Executive summary

Compilation of the 15-year Western Cape Integrated Drought and Water Response Plan

Western Cape Government

Department of Local Government

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Acronyms

BGCMA	Breede-Gouritz Catchment Management Agency
CAPEX	Capital Expenditure
CPAF	Construction Price Adjustment Factors
CPI	Consumer Price Index
CSIR	Council for Scientific and Industrial Research
DEA&DP	(Western Cape) Department of Environmental Affairs and Development Planning
DEDAT	(Western Cape) Department of Development and Tourism
DoA	(Western Cape) Department of Agriculture
DOP	(Western Cape) Department of the Premier
DLG	(Western Cape) Department of Local Government
DWS	(National) Department of Water and Sanitation
IAP	Invasive Alien Plant
KSA	Key Strategic Area
MIT	Municipal Information Tool
MTEF	Medium Term Expenditure Framework
NRW	Non-Revenue Water
O&M	Operation and Maintenance
PSC	Project Steering Committee
PSP	Provincial Strategic Plan
SLA	Service Level Agreement
ToR	Terms of Reference
VIP	Vision Inspired Priority
WBT	Water Balance Tool
WC	Western Cape
WCERR	Western Cape Enterprise Risk Register
WCG	Western Cape Government
WCIDWRP	Western Cape Integrated Drought and Water Response Plan
WCIF	Western Cape Infrastructure Framