet been implemented. Successful establishment of this team will require strong cooperation and buy-in across CCT departments and branches. This action directly improves groundwater management and indirectly enhances the coping capacity of groundwater users.

Table 6-1 Implementation details for the establishment of an internal groundwater steering committee.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Reticulation Branch, Catchment, Stormwater and river Management Branch, Wastewater Treatment Works Branch, Water Demand Management and Strategy Branch, Scientific Services Branch, Environmental Planning and Sustainability Branch, and Disaster Risk Management Centre.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Determining lead directorate/branch within CCT (0-3 months), • Developing Terms of Reference for Steering Committee (3-6 months), • Establishing a quarterly meeting programme and proceedings process (0-12 months); • Full implementation (1-2 years).
Priority	High

6.3.1.2 The establishment of an aquifer advisory forum

Effective groundwater management in Cape Town is constrained by limited coordination across different levels of government, particularly between the National DWS and CCT. To address this, the Draft Groundwater Framework for the CCT recommends establishing an aquifer advisory forum either informally or formally under the National Water Act. The forum would serve as a dedicated entity operating across different levels of government with participation from private groundwater users, improving public communication and fostering transparency through the sharing of groundwater management challenges and successes.

The forum would also provide expert guidance to regulators on groundwater management, as well as provide a platform for stakeholder engagement to align policy and operations across different levels of government and high-volume users, ultimately addressing groundwater management challenges and improving the City’s coping capacity against groundwater-related hazards. The establishment of an aquifer advisory forum aligns closely with the governance and coordination objectives of CCT’s Draft Groundwater Management Framework and also complements the proposed internal groundwater steering committee, while extending participation to non-governmental institutions or stakeholders. This action plan is also highly dependent on strong stakeholder buy-in and ensuring effective representation across the groundwater sector.

Table 6-2 Implementation details for the establishment of an aquifer advisory forum.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Catchment, Stormwater and river Management Branch, Scientific Services Branch, CMA, National DWS, Department of Environmental Affairs and Development Planning (DEA&DP), WWF, TMWSP, Private Sector, University Institutions, Ward Councillors
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Initiation of the forum through DWS or the CMA with support from CCT, DEA&DP, and civic society organisations, with representation from key stakeholders; establishment of a permanent secretariat, and scheduling of quarterly meetings with provision for sub-committees (0–12 months). Full implementation (1-2 years).
Priority	High

6.3.1.3 Registration of Schedule 1 water users

Schedule 1 water use under the National Water Act (NWA), Act 36 of 1998, does not require a license or registration with the national DWS. This lack of water use registration is a critical governance gap that leaves the city with no authority or mechanisms to track widespread individual groundwater use. With registration largely voluntary, the risk of over-extraction and aquifer depletion can go unnoticed, while use in high contamination risk areas may also pose a health hazard. Since the direct enforcement of Schedule 1 water users is limited, the CCT can create practical governance mechanisms, such as requiring the minimal registration of boreholes (e.g. locations and estimated use). Accounting for this water use, especially in vulnerable or high-risk areas, will improve governance and ensure appropriate actions are taken to protect groundwater in these areas. Proof of registration could be made a condition for the connection of new boreholes and for building plan sign-off, where applicable. A digital self-registration tool or platform would streamline this process and should be communicated through public awareness campaigns.

Table 6-3 Implementation details for the registration of Schedule 1 water users.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch, Auxiliary Services Branch, Communications and Partnerships Branch, National DWS
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> Integrate Schedule 1 registration into the borehole drilling process, while aligning monitoring data formats and data handling processes with DWS. Schedule 1 registration should also be included in policies and bylaws that mandate submission of data to DWS. In parallel. building awareness and buy-in through marketing should also be prioritised (0-12 months).
Priority	High

This action plan is designed to strengthen the monitoring and management of groundwater use in Cape Town. It aligns with the Draft Groundwater Framework (CCT, 2025) under the category of Municipal Control of Groundwater Development and Use. Successful implementation will depend on effective education, clear communication and appropriate incentives to encourage Schedule 1 water users to register their groundwater use. Registration efforts should be prioritised in areas at high risk of over-abstraction—where groundwater use is high, aquifers are stressed, and the recharge-to-yield ratio is low. Priority areas include parts of the CFA, particularly the PHA, where groundwater use is substantial, as well as the northern suburbs, where yields exceed recharge (see **Figure 6-1**).

6.3.1.4 Requiring driller accreditation and submission of drill logs and testing data

The borehole drilling industry in South Africa remains largely unregulated, leading to poor practices that risk damaging municipal infrastructure, contaminating groundwater and surface water, and causing the loss of valuable drilling data. To address these risks, this action plan aligns with the Draft Groundwater Framework for Cape Town and recommends that the national DWS, in collaboration with industry stakeholders, establish a regulatory framework for drillers. This should include mandatory driller registration, accreditation, and the submission of relevant drilling data. By improving standards and oversight, this action addresses the risk of groundwater over-abstraction and aquifer contamination and can also enhance the coping capacity of groundwater users over the long term.

The national DWS has already announced the imminent launch of a driller registration process and an accompanying accreditation course. Stakeholders have been invited to contribute to the development of the course curriculum through participation in its design and review. The success of this action plan is dependent on the consistent enforcement of this process and the establishment of appropriate digital systems that facilitate the data management process. The CCT should also publish and maintain a list of compliant drillers and ensure the use of accredited drillers. Also important is ensuring the submission of drilling data, which can be mandated as a condition for relevant permits and enforced by by-laws.

Table 6-4 Implementation details for the requirement of driller accreditation and submission of drill logs and testing data.

Category	Description
Implementing Organisations	National DWS, CCT - Bulk Water Branch, Auxiliary Services Branch, Private sector, University Institutions.
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> Launch of a driller registration process and a driller accreditation course. City of Cape Town to support DWS in the development and review of the driller accreditation curriculum by registering as a Curriculum Reviewer, contributing local expertise, and coordinating data collection and submission processes (0-12 months).
Priority	High

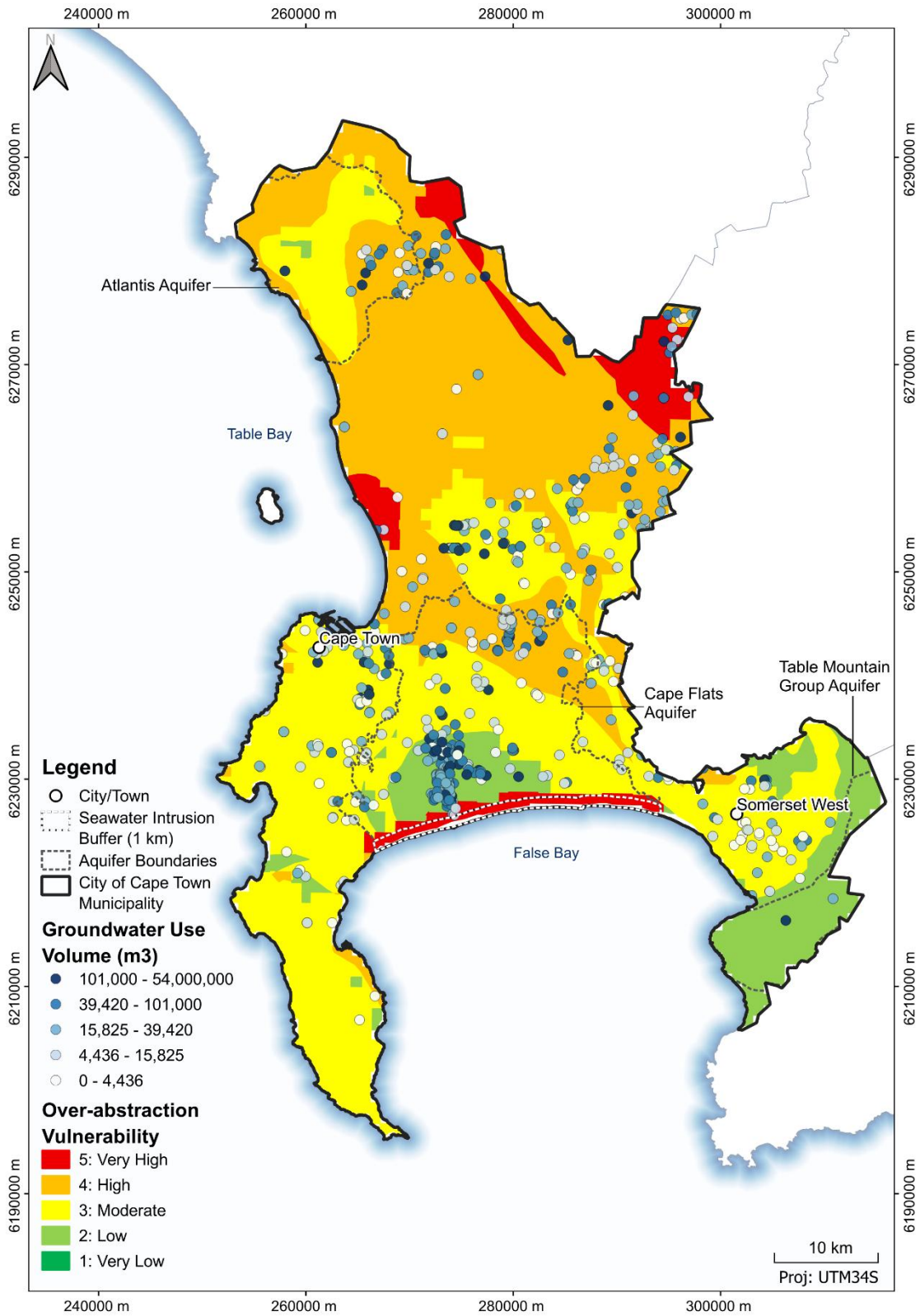


Figure 6-1 Aquifer over-abstracton vulnerability map overlain with registered groundwater users, highlighting areas at high risk of over-abstracton.

6.3.1.5 The development of a managed aquifer recharge strategy

During the stakeholder workshop, the development of a MAR strategy by the National Department of Water and Sanitation or the City of Cape Town Municipality was recommended for addition into the proposed action plans for the City of Cape Town. The proposed strategy would provide a structured framework for enhancing MAR efforts in the city and would be aimed at improving water security by replenishing aquifers and improving groundwater quality. Part of its aim would be to address the risk of salinisation and over-abstraction, while also improving groundwater management and the coping capacity of users.

The strategy will also define institutional and governance arrangements between the CCT, national DWS, and other stakeholders to ensure alignment with existing groundwater management and planning frameworks. Key components will include environmental safeguards, monitoring and data management systems, financial planning for phased implementation, and capacity-building programmes to strengthen technical and institutional expertise. Continuous stakeholder engagement and transparent communication will be essential to foster collaboration, public confidence, and adaptive management of the city’s aquifer systems.

This strategy would include the major aquifers within Cape Town and would likely propose additional locations for MAR. This action plan aligns closely with the City's Water Strategy and the New Water Programme. The successful implementation of this strategy is dependent on Inclusive planning involving stakeholders across the water sector alongside the CCT and national DWS, as well as securing adequate financing for the rollout.

Table 6-5 Implementation details for the development of a managed aquifer recharge strategy.

Category	Description
Implementing Organisations	CCT-Bulk Water Branch, Catchment, Stormwater and River Management Branch, Wastewater Treatment Works Branch, Scientific Services Branch, Auxiliary Services Branch, Environmental Planning and Sustainability Branch, Environmental Compliance Branch, District Planning and Mechanisms, Urban Sustainability Unit, DEA&DP, National DWS, Private Sector and University Institutions.
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Collating current learnings and systems integration (1-2 years); • Feasibility and siting for expansion (2-3 years).
Priority	Medium

6.3.1.6 The introduction of a development life-cycle approach into the stormwater management and pollution prevention and control process

Currently, stormwater management plans submitted to the City are focused on a regional approach at the land use planning application level. There is a need for more detailed site-specific stormwater management plans at the building application phase of development, and the compilation and implementation of a Pollution Prevention Plan during the operational phase. As such, Cape Town’s Draft Groundwater Management Framework recommends that stormwater management and pollution control should be operationalised at all stages of the life cycle of a development, i.e. Stage 1 (Land Use Planning), Stage 2 (Building Construction), and Stage 3 (Operational). This would ensure that pollution prevention and control measures are applied throughout the life cycle of a development or business.

The implementation of this approach would address aquifer contamination, especially in high risk areas. This action plan aligns with the Draft Management Framework of Cape Town by calling for a revision of the City’s Stormwater By-law to incorporate life-cycle-based stormwater management, as well as both the Environmental Strategy and Water Strategy. The plan’s success will ultimately depend on two key factors: the effective implementation of the revised by-law and a robust monitoring regime to ensure compliance, with a specific focus on high-risk activities and land uses. This action plan should be prioritised in areas with high development and areas with existing high-risk land uses and activities.

Table 6-6 Implementation details for the introduction of a development life-cycle approach into stormwater management, and pollution and control processes.

Category	Description
Implementing Organisation/s	CCT - Catchment, Stormwater and River Management Branch, Environmental Compliance Branch, Environmental Planning and Sustainability Branch, District Planning and Mechanisms, and DEA&DP.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Employ a senior pollution control official and involve all the affected apartments (0-12 months)
Priority	Medium

6.3.1.7 The development of a pollution prevention and control plan for future and existing developments within GPZs

The Draft Groundwater Framework for Cape Town emphasises the urgent need to develop a pollution prevention and control action plan for all commercial operations and high-density residential developments within each GPZ. The development of a pollution prevention and control plan for future and existing developments within GPZs will limit the impacts of potentially contaminating activities on groundwater quality, addressing the risk of aquifer contamination. This plan also aims to create awareness on the importance of pollution control among businesses, as well as implement quick-win actions to improve the quality of runoff in the short term. It is further recommended that this plan be included in the stormwater management guidelines, stormwater by-laws and urban planning processes. The success of this initiative is largely dependent on compliance monitoring to ensure these safeguards are adhered to, and its incorporation in urban and spatial planning policies/by-laws. The prioritisation of this action plan should be focused primarily on the CFA and the Atlantis Aquifer groundwater schemes.

Table 6-7 Implementation details for the development of a pollution prevention and control plan for future and existing developments within GPZs.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch, Catchment, Stormwater and River Management Branch, Water Demand Management and Strategy Branch, Environmental Compliance Branch, Urban Design and DEA&DP.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Refer to the City of Cape Town's Draft Groundwater Management Framework (0-12 months)
Priority	High

6.3.1.8 Enforcement of SANS standards during groundwater development

Groundwater development, maintenance and management in South Africa are guided by SANS 10299 standards. However, weak enforcement of these standards has led to widespread non-compliance in groundwater development (borehole siting, drilling, testing, commissioning and decommissioning), often characterised by poor practices, which pose a risk to the aquifer, the City’s infrastructure, the environment, and the loss of valuable data. To address this, the Draft Groundwater Framework for Cape Town recommends the development of a groundwater policy that requires adherence to SANS standards, aligning with the Water Strategy. The framework suggests amending the drilling and borehole registration application process to include compliance with these standards as a requirement. Such enforcement will improve contractor practices and professionalism, data collection, environmental and infrastructure protection, regulatory compliance and most importantly, strengthen groundwater protection. Through these improvements, this action plan will assist in addressing the risk of over-abstraction and aquifer contamination. Its implementation directly aligns with the CCT’s Draft Groundwater Management Framework, specifically under Focus Area B, Municipal Control of Groundwater Development and Use category.

Table 6-8 Implementation details for the enforcement of SANS standards during groundwater development.

Category	Description
Implementing Organisations	CCT - Water Demand Management and Strategy Branch, Auxiliary Services Branch
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Development of a groundwater policy that requires adherence to the relevant standards. The application to drill and borehole registration process to include the need for compliance to these standards (0–12 months).
Priority	High

6.3.1.9 Incorporating GPZs in the National Environmental Screening Tool

Groundwater is currently not spatially identified in the National Environmental Screening Tool under the NEMA of 1998 as a sensitivity requiring assessment when an environmental impact assessment is undertaken. As a result, necessary hydrogeological studies are often overlooked, leading to inadequate groundwater protection. To address this gap, the Draft Groundwater Framework for Cape Town recommends incorporating the City’s defined GPZs into the National Environmental Screening tool. This would provide a spatial basis for identifying when a hydrogeological impact assessment is required. This initiative aims to assist in addressing the risk of aquifer contamination. The successful development and implementation of this tool depend on effective collaboration between the Department of Forestry, Fisheries and the Environment (DFFE), national DWS and CCT, and maintaining its accessibility.

Table 6-9 Implementation details for the incorporation of GPZ in the National Environmental Screening Tool.

Category	Description
Implementing Organisation/s	DFFE
Supporting Organisation/s	CCT and DWS
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Improving the screening tool through the addition of groundwater protection zones and inclusion of a specialist hydrogeological study requirement to the process. This would require engagement by the DWS or City of Cape Town with the DFFE (0–12 months).
Priority	High

6.3.1.10 Disaster Preparedness

A core element of building resilience and coping capacity to climate change and water scarcity is strengthening disaster preparedness. Proactive preparedness not only reduces risks but also strengthens groundwater governance. In preparation for potential climate change-induced hazards and disasters, emergency boreholes and points of distribution sources can be installed and mapped out to provide equitable access during times of need, while spill prevention and rapid response systems can be established for high-risk and vulnerable areas to mitigate disasters. Several water-scarce cities across the world have made efforts to encourage the use of rainwater harvesting. For those who already struggle with access to water, the subsidisation of rainwater tanks and encouragement of their use to the general public will improve the coping capacity of communities when supply is low. Through proactive governance, measures can be implemented to offset the impacts of climate change on water supply and improve the CCT’s resilience to water scarcity.

Table 6-10 Implementation details for Disaster Preparedness.

Category	Description
Implementing Organisation/s	CCT – Disaster Risk Management Centre, Bulk Water Branch
Supporting Organisation/s	DWS
Budget Class	Medium
Timeline	<ul style="list-style-type: none"> Development of plan, resource acquisition, training and integration, establishment of early warning triggers (1-2 years); Full operational capability and improvements (2–5 years).
Priority	Medium

6.3.1.11 Summary

This section recommends 10 priority actions to strengthen groundwater governance in Cape Town. Some of these proposed actions align with those proposed in the Groundwater Framework of Cape Town, which is yet to be implemented. These include:

- The establishment of an internal groundwater steering committee for improved coordination within the CCT.
- The establishment of an aquifer advisory forum for improved coordination across different levels of government, particularly between the national DWS and CCT.
- The implementation of mandatory minimal registration of boreholes to counter the lack of Schedule 1 water use registration, particularly in high-risk areas where groundwater use is high.
- Requiring driller accreditation and submission of drill logs and testing data to prevent poor drilling practices, protect municipal infrastructure, safeguard groundwater and surface water from contamination, and ensure the capture of valuable drilling information.
- The development of a MAR strategy to provide a structured framework for enhancing MAR efforts in the city, aimed at improving water security by replenishing aquifers and improving groundwater quality.
- The adoption of a life-cycle approach, requiring stormwater and pollution control measures at the planning, building and operational phases of development.
- The development of a pollution prevention and control plan for future and existing developments within GPZs to limit the impacts of commercial operations and high-density residential developments on groundwater quality.
- Enforce SANS standards during groundwater development to reduce non-compliance, protect aquifers, infrastructure and the environment, and ensure valuable drilling and testing data is captured.
- Incorporating GPZs into the National Environmental Screening Tool to ensure groundwater assessments are integrated into Environmental Impact Assessments to improve the protection of groundwater resources where municipal supply is involved.
- The adoption of a proactive approach to strengthen disaster preparedness, building resilience to future disasters.

Collectively, these action plans aim to close regulatory gaps to protect aquifers from overuse and pollution and strengthen Cape Town's transition to a water-sensitive city.

6.3.2 Urban Planning

6.3.2.1 Naturalisation and improvement of urban waterways

The naturalisation and improvement of waterways is recommended for waterways in Cape Town, because many rivers, lakes and wetlands within the City are degraded due to urbanisation, land use changes and pollution. During development projects, many wetlands are drained, and rivers are converted into concrete canals, resulting in the loss of biodiversity, while also affecting the river-wetland-aquifer continuum, which alters aquifer recharge. Furthermore, many waterways are polluted, resulting in elevated nutrient levels and the rapid growth of algae, which depletes the oxygen required by aquatic plants and animals for survival. Invasive alien vegetation present in these environments also soaks up water and clogs these systems. The restoration of such waterways is a necessary step that will allow these waterways to function more naturally, providing multiple benefits, such as improved water quality, flood management, better ecological functioning, increased aquifer recharge, ecosystem services and social and economic benefits. This recommended action plan,

therefore, addresses the risk of reduced recharge, aquifer contamination and the coping capacity of the user.

The GIP and the LUW Programme are key initiatives that are currently ongoing, aimed at naturalising and improving Cape Town’s urban waterways, a key action recommended in this report. The implementation of Green Infrastructure elements around the city has been ongoing for nearly the last three decades, even though GIP was only officially established in 2021. Urban waterways and their associated features have seen significant value from the addition of these elements, through nature-based solutions that enhance stormwater management, improve water quality and support groundwater replenishment. The establishment of the LUW Programme serves as an important step towards transitioning from grey waterway infrastructure to natural to semi-natural green assets.

The development of the GINet and its implementation framework has further strengthened and accelerated the city’s ability to identify opportunities for Green Infrastructure, developing a pipeline of future projects. GINet has identified urban waterways with grey infrastructure, which could potentially be naturalised and improved, further expanding the work already achieved and expanding the current register of green assets in Cape Town. This also makes a significant contribution towards achieving the objectives of the LUW Programme and, more so, the goals of the CCT Water, Resilience, Environmental and Climate Change Strategies.

Figure 6-2 identifies several potential areas for GI interventions, suggesting potential urban waterways that can be improved upon or transformed, from grey to green assets. These include the Diep, Swart, Vygekraal, Elsiekraal, Lotus and Kuils rivers. Each of these waterways has significant potential for enhanced infrastructural, ecological and social functions. Through the implementation of GI, these waterways could become functional green assets that strengthen resilience against flooding and contamination, while also providing social benefits. Incorporating GI elements such as SuDS would further enhance infiltration, filtration, retention and polishing capacity, contributing to a healthier and more resilient city.

The LUW programme initiated by the City of Cape Town in 2018 has successfully rehabilitated several waterways, such as the Century City Canals and Intaka Island, Edith Stephens Nature Reserve, Silvermine Wetlands, Upper Liesbeek River and the Zandvlei Estuary Nature Reserve, which the CCT now deems as safe and attractive ecosystems that provide several ecosystem services and benefits, the expansion of this programme is recommended. This programme can be expanded to the mouth of the Salt River and its tributaries near Paarden Eiland, as well as the lower Hout Bay River, both of which are highly degraded systems, currently showing unacceptable E. coli levels and requiring intervention (CCT, 2024d).

A large component of the GIP and LUW programme is to enhance groundwater recharge through restoring the disrupted natural river-wetland-aquifer continuum. **Figure 6-3** illustrates the potential for increased aquifer recharge in Cape Town, particularly in the southern regions of the City. This can be achieved through the removal of lining in lined watercourses, which would create connectivity with groundwater and the naturalisation of canalised systems, which would serve to slow down flow (enabling a longer duration for infiltration) and likely create a larger wetted perimeter (increasing infiltration). Such interventions are likely to be most effective when positioned over an unconfined, sandy (intergranular) aquifer (e.g. CFA and Atlantis Aquifer). Highly modified systems should be prioritised.

Also illustrated on **Figure 6-3** are other efforts to enhance recharge, which include;

- Retrofitting stormwater/ infiltration ponds to enhance existing recharge.
- The discharging of treated effluent from WWTWs into unlined, naturalised watercourses, particularly in the dry season, where watercourse baseflows are low and infiltration potential is underutilised. Alternatively, the discharge of treated effluent from WWTWs into adjacent infiltration ponds.

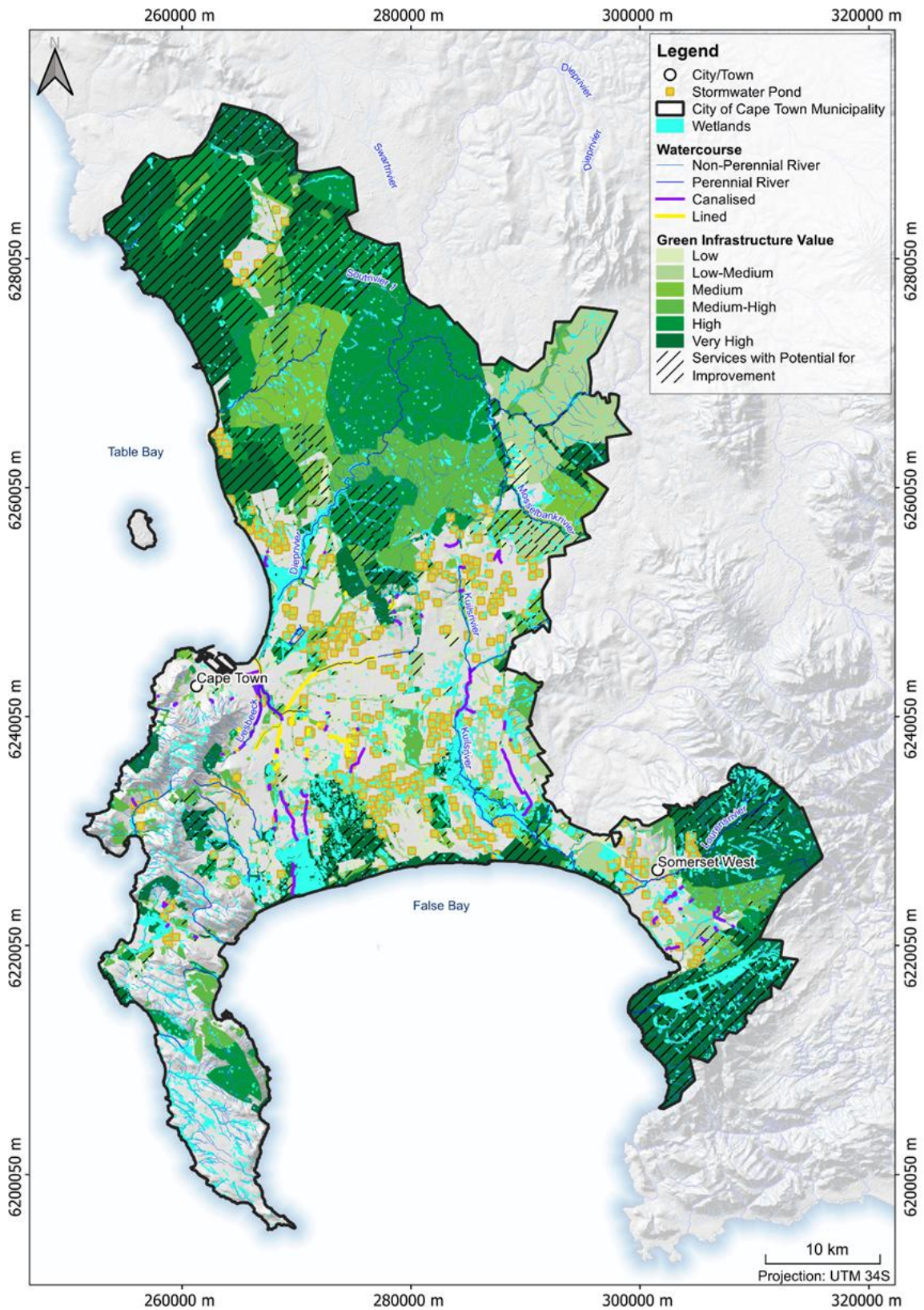


Figure 6-2 Green Infrastructure Network and City of Cape Town Waterways (Adapted from CCT, 2024c).

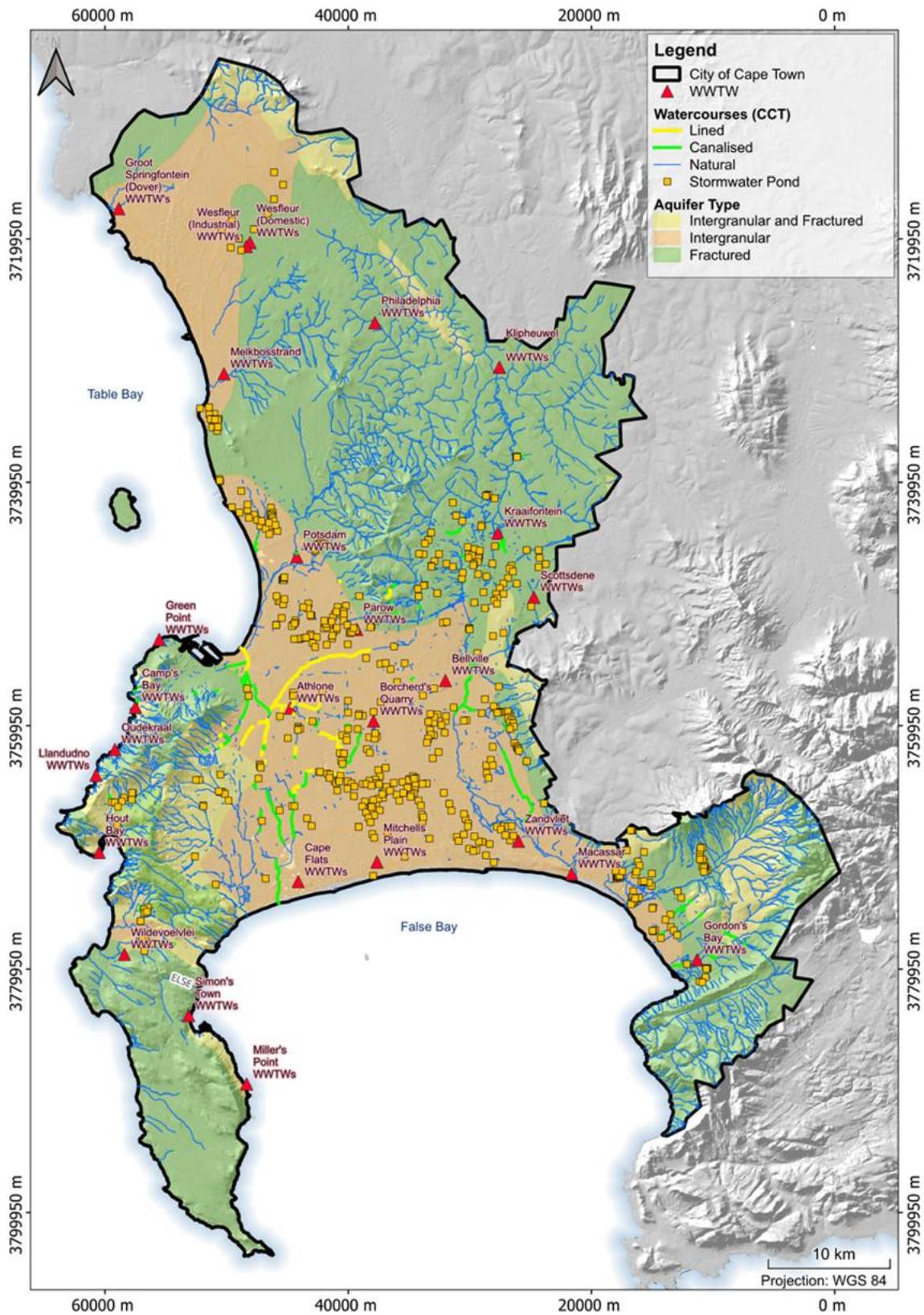


Figure 6-3 Identification of canals and watercourses for potential Liveable Urban Waterway and Green Infrastructure projects.

The purpose of encouraging these actions is to promote the use of recharge-enhancing mechanisms around the city that improve groundwater availability and resilience to drought, while building infrastructure that promotes ecological function and green spaces. Moreover, these naturalisations and improvements are designed to improve the quality of stormwater recharging aquifers and reduce the risk of contamination. The LUW and GIP are two examples of how these objectives can be met, as both initiatives either directly or indirectly incorporate these functions and are aligned with Cape Town’s Water strategy. The success of this plan depends on securing sufficient funding for large-scale naturalisation works, strong coordination across multiple CCT departments and programmes (particularly LUW and GIP), and sustained partnerships with external stakeholders to ensure that restoration, green infrastructure upgrades and pollution control measures are implemented effectively, especially in highly degraded waterways and high-recharge zones.

Table 6-11 Implementation details for the naturalisation and improvement of urban waterways in Cape Town.

Category	Description
Implementing Organisations	CCT- Environmental Planning and Sustainability Branch, Biodiversity Management Branch, Bulk Water Branch, Catchment, Stormwater and River Management Branch, Scientific Services Branch, Urban Sustainability Unit, District Planning and Mechanisms Department, and DEA&DP.
Budget Class	High
Activities and Timelines	<ul style="list-style-type: none"> • Review current GIP and LUW project pipeline and prioritise key waterways (1-2 years); • Naturalise and improve key urban waterways (4-6 years); • Complete the naturalisation of all major urban waterways (10-15 years).
Priority	Medium

6.3.2.2 Rehabilitation of the Lotus Canal

The Lotus River is one of Cape Town’s most important waterways, serving as a major canal and stormwater feature throughout most of the Cape Flats region. It is also considered one of Cape Town’s most polluted waterways, where industrial discharge, wastewater and stormwater from amongst some of the most polluted areas contribute to the degradation of water quality before it reaches Zeekoevlei, a coastal lake and RAMSAR site.

The proposed transformation of the Lotus Canal under the LUW Programme provides an opportunity to reclaim this important urban waterway in the city, and aligns with the Water Strategy and GIP. Several major projects intended for rehabilitation within Cape Town have been delayed by a decade due to budgetary constraints. The Lotus Canal was initially developed to accommodate runoff during the development of the Cape Flats. Part of its establishment involved the canalising over much of its extent from the Airport Industria on the N2 down to the inlet of the Zeekoevlei. Rehabilitation has been recommended in the canal's upper reach to turn it into a LUW. The transformation from canalised grey infrastructure to natural to semi-natural green infrastructure would improve flood control, aquifer recharge, water conservation and water re-use, with the added benefit of ecosystem services. These improvements would help reduce the risks of aquifer contamination and reduced recharge.

Meaningful rehabilitation cannot occur without first regulating and mitigating the numerous known and unknown discharges that currently cause extremely poor water quality in the canal. If these pollution sources are not addressed, contaminated water will continue to infiltrate the underlying CFA. Due to the unconsolidated and unconfined nature of the CFA, it is highly susceptible to pollution, making it essential to improve surface water quality before any naturalisation or green-infrastructure interventions take place. Rehabilitation should therefore begin in the headwaters near the N2, where regulating discharges and improving water quality will prevent downstream naturalisation efforts from unintentionally degrading groundwater quality. Ensuring upstream quality is sufficient is critical to protecting the aquifer from ongoing contamination.

Given these facts, the overall success of this plan depends on effectively identifying, regulating and mitigating all pollution sources in the Lotus River catchment, securing adequate funding for rehabilitation, and ensuring strong coordination between LUW, GIP and relevant CCT departments so that naturalisation efforts begin in the headwaters and do not expose the underlying CFA to further contamination.

Table 6-12 Implementation details for the rehabilitation of the Lotus Canal.

Category	Description
Implementing Organisations	CCT - Environmental Planning and Sustainability Branch, Biodiversity Management Branch, Bulk Water Branch, Catchment, Stormwater and River Management Branch, Scientific Services Branch, District Planning and Mechanisms Branch, DEA&DP.
Budget Class	High
Activities and Timelines	<ul style="list-style-type: none"> • Fully evaluate the canal system and develop a plan for its rehabilitation (0–12 months); • Identify sources of pollution, enforcement of by-laws to prevent further contamination (1–2 years); • Fully rehabilitate the Lotus Canal (5-10 years).
Priority	High

6.3.2.3 Groundwater Protection Zones

The establishment of GPZs around key water resources and designated terrestrial areas that function as mechanisms of infiltration and recharge to the underlying aquifer would be a beneficial measure to improve groundwater management and address the risks of aquifer contamination. Through appropriate governance and urban spatial planning, these features and areas can be protected from various levels of high-risk land uses and PCAs that could negatively impact the quality of groundwater. This includes upgrading infrastructure to reduce the risk of contamination in recharge zones and priority precincts with solutions and retrofits that incorporate WSUD. The implementation of GPZs address the risk of aquifer contamination and improves the coping capacity of the water users who fall within its bounds. Furthermore, it aligns with aims of the Water and Resilience strategies by working towards a city that is water sensitive and resilient.

This approach especially applies to the development of LUWs and Green Infrastructure, where natural and semi-natural infiltration processes and stormwater management principles are core elements. This would aid in avoiding potentially undermining the progress of transforming the City’s waterways and important recharge areas into green assets that build climate change resilience and resilience against water scarcity. Another important component is the establishment of systems and processes with stakeholders in mind to ensure implementation, compliance, and enforcement, as without buy-in from these entities, the long-term effectiveness of these zones is undermined.

Table 6-13 Implementation details for the formalisation of GPZs.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Catchment, Stormwater and River Management Branch, District Planning and Mechanisms, Environmental Compliance Branch, Environmental Planning and Sustainability Branch, and DEA&DP
Budget Class	High
Activities and Timelines	<ul style="list-style-type: none"> • Scoping out potential zones and laying the foundation for their formalisation. The development of a work plan and stakeholder mapping (0-12 months); • Hydrogeological investigations and delineations resulting in a draft zonation map delineation (1-2 years); • Regulatory development and stakeholder consultation resulting in the finalisation of GPZ maps (2-3 years); • Adoption and implementation, formally enact GPZs and begin with enforcement and management (3-4 years).
Priority	High

6.3.2.4 Improved waste management in informal settlements

A significant improvement in solid and liquid waste management, particularly within informal settlements, is highly recommended to reduce pollution in Cape Town’s waterways. To achieve this, waste interventions should be incorporated into urban planning. This could involve the designation of accessible waste sites for regular collection or the incorporation of waste trapping features into stormwater drainage systems and improved liquid waste infrastructure to prevent the discharge of waste into roads, rivers and stormwater drains.

Solid waste accumulation is a widespread problem across many of the City’s low-income/ informal settlements, where service delivery is limited. This waste passes readily into stormwater systems and blocks sewers and pump stations, resulting in added watercourse pollution, which ultimately also results in aquifer pollution. Once in these systems, waste is costly to remove. Therefore, addressing this issue through ramped-up and regular solid waste collection and devising innovative ways to address the dumping of solid waste in informal settlements are all essential. Such efforts will lower maintenance and operation costs to remove waste in systems, improve water quality in urban waterways and enhance service delivery in low-income areas.

Particularly within the Cape Flats, liquid waste is often seen stagnant or draining along streets, stormwater drains or into rivers. The development of liquid waste infrastructure is a longstanding issue within informal settlements and is part of a larger plan by the CCT and the National government to address this issue as a human right in South Africa. Reducing the volume of liquid waste discharged into these receiving environments would help reduce the impact on water bodies and underlying aquifers, which often exhibit poor water quality in these areas.

This action plan aims to reduce the risk of aquifer contamination and strengthen the coping capacity of users in affected areas, who are most vulnerable to deteriorating water quality. Improving waste management in these locations aligns with the City’s Environmental and Water Strategies, particularly their objectives to protect the environment and safeguard water resources. The success of this plan depends on identifying sustainable waste management solutions and ensuring strong cooperation across CCT departments and branches so that appropriate measures are implemented effectively and efficiently.

Table 6-14 Implementation details for the improved waste management in informal settlements.

Category	Description
Implementing Organisations	CCT- Waste Services Department, Scientific Services Branch, Catchment, Stormwater and River Management Branch, Environmental Planning and Sustainability Branch, and Urban Development Implementation.
Budget Class	High
Activities and Timelines	<ul style="list-style-type: none"> Community engagement and baseline assessment (0-12 months); Co-design and pilot implementation (1-2 years); Scaling and formalising systems and ensuring sustainable management and transition to a financially sustainable system (4-5 years).
Priority	High

6.3.2.5 Formalising the protection of recharge areas

The CCT has long been in support of the formal designation of groundwater recharge areas for protection. The determination of these areas is ongoing, however, significant progress has been made under the Refinement of Strategic Groundwater Source Areas Project. This project supports this effort by updating recharge maps and strengthening the management of recharge areas. Once these maps have been finalised, it is recommended that they are incorporated into urban and spatial planning to protect recharge zones from contamination and over-abstraction by limiting or prohibiting high-risk activities in these areas. This would aid in strengthening the coping capacity of groundwater users and improve groundwater governance by ensuring recharge boundaries and their volumes are better defined. The success of formalising the protection of recharge areas is dependent on defining the spatial extent of recharge boundaries. Once these are established, the enforcement of regulations and regular monitoring to ensure these areas are not impacted should be focused on.

Table 6-15 Implementation details for the protection of recharge areas.

Category	Description
Implementing Organisations	CCT - DWS, UPD, DEA&DP
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Identifying vital recharge areas and zones (6-12 months); The formalisation and implementation of protection measures for recharge areas (1-2 years).
Priority	High

6.3.2.6 The identification of appropriate stormwater management measures for each groundwater protection zone and each stage of development

The management of stormwater in Cape Town is a major component of the City’s plans to address the risk of aquifer contamination, water scarcity and improve resilience to drought. The CCT’s Draft Groundwater Framework proposes simplifying existing stormwater guidelines and adapting them to local conditions, particularly within GPZs and at each stage of land development. These recommendations align with Focus Area A: Managing Land-Use and Contamination, by aiming to streamline spatial planning and construction processes and make it easier for officials to assess stormwater master plans.

Improved stormwater management is directly linked to improved groundwater management, as effective systems can enhance recharge and reduce contamination risks. This proposed initiative therefore supports the broader efforts to minimise land-use related impacts on groundwater. However, the success of this plan depends on the accurate characterisation of each aquifer and its overlying land use at each stage of development.

Table 6-16 Implementation details for the identification of stormwater management measures for GPZs.

Category	Description
Implementing Organisations	CCT - Catchment, Stormwater and River Management Branch, Bulk Water, Urban Sustainability Unit, and DEA&DP.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Refer to the City of Cape Town's Draft Groundwater Management Framework (0-12 months).
Priority	Medium

6.3.2.7 Categorising different land uses and operational activities as high, medium and low risks to the water quality of the aquifer.

Prevention and preparation underpin several of the CCTs planned initiatives to strengthen groundwater management. The categorisation of different land uses and operational activities according to their level of risk to the water quality of an aquifer, and its integration into spatial planning, is one of the action plans included in the CCT’s Draft Groundwater Management Framework. This action plan aligns with the managing land use and contamination category of the framework. The report emphasises the need to accurately identify PCAs and contamination sources to aid in the development of appropriate mitigation measures. By integrating the risk information into spatial planning, the City can map high-risk activities and potential contamination sources and apply these insights to groundwater management. This includes informing the design and updating of the municipal monitoring network, guiding the expansion and operation of municipal wellfields, and regulating land-use activities to protect aquifers and safeguard groundwater users. The implementation of this action plan directly addresses the risk of aquifer contamination by improving spatial planning and regulating its occurrence according to its risk to aquifer water quality. The success of this initiative is dependent on embedding this measure into land-use planning, development application processes and environmental management frameworks.

Table 6-17 Implementation details for categorising land use and operational activity risks to the aquifer.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Scientific Services Branch, Environmental Compliance Branch, District Planning and Mechanisms, and the Urban Sustainability Unit.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Refer to the City of Cape Town's Draft Groundwater Management Framework (0-12 months)
Priority	Low

6.3.2.8 Incorporating groundwater protection measures more fully into municipal planning (both prescriptions and overlay zoning)

Municipal land-use planning in Cape Town empowers the CCT to regulate the development of land uses that may contaminate groundwater. However, the City’s Municipal Planning By-Law (2015) currently contains no provisions specific to groundwater protection. To address this, the Draft Groundwater Framework of Cape Town recommends an action plan that aims to amend the by-law to require the review and mitigation of land-use–related risks to groundwater quality.

This action plan aims to address the risk of aquifer contamination and improve the coping capacity of groundwater users, starting at the highest level. The Groundwater Framework outlines two mechanisms to support this amendment: first, incorporating groundwater impact assessments into pre-application meetings with developers; and second, introducing a zoning overlay that requires approval for PCAs within designated high-risk areas. Together, these mechanisms would strengthen the CCT’s ability to regulate PCAs and protect vulnerable aquifers from contamination. These measures should be prioritised in areas with high levels of development and in existing areas vulnerable to aquifer contamination. The successful implementation of these measures will require the swift integration of groundwater protection measures into the Municipal Planning By-law.

Table 6-18 Implementation details for the incorporation of groundwater protection measures into municipal planning.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch, Catchment, Stormwater and River Management Branch, District Planning and Mechanisms, Urban Sustainability Unit, DEA&DP.
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> Updating the existing development prescriptions, specifically the regulation under item 70(2) of the By-Law to mandate pre-application consultations for high-risk developments in demarcated groundwater protection zones (0 -12 months); The creation of a new groundwater protection overlay zoning, such that it meets the requirements of item 148 of the By-law (2-3 years).
Priority	High

6.3.2.9 Summary

This section outlines the recommended urban planning actions to improve the management of waterways and groundwater in Cape Town. These include:

- The naturalisation and improvement of urban waterways through the expansion of the GIP and the LUW programme, which will enhance water quality, improve aquifer recharge and improve ecosystem services in degraded or highly modified systems within the city.
- The rehabilitation and transformation of the Lotus Canal from canalised grey infrastructure to natural green infrastructure that enhances flood control, aquifer recharge, water conservation, water re-use, and ecosystem services. The rehabilitation of sections of the Lotus River is currently planned under the LUW programme.
- The establishment of GPZs that protect water resources and designated terrestrial areas from high-risk land uses and PCAs that could alter the quality of groundwater. These GPZs will also function as mechanisms for infiltration and recharge to the underlying aquifer.
- The implementation of action plans recommended in the Draft Groundwater Management Framework, which include identifying appropriate stormwater management measures for each GPZ and for each stage of development, categorising different land-uses and operational activities as high, medium and low-risk to the aquifer water quality, and incorporating groundwater protection measures into the municipal planning by-law.
- The protection of groundwater recharge areas as recommended by the CCT's Draft Groundwater Management Framework. Once these areas are identified, they can be incorporated into urban and spatial planning to protect recharge zones from contamination and over-abstraction. Overall, this would strengthen the coping capacity of groundwater users and ensure recharge boundaries are well defined for incorporation into groundwater governance.
- The improved management of solid waste in informal settlements to reduce pollution in Cape Town's waterways. This can be achieved through the incorporation of solid waste interventions into urban planning.
- The identification of appropriate stormwater management measures for each groundwater protection zone and for each stage of development is a key part of the CCT's plan to simplify stormwater guidelines and streamline the spatial planning and construction process. The goal of this action is to reduce land-use impacts on water resources.
- The categorisation of different land uses and operational activities as high, medium and low risks to the water quality of the aquifer. Accurately identifying PCAs and their sources is an important step in precautionary management, as it enables the development of appropriate mitigation measures and spatially aids in identifying locations at an increased risk and in need of mitigation measures.
- The incorporation of groundwater protection measures more fully into municipal planning at both a prescription and overlay zoning level to include groundwater considerations during pre-application meetings for developers and require permissions for certain land uses in designated areas.

6.3.3 Data Acquisition and Management

6.3.3.1 Promoting citizen science

While citizen science has become a growing tool for freshwater monitoring, groundwater has remained relatively underrepresented in this space. Cape Town's Table Mountain Water Source Partnership, funded in 2021, is a notable exception that directly addresses this gap. This initiative was established to enhance the city's water resilience by improving the understanding, monitoring, and management of groundwater resources. The project engages with volunteer residents who allow their private boreholes to be equipped with data loggers to record water levels. Initially launched in Newlands and Epping/Airport Industria, the network has since expanded to include areas such as Kommetjie, Scarborough, Bergvliet, Noordhoek, and Brackenfell. The collected data is presented on an interactive public dashboard, serving as a useful resource for scientists, practitioners, and residents to monitor and manage the city's groundwater collaboratively. This project highlights the opportunities to improve the conjunctive management of Cape Town's groundwater in a cost-effective manner that generates large-scale datasets through educating the general public to assist in data collection to improve groundwater management and effectively monitor changes in groundwater levels. This type of initiative could be especially beneficial to the City's most vulnerable communities and those dependent on groundwater. The success of this plan is highly dependent on citizen buy-in to groundwater monitoring efforts.

Table 6-19 Implementation details for promoting citizen science.

Category	Description
Implementing Organisations	CCT, national DWS, WWF, WRC, Table Mountain Water Source Partnership (TMWSP)
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Programme design and partnership building, including consultation with stakeholders, e.g. the Table Mountain Water Source Partnership, to collaborate or integrate into their programme. Building awareness to improve buy-in from potential citizen scientists and the identification of areas where data is sparse or needed (0-12 months); • Tool sourcing, development, and pilot testing. This would include developing monitoring kits, building digital infrastructure for data submission and management, and piloting the programme for 3 – 6 months (1-2 years); • Fully recruit, launch and implement programme, marketing it and involving ward councillors, hosting training sessions and rolling out workshops (2-3 years).
Priority	High

6.3.3.2 Expanding the current monitoring network

The monitoring of groundwater in Cape Town is currently conducted through three different networks managed by the CCT, National DWS, and the TMWSP. This fragmented approach limits the effective analysis and management of groundwater. Given this challenge, the Draft Groundwater Management Framework (CCT, 2025) recommends a more holistic and integrated monitoring strategy that brings together these networks to ensure sufficient spatial distribution of monitoring points and standardises data formats to improve accessibility for presentation, visualisation and

interpretation. The integration of these datasets would enhance spatial coverage and provide a clearer understanding of changing aquifer conditions across Cape Town.

To complement this, the CCT aims to strengthen and expand its monitoring network, particularly in high-risk areas, pristine environments and groundwater protection zones around abstraction and MAR schemes. A coordinated and expanded monitoring network would strengthen early warning systems, prevent over-abstraction, protect water quality and support strategic planning and policy development. Ultimately, these improvements will strengthen groundwater governance by equipping decision makers with the information required to mitigate the risk of over-abstraction and protect public health from groundwater contamination. The success of this action is dependent on collaboration and coordination between the CCT, national DWS and the TMWSP

Table 6-20 Implementation details for expanding the current monitoring network.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch, TMWSP
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> Once the Aquifer Advisory Forum is established, a comprehensive assessment of current groundwater monitoring activities should be undertaken. The CCT should partner with the TMWSP to evaluate the suitability of the existing monitoring networks and identify gaps and areas for improvement (0-12 months). Once identified, these gaps can be filled through the establishment of new monitoring sites and regularly monitored on a schedule with an established protocol for the correct handling of data (1-2 years).
Priority	High

6.3.3.3 Developing an effective groundwater monitoring database and ensuring a feedback loop to inform governance and management

Currently, large volumes of groundwater monitoring data are collected as part of compliance monitoring by the CCT, private users and other entities. However, most of this data is usually submitted in formats (PDFs) that require manual extraction and reformatting, making it difficult to readily access or analyse the data to inform groundwater management or decision-making. To address this, the Draft Groundwater Framework for Cape Town recommends a partnership between the CCT and DWS to establish a streamlined process that can standardise, consolidate, and store data in usable formats. This would involve the national DWS sharing preferred data formats with the CCT and other private users, which would enable the submission of groundwater data in correct formats, reducing the need for manual extraction and the reprocessing of data. This usable data can then be stored within a database system that is easily accessible. Streamlining this process can facilitate the early detection of groundwater risks to hazards such as over-abstraction and contamination, identifying areas requiring intervention and increasing collaboration between the CCT, national DWS and private groundwater users, a key factor required for the success of this plan.

Table 6-21 Implementation details for developing an effective groundwater monitoring database and ensuring a feedback loop to inform governance and management.

Category	Description
Implementing Organisations	CCT- Bulk Water and Communications and Partnership Branch, national DWS
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Collaboration with national DWS to confirm specific data formats, handling processes and storage requirements through the development of a strategy, in addition to forming an aquifer advisory forum with a variety of stakeholders. • Once finalised, the CCTs' groundwater policy should support the national DWS and their requirements by mandating data submission in the approved DWS formats (0-12 months).
Priority	Medium

6.3.3.4 Monitoring of groundwater levels and volume data by groundwater users

In South Africa, Schedule 1 water users are not required to register with the national DWS, therefore, registration is often lacking, resulting in data gaps, particularly in terms of groundwater abstraction volumes and the extent of groundwater users. Additionally, illegal groundwater use, which can be prompted by backlogs and delays in Water Use License applications, can also result in such gaps, as only 20% of groundwater use is verified in South Africa (DWS, 2016). Information on groundwater abstraction volumes and the extent of groundwater users in Cape Town is vital in determining the dependency of groundwater in the city and the vulnerability of the groundwater resources to over-abstraction.

Currently, monitoring of groundwater levels and abstraction volumes is largely limited to users with Water Use Licences and, in some cases, General Authorisations. Private schedule 1 groundwater use does not require registration with the national DWS, and while the CCT by-laws require boreholes to be registered, neither system requires the monitoring of abstraction volumes or groundwater levels. Consequently, private groundwater use remains largely unregulated and is not incorporated into regional or local water allocation planning.

To address these gaps, the City of Cape Town Draft Groundwater Framework recommends that private users begin monitoring their abstraction volumes and groundwater levels. Collecting this information would enable more accurate assessment of aquifer storage changes, usage patterns and emerging risks, thereby supporting improved groundwater management. Once implemented, the additional data could be used to evaluate changing aquifer conditions in Cape Town, update conceptual and numerical groundwater models, and strengthen scenario analyses related to climate change impacts, over-abstraction, saline intrusion, reduced recharge and contamination.

Overall, this action supports improved data acquisition and management, ultimately enhancing the management of groundwater use. The success of this action plan is dependent on buy-in from private groundwater users and their willingness to monitor their abstraction volumes and groundwater levels.

Table 6-22 Implementation details for the monitoring of groundwater levels and abstraction volume data by users.

Category	Description
Implementing Organisations	National DWS, CCT-Bulk Water Branch
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> Engaging and aligning with the DWS to clarify their specific monitoring requirements and data formats, while supporting the DWS with data handling and ensuring their systems are prepared to effectively receive incoming groundwater data. There should also be an inclusion of DWS monitoring requirements in groundwater policy and bylaws. Moreover, WSI agreements should also include groundwater monitoring requirements (0-12 months).
Priority	High

6.3.3.5 Summary

Data acquisition and management are among the foundational pillars of effective groundwater management. This section recommends priority actions to strengthen data acquisition and management in Cape Town. Some of these proposed actions align with those proposed in the Groundwater Management Framework of Cape Town. These include:

- An expansion of the Table Mountain Water Source Partnership’s citizen science initiative to generate cost-effective groundwater data and improve monitoring coverage across the city.
- An expansion of the current monitoring network to achieve a more holistic and integrated monitoring strategy that brings together monitoring efforts across the city to ensure the sufficient spatial distribution of monitoring points and standardisation of data formats.
- The development of an effective groundwater monitoring database and ensuring a feedback loop to inform governance and management, which involves collaboration between the CCT and DWS to establish a streamlined process to standardise, consolidate, and store data in usable formats.
- Monitoring of groundwater levels and volume data by groundwater users to address abstraction volumes and groundwater level data gaps that currently exist.

6.3.4 Outreach and Education

6.3.4.1 Aquifer Park

The Cape Flats Conservation Park is currently in its design phase with the intention to serve as an educational and community outreach resource, to raise awareness and public knowledge on biodiversity, ecology, and how these systems are linked to the underlying CFA. This project would, in effect, bring together different programmes to educate communities on how these different elements and mechanisms are interlinked. It plans to build a wetland (LUW) with the functions of Green Infrastructure next to a WWTW. Combining these programmes will demonstrate how these mechanisms operate in conjunction with each other to the benefit of ecosystems, the underlying groundwater, and ultimately offer an opportunity to educate communities on ecology, biodiversity, GDEs, groundwater and the role of the CCT in the management of these systems. This action, through education and awareness, addresses the issue of sustainable groundwater use and protection through behaviour changes and stewardship. The success of this plan is highly dependent on community participation and ongoing engagement to sustain education and awareness efforts through this initiative.

Table 6-23 Implementation details for the development of an aquifer park.

Category	Description
Implementing Organisations	CCT-Bulk Water Branch, Communications and Partnership Branch; National DWS
Budget Class	High
Activities and Timelines	<ul style="list-style-type: none"> • Feasibility and environmental approvals (0-12 months); • Construction and development of park (1-3 years); • Programme integration and commissioning (3-5 years).
Priority	Low

6.3.4.2 Groundwater Training and Education – Trilingual Public Campaign

The development and implementation of a citywide behaviour-change campaign aimed at raising awareness on the importance of good groundwater practices, which promote aquifer protection from contamination and over-abstraction, delivered in English, Afrikaans and isiXhosa, is recommended.

The campaign can use accessible communication tools, such as:

- A3 infographics for distribution at civic facilities, schools, and community centres.
- Short explainer video clips for social media and public transport platforms.
- A comprehensive FAQ document addressing common groundwater use questions.
- A dedicated micro-site guiding safe abstraction practices, aquifer protection zones, and procedures for reporting spills and contamination incidents.

Priority areas should include the CFA (e.g., Philippi, Mitchells Plain, Khayelitsha) and Atlantis protection zones and suburbs along the Table Mountain Group foothill that have a large reliance on groundwater, particularly springs (e.g. Newlands, Constantia, Bishops Court), as well as other locations such as transport hubs and civic facilities. The success of this plan depends on strong community engagement and ensuring that the campaign reaches and resonates with audiences in priority areas across all three languages.

Table 6-24 Implementation details for a groundwater training and education campaign.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Communications and Partnership Branch, HR Business Partner Branch, Disaster Risk Management (DRM); NGOs
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Development of Info packs and launch of campaigns (0-12 months); • Seasonal refresher campaigns (1-3 years); • Integration into the annual water week (3-5 years).
Priority	High

6.3.4.3 Schools Water Clubs & Youth Ambassadors

This action plan recommends the rollout of an interactive education and stewardship programme for schools with activities designed to build awareness on groundwater protection and practical conservation behaviours. This initiative could be a critical entry point for shaping long-term behaviour changes in communities and households. It promotes the culture of water conservation and protection from an early age.

Core components can include:

- A starter kit with educational materials and simple groundwater experiments (e.g., infiltration tests, water quality demonstrations).
- Leak-hunt campaigns on school grounds to identify and fix water wastage.
- Tree planting and aftercare to demonstrate links between vegetation, infiltration, and aquifer recharge.
- An annual citywide challenge to showcase school initiatives, encourage peer learning, and recognise best practices.

This initiative can be targeted towards learners of all age groups, with tailored activities for different grades, government bodies and facility managers responsible for day-to-day water and infrastructure maintenance at schools. Target areas can include schools within the key aquifer areas and those within informal settlements where awareness and stewardship can benefit the community.

The success of this plan depends on securing adequate resources for programme delivery, strong collaboration with schools and education authorities, and sustained participation from learners, teachers and facility managers to ensure that stewardship activities are implemented and maintained over time.

Table 6-25 Implementation details for school water clubs & youth ambassador programmes.

Category	Description
Implementing Organisation/s	CCT - Communications and Partnership Branch, Environmental Management Department; Western Cape Education Department; NGOs
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Launch of school campaigns (0-12 months); • Establishment of clubs throughout priority areas (1-3 years); • Embedding groundwater awareness into the school curriculum and establishment of partnerships with sponsors (3-5 years).
Priority	Low

6.3.4.4 Seasonal Risk Alerts (Floods, Droughts, Heatwaves)

Climate-related risks such as flooding, drought, contamination and heatwaves pose growing threats to Cape Town’s communities, infrastructure and water security. Vulnerable communities are often most affected, yet the least informed. The development and implementation of a citywide early warning and seasonal risk alert system using pre-templated alerts delivered in English, Afrikaans and isiXhosa is recommended for timely communication on:

- Flood risks and safety measures.
- Water contamination alerts.

- Drought stages and water-use restrictions.
- Heat-health warnings and protective actions.

Alerts targeted at all Cape Town residents, with special focus on vulnerable areas such as informal settlements with limited coping capacity, can be disseminated through multiple accessible channels, including community radio, WhatsApp groups, ward councillor channels, and loud-hailing in high-risk areas. This would support faster, more coordinated communication of seasonal risks across the city.

During drought periods, residents can be informed that dedicated community boreholes and springs are available as relief measures. Proactive communication ensures that all citizens, particularly the most vulnerable, are aware, ahead of restrictions or severe drought conditions, of where they can access groundwater for emergency water supply. Such proactive communication will improve the coping capacity of residents across the city.

The success of this plan depends on good coordination across CCT departments, reliable communication channels, and effective outreach so that alerts are delivered and understood by all residents, especially in vulnerable communities and in all three languages.

Table 6-26 Implementation details for a seasonal risk alert system.

Category	Description
Implementing Organisations	CCT- Disaster Risk Management Centre, Communications and Partnership Branch; national DWS
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Development of templates (0-12 months); • Development of automated triggers (1-3 years); • Integration with Monitoring Evaluation Report dashboards (3-5 years).
Priority	Low

6.3.4.5 Protection Zone Compliance Campaign

Human activities within groundwater protection zones can pose significant risks to groundwater quality if not properly managed. To minimise these risks, comprehensive awareness and capacity-building campaigns should target all users living, working or operating within sensitive protection areas. These campaigns can provide practical guidance on good environmental and operational practices, including the correct use and maintenance of separators, ensuring underground storage tank (UST) integrity, implementing stormwater best management practices (BMPs), and safe handling, storage and disposal of waste and hazardous materials.

While all user groups should be engaged, industry-focused workshops remain essential in areas where high-risk activities are concentrated to limit groundwater contamination. These sessions can offer tailored training for managers, technicians and operators at industrial and commercial premises, supported by compliance checklists, visual guidance materials and on-site signage to reinforce correct practices. Priority areas may include Philippi North, Atlantis, Epping, Montague Gardens and Bellville South, where industrial activities are prominent within groundwater-sensitive zones.

The success of this plan depends on strong participation from businesses and residents in protection zones, effective delivery of training and awareness materials, and ongoing follow-up by the City to reinforce good practices and ensure that high-risk activities adopt the required safeguards.

Table 6-27 Implementation details for a protection zone compliance campaign.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch and Communications and Partnership Branch; national DWS
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Mapping and site visits (0-12 months); • Expansion to a quarterly outreach wave (1-3 years); • Annual relicensing checks (3-5 years).
Priority	High

6.3.4.6 Municipal Training on Groundwater and Waste Sensitive Urban Design

This action plan involves the development and implementation of a groundwater management and WSUD modular training course, which includes classroom and field sessions. This training would cover topics such as aquifer systems, protection zones, monitoring methods, spill response, WSUD operations and maintenance and risk communication. The target audience for this training can include individuals from the Department of Water and Sanitation Reticulation and Treatment team, the Solid Waste and Stormwater Management branch of the City of Cape Town Municipality and other relevant stakeholders.

As groundwater increasingly becomes part of Cape Town’s water supply mix, effective management, which requires cross-departmental capacity and technical knowledge, is essential. This training is aimed at building shared understanding and practical skills across departments, enabling integrated approaches to water security, compliance and risk reduction. It also supports the City’s vision of transitioning into a water-sensitive city by including WSUD in day-to-day municipal operations.

The success of this plan depends on strong participation from all relevant CCT departments and sustained cross-departmental collaboration to ensure that the skills gained are applied consistently in day-to-day groundwater and WSUD management.

Table 6-28 Implementation details for municipal training on groundwater and WSUD.

Category	Description
Implementing Organisations	CCT-HR Business Partner Branch and Bulk Water Branch
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Training of first cohort of 50 staff members (0-12 months); • Training of 300 staff across departments (1-3 years); • Implementation of annual refresher courses (3-5 years).
Priority	Medium

6.3.4.7 Train-the-Trainer and Expanded Public Works Programme (EPWP) Wellfield Maintenance

Wellfield and WSUD infrastructure require regular maintenance to remain effective, yet CCT's resources are limited. Empowering EPWP teams and community-based organisations (CBOs) with targeted training creates local capacity for ongoing upkeep, while generating employment opportunities. This approach strengthens groundwater protection, ensures that recharge and monitoring sites remain functional, and fosters a culture of stewardship by embedding maintenance skills within local communities.

To achieve this, the CCT can develop a train-the-trainer programme to build the capacity of EPWP teams for wellfield and WSUD asset maintenance. Training will cover routine tasks such as litter and oil-trap cleaning, basic field measurements (e.g., groundwater level and electrical conductivity readings), upkeep of environmental signage, and hazard identification and reporting. Selected EPWP members will be trained as peer-trainers to ensure continuity and scalability of skills across teams. Target areas can include WSUD and green infrastructure sites in key recharge areas and production and monitoring borehole zones across municipal wellfields.

Empowering EPWP teams and community-based organisations to support wellfield and WSUD maintenance directly enhances the protection and functioning of groundwater systems. The success of this plan depends on sustained funding for training and EPWP participation, strong coordination between CCT departments and local organisations, and consistent implementation of maintenance tasks to ensure that wellfield and WSUD infrastructure remains functional over time.

Table 6-29 Implementation details for a train-the trainer and EPWP programme.

Category	Description
Implementing Organisations	CCT- Auxiliary Branch, HR Business Partner Branch
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Training of 4 EPWP teams (0-12 months); • Citywide rotation of the training programme (1-3 years); • Shift from ad hoc EPWP work to multi-year SLAs that ensure consistent, long-term maintenance of Water Sensitive Urban Design sites (3-5 years).
Priority	Medium

6.3.4.8 Integration of groundwater and environmental-focused topics in the induction training programme of ward councillors

During the validation workshop, stakeholders highlighted the limited groundwater and environmental knowledge among ward councillors, emphasising the need to strengthen their training in this regard. To address this gap, it was recommended that groundwater and environmental-focused topics be integrated into the induction training programme for ward councillors, together with a parallel plain-language public short course on groundwater that uses relatable everyday examples. This initiative could be built on from the WRC-funded training program on groundwater management developed specifically for municipal officials by the University of the Free State, which has yet to be implemented.

Better-informed councillors are more capable of recognising groundwater risks, supporting appropriate land-use decisions, communicating issues to communities, and advocating for necessary interventions. Increased public understanding also reduces behaviours that contribute to

contamination or over-abstraction. The success of this plan depends on successfully integrating groundwater and environmental content into councillor training programmes, securing participation from ward councillors, and providing accessible public courses that effectively build understanding and encourage behaviour change.

Table 6-30 Implementation details for the integration of groundwater and environmental topics in the induction training of ward councillors.

Category	Description
Implementing Organisations	CCT – DWS and EMD; University of the Free State
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Integration of environmental topics into the WRC-funded groundwater training program and programme roll-out (0-12 months); • Implementation of annual refresher courses (3-5 years)
Priority	Low

6.3.4.9 The training and incentivising of drilling companies to become groundwater ambassadors

During the validation workshop, stakeholders highlighted a missed opportunity to educate and incentivise drilling companies to become groundwater ambassadors, given their role as the first point of contact for individuals or businesses developing boreholes. By equipping them with training and incentives, drilling companies can help raise awareness and support compliance by informing their clients about the need for borehole registration and the registration of groundwater use. Such initiatives would also promote best drilling and borehole construction practices, encourage the submission of groundwater data collected during drilling and testing, ultimately reducing the number of unregistered boreholes and unmanaged abstractions. In addition, improved construction would also reduce the risk of aquifer contamination from poorly constructed boreholes. The success of this plan depends on securing the participation of drilling companies, providing effective training and incentives, and ensuring that drillers consistently promote registration, good construction practices and data submission to support compliant and sustainable groundwater use.

Table 6-31 Implementation details for the training and incentivising of drilling companies to become groundwater ambassadors.

Category	Description
Implementing Organisations	CCT- Bulk Water Branch and HR Business Partner Branch
Budget Class	Low
Activities and Timelines	<ul style="list-style-type: none"> • Development of training material and launch with 5- 10 drillers (0-12months); • Expanding to all registered drilling companies (1-3 years); • Implementation of refresher courses (3-5 years).
Priority	Low

6.3.4.10 Summary

This section recommends a number of outreach and education actions aimed at building public awareness and education, improving groundwater stewardship, and strengthening community and institutional capacity in Cape Town. Key actions include:

- Developing an Aquifer Park as an education and outreach community resource, to raise awareness and public knowledge on biodiversity, ecology, and how these systems are linked to the underlying aquifer.
- Launching a citywide groundwater training campaign delivered in English, Afrikaans, and isiXhosa aimed at raising awareness on the importance of good groundwater practices, which promote aquifer protection from contamination and over-abstraction.
- The rollout of School Water Clubs and Youth Ambassador programmes to instil conservation behaviours and community stewardship around the issue of groundwater protection from an early age.
- The development and implementation of a citywide early warning and seasonal risk alert system using pre-templated alerts delivered in English, Afrikaans and isiXhosa for timely communication on climate-related risks such as flooding, drought, contamination and heatwaves.
- The development and implementation of a Protection-Zone Compliance Campaign that provides tools, guidance and support to reduce groundwater contamination risks from human activities within groundwater protection zones.
- The development and implementation of a groundwater management and WSUD modular training course, which includes classroom and field sessions, covering topics such as aquifer systems, protection zones, monitoring methods, spill response, WSUD operations and maintenance and risk communication.
- The Introduction of a train-the-trainer programme for EPWP teams, enabling the local maintenance of wellfields and WSUD assets while creating jobs.
- The integration of groundwater and environmental-focused topics in the induction training programme of ward councillors, together with a parallel plain-language public short course on groundwater that uses relatable everyday examples to improve groundwater awareness among ward councillors and the general public.
- The training and incentivising of drilling companies to become groundwater ambassadors that raise awareness and support compliance by informing their clients about the need for borehole registration and the registration of groundwater use.

6.3.5 Cross-Cutting Action Plans

Many of the above action plans relate to more than one category and can be considered cross-cutting. A good example of this is the management of springs within the city and their importance for the conjunctive management strategy, as this requires coordinated action across all four categories outlined above. Currently, there is little to no monitoring data available, governance mechanisms are weak, and public awareness around spring protection and sustainable use remains limited. Addressing this issue requires better governance structures, the integration of spring management into urban planning, improved data collection and management and dedicated community outreach. The following section presents action plans for governance, urban planning, monitoring, outreach and education with springs as a central theme.

6.3.5.1 Urban Planning: Protection of Springs

The management of springs has often been an underrepresented component of groundwater management on a national and local level. In 2004, the DWAF published the Groundwater Protection Guidelines for Protecting Springs, while on a local level, springs have not received the same level of attention. Cape Town has numerous springs found throughout its municipal boundary, and they were considered vital sources of freshwater for those in need during the “Day Zero” drought. These resources also regularly maintain many of the city’s GDEs. Given the role these resources play in the coping capacity of citizens in Cape Town, their protection should be prioritised.

To achieve this prioritisation, the Spatial Development Framework should include explicit measures to protect springs from contamination and over-utilisation, both of which can compromise their water quality and discharge volumes. This requires the protection of recharge zones upstream as well as intermediate zones that lead to their discharge points. Additionally, springs should also be incorporated into the implementation framework of the LUWs programme and brought under the CCTs Water By-law to ensure they are not over-exploited or contaminated before reaching users. Protecting springs offers an additional layer of water resource diversification, enhances user coping capacity, reduces risks of groundwater contamination and over-abstraction, and strengthens the City’s resilience to climate change and water scarcity.

The success of this plan depends on integrating spring protection into the City’s Spatial Development Framework, ensuring alignment with the Liveable Urban Waterways Programme, and enforcing protective measures through the CCT Water By-law to prevent over-use and contamination of springs and their recharge zones.

Table 6-32 Implementation details for the protection of springs.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Catchment, Stormwater, and River Management Branch, Communications and Partnerships Branch, Environmental Planning and Sustainability Branch, and District Planning and Mechanisms, DEA&DP
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> Foundation and delineation of protection zones (1- 2 years); Integration into planning instruments and policies, and implementation through the onboarding of planners, engineers and permit officers (2–3 years).
Priority	High

6.3.5.2 Data and Management: Monitoring of Springs

The monitoring of springs is another underrepresented aspect of groundwater monitoring on both a national and local level. Springs provide an alternative point of access to groundwater that is generally available to the broader public. The monitoring of these resources in Cape Town is not included in any plans, policies, frameworks or strategies, even though springs are found throughout Cape Town, and have been a major source of relief to communities during times of drought, strengthening the City’s resilience to climate change. The dependency of GDEs on springs further warrants the need for their monitoring.

Through assessments and the regular monitoring of the quality and quantity of known springs, such as those that occur along the Peninsula mountain chain and Hottentot Hollands mountains, valuable information on aquifer health and the sustainability of current or potential spring use can be generated. Long-term data would also enable their integration into the City’s early warning systems by revealing signs of declining baseflows and shifting recharge patterns due to changing rainfall conditions.

The success of this plan depends on establishing a formal spring monitoring programme, securing the resources needed for regular sampling, and ensuring that collected data is integrated into groundwater assessments and early warning systems to inform proactive management.

Table 6-33 Implementation details for the monitoring of springs.

Category	Description
Implementing Organisations	CCT - Bulk Water Branch, Scientific Services Branch, Disaster Risk Management Centre
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Identification and mapping of priority springs for monitoring (0-12 months); • Implementation of routine monitoring (flow, quality) and Installation of protective structures (fences, signage and drainage) at high-risk springs (1-3 years); • Integration of springs into GPZ and Municipal Spatial Development Framework (MSDF) (3-5 years).
Priority	High

6.3.5.3 Outreach and Education: Awareness of Springs

Spring protection can be supported not only through spatial planning and urban development measures, but also through outreach and education aimed at the communities that rely on them. Consistent, long-term awareness and education programmes can build the public understanding of springs, increasing awareness of their value and the benefits they provide. The improved knowledge of spring locations enhances community adaptive capacity, while the awareness of their ecological role and appropriate use helps to reduce the risk of over-exploitation and contamination.

Understanding how their actions can negatively impact spring resources fosters a sense of ownership and stewardship among communities, motivating them to adopt water-saving practices, protect recharge areas and support sustainable policies. Linking public awareness and education with the monitoring and protection of springs represents a cross-cutting approach to groundwater management. Together, these efforts provide communities with the knowledge and tools needed to understand their influence on groundwater resources and the broader environmental consequences of over-exploitation.

Targeted campaigns focused on springs along the Peninsula mountain chain and the Hottentots Holland mountains can strengthen public awareness and education on these systems. Such grassroots engagements can serve as an effective tool for building resilience to climate change and water scarcity. The success of this plan depends on sustained community engagement, consistent long-term education efforts, and close coordination between the CCT and local communities to ensure awareness translates into stewardship, reduced misuse, and stronger protection of spring and recharge areas.

Table 6-34 Implementation details for raising awareness on springs.

Category	Description
Implementing Organisations	CCT - DWS Communications and Partnerships Branch, Civil and Private - WWF, Table Mountain Water Source Partnership.
Budget Class	Medium
Activities and Timelines	<ul style="list-style-type: none"> • Designing of info packs and launching of spring awareness campaigns in high-risk areas (0-12 months); • Integration of spring awareness into citywide groundwater and WSUD campaigns (1-3 years); • Establishment of ongoing spring stewardship (3-5 years).
Priority	High

6.3.5.4 Summary

This section recommends the following crosscutting action plans aimed at improving the management of springs. These include:

- The protection of springs through urban planning, which involves the inclusion of explicit measures to protect springs from contamination and over-utilisation in the Spatial Development Framework.
- The improved monitoring of springs to generate valuable data on aquifer health, assess the sustainability of spring use, and support early warning systems by detecting declining baseflows and changing recharge patterns.
- Raising awareness on the importance of springs through targeted outreach and education programmes that build public understanding, increase recognition of their value, and promote their protection among the communities that rely on them.

7 Conclusion

To achieve the objectives of this strategic action plan for conjunctive management in Cape Town, a top-down approach was adopted. The process began with a critical review of the City's overarching strategies, including the Water Strategy, Resilience Strategy, Climate Change Strategy and Environmental Strategy. These strategies were largely formulated in response to the 2015-2018 drought crisis and to support Cape Town's vision of transitioning into a water-sensitive city by 2040.

Relevant policies were then reviewed as the first layer of implementation, providing guiding principles that shape the overall approach of each strategy. Associated bylaws, which translate these principles into enforceable legal rules and standards, were also discussed. Finally, plans, frameworks and programmes implemented to support each of the overarching strategies were assessed, with attention given to their effectiveness and spatial coverage in the city. This review identified several gaps, which informed the formulation of targeted action plans.

Using this approach, action plans were developed across four main categories: improved governance, urban planning, data acquisition and management, and outreach and education. The management and protection of springs, an area that cuts across all four categories, has been highlighted as a dedicated cross-cutting theme to illustrate the need for an integrated and holistic approach. Within each category, action plan recommendations were formulated, including those from the Draft Groundwater Framework for Cape Town, noting where initiatives are already underway, where expansion opportunities exist, and where critical gaps remain.

For each action plan, detailed implementation requirements were specified, including the rationale, objectives, strategic alignment, dependencies, priority areas, implementing organisations, budget class, timelines and priority level, to support the effective and coordinated execution of the proposed action plans.

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Appendix A - Legislation and Regulations

Appendix A.1: Water Related Legislation and Governance

A.1.1 National Water Act

The National Water Act (NWA), Act 36 of 1998, is the primary legal framework for water resource management in South Africa (Government of South Africa, 1998; WRC, 2011). It governs water resources, including rivers, streams, dams, and groundwater and mandates an Integrated Water Resource Management (IWRM) approach to ensure the consideration of all aspects of water resource management. The Act provides the legal framework for protecting, using, developing, conserving, managing, and controlling South Africa's water resources. The National Water Resources Strategy (NWRS) is the legal instrument for implementing and operationalising the National Water Act (NWA) (Act 36 of 1998).

The purpose of the National Water Act is to:

- a) Meet the basic human needs of present and future generations
- b) Promote equitable access to water
- c) Redress the results of past racial and gender discrimination
- d) Promote the efficient, sustainable, and beneficial use of water in the public interest
- e) Facilitate social and economic development
- f) Provide for the growing demand for water use
- g) Protect aquatic and associated ecosystems and their biological diversity
- h) Reduce and prevent pollution and degradation of water resources
- i) Meet international obligations
- j) Promote dam safety
- k) Manage floods and droughts

The Act also redefines water as a unified national resource under the custodianship of the national government, replacing the previous system in which landowners of a property owned the rights to the underlying groundwater on their property and could abstract it with little to no regulations (WRC, 2014). This transition from previous groundwater legislation has led to vast improvements in groundwater management, protection and distribution (National Groundwater Strategy, 2016).

Chapter 14 of the NWA outlines the laws and requirements around the monitoring of water resources (what data is to be collected) and the management of collected data (storage and availability of data). The act mandates the establishment of national monitoring systems that collect data and information necessary to assess:

- The quantity of water in the various water resources;
- The quality of water resources;
- The use of water resources;
- The rehabilitation of water resources and compliance with resource quality;
- The health of aquatic ecosystems; and
- Atmospheric conditions that may influence water resources.

According to the Act, collected datasets must be stored in national information systems (e.g., Hydrological Data Management System - Hydstra, National Groundwater Archive - NGA, Water Management System - WMS and Water Authorisation and Registration Management System - WARMS) designed to support the protection, sustainable use, and management of water resources. These systems also serve to facilitate the development and implementation of the national water strategy and to provide data access for water management institutions, water users, and the public (Government of South Africa, 1998).

Groundwater Use Authorisation and Registration

Once put in place, the NWA (No. 36 of 1998) mandated the registration of groundwater use for the improved management of groundwater resources. This information is stored on the departmental Water Use Authorisation and Registration Management System (WARMS) national register (defined in terms of Section 139 (2) (d)). The national register is used to facilitate fair economic growth, development, and democracy within South Africa.

The NWA (No. 36 of 1998) stipulates that any water use requires authorisation from the Department of Water and Sanitation (DWS) or its appointed regulator (for example, a catchment management agency (CMA) such as the Breede-Olifants CMA for the City of Cape Town). This is to ensure that relevant groundwater data is collected and stored on the national databases to enable the DWS or appointed regulator to make effective decisions regarding the current state and future allocation/distribution of groundwater.

Groundwater authorisation is divided into three categories based on the type of groundwater use and associated volumes: Schedule 1 Use (as defined under Schedule 1 of the NWA), General Authorisation (GA), and Water Use Licenses (WULs):

- Schedule 1 water use is defined as a reasonable domestic use that does not exceed 10m³/day and includes use for garden irrigation or potable water if outside an urban area on a farm with no water service provision.
- General Authorisation (GA) are considered based on the GA volumes specific to property size and quaternary catchment allocations provided this volume does not exceed 40 000 m³/a
- Water Use Licenses (WULs) are required if a GA volume exceeds 40 000 m³/a or if water use is 500m from a delineated boundary edge of a wetland/estuary; within 100m of a delineated watercourse riparian edge or state dam; or within 500m of a state dam or highwater mark of the ocean. Moreover if a water use is in an alluvial aquifer connected directly to a stream or river, or the quaternary catchment volume allocation is equal to 0.

Schedule 1 water users are not required to register with the DWS, therefore, registration is often lacking, resulting in data gaps, particularly in terms of groundwater abstraction volumes and the extent of groundwater users. Additionally, illegal groundwater use, which can be prompted by backlogs and delays in WUL applications, can also result in such gaps, as only 20% of groundwater use is verified in South Africa (DWS, 2016). Information on groundwater abstraction volumes and the extent of groundwater users in Cape Town is vital in determining the dependency of groundwater in the city and the vulnerability of the groundwater resources to over-abstraction.

The different types of water use that require authorisation are defined in Section 21 of the NWA, as highlighted in the box below.

21. For the purposes of this Act, water use includes -

- (a) taking water from a water resource;
- (b) storing water;
- (c) impeding or diverting the flow of water in a watercourse;
- (d) engaging in a stream flow reduction activity contemplated in Section 36;
- (e) engaging in a controlled activity identified as such in Section 37(1) or declared under Section 38(1);
- (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- (g) disposing of waste in a manner which may detrimentally impact on a water resource;
- (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- (i) altering the bed, banks, course or characteristics of a watercourse;
- (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- (k) using water for recreational purposes.

A.1.2 Water Services Act

The Water Services Act, Act 108 of 1997, deals mainly with water services or potable (drinkable) water and sanitation services supplied by municipalities to households and other municipal water users. It contains rules about how municipalities should provide water supply and sanitation services. The Act defines the municipal functions of ensuring water services provision and sets out guidelines for Water Services Authorities (WSA) as well as Water Services Providers (WSP).

The Water Services Act sets out the conditions under which a WSP can operate, whereby paragraph 11 describes the duties of the WSA. The roles and responsibilities of the WSA and WSP in terms of water resource management are not explicitly stated, but can be inferred from their different roles in the provision of water services.

A.1.3 Drinking Water Standard: SANS 241

The South African National Standard for drinking water (SANS 241:2015) defines the acceptable quality of drinking water in South Africa in terms of microbiological, physical, aesthetic and chemical determinands (SANS 241, 2015). These standards serve as the benchmark for drinking water under the Water Services Act (Act 108 of 1997) and the National Health Act (Act 61 of 2003), ensuring the protection of public health by setting criteria that all water service institutions and providers should meet. Water that complies with this criterion is deemed fit and safe for lifetime consumption.

All water service institutions and providers are legally required to ensure that the water they supply to the public complies with the numerical limits specified in the standard. To achieve this, they must implement water quality monitoring programmes that conduct routine water quality monitoring and risk assessments to identify potential hazards (e.g., contamination risks) in the water supply system. Such proactive monitoring and hazard identification enable early detection of water quality issues and allows for the early implementation of interventions and mitigation measures.

SANS 241 specifies drinking water quality in terms of four categories:

- Microbiological determinants: should be undetectable in water (e.g., *E. coli* and faecal coliforms) and can indicate acute health risk if present at high concentrations. The presence of *E. coli* and faecal coliforms in water indicates recent faecal pollution.
- Physical and Aesthetic determinants: These parameters relate to acceptability for consumers and operational performance and include colour, taste, odour, turbidity, pH, total dissolved solids, conductivity, etc.
- Chemical determinants: These address chronic health risks from long-term exposure and include parameters such as fluoride, nitrate, nitrite, sulphate, chloride, arsenic, lead, etc.
- Operational determinants: These parameters ensure treatment systems and distribution networks function properly and include turbidity and disinfection residual, etc.

The risk posed by these determinants is classified as follows in the Standard:

- Acute health: determinants that poses an immediate unacceptable health risk if present at concentrations exceeding the numerical limits of the standard.
- Aesthetic: determinant that taints water with respect to taste, odour, and colour, but does not pose an unacceptable health risk if present at concentrations exceeding the stipulated limits of SANS 241.
- Chronic health: determinant that pose unacceptable health risks if ingested over an extended period of time, if present at concentrations exceeding the numerical limits specified by the standard.
- Operational: determinant that is essential for assessing the efficient operation of systems and risks to infrastructure.

Appendix A.2: Environmental Related Legislation and Governance

A.2.1 National Environmental Management Act (Act 107 of 1998 as amended by Act 62 of 2008)

The National Environmental Management Act of 2008 (NEMA), outlines measures that "...prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Of particular relevance to this groundwater dependency report is Chapter 1(4r), which states that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems, require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Section 24 of NEMA requires that the potential impact on the environment, socio-economic conditions and cultural heritage of activities that require authorisation or permission by law, must be considered, investigated and assessed prior to implementation and reported to the relevant regulatory authority.

A.2.2 National Environmental Management: Biodiversity Act (Act 10 of 2004)

The purpose of the National Environmental Management: Biodiversity Act 10 of 2004 is to provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act of 1998. The focus of this act also includes:

- The protection of species and ecosystems that warrant national protection;
- The sustainable use of indigenous biological resources;
- The fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources;
- The establishment and functions of a South African National Biodiversity Institute.

A.2.3 National Environmental Management: Waste Act (2008)

The overarching purpose of the National Environmental Management: Waste Act (2008) is to reform the law regulating waste management in order to protect health and the environment. It aims to achieve this by providing a systemic legal framework for the entire waste management cycle, which is both systematic and modern. At its core, it attempts to minimise the generation of waste, reduce the negative impacts of waste on human health and the environment, and promote the sustainable use of resources through integrated waste management. To achieve its aims, the act sets out several key objectives:

- To minimise waste: Give effect to the waste hierarchy, prioritising avoidance, reduction, reuse, recycling and recovery.
- To ensure effective delivery of waste services: Ensure that waste management services are delivered in an efficient, effective and sustainable manner.
- To remediate contaminated land: Provide for the remediation of contaminated land and the rehabilitation of polluted environments.
- To hold polluters accountable: Implement the "polluter pays" principle, making those who generate waste responsible for the costs of managing its environmental impacts.

- To establish a national waste information system: Provide for a national system for storing and accessing information on waste generation and management, which is critical for planning and monitoring.
- To regulate and license activities: Provide for a system of waste licensing and permits for activities that have a significant impact on the environment.
- To combat illegal dumping: Provide for measures to combat illegal dumping and littering.
- To manage hazardous waste: Provide for specific and stringent controls for the management of hazardous waste.
- To promote product responsibility: Encourage manufacturers and importers to take responsibility for their products throughout their life cycle, including once they become waste.

A.2.4 National Environmental Management: Integrated Coastal Management Act (2008)

The primary purpose of the National Environmental Management: Integrated Coastal Management Act (NEM:ICMA) is to establish a uniform, holistic and integrated system for the management of South Africa's coastal region. The act has several key focal areas that emphasise integrated coastal management. These include defining and protecting coastal zones, managing specific coastal activities, adapting to climate change, integration across all spheres of governance, and promoting ecosystem-based management that focuses on the coast as a dynamic system rather than separate pieces of land. The aim of the NEM:ICMA is ultimately to ensure the health of the coastal environment by establishing a system of integrated coastal and estuarine management. To achieve this aim, the act sets out several key objectives:

- To provide public access: Guarantee the public's right to access and enjoy the coastal zone, including creating and protecting coastal accessways.
- To protect coastal property: Declaring coastal public property and safeguarding it from inappropriate development and privatisation.
- To protect coastal ecosystems: Conserving, protecting and restoring the coastal environment and its natural processes and ecosystems.
- To promote sustainable development: Ensuring that economic and social development in the coastal zone is ecologically sustainable.
- To rehabilitate and remediate: Providing for the remediation of degraded coastal areas and the rehabilitation of natural habitats.
- To manage estuaries: Providing for the specific protection and management of estuaries.
- To establish setback lines: Allowing for the declaration of coastal setback lines to restrict development of areas vulnerable to coastal processes and climate change impacts.
- To involve the public and communities: Involving communities and other stakeholders in coastal management decision-making processes.
- To give effect to South Africa's international obligations: implementing relevant international agreements.

A.2.5 Spatial Planning and Land Use Management Act (SPLUMA), 2013 (Act 16 of 2013)

SPLUMA is a key legislative tool for guiding land use at the municipal level, and it embeds the principle of environmental sustainability into spatial planning. This is highly relevant to groundwater resilience, as land use decisions directly affect aquifer recharge and contamination risk. Through mechanisms like Spatial Development Frameworks (SDFs) and zoning schemes, local governments can protect critical groundwater areas, for instance, by controlling development on natural recharge zones, delineating wellfield protection areas, and safeguarding GDEs with buffer zones. Protecting recharge areas is vital because urbanisation or impermeable surfaces can greatly diminish infiltration and natural groundwater replenishment (Fourie et al., 2020). Likewise, certain land uses (industrial, waste disposal, mining) can pollute aquifers if not appropriately sited or regulated. SPLUMA provides the mandate for municipalities to include environmental considerations in their SDFs and land use schemes, ensuring that important aquifers and recharge zones are identified and receive special land use management status (RSA, 2013). In practice, this means a municipality can declare a “groundwater protection zone” in its zoning plan, where land uses that pose pollution threats are restricted (Viljoen & Bosman, 2022). By integrating such controls, spatial planning under SPLUMA becomes a preventative measure for groundwater management – complementing water laws by managing activities on the land surface that impact subsurface water (Nel et al., 2009). Notably, researchers have highlighted that land-use planning is an underused tool in South African water governance, and recommend the formal adoption of aquifer protection zoning to build climate resilience (Viljoen & Bosman, 2022). Groundwater offers natural storage that can buffer droughts, but only if recharge areas are preserved and the resource is kept free from contamination; SPLUMA-oriented planning is therefore crucial to long-term groundwater sustainability (Viljoen & Bosman, 2022).

Municipal obligations and groundwater alignment:

Under SPLUMA, municipal SDFs must map environmentally sensitive areas and guide land use accordingly. Many municipalities now incorporate groundwater data (e.g. aquifer vulnerability maps or strategic water source areas) into their SDFs and environmental management overlays (Fourie et al., 2020). For example, dolomitic areas with high infiltration capacity are often classified as conservation or limited development zones, since *“dolomitic areas are also favourable for groundwater recharge and should be avoided by development at all costs”* Likewise, buffers around springs, wetlands, or known GDEs can be set in planning schemes to protect those ecosystems and the underlying water table. SPLUMA’s regulations enable the use of overlay zones in municipal planning – a technique where an extra layer of restrictions is superimposed on base zoning for areas needing special protection (RSA, 2013). In the context of groundwater, an overlay could stipulate conditions such as maximum impervious surface percentage, mandatory sustainable drainage (to enhance infiltration), or prohibition of hazardous land uses within a certain radius of a wellfield (Viljoen & Bosman, 2022). The City of Cape Town, for instance, has implemented groundwater protection zones in its Municipal Planning By-law, restricting high-risk activities above its primary aquifers and requiring environmental assessment for developments in those zones (CCT, 2022b). These measures echo academic recommendations that *“declaring recharge areas as ‘groundwater protection zones’ and limiting activities in these areas”* would significantly aid groundwater protection. Furthermore, SPLUMA-driven land use conditions can reduce pollution threats: municipalities may require developments to include pollution safeguards (for example, linings for fuel storage tanks or advanced stormwater treatment) if they are located in sensitive aquifer areas (Fourie et al., 2020). By embedding such requirements, local authorities ensure that urban growth or agriculture does not compromise underlying aquifers. In sum, SPLUMA empowers municipalities to use forward-looking spatial planning to bolster the climate resilience of groundwater – preserving natural recharge processes, preventing land-use induced aquifer contamination, and maintaining the ecological buffers (like wetlands) that rely on groundwater. This integration of land use control with water resource protection is increasingly recognised as essential for sustainable groundwater management in South Africa’s changing climate (Viljoen & Bosman, 2022).

Appendix A.3: Climate Change and Spatial Planning Related Legislation

South African municipalities operate within a legal architecture that requires them to assess climate risk, plan adaptations, safeguard wellfields and recharge areas, and report progress. Three statutes are particularly salient at local level: the Climate Change Act, 2024, the Disaster Management Act, 2002, as amended by the Disaster Management Amendment Act, 2015 (Act 16 of 2015) (together with the National Disaster Management Framework, 2023), and SPLUMA, 2013. Read together, they compel municipalities to identify groundwater-relevant hazards (drought, contamination, saline intrusion), mainstream protective measures in planning and budgeting, and activate contingency powers when pre-defined thresholds are crossed (RSA, 2002; RSA, 2005; RSA, 2013; RSA, 2024).

A.3.1 Climate Change Act, 2024 (Act 22 of 2024)

The Climate Change Act establishes a statutory basis for climate-risk and vulnerability assessments and for the preparation of Climate Change Response Implementation Plans (CCRIPs) across spheres of government, supported by national systems for measurement, reporting and verification (MRV) and early warning (RSA, 2024; Wright, 2024). For groundwater, this creates a clear mandate to integrate aquifer considerations into municipal climate planning: municipalities can embed borehole level and water-quality indicators (e.g., conductivity, nitrates) and triggers in CCRIPs and performance systems so that drought demand management, MAR, emergency augmentation, or contamination response measures are automatically activated when thresholds are breached (RSA, 2024; Viljoen & Bosman, 2022). As sectoral adaptation planning under the Act matures (including the water sector), it is expected to guide local groundwater resilience measures and reporting, aligning municipal monitoring with national MRV processes (RSA, 2024; Makaya et al., 2020). Statutory **risk assessment** and **CCRIP** requirements provide the vehicle to mainstream groundwater protection and demand management as adaptation actions, while alignment with **MRV and early warning** enables consistent tracking of groundwater conditions and climate signals to inform staged responses (Baudoin et al., 2017; RSA, 2024; Wright, 2024).

Municipal obligations and groundwater alignment:

Once in force (the Act was assented to in July 2024 but awaits commencement as of late 2024), it will bind municipalities to new climate resilience duties (Wright, 2024). Within one year of the publication of the National Adaptation Strategy, every municipality's mayor is required to conduct a climate change needs and response assessment, producing a spatial map of climate risks and vulnerabilities in their jurisdiction. Based on this, municipalities must prepare Climate Change Response Implementation Plans as components of their integrated development plans (IDPs). These plans should incorporate groundwater considerations, for example, monitoring groundwater levels as climate indicators, setting trigger points for drought response, and including aquifer recharge or water conservation projects as adaptation actions. The Act also calls for improved early warning systems for climate hazards (RSA, 2024: s.20), which can integrate groundwater drought early warnings (e.g. declining water tables) to enable proactive responses. Overall, the Climate Change Act creates an enabling environment for climate-resilient water and groundwater management by making adaptation planning compulsory and aligning it with existing municipal planning processes (Wright, 2024). In future, as sector adaptation plans for water are developed under the Act, these will guide local authorities on sustaining groundwater yield and quality under climate change, consistent with national adaptation objectives (Makaya et al., 2020). By formalising climate risk assessment and response, the Act ensures that groundwater resilience (e.g. maintaining aquifer recharge, preventing over-abstraction in droughts) becomes part of local development strategy, supported by national monitoring and reporting frameworks (Wright, 2024).

A.3.2 Disaster Management Act, 2015 (Act 16 of 2015) and National Disaster Management Framework (2005)

The Disaster Management Act (DMA), as amended (2015), provides an integrated approach to managing risks of natural and human-induced disasters, including those affecting groundwater, such as droughts, contamination incidents (e.g. chemical spills polluting aquifers), and saline intrusion in coastal aquifers. Drought is explicitly recognised as a slow-onset disaster in South Africa’s disaster policy, and the DMA is “the primary legislation dealing with drought conditions” (Makaya et al., 2020). During declared disasters, the DMA provides extraordinary measures to protect water security (e.g., emergency abstraction or restrictions), enhancing climate resilience during extreme events (RSA, 2002; Baudoin et al., 2017).

The Act and the National Disaster Management Framework (NDMF) emphasise proactive disaster risk reduction: municipalities must identify likely disaster scenarios and “place emphasis on measures that reduce the vulnerability of disaster-prone areas, communities and households”. Groundwater shortages due to drought or aquifer contamination events fall into this mandate. The NDMF (2005) calls for risk assessments and early warning systems for hazards, including droughts, enabling at-risk communities to take preventive action. For example, early warning of declining groundwater levels or rainfall deficits can trigger water restrictions or augmentation measures in advance (Baudoin et al., 2017).

Overall, the DMA framework promotes preparedness and resilience: in the context of groundwater, this means ensuring alternative water supply plans (e.g. emergency boreholes or water tankers) and protecting critical aquifers from overuse or pollution that could precipitate a local water disaster (Makaya et al., 2020). Saline intrusion (the inland movement of seawater into coastal aquifers due to over-pumping or sea-level rise) is also viewed as a disaster risk, as it can render groundwater unusable – under the DMA, such slow-developing crises should be monitored and mitigated through risk reduction plans at municipal and provincial levels (Viljoen & Bosman, 2022).

Municipal obligations and groundwater alignment:

The DMA requires every municipality to develop and integrate a Disaster Management Plan into its IDP, including contingency strategies for water-related disasters. This entails assessing the likelihood and impact of droughts and water contamination events locally, designating high-risk communities or wellfields, and outlining response actions. Key elements include early warning dissemination, readiness of relief resources, and “*prompt disaster response and relief; ... the procurement of essential goods and services; ... and the dissemination of information*”. In practical terms, a municipality’s plan might establish trigger levels for dam or aquifer drawdown that signal a looming drought emergency, and detail steps such as drilling emergency boreholes or enforcing water rationing when those triggers are reached (Pietersen and Beekman et al, 2011; Faragher and Carden, 2023). The Act also empowers authorities to declare a state of disaster, which unlocks extraordinary measures. During the Cape Town drought, for example, the Western Cape’s disaster declaration enabled “*the drilling of boreholes... in high-risk areas*” and expedited use of the Table Mountain Group aquifer to avoid “Day Zero”.

Similarly, disaster regulations can impose emergency groundwater abstraction beyond normal license limits or fast-track water trucking to communities (CoGTA, 2017). Conversely, the Act provides for enforcing restrictions: under disaster conditions, municipalities can more rapidly institute stringent water-use limitations or temporarily suspend certain activities (like industrial use of groundwater) to conserve the resource. The NDMF underpins these powers by urging contingency planning for “*emergency procedures in the event of a disaster*”, including allocation of responsibilities and coordination of agencies. Through this act, there are opportunities to include wellfield risk registers, alternative supply routes, and staged restrictions linked to measurable groundwater indicators. In summary, the DMA and its framework ensure that local governments plan ahead for groundwater-related disasters (drought, contamination, saltwater intrusion) with defined early warnings and responses, and grant legal authority to take urgent action to protect life and water security when a crisis occurs (Makaya et al., 2020). This enhances climate resilience by enabling

swift adaptation measures (like emergency water supply or restrictions) in the face of extreme droughts and other water shocks, which are expected to increase with climate change (Baudoin et al., 2017).

Appendix A.4: Provincial Planning Laws

A.4.1 Western Cape Land Use Planning Act, 2014 (Act 3 of 2014)

The Western Cape Land Use Planning Act, 2014 (Act 3 of 2014) was passed to consolidate and modernise the Province's legislation pertaining to land use. It covers provincial, regional, urban and rural planning and development, and supports and monitors municipal planning as well as the regulation of public places and municipal roads created through subdivisions.

The act further aims to:

- Make provision for provincial spatial development frameworks;
- Set minimum standards and ensure the efficient coordination of spatial development frameworks;
- Define minimum norms and standards for effective municipal development management;
- Regulate provincial development management;
- Regulate and manage the effect of land development on agriculture;
- Introduce land use planning principles to guide decision making;
- Repeal outdated laws that no longer align with the constitution or modern planning practices; and
- Provide for additional measures necessary to give effect to the Act.

The Act achieves these aims by creating a structured planning system, with a clearly defined role:

- Municipalities are required to:
 - Manage local land use planning;
 - Adopt and review a single zoning scheme every 10 years;
 - Process land use applications (zoning, subdivision, consent uses, departures);
 - Facilitate public participation in land use planning; and
 - Enforce zoning by-laws and conditions of approval.
- The Province is required to:
 - Develop and maintain the Provincial Spatial Development Framework (PSDF);
 - Approve provincial or cross-boundary land development applications;
 - Decide on appeals against municipal planning decisions;
 - Monitor and support municipalities (guidelines, training, technical assistance); and
 - Ensure alignment with provincial priorities (climate change, housing, energy, biodiversity).

A.4.2 Western Cape Provincial Spatial Development Framework (March 2014)

Policies regarding the protection of biodiversity and ecosystem services in the Western Cape are:

- The Western Cape’s Critical Biodiversity Area (CBA) mapping, together with the draft priority climate change adaption corridors, comprises the spatial extent of the Western Cape’s biodiversity network. This must inform spatial planning and land use management decisions throughout the province.
- Using the latest available CBA mapping as a primary informant, regional, district and municipal SDFs must delineate Spatial Planning Categories (SPCs) that reflect suitable land use activities in the different CBA categories.
- To complement CapeNature’s protected area expansion strategy and their Stewardship programme, SDFs should highlight priority areas outside the protected area network that are critical for the achievement of the province’s conservation targets.
- Policies regarding the management, repair and optimisation of inland water resources are:
 - Given current water deficits, which will be accentuated by climate change, a ‘water-wise’ planning and design approach in the Western Cape’s built environment is to be mainstreamed.
 - Rehabilitation of degraded water systems is a complex inter-disciplinary intervention requiring built environment upgrading (i.e. infrastructure and the built fabric), improved farming practices, as well as the involvement of diverse stakeholders.
 - Introduce and retrofit appropriate levels of water and sanitation systems technologies in informal settlements and formal neighbourhoods with backyard shacks as a priority.
 - An overarching approach to water demand management is to be adopted – firstly, efficiencies must be maximised, storage capacity sustainably optimised and groundwater extraction sustainably optimised, with the last resort option of desalination being explored, if necessary.
 - Protection and rehabilitation of river systems and high-yielding groundwater recharge areas, particularly in areas of intensive land use (i.e. agricultural use, industry, mining and settlement interactions) should be prioritised.
 - Regional Plans to be developed for Water Management Areas to ensure clear linkages and interdependencies between the natural resource base (including water resources) and the socio-economic development of the region are understood and addressed.
 - Agricultural water demand management programmes to be developed with an emphasis on the Breede Valley and Oliphants / Doorn agricultural areas. Industrial water demand management programmes to be developed with an emphasis on Saldanha, Southern Cape and Cape Town. Settlement water demand management programmes to be developed with an emphasis on the Cape Town functional region.
 - Government facilities (inclusive of education, health and public works facilities) to lead in implementing effective and efficient water demand management programmes.
 - Continue with programmes (such as Working for Water) which reduce the presence of alien vegetation along river systems.

A.4.3 Western Cape Biodiversity Act (2021)

The Western Cape’s Biodiversity Act aims to provide for “...the framework and institutions for nature conservation and the protection, management and sustainable use of biodiversity and ecosystems in the Province; and for matters incidental thereto.” The objectives of the Act are to:

- Give effect to the obligation of the state in terms of national legislation to act as trustee in relation to the environment;
- Give effect to section 81(m) of the Western Cape Constitution to protect and conserve the environment in the province, including its unique biodiversity, for the benefit of present and future generations;
- Ensure the long-term ecological sustainability and resilience of biodiversity, ecosystems, ecosystem services and ecological infrastructure through implementation of the principles of ecological sustainability contemplated in section 6 and the protection of priority biodiversity and ecological infrastructure;
- Ensure human well-being and the long-term resilience of society and the economy through the conservation of protected areas, biodiversity, ecosystems, ecosystem services and ecological infrastructure;
- Enable reasonable and sustainable access to benefits and opportunities emanating from the conservation of protected areas, biodiversity, ecosystems, ecosystem services and ecological infrastructure;
- Establish institutional structures and organisational capacity for the effective discharging of the conservation and management of biodiversity and nature in the province;
- Promote consultation, cooperation, integrated planning, decision-making and management in support of the conservation and sustainable use of biodiversity and ecosystem services in the province;
- Promote systematic biodiversity planning and the attainment of the biodiversity targets for conservation set in the biodiversity spatial plan and the provincial protected areas expansion strategy;
- Regulate certain activities to be undertaken in a manner that enhances and protects the integrity and health of the environment;
- Subject to section 231 of the constitution, implement and give effect to international agreements and best practices pertaining to the environment and conservation of biodiversity;
- Enable the financial and economic sustainability of the relevant institutions responsible for the conservation and management of biodiversity and nature in the province; and
- Enable and develop an equitable and sustainable biodiversity economy in the Province, including the promotion and development of eco-tourism in areas under the control of CapeNature.

Appendix B – City of Cape Town Strategies

Appendix B.1: Water Strategy (2019)

Background

In 2019, the City of Cape Town developed and adopted its “Our Shared Water Future” strategy to support its vision of becoming a water-sensitive city by 2040 that optimises and integrates the management of water resources, to improve resilience, competitiveness and liveability for the prosperity of its people (CCT, 2019a). The Strategy highlights the following commitments:

1. Safe Access to Water and Sanitation

This commitment focuses on ensuring safe and reliable access to water and sanitation for all residents, in line with well-defined minimum standards. A key emphasis is on working with informal settlements and relevant stakeholders to enhance daily water and sanitation services. These improvements directly support groundwater protection, particularly in shallow unconfined aquifers such as the Cape Flats Aquifer (CFA), by reducing the risk of contamination from inadequate sanitation infrastructure. Through these efforts, the City aims to foster trust and improve community safety.

2. Wise use of water

The City commits to promoting wise water use amongst all of its users. This primarily includes promoting and emphasising responsible water conservation behaviour through several measures, which include;

- a) pricing water in line with the cost of providing additional supply, while maintaining a basic free allocation for households unable to afford it. It is recommended that these prices should take into account annual household income to not make already vulnerable groups even more vulnerable.
- b) revising by-laws and planning requirements, and including incentives which support water efficiency, treatment, and reuse.
- c) improving customer management and engagement to support active citizenship, and
- d) reducing water supply losses and non-revenue water through the effective management of the city’s water network.

Reducing overall demand through these initiatives forms part of sustainable groundwater management, as it reduces stress on groundwater abstractions.

3. Sufficient, reliable water from diverse sources

Increasing water supply capacity through diversification of its water supply network, which includes developing new supplies from groundwater schemes, water reuse and the desalination of water in a cost-effective and timely manner, to increase resilience and reduce the likelihood of severe water restrictions in the future. Through this strategy, the CCT is aiming to grow water supply capacity by 300 million litres per day over the next ten years. Where necessary, suitable increments in a way which is adaptable and robust to changes in circumstances will be developed.

4. Shared benefits from regional water resources

Collaboratively optimising the economic, social and ecological benefits of regional water resources and reducing their associated risks. The goal is to work with water users and relevant stakeholders to reduce the risk of contamination and over-exploitation for Cape Town’s shared water resources, while simultaneously optimising the economic, social and ecological benefits through its use. CCT is especially interested in working with urban and agricultural water users, government and other key stakeholders to maximise these benefits. The use of springs is an example of what the CCT is trying

to achieve, as they offer ecological benefits, are communal points that offer relief to society during times of drought and have historically been used for various economic benefits, particularly in the brewing industry. Through improvement management and infrastructural upgrades, these water sources could be sustainably utilised to optimise these benefits, while ensuring they are protected from over-exploitation and contamination.

5. A water-sensitive city

Actively facilitating the transition of Cape Town to a water-sensitive city, supported by diverse water sources, resilient infrastructure, and the efficient use of stormwater and urban waterways. This approach will enhance flood management, groundwater recharge, water reuse and recreation while considering sustainable ecological principles. CCT aims to achieve this through new incentives, regulatory mechanisms and the way in which the CCT invests in new infrastructure.

Motivation for Cape Town’s Water Strategy

The City of Cape Town developed its **Water Strategy** largely in response to the severe 2015-2018 drought, which brought the city to the brink of “**Day Zero**”, a scenario where municipal water supply would have been shut off due to critically low surface water availability. This crisis exposed vulnerabilities in the City’s water system and highlighted the urgent need for long-term resilience against climate change, urbanisation, and population growth. The strategy shifts Cape Town from a restricted, linear water supply model, where supply is dependent on dams and reservoirs, to a dynamic and diverse water-sensitive city that maximises reuse, stormwater management, conservation and the diversification of water sources. Key motivations behind this strategy include drought preparedness, climate change adaptation, rapid urbanisation and population growth, infrastructure and equity challenges, economic stability and environmental sustainability. This approach aims to ensure long-term water security, while promoting social equity and ecological health.

Implementation of the Strategy

To achieve the commitments outlined in the Water Strategy, the City of Cape Town has developed a Water Transition Plan, which is implemented through the **New Water Programme (NWP)**. The purpose of the New Water Programme is to ensure that the city has a reliable, diversified and climate-resilient water supply that can meet future demand, while reducing the risk of another “Day Zero” scenario in Cape Town. The programme specifically focuses on transitioning from a reliance on rain-fed dams to a mix of water sources. The City plans to increase supply by more than 300 million litres per day by 2030, with a significant portion expected from groundwater abstraction and MAR to maintain groundwater levels, linking groundwater directly to drought resilience, climate adaptation, regional cooperation, ecological sustainability, and long-term water security.

Besides the augmentation of groundwater, other initiatives such as water reuse, desalination and the clearing of invasive vegetation are currently ongoing or planned. However, due to delays in implementing parts of the NWP and continued growth in water demand, timelines for these initiatives may need to be moved forward and targeted supply assurances and climate change allowances may need to be adjusted to reach the NWP’s 2030 goal (CCT, 2024b).

To support Cape Town’s goal of transitioning into a water-sensitive city as stipulated in the Water Strategy, the CCT has also implemented the Liveable Waterways Programme and the Green Infrastructure Programme, which are discussed in the following sections of this report.

Appendix B.2: Resilience Strategy (2019)

Background

Cape Town's resilience strategy, adopted in August 2019 provides an innovative roadmap to strengthen the City's adaptive capacity against a range of potential sudden **shocks** in the future (e.g., storm surges, droughts, flooding and heat waves), while addressing existing underlying **chronic stress** (e.g. climate change, informal settlement, poverty, crime, substance abuse and a lack of social cohesion) that affects the CCT's ability to respond to sudden shocks effectively (CCT, 2019b). A central focus of the Strategy is the need to partner across all sectors, including the government, businesses, community organisations, academia and households, to build collective resilience to shocks and stresses.

The Strategy strengthens the role of groundwater in building long-term water security and reducing vulnerability to future droughts. The strategy recognises that the city's heavy dependence on surface water makes it highly exposed to climate-driven shocks, and therefore prioritises both the diversification and protection of groundwater resources. Key actions include protecting water sources through MAR to ensure the long-term health and sustainability of the city's major aquifers, as well as promoting enhanced recharge through catchment restoration under the Greater Cape Town Water Fund. The Strategy also encourages responsible private groundwater use through improved data capture and user awareness, and emphasises stronger data, monitoring and scenario planning to support evidence-based decisions on groundwater and overall water resilience.

Cape Town's Resilience Strategy is structured around 5 resilience pillars, 20 goals and 75 actions. However, this section only focuses on the pillars, goals and actions that are relevant to the project.

Motivation for the Resilience Strategy

Cape Town's Resilience Strategy was developed in response to the 2015-2018 "**Day Zero**" drought, which revealed both the city's strengths and weaknesses in managing extreme climate events. While Cape Town demonstrated a strong resilience during this period, this extreme drought significantly tested the city's adaptive capacity. Day Zero was ultimately avoided through the implementation of water restrictions and reduction of water pressure by the City of Cape Town Municipality and the collective efforts of their residents, who together significantly reduced water consumption by more than 50%. Although reduced water use was largely driven by temporary crisis behaviour and water restrictions, several interventions from this period, such as improved leak detections, the installation of household water management devices, the diversification of water resources and increased public awareness, have led to long-term structural improvements in water management.

With this crisis now averted, the city, in response, developed the Resilience Strategy aimed at strengthening the ability of Cape Town's communities, institutions, businesses and systems to survive, adapt and thrive no matter the future stresses or shocks experienced. This is important since climate projections for Cape Town predict a likelihood of more frequent and intense droughts, which may challenge existing adaptive capacities. These predictions, coupled with the almost exclusive reliance on surface water for municipal water supply, make Cape Town highly vulnerable to drought shocks, increasing the need for improved preparedness in the city.

Implementation of the Strategy

Some actions detailed in the Resilience Strategy are new, while others are pre-existing but require further reframing, upscaling and support to increase the city's resilience. It is also important to note that several actions, either already implemented or in the process of implementation, may be aligned with those described in the Climate Change Strategy described in **Section 4.1.3**. This section describes implemented actions stipulated in the strategy that are related to the project.

The following sections summarise selected actions from the Pillars most relevant to this project: Pillar 2 (**Collectively, Shock-related City**), Pillar 4 (**Collaborative, Forward-looking City**) and Pillar 5 (**Connected, Climate-adaptive City**).

Pillar 2 (Collectively, Shock-related City)

Goal 2.2 (Engaging communities and the private sector to improve public spaces)

- Action 2.2.4 (**rejuvenate rivers and the spaces around them to create liveable urban waterways**) promotes healthy safe and productive urban waterways that produce multiple dividends. Cape Town's rivers have been negatively affected by development, urbanisation, pollution and land use changes, resulting in their modification from natural to canalised systems. This action aims to build the City's resilience against the effects of climate change while making progress towards meeting SDG 6 (Clean water and sanitation). To achieve this goal, the CCT has implemented the **Liveable Urban Waterways Programme** in parts of the city. This programme creates healthy, safe and productive urban waterways which provide resilience by reducing flooding, creating jobs and recreation spaces, improving water quality and lowering crime.

Goal 2.3. (build climate resilience) of the strategy includes a number of actions relevant to groundwater. Action number 2.3.4, described below has an explicit focus on aquifer recharge.

- Action 2.3.1 – **Strengthening the capacity to interpret and integrate climate impacts into planning:** This action is focused on the ability to obtain improved climate change data and projections applicable to the city-region level to improve long-term planning, reduce vulnerability to climate change-related shocks (e.g. drought, rainfall flooding and heat waves) and improve adaptive capacity in Cape Town. To achieve this, the CCT aims to build internal capacity to develop scenarios on the impacts of climate change at a downscaled level, grow awareness among city planners and project managers to consider the impacts of climate change at a downscaled level and to collaborate with academics (universities and academic institutions) to turn climate change projections into useful policy briefs for local decision-makers.
- Action 2.3.2 – **Enhancing partnerships for improved water governance and holistic water resilience:** This action focuses on strengthening relationships with large water users in the Western Cape Water Supply System (WCWSS) and continuously collaborating and engaging with civil society, academics and business partners in the urban water system to promote shared responsibilities in water governance. The recent drought experienced in Cape Town highlighted the need for partnering to achieve good water governance. To achieve this, the CCT will extend the life of the Section 80 Water Resilience Advisory Committee, which consists of a unique group of experts that supports the city's efforts to become a resilient, water-sensitive city. The CCT will also use partnering solutions to improve trust building and benefit sharing among users of the WCWSS.
- Action 2.3.3.– **Protecting water sources by supporting the Greater Cape Town Water Fund:** This action focuses on the involvement of various stakeholders to clear alien invasive vegetation from catchments around large dam systems for the purpose of augmenting the water supply in the bulk water supply system. This is necessary because over two-thirds of the sub-catchments supplying the WCWSS are affected by alien invasive plants that reduce the amount of water reaching the dams. The Greater Cape Town Water Fund, launched in 2018, is a collaborative initiative aimed at restoring catchments through alien vegetation clearing and forms an integral part of the New Water Programme.
- Action 2.3.4 – **Protecting water sources through managed aquifer recharge:** The protection of water resources through MAR, aimed at ensuring the long-term health and sustainability of key aquifers in Cape Town, is currently in progress. This approach enables groundwater abstractions to sustainably augment bulk water supplies. As outlined in the CCT

Water Strategy, Cape Town plans to abstract groundwater from aquifers to reduce reliance on surface water, given the dam system’s vulnerability during drought periods. In terms of its implications for Groundwater Management the New Water Programme has developed a groundwater MAR programme aimed at maintaining a sustainable yield from the aquifer and limiting the possibility of aquifer degradation due to seawater intrusion.

Pillar 4 (Collaborative, Forward-looking City)

Pillar 4, **Goal 2** of the strategy focuses on strengthening individual, household and community resilience. The following actions included under this goal related to this project include;

- Action 4.2.1 – Develop and deploy the neighbourhood resilience assessment by 2030: This action is aimed towards building the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related shocks and other economic, social and environmental shocks.
- Action 4.2.2 – Expand the women and girls' resilience programme: Includes the empowerment of women and girls, particularly those living in vulnerable communities with knowledge and skills that are important for surviving, adapting and thriving during shock events.
- Action 4.2.3 – Deploy smart technology and predictive analytics to inform pre-and post-disaster planning: The improvement of early warning systems for shock events and better information on measures following shock events by using smart technology empowered by stronger predictive analytics.
- Action 4.2.4 – Launch the “Be a Buddy” programme: Increased social networks, volunteerism and active citizenry that results in Capetonians pulling together in times of shock, especially to support the most vulnerable residents.

Pillar 4, **Goal 3** of the strategy focuses on encouraging responsible investment in household and business resilience. The following actions included under this goal related to this project include;

- Action 4.3.1 – The launch of a borehole data capture and owner awareness project: This project will encourage the responsible use of boreholes and well-points by private users through data-driven awareness and collective action to protect and sustain groundwater.

Pillar 5 (Connected, Climate-adaptive City).

Goal 5.1 – Develop and approve portfolios of projects that maximise the resilience dividend

- Action 5.1.1 – Screen for resilience in the management of capital project portfolios: Improves the alignment of major infrastructure programmes to maximise long-term resilience benefits.
- Action 5.1.2 – Maximise the resilience dividend at the project conceptualisation stage: Involves embedding resilience planning from the inception of every project initiative to enhance long-term co-benefits.

Goal 5.2 – Mainstream resilience in decision-making

- Action 5.2.1 – Integrating resilience considerations into integrated risk management: Productive use of the data generated by the City’s extensive Integrated Risk Management System to generate a multitude of new resilience-building actions and strong consideration by City risk champions of how the wide variety of shocks and stresses relevant to Cape Town can impact operations.
- Action 5.2.2 – Improving intergovernmental relations for resilience: Effective and streamlined intergovernmental relations for the purpose of building resilience to prioritised shocks and stresses, particularly where the effectiveness of Cape Town’s responses relies on powers and competencies beyond the control of the City government.

- Action 5.2.3 – Adaptive management capabilities for resilience: A cohort of leaders in the City government capable of managing in volatile, uncertain, complex and ambiguous environments, who are acutely aware of the shocks and stresses that confront Cape Town and how these affect their functional responsibilities, and who are committed to finding solutions to problems rooted in reflective learning and adaptive management.
- Action 5.2.4 – Improve decision-making for systems in stress: Improved decision-making for systems in stress based on trigger points that deliberately require consideration of whether alternative strategies or action plans need to be implemented to ensure the integrity of such systems.
- Action 5.2.5 – Engage in inclusive public participation processes that empower Capetonians: Improved methods of public participation and engagement that empower Capetonians to actively contribute to City decision-making processes, resulting in the co-design and co-ownership of projects and plans that have multiple resilience dividends.

Goal 5.3 – Enhance knowledge management and data use

- Action 5.3.1 – Use data for resilient decision-making: Enhanced use of data science to improve decision-support systems, helping to make more informed decisions in a future which is expected to be increasingly complex with regard to the intersection of shocks and stresses.
- Action 5.3.2 – Develop resilient technology platforms to enhance service delivery and improve cybersecurity: Improved robustness of the transactional and analytical platforms that the City uses to conduct its business and deliver its services, in order to reduce the risk of cyberattack and promote new innovations.
- Action 5.3.3 – Utilise robust scenario planning for improved resilience: Improved anticipation of a multitude of futures when considering the development of strategies and plans for the purpose of developing resilient actions in the urban environment.
- Action 5.3.4 – Conduct reflective learning after shock events: A culture of reflective learning after shock events to allow decision-makers and affected stakeholders to outline what happened, how decisions were made and the consequences thereof, and lessons learnt — for the purpose of improving performance next time a similar shock occurs.

Goal 5.4 – Monitor and evaluate resilience outcomes

- Action 5.4.1 – Evaluate city-wide resilience by 2021: Provision of quality data and insights for the purpose of assessing progress in the attainment of resilience goals in the Resilience Strategy, to understand relative progression or regression of city-wide resilience over time, and to inform decision-making on new or amended programmes and projects.
- Action 5.4.2 – Determine progress towards attainment of improved water resilience: Development of a comprehensive water resilience framework for Cape Town that outlines strengths and vulnerabilities of the city's water system against the drivers of water resilience to support informed decision-making.
- Action 5.4.3 – Develop a vulnerability index for each ward in the city: Practical, data-driven insights into ward-level determinants of relative vulnerability to shocks and stresses for improved planning and assignment of resources.

Appendix B.3: Climate Change Strategy and Climate Change Action Plan (2021)

Background

The vision behind Cape Town's Climate Change Strategy is to become a climate-resilient, resource-efficient, and carbon-neutral city that enables inclusive economic development and healthy, thriving communities and ecosystems (CCT, 2021a). This strategy also aims to contribute towards achieving the city's goal of transitioning into a water-sensitive city by 2040.

A critical component of the strategy is groundwater management due to its role in the adaptive capacity to droughts. The plan emphasises sustainable groundwater use to prevent over-abstraction and aquifer contamination. Moreover, the strategy plans to diversify and augment water supply, enhance artificial recharge measures and integrate groundwater with surface water systems for greater reliability and availability.

The Climate Change Strategy is based on the following principles:

1. Resilience

Take a comprehensive, proactive approach to climate risks by strengthening the city's capacity to anticipate, absorb, adapt and recover from shocks and stresses. This includes scenario planning, redundancy in critical lifelines (water, power, mobility, communications), and adaptive maintenance regimes. Systems should be flexible to multiple futures and updated through periodic stress-testing and drills.

2. Economic inclusiveness

Align climate action with socio-economic development by prioritising poverty reduction, equity and a just transition. Delivery should support low-income communities and informal-economy enterprises, local job creation and skills pathways (e.g., retrofitting, urban greening, repair and maintenance). Where sectors face disruption, provide reskilling, supplier development, and diversification support.

3. Embedded sustainability

Preserve, restore and expand ecosystems and green/blue infrastructure to enhance resilience and sequestration. Integrate ecological buffers and nature-based solutions into precinct planning, stormwater design and coastal management, and screen projects to avoid activities that undermine biodiversity, soil health, water quality or long-term ecosystem services.

4. Carbon Neutrality

Advance net-zero pathways across residential, commercial, industrial, transport and waste sectors, and within municipal operations. Set sectoral targets, tighten energy and building standards, accelerate clean energy and efficiency, and scale circular-economy measures. Use procurement and asset strategies to shift markets while safeguarding service affordability.

5. Health and well-being

Ensure climate responses promote public health, addressing heat stress, air quality, water- and vector-borne disease risks, mental health, and pollution. Implement heat-health action plans, cool community facilities, shade and greening programmes, and integrate early warning with social protection and emergency services to reach vulnerable groups.

6. Collaboration and integration

Pursue partnerships across spheres of government, civil society, academia and business; enhance public participation; and coordinate data and standards. Use memoranda of understanding for shared assets and programmes, pilot innovative regulatory and utility models (e.g., tariffs, embedded generation), and formalise knowledge exchange.

7. Climate-responsive urban development

Guide growth to avoid high-risk and sensitive areas, enable climate-smart densities and infrastructure, and improve liveability and economic vitality. Use risk-based zoning, overlays and development conditions in the SDF and scheme to protect ecological networks, reinforce transport resilience, and require sustainable drainage and permeable surfaces.

8. Equitable and inclusive service delivery

Implementing an equitable and inclusive climate change response that prioritises vulnerable groups, while still ensuring sustainable service delivery. Additionally, incentives focused on supporting carbon neutrality will only be considered if they also foster local employment and economic development.

9. Precautionary principle

Apply the precautionary principle in climate-related decision-making, where uncertainty exists, avoiding delays to no-regrets measures. Set clear thresholds and triggers for protective action (e.g., drought levels, heat alerts, coastal risk), adopt adaptive management, and embed monitoring to escalate responses as evidence strengthens.

10. Innovation and transformational planning

Foster innovation in technologies, finance and governance, and adopt transformational interventions where incremental change is insufficient (e.g., precinct-scale blue-green infrastructure, deep energy retrofits, modal shifts). Use pilots, regulatory sandboxes and blended-finance instruments to de-risk and scale what works.

Motivation for Climate Change Strategy

Cape Town's Climate Change Strategy is a necessary and forward-thinking response to the threats posed by global warming, and a critical step towards ensuring the City's long-term resilience and sustainability. The strategy was largely motivated by the 2015 – 2018 drought, when taps were projected to run dry, exposing Cape Town's vulnerability to climate change-related hazards. Rising temperatures, extreme weather events, and sea-level rise further highlighted the urgent need for a structured approach to climate adaptation and mitigation. Building on the **2006 Energy and Climate Change Strategy** and City of Cape Town **2017 Climate Change Policy**, the current strategy introduces more urgent and comprehensive measures that address local risks, while aligning with global commitments such as the Paris Agreement.

The Strategy shifts Cape Town towards greater climate resilience, through key concepts such as:

- **Adaptive planning** – preparing for water scarcity, extreme weather events and extreme heat
- **Mitigation efforts** – reducing emissions via renewable energy and sustainable transport
- **Integrated resource management** – ensuring water, energy and food security
- **Community engagement** – empowering citizens and businesses in climate action

By addressing both intermediate and long-term sustainability, Cape Town's Climate Change Strategy is essential for ensuring the city remains liveable, economically stable, and environmentally secure.

Driven by several key motivations, the strategy attempts to prevent another Day Zero crisis by ensuring water security, maintaining economic stability by protecting vital sectors, promoting social equity to safeguard vulnerable communities from climate impacts, and preserving biodiversity through environmental protection measures. At its core, the strategy aims to reduce carbon emissions in line with global climate goals, strengthen critical infrastructure to withstand climate-related hazards (which includes provisions for addressing groundwater supply), encourage

sustainable resource management, and foster innovative approaches to urban planning that enhance long-term resilience. These interconnected priorities form the foundation of Cape Town’s approach to building climate change resilience, while addressing both immediate risks and future sustainability challenges.

Implementation of the Strategy

This section identifies, describes and examines measures or actions undertaken by the City of Cape Town as part of their Climate Change Strategy and the Climate Change Action Plan. It is important to note that several measures, either already implemented or in the process of being implemented, may align with those described in the Resilience Strategy. The Resilience Strategy is not the only initiative with overlapping actions and measures. Many actions align with several of the City’s various strategies, policies and programmes. Where such overlaps occur, these points of commonality are highlighted.

Within the strategy’s existing action plan framework, actions are organised into strategic focus areas (SFAs) and cross-cutting work areas (CCWAs). Each SFA and CCWA supports the achievement of the strategy’s goals while aligning with its guiding principles, and together they contribute to the pathways that deliver its vision, principles and desired outcomes. For the purposes of this study, only action plans related to water management are considered. These are strategic focus areas 2 and 3, which deal specifically with water security, drought-readiness, water sensitivity, flood readiness and storm management, all of which are relevant to groundwater management given the critical role groundwater can play in achieving water security, whilst also acknowledging the relationship between storm and flood management on the health of aquifers in terms of recharge and contamination.

Climate Change Strategy SFA 2: Water Security and drought-readiness is aimed at **developing water security and drought readiness**, one of the most impactful climate change challenges faced by the city. The Water Strategy and Resilience Strategy are key overarching strategies that align actions and measures to achieve this goal. The drought Cape Town experienced, from 2015 to 2018, expedited the formulation and establishment of these plans to ensure the water sector is protected against the threats of climate change. The actions covered in this SFA are therefore focused on adapting to the impacts of reduced rainfall, drought and increased water scarcity.

Implementation of the City’s water conservation programme focused on demand-side management (SFA 2, Goal 3, Action 3.1)

The first action under SFA 2 is the **continued implementation of the City’s water conservation programme, focused on demand-side management** and corresponds with Goal 3 – Reduce demand for water to protect water resources and ensure sustainability of supply. Water conservation plans by the City of Cape Town have historically been successful at reducing water demand through behavioural and infrastructure interventions. **Implemented behavioural interventions** include:

- raising awareness and providing users with information on how they can reduce their water use,
- pricing mechanisms to encourage responsible water use and reduce water wastage,
- water restrictions aimed to limit overuse for certain activities and households.

While the continued **implementation of infrastructural interventions** focused on:

- pressure management and reduction programmes,
- upgrading of monitoring infrastructure to improve optimisation using new technologies, loggers, controllers, etc.
- programmes focused on leak detection and repair, essentially adopting a proactive approach to repair ageing reticulation infrastructure to prevent leaks from wasting water,
- retrofitting City facilities with water-efficient plumbing fixtures and fittings.

Another aspect of actions undertaken by the CCT is **promoting the use of alternative water sources for non-potable use**. For example, the City are encouraging the reuse of rainwater, grey water, groundwater and or treated effluent for use in industries, construction and irrigation. These actions originate from the CCT Water Strategy and highlight the integration of these actions to cover and align with the resilience-building strategies. While still in the implementation phase, the CCT has made progress implementing these actions. Major infrastructural upgrades have been ongoing to improve pressure and replace ageing infrastructure. Pricing structures have been implemented to manage usage throughout the municipality, and development of the CCT wellfields, for groundwater and the Faure New Water Reuse Scheme for the reuse of treated effluent has been ongoing, highlighting the city's commitment to including groundwater as a water supply contributor. Emphasis on behavioural changes and education around sustainable water use and management has also been an ongoing part of the city's approach since the end of the 2015 – 2018 drought.

Augmentation of Cape Town's water supply to ensure long-term sustainability of supply (SFA 2, Goal 4, Action 4.1)

The second action under SFA 2 is the **augmentation of Cape Town's water supply to ensure long-term sustainability of supply**. Goal 4 is associated with this action as well as Action 4.2 discussed below and is focused on **working to augment and increase water supplies in order to achieve a 99.5% assurance of supply for planned demand by 2030**. Currently, the CCT is still highly dependent on surface water for its water supply needs. 6 large dams supply the bulk of water through Cape Town's water supply system as part of the WCWSS. As the future is projected to get drier in Cape Town, the CCT has taken steps to diversify and augment its water supply, and invest in new initiatives, programmes and infrastructure to improve water security. This action originates from the City's Water Strategy and includes many sub-actions detailed in the Climate Strategy. Sub actions undertaken and or in the process of implementation include:

- Implement Committed Water Augmentation projects between 2019 and 2030, to add 290 ML per day to the supply network. Achieving this through management interventions, **groundwater abstraction**, wastewater reuse, desalination and additional surface water supply;
- To ensure the Adaptable Programme of Water Augmentation projects up to 2040 are planned for and, where necessary, implemented;
- Increase supply assurance to 99.5%;
- Continued implementation of climate change research and good governance measures;
- Increase the capacity of the WCWSS, as well as improve its management through a hydro-economic analysis of itself;
- Develop a bulk water decision support system to ensure that the CCT can operationally integrate new water sources with the management of the WCWSS.

Action 2 works toward the attainment of Goal 4 through the **removal of invasive alien species in water supply catchment areas and aquifer recharge areas, and in natural areas across the city**. The presence of invasive alien plants, which are not adapted to local conditions, consumes more water than indigenous plants that have adapted to water-scarce conditions. This indirect measure increases recharge by removing alien plants that reduce the volume of water that would otherwise replenish groundwater reserves. Sub-actions undertaken to supplement this action and achieve its goal include:

SFA 3 of the Climate Change Strategy deals with **water sensitivity, flood readiness and storm management**. Climate modelling suggests Cape Town will experience less rainfall but at higher intensities in its future. Each year, Cape Town experiences flooding and gale-force winds that cause damage to properties and leave residents highly vulnerable. Flooding, in particular, is an issue faced by many residents of the city, and is often less about the intensity of the rainfall and more about

geographical location and economic vulnerability. From a groundwater perspective, flooding can introduce poor-quality water into the aquifer and alter its condition. Part of addressing flood readiness and water sensitivity is covered in the City of Cape Town’s Water Strategy. Therefore, many of the actions covered in this SFA are aligned with the CCT Water Strategy.

Development and implementation of a water-sensitive city strategy or plan for Cape Town (SFA 3, Goal 5, Action 5.1)

The first action under SFA 3 is the **development and implementation of a water-sensitive city strategy or plan for Cape Town**. This action aims to **proactively reduce flood risk through the implementation of a water-sensitive city strategy or plan**. Due to the extensive network of rivers and wetlands, as well as built stormwater infrastructure, there is a high coverage of waterways that connect to freshwater and coastal environments. It is therefore essential that an integrated management approach is utilised to effectively protect these resources, especially as ongoing organic and inorganic pollution makes its way into Cape Town’s waterways and potentially into adjacent and or underlying groundwater systems. For these reasons, the CCT has looked to transition to a water-sensitive city. Sub actions undertaken to reach this goal include:

- Economic and financial incentives for water-sensitive urban design
- Regulatory mechanisms to enable water-sensitive urban design that better accounts for stormwater
- Direct investment in infrastructure that mitigates the impacts of flooding and promotes the attenuation of pollutants from stormwater and recharge of groundwater.
- The City is currently developing a water-sensitive city plan, due for completion in 2026.

Restore and rehabilitate the City’s rivers and wetlands to create liveable urban waterways (SFA 3, Goal 5, Action 5.2)

The second action of SFA 3 is to **restore and rehabilitate the City’s rivers and wetlands to create liveable urban waterways**. Cape Town is home to several rivers and wetlands, of which most rivers have been negatively affected by urbanisation and pollution. Healthy urban waterways provide essential environmental services, improving water quality, mitigating against floods and, where hydrogeological conditions are sufficient, facilitating recharge. Canalisation has significantly impacted Cape Town's waterways, as it is estimated that 480 km of Cape Town’s 1,900 km rivers have been canalised. The restoration and rehabilitation of the city’s waterways will improve its climate change resilience and protection against flooding. These efforts fall part of the Resilience Strategy and include several sub-actions that are in alignment. These actions include:

- Implement a demonstration building on the conceptual work of the “Source to Sea” initiative. The demonstration project could include;
- De-canalise part of a river and rehabilitate the surrounding wetland in partnership with the local community;
- Encouraging interaction between rivers and groundwater, and surrounding wetlands;
- Foster long-term engagement, collaboration and educational opportunities together with the surrounding community; and
- Identify locations to replicate and scale up similar projects around the city.

Appendix B.4: Environmental Strategy (2017)

Background

The City of Cape Town's Environmental Strategy was approved by Council in August 2017 (CCT, 2017). The vision of the Strategy is "To enhance, protect and manage Cape Town's natural and cultural resources for long-term prosperity, in a way that promotes access and social wellbeing, and optimises economic opportunities." A core principle of the Strategy is that the City's environment is a shared public asset, and its protection is the collective responsibility of all municipal departments.

At its core, the Environmental Strategy aims to build a resilient city that can withstand environmental shocks, especially climate-induced droughts. By prioritising environmental protection, it seeks to safeguard all water resources from contamination and unsustainable use, both of which directly affect ecosystems as well as surface and groundwater environments. The Strategy reinforces principles of Integrated Water Resource Management, sustainable resource use, climate change adaptation, and the protection of biodiversity and ecological systems.

Motivation for the Strategy

Cape Town is located within a globally unique and species-rich natural and cultural environment. The city's ecological infrastructure provides a number of goods and services that are beneficial for the city. As in many cities, there is a lack of recognition of the importance and value of these ecosystem services and the ecosystems that provide them. In addition, the city faces a number of challenges that are and could place pressure on the natural environment. These include:

- Rapid urbanisation and growth (of the city's footprint and of its population), which place pressure on land and natural resources;
- Historically inappropriate city planning and location of infrastructure and residential areas, including informal settlements, into areas that are prone to flooding and erosion
- Limited energy and water resources, and limited capacity to manage solid and liquid waste;
- Pollution of the air, open spaces, aquatic ecosystems, beaches and oceans, leading to unhealthy living conditions;
- Exposure to risks associated with natural hazards and climate change;
- Challenges associated with conserving the city's unique cultural heritage and landscapes;
- High levels of unemployment, poverty, inequality, crime and social injustice, and a significant number of residents without optimal access to opportunities and basic services.

It was recognised that a comprehensive Environmental Strategy is required to address these challenges. A Strategy provides the structure and frameworks for good environmental governance, long-term planning and the optimisation of resources. It also provides a transparent framework for the mechanisms and regulations that are needed to achieve the city's desired outcomes with regard to long-term environmental management.

Implementation of the Strategy

Implementation of the Strategy depends on partnerships and management approaches that share responsibilities and decision-making across line departments. The Environmental Strategy identifies 11 principles to collectively enable the City of Cape Town to achieve its vision of long-term sustainability, and each principle is associated with a directive that gives effect to the principle.

Long-term approach

The CCT will work to ensure that its actions and decisions do not undermine the long-term benefits that the natural environment provides, and that the needs and interests of future generations will be considered and respected.

Equity and accessibility

Equitable access will be promoted, with a strong focus on the needs of vulnerable groups and on improving living environments.

Economic and social benefits

The social, cultural, and economic value of the natural environment to communities, businesses and individuals will be recognised, protected, made accessible and promoted. The green economy and green jobs are central to this principle,

Resilience

The CCT will ensure a focus on resilience, enabling the city to withstand and mitigate the negative impacts of environmental hazards, proactively reduce Cape Town’s vulnerability, and protect the city’s economy.

Ecosystems approach

The contribution (and associated value) of ecological infrastructure and ecosystem goods and services will be recognised, protected, and, where possible, proactively restored.

Preventing, minimising and mitigating environmental impacts

The CCT will ensure adherence to the principle of proactively preventing adverse environmental impacts, including the impacts of pollution and the generation of waste and, where this is not possible, minimising and managing those impacts.

Resource efficiency

The CCT will ensure that resource efficiency and low-carbon development are embedded in all aspects of its work.

Environmentally sensitive and low-impact urban design

The CCT will adopt an urban design methodology that is environmentally sensitive and low-impact, in order to ensure the long-term functionality of key ecological infrastructure.

Educated and empowered citizens

Education and empowerment of all citizens of Cape Town will be prioritised and promoted.

Protected natural heritage

The CCT will ensure that the value of the city’s natural heritage is recognised, protected and promoted, and that the benefits and opportunities it provides to communities are realised.

Protected cultural heritage

The CCT will ensure that the value of the city’s cultural heritage is recognised, protected and promoted, and that the benefits and opportunities it provides to communities are realised.

Appendix B.5: Catchment, Stormwater and River Management Strategy (2002-2007)

The City of Cape Town’s Catchment, Stormwater and River Management Strategy (2002-2007) transitions from prioritising basic drainage to integrated catchment management, addressing growth, development impacts, and rising community demands for flood safety and ecological health. Its goal is to provide effective stormwater systems while ensuring safe rivers and improved water quality in rivers, wetlands, and coastal areas for residents.

This framework is built upon six strategic focus areas:

1. Holistic Planning and Management to balance societal needs with environmental requirements through catchment-level plans.
2. System Development, Upgrading, and Maintenance using a risk-based approach and environmentally sensitive methods.
3. Public Safety and Environmental Protection through flood disaster mitigation and water pollution reduction.
4. Information Management to create robust data systems for monitoring and planning.
5. Regulatory actions, including new by-laws and development controls to protect watercourses.
6. Relationship Management to ensure cooperation between city departments and foster public partnerships and education.

The strategy is based on principles including sustainability, customer focus, co-operative governance, and ongoing improvement. The document outlines programs, timelines, and performance indicators for each focus area, with the intention of establishing a multi-functional urban water system. These strategic focus areas and their supporting programmes have been summarised below.

Table B-1 Summary of Strategic Focus Areas and Supporting Programmes.

Strategic Focus Areas	Supporting Programmes
Holistic Planning and Management	1. Catchment, Stormwater and River Planning 2. Integrated Urban Water Management
System Development, Upgrading, and Maintenance	1. Stormwater Management Guidelines and Design Criteria for New Developments 2. Risk-Based Approach to Upgrading and Maintenance 3. Infrastructure Management System 4. Environmentally Sensitive River Maintenance
Public Safety and Environmental Protection	1. Flood Disaster Mitigation 2. Water Pollution Abatement
Information Management	1. Information Systems 2. Data Bureau Services
Regulatory	1. Control of Development near Watercourses 2. By-Laws 3. Tariff Funding Options
Relationship Management	1. Management Integration Mechanisms 2. Customer Care 3. Staff Development 4. General Education Initiatives 5. Partnership Development

Catchment, Stormwater, and River Planning programmes have been divided into the following categories listed in **Table B-2** below.

Table B-2 City of Cape Town river and stormwater management plans and their purposes.

Plan Category (Level)	Purpose
Catchment and River Management Plan (CRMP)	Sets overall management objective and recommends key management actions with respect to runoff quantity, quality, and other associated environmental and social issues.
Stormwater Management Master Plan (SMMP)	Identifies bulk infrastructure required within developing areas where applicable.
Local Stormwater Management Plan (LSMP)	Details how stormwater is to be managed within proposed or existing developments, focusing on localised issues.

Catchment and River Management Plans will incorporate specific elements and/or inform related strategies, including but not limited to the following:

- Water Services Development Plan Metropolitan
- Spatial Development Framework Metropolitan
- Open Space Systems Integrated Metropolitan Environmental Management Framework
- Coastal Management Framework

The Catchment, Stormwater and River Management Branch (CSRMB) assumes responsibility and, in coordination with various city departments, provides catchment-wide strategies.

Summary and Groundwater Relevance

The CCT’s Catchment, Stormwater and River Management Strategy (2002-2007) represents a fundamental shift from basic drainage to an integrated, sustainable approach that manages entire catchments to balance flood safety, ecological health and water quality. Based on holistic planning, risk-based infrastructure maintenance, pollution reduction, and strong regulatory controls, the strategy is implemented across spatial scales, setting broad objectives from high-level catchment and river management plans down to local stormwater management plans for specific developments. The strategy focuses on pollution reduction at the source and the use of regulatory controls to prevent contamination in rivers and wetlands that ultimately replenish groundwater systems. Moreover, by maintaining the natural function of watercourses and promoting environmentally sensitive design, the strategy sets out to ensure stormwater becomes a source of water for groundwater recharge.

Appendix C – Policies and By-laws

Appendix C.1: Policies

C.1.1 Water and Sanitation Services Policy

The City of Cape Town's Water and Sanitation Services Policy (2023), is a legal instrument that supports the City's vision of transitioning into a water-sensitive city by 2040, by providing principles for how Cape Town will deliver water and sanitation services in a way that is sustainable, equitable, and aligned with broader city strategies such as the Water Strategy, Resilience Strategy and Climate Change Strategy discussed in previous sections of this report (CCT, 2023b). This policy also promotes a transversal approach that fosters coordination and partnerships with all stakeholders to ensure sustainable water supply and the provision of sanitation services.

The policy also emphasises the need to move beyond the conventional approach for the provision of water and sanitation services by introducing, among others, water-sensitive urban design, green infrastructure, climate resilience and long-term sustainable development principles.

The implementation of the policy is guided by policy directives, which set the framework for how Cape Town delivers water and sanitation services. These include:

- **Service provision:** delivery of basic, intermediate and higher service levels, including informal settlements, during emergencies, and through the provision of free basic services.
- **Resource and infrastructure management:** integrating planning, stormwater and wastewater management, asset management and metering systems.
- **Governance and sustainability:** financial management, regulation, compliance with standards and improved information systems.
- **People and Innovation:** the promotion of research and innovation and partnership with communities, academia and the private sector.
- **Safety and resilience:** Including health, safety, risk management and environmental protection in all water and sanitation operations.

The policy also closely aligns with city strategies, particularly through the Excellence in Water and Sanitation Services Delivery Programme, which aims to improve infrastructure and improve service in informal settlements through initiatives and projects such as the Reticulation Network Modernisation Initiative, Wastewater Treatment Project and the Sewer and Pump Station Maintenance Project. The policy also aligns with the New Water Programme, which aims to diversify water sources in the city (which involves water reuse, desalination and augmentation of groundwater).

C.1.2 Critical Water Shortages Disaster Plan/ Drought Response (2018)

The plan sets out Cape Town's preparedness and operational response to a multi-year drought, pairing an emergency Critical Water Shortages Disaster Plan with a parallel New Water Programme to diversify supply. It is designed for worst-case planning (minimal new supply before the next rainy season), yet adaptable as conditions change across the Western Cape Water Supply System (WCWSS). It aims to safeguard life and dignity, maintain critical municipal services, protect infrastructure, and ensure a basic lifeline supply while curbing the escalation of the disaster. An overview of the key components of the plan is provided below:

Supply augmentation (2018–2022 programme)

The City's supply augmentation programme aimed to enhance water security through diversification across desalination, aquifers, springs, reuse, and inter-basin transfers. This approach reduces reliance on a single source, builds redundancy into the system, and improves long-term resilience. Sequencing of short-term temporary interventions with long-term sustainable assets formed a key element of the strategy.

The plan to augment supply included the following components:

- **Groundwater abstraction (peak ≈150 ML/d):**

Groundwater schemes were piloted in the Cape Flats Aquifer (up to 80 ML/d) and the Table Mountain Group Aquifer (up to 50 ML/d), while the Atlantis Aquifer scheme was refurbished to produce an additional 20 ML/d to feed into the bigger water supply system from the current 12 ML/d that is already operating off-grid.

- **Desalination:**

Temporary desalination plants were established in Strandfontein (7 ML/d), Monwabisi (7 ML/d) and the V&A Waterfront (2 ML/d), between February and May 2018. The Strandfontein and V&A Waterfront plants operated successfully but were decommissioned once dam levels recovered after the "Day Zero" 2015-2018 drought, while the Monwabisi Plant ceased operation before it was fully implemented due to technical challenges. A planned permanent desalination plant is underway at Parden Island, but is not fully operational yet.

- **Water re-use (commissioning through 2018–2021):**

An expansion of advanced water treatment facilities was undertaken at Zandvliet (from 10 to 50 ML/d), Cape Flats (10 to 75 ML/d), Macassar (20 ML/d), Potsdam (10 ML/d), and Athlone (to 75 ML/d). Permanent water reuse at the Faure New Water Scheme (FNWS) with a treatment capacity of 70 ML/d is currently underway.

- **Springs:**

Newlands–Albion is operational at ~3 ML/d, while Oranjezicht has routed ~1 ML/d into the system.

- **Transfers (±60 MLD over two months):**

Achieved through ~8 Mm³ from Groenland Water User Association, based on a release of ~10Mm³ (assuming approximately 20% losses).

Disaster response architecture (three phases with triggers)

The plan entailed the following Phases and associated triggers:

- **Phase 1: Preservation Restrictions**

This phase involves pressure management, throttling and limited water supply to cap citywide use at approximately **450 ML/d**. It includes the intensified installation of water management devices for non-compliant users, consistent with Level 6B restrictions.

- **Phase 2: "Day Zero" (Disaster Restrictions)**

This phase is triggered when dam storage falls to about approximately 13.5% at which point the municipality assumes active control of the daily water supply. Residential reticulation is largely shut down and approximately 200 Points of Distribution (PODs) are established to provide lifeline water supplies. Prioritised network connectivity is retained where feasible for critical services (hospitals, clinics), strategic commercial nodes, high-density areas with elevated disease risk, and densely populated informal settlements already reliant on standpipes. Furthermore, security and disease-outbreak plans are implemented with SAPS/SANDF support and vulnerable groups (e.g., care facilities) receive targeted assistance.

- **Phase 3: Full-scale Disaster Implementation**

This phase commences once Western Cape Water Supply System (WCWSS) dams are effectively depleted. At this point, only lifeline drinking water from non-surface sources (aquifers, springs) is distributed by the CCT and bottled water via PODs. During this phase, the City progressively rationalises services and shuts down non-critical operations. A major risk to this plan is the increased pressure applied to groundwater systems due to the surge of private borehole drilling and associated over-utilisation of groundwater.

Governance, principles and coordination

The Plan is anchored in principles to: minimise impacts on life and dignity; continue critical services; prevent escalation through mitigation; protect infrastructure; assure basic health and hygiene; limit/respond to water-borne disease; and prioritise support to the most vulnerable. Delivery uses a transversal project approach across Water and Sanitation, City Health, Emergency and Policing services, Parks and Social Development, with intergovernmental partners and structured communications to businesses, communities and NGOs. It is recommended that the plan be revised to reflect the current infrastructural improvements, which should therefore also make provisions for groundwater governance during times of disaster. Governance over groundwater use by municipal schemes and private users should be accounted for to promote sustainable use of groundwater during times when it is likely to be highly relied upon and stressed.

Operational readiness and public communication

Preparedness covers POD site planning (pedestrian/vehicle), emergency procurement and logistics, business continuity plans per directorate, and public guidance on how phases affect service access. The CCT emphasises early, transparent communication to allow external actors to implement their own mitigation measures.

C.1.3 Management of Urban Stormwater Impacts Policy (2009)

The City of Cape Town's Management of Urban Stormwater Impacts Policy (2009) establishes a framework designed to minimise the adverse effects of urban development on water bodies, including rivers, wetlands, and coastlines. It requires the implementation of WSUD principles and SuDS in both new and existing developments.

The policy's primary objectives are to:

- Improve the quality of stormwater runoff.
- Control the quantity and rate of runoff.
- Encourage natural groundwater recharge.

The CCT stormwater management policy sets clear objectives to reduce the negative impacts of urban runoff through the implementation of SUDS. These objectives include improving stormwater quality, controlling runoff quantity and rate, and promoting natural groundwater recharge. The policy mandates that new developments, whether on greenfield or brownfield sites, integrate SUDS at the planning and design stages, while existing developed areas adopt SUDS through retrofitting based on Catchment and River Management Plans.

The policy recommends the use of various Best Management Practices (BMPs) that fall under structural (litter traps, infiltration devices, bioretention cells, basins, detention ponds and constructed wetlands) or non-structural controls (town planning incentives, stormwater master plans, pollution prevention maintenance practices, and public education) to achieve these objectives through SUDS and WSUD. Through these methods, urban pollutants can be reduced in stormwater, thereby reducing the risk of pollution to the aquifer during recharge. The policy recognises that single measures are rarely sufficient for water quality treatment, suggesting that often a series of measures is the most effective approach.

Technical standards outlined in the policy vary according to the type and size of development, aiming to achieve significant pollutant reductions (up to 80% in suspended solids) and manage peak flows for storm events up to a 50-year return interval to pre-development levels. Responsibilities for the operation and maintenance of on-site stormwater measures lie with property owners or bodies corporate, ensuring accountability.

The approach includes a combination of on-site and regional controls with extended detention of runoff from frequent storm events to protect downstream channels and properties from flooding. Developments near floodplains must comply with additional floodplain management policies. Overall, the policy promotes a balanced, integrated approach that safeguards waterways, reduces flood risks, and supports urban ecological health.

This policy is legally enforceable and aligns with the CCT Stormwater Management By-law, applying to all private, public, and governmental stakeholders in Cape Town.

C.1.4 Floodplain and River Corridor Management Policy (2009)

The City of Cape Town's Floodplain and River Corridor Management Policy (2009) provides a framework for sustainable development around watercourses and wetlands. A 'River Corridor' is defined as the watercourse, wetlands, floodplain, ecological buffer, and the associated area. This policy was developed to reduce the impacts of flooding on people and property, safeguarding human health and aquatic ecosystems, and maintaining or improving recreational water quality.

Within this policy, rivers, wetlands, riparian areas and floodplains are seen as integral elements of the City's stormwater management system, and as important components of the Biodiversity Network (see **5.6 Stormwater Management Plan**). These ecosystems also provide essential recreational and economic opportunities.

The policy acknowledges that development, land use and human activities will occur close to rivers and wetlands, and aims to provide an effective decision-making tool for officials, developers and consultants to use for planning and for applications for developments adjacent to these aquatic ecosystems.

The objectives of the policy are to manage development, land use and activities around rivers, wetlands, riparian areas and floodplains in a manner that:

- Limits or reduces exposure to flood risk by avoiding hazardous, uneconomic or unwise use of floodplains;
- Protects the natural flood storage and attenuation capacity of rivers, floodplains and wetlands;
- Protects and enhances the intrinsic value and ecosystem services provided by these ecosystems, and
- Facilitates the beneficial integration of these ecosystems into the urban landscape.

The protection of biodiversity and ecosystem functions of the city's aquatic ecosystems is enhanced through the provision of ecological buffers around sensitive aquatic ecosystems. Ecological buffers have several benefits, including:

- Provision of continuous corridors and habitat for flora and fauna;
- Provision of space for lateral connectivity between aquatic ecosystems and their surrounding catchments for ecological processes to occur;
- Water quality improvement of point and diffuse sources of pollution;
- Erosion protection from hydrological impacts associated with the hardening of catchments through development;
- Provision of space for the implementation of water-sensitive urban design elements;

- Provision of open space for recreational and educational activities, and
- Enhancement of the aesthetic value of properties.

The policy provides some guidance on how and when to set ecological buffers, and guidance on the activities that can safely and effectively take place within the ecological buffer. Indirectly, this policy protects groundwater quality by restricting developments and land-use that would affect the health of ecosystems and recreational water quality. It encourages the incorporation of Water-Sensitive Urban Design principles to encourage groundwater recharge and mitigate the impacts of drought and flooding.

C.1.5 Urban Watercourses Guide

The Urban Watercourse Guide was developed by the Green Infrastructure Programme (GIP) as part of a series of best practice guidelines for relevant stakeholders and communities. The main goal of these guidelines was to provide these stakeholders with the necessary information to guide them in managing, protecting and enhancing Green Infrastructure in a manner which is sustainable and creates both safe and contextually appropriate environments. This document takes into account”

- Relevant legislation, policies and by-laws,
- Development and Planning considerations,
- Responsible alterations to watercourse banks and vegetation,
- Prevention of pollution,
- The improvement of water quality, ecological function and amenity value of urban watercourses.

Based on these guiding principles, the result is the creation or improvement of Liveable Urban Waterways. Green Infrastructure is therefore closely linked and aligned with the Liveable Urban Waterways, as most Blue Infrastructure will likely include these elements in its design. The use of these guidelines and the direction they take provides a first layer of implementation for parts of the Water Strategy, Climate Strategy, Resilience Strategy and Environmental Strategy. Ultimately, the goal is to improve the city's current green assets and, where possible, create new ones.

Through this guideline, the increased development of recharge-enhancing features and assets beyond those maintained by local government can contribute to improving groundwater availability and reducing the impacts of floods and drought.

Appendix C.2: By-laws

C.2.1 Water By-law (2010 as amended in 2018)

The City of Cape Town's Water By-law (2010 as amended in 2018) was introduced and then later amended to regulate the installation, use, conservation, and protection of water installations and water services within the city. It establishes a legal framework for the CCT to manage its water supply system, ensure its water quality and quantity, and promote the conservation of water, especially during times of water scarcity. This by-law aims to ensure a safe and reliable supply of water, the protection of water supply infrastructure, regulate all water-related infrastructure installations, and promote the conservation and demand management of water. To achieve these aims, the Water By-law looks to:

- Protect the water supply system and infrastructure from contamination,
- Regulate the installation of water-related infrastructure by ensuring it is completed by registered plumbers in accordance with the national building regulations and standards,
- Controlling water connections to prohibit unauthorised access to municipal water supply systems and prohibiting misuse and wastage of water,
- Encouraging the use of water-saving devices in new developments,
- Regulating alternative water sources such as boreholes, wellpoints, and rainwater tanks to control the installation and their use,
- Enforcement and metering through the authorisation of city officials to monitor compliance, as well as providing a legal basis for implementing water restrictions and tariffs.

This by-law serves as a fundamental component of implementation for achieving the city's water security and resilience objectives. It provides the enforceable rules needed to achieve the goals of the Water Strategy, Resilience Strategy and Climate Change Strategy, by directly supporting water conservation, demand management, and the safe integration of alternative water sources. This by-law contributes to becoming a resilient city and is therefore a critical tool for climate change adaptation and withstanding future droughts.

C.2.2 Wastewater and Industrial Effluent By-law (2013)

The primary purpose of the Wastewater and Industrial Effluent By-law (2013) is to protect the City of Cape Town's wastewater system and environment from damage and pollution. It achieves this by regulating the quality and quantity of all wastewater and industrial effluent discharged into the municipal sewer system. This ensures the system operates efficiently, reduces maintenance costs and safeguards the environment and public health. This by-law aims to control and manage all discharges to prevent harmful or hazardous discharge, while minimising the risk of blockage, overflow and damage to sewer infrastructure. Ultimately, this is to protect the health and safety of the city and recover costs of discharged effluent, which may require additional treatment. To achieve these aims, the by-law sets out the following objectives:

- Prohibiting or restricting the discharge of certain substances into the sewer system,
- Setting minimum standards for the quality of effluent discharged into municipal systems
- Requiring pre-treatment where effluent exceeds standards and minimum requirements
- Enforcing permits such that high-risk or high-volume dischargers are held to permit limits
- Granting powers of inspection for CCT officials to monitor compliance
- Holding polluters accountable through the use of legal channels to issue fines, recover costs and prosecute offenders.

The Wastewater and Industrial Effluent By-law (2013) is used as a regulatory tool for implementing several of the City's key environmental and service delivery policies and strategies. Primarily, it is used to enforce the CCT Integrated Wastewater Management Plan (IWWMP) and to support the CCT SDF through the protection of water resources and public health. This helps guide urban growth away from overwhelming and polluting the environment and or wastewater infrastructure. It also supports the Water Strategy, Resilience Strategy and Climate Change Strategy, as protecting water quality and the health of ecosystems builds resilience to climate change. It protects groundwater and surface water quality and further aligns the city's goal of reenvisioning wastewater as a resource rather than waste. The by-law is also complemented by the CCT Stormwater Management By-law (2015), as sewer overflows can contaminate stormwater systems and the receiving environment these systems channel stormwater to.

C.2.3 Stormwater Management By-law (2005)

The City of Cape Town's Stormwater Management By-law (2005) intends to regulate the city's stormwater system and protect against flood risk and pollution. The by-law distinguishes stormwater from drinking water or wastewater systems and encompasses both natural and constructed facilities (e.g. rivers, pipes, wetlands, and floodplains) used to manage this water.

Key regulations include:

- **Prohibited Discharges:** No person may discharge anything other than stormwater into the system without written consent from the Council.
- **System Protection:** It is forbidden to damage, endanger, obstruct, or interfere with the stormwater system. This includes building unauthorised structures, making openings into pipes, diverting water, or undertaking landscaping that affects the system.
- **Flood Risk Prevention:** Activities that reduce the system's capacity or could increase flood levels are prohibited without the Council's permission. The Council may require applicants to fund impact studies or other assessments before granting consent.
- **Pollution Incidents:** The property owner or person responsible for a pollution incident must immediately report it to the Council and cover all costs for containment, cleanup, and environmental rehabilitation.
- **Private Systems:** Owners of property with private stormwater systems are responsible for keeping them functioning effectively at their own expense.

The Council is granted extensive powers to enforce these rules, including demolishing non-compliant structures, repairing damage, and recovering all costs from the responsible party or property owner. Violating the by-law is an offence punishable by a fine.

C.2.4 Integrated Waste Management By-law (2009)

The purpose of the Integrated Waste Management By-law (2009) is to provide a legal framework for the effective and environmentally sound management of waste within the City of Cape Town. It aims to protect public health and the environment by regulating all activities, ranging from waste generation to its disposal. This by-law seeks to minimise the negative impacts of waste through a hierarchy that prioritises waste avoidance, reuse, recycling, and recovery in an attempt to treat waste disposal as a last resort. To achieve these aims, the by-law makes use of the following objectives:

- To place a general duty on all persons and businesses in order to avoid waste generation and, where applicable, manage their generation in a manner which does not harm the public health or the environment,
- Setting requirements for the storage of waste on residential, commercial, and industrial properties, while prohibiting illegal dumping, littering and unauthorised burning of waste

- To outline the city’s responsibilities and the rights of its residents regarding the domestic waste collection service,
- To require businesses and industries to make their own arrangements for waste collection and disposal with licensed service providers, and to keep records of this waste
- Licensing waste, particularly waste activities such as waste storage, treatment, processing and or its transport for commercial purposes,
- Providing for the management of different types of waste that may require special handling,
- Enforcing the by-law through the issuing of compliance notices and fines.

The Integrated Waste Management By-law is an important tool that is used by the CCT for the implementation of its various overarching strategies, policies and frameworks. It provides the legal framework and enforcement mechanisms to achieve its targets set out in the IWMP, directly supporting the IDP vision for a safe and sustainable city. Furthermore, it supports the Climate Change Strategy by diverting waste from landfills to reduce greenhouse gas emissions. It also underpins the Water Strategy and urban management policies through its direct protection of water resources and public health. Illegal dumping and poorly managed waste facilities can lead to soil and water pollution through leachate contaminating groundwater and or stormwater runoff transporting contaminants into receiving water bodies.

C.2.5 Municipal Planning By-law (2015)

The Municipal Planning By-law (2015) is a legal and administrative framework for land use planning and development management within the City of Cape Town. It is designed to manage and regulate land development in a way that gives practical effect to the principles of spatial planning, sustainable development and effective administration as set out in the national and provincial legislation. The core function of the by-law is to determine what can be built, where it can be built and how the process of approval works. The overarching aims of the by-law are to implement a planning system that is clear, predictable, and efficient for processing land development applications and guide urban growth and change in a manner that is orderly, sustainable, and aligns with the city’s spatial planning vision. Moreover, it attempts to balance the rights of landowners to develop their properties with public interest and create certainty for developers, investors, and the public about the rules and regulations that govern land use and development. The core objectives set out by the by-law include:

- Establishing application procedures
- Creating the Municipal Planning Tribunal (MPT)
- Regulating land use rights
- Providing for public participation
- Enabling enforcement

The Municipal Planning By-law is one of the key implementation tools for realising the city’s spatial and development vision. It provides the legal processes to give effect to the SDF and helps achieve the strategic objectives of the IDP. The by-law integrates environmental and heritage protection into the development process, and requires applications consider environmental constraints to ensure the development is managed in a way that is sensitive to the natural environment. This links directly to the Environmental Strategy and both the Resilience and Water Strategies. Through the correct implementation of this by-law groundwater and groundwater recharge zones are better protected through the spatial controls and conditions included in the by-law.

C.2.6 Recreational Water-Use By-law (2018)

The purpose of the City of Cape Town's Recreational Water-use By-Law (2018) is to regulate all recreational activities on inland public waterways and water bodies under CCT's jurisdiction. This is to protect its waterways, prevent nuisances and ensure public safety. It establishes a clear set of rules of conduct for various water-based activities in order to manage various water uses and minimise the risk of conflict and or its overuse. This by-law essentially aims to ensure public safety, provide a clear regulatory framework for the use of the city's waterbodies, and protect both its water quality and environment. To achieve these aims, the by-law sets out several objectives that include:

- Explicitly prohibiting the discharge of oil, fuel, sewage, litter and or any other kind of pollutant,
- Designating usage zones for specific activities
- Regulating vessel registration to ensure that various types of motorised vessels and crafts require permits
- Prohibiting reckless operation of vessels or crafts on waterbodies
- Authorising designated law enforcement officers to enforce the by-law, conduct inspections, and issue fines for non-compliance.

These objectives ultimately attempt to protect the health and safety of users by ensuring that only viable water bodies are utilised, and to protect ecosystems and the quality of water for these water resources. This is especially relevant where water bodies are groundwater-fed. The Recreational Water-Use By-law (2018) works conjunctively with the Coastal By-Law (2020) to cover both inland bodies of water and along Cape Town's coastline. Together, they form a cohesive system to manage water-related activities across the city. The by-law is also another mechanism of implementation for the Water Strategy, Environmental Strategy, as it attempts to prevent pollution and protect freshwater ecosystems. It also supports the SDF by ensuring the structured recreational use of natural spaces to avoid over-stressing water systems and their environments.

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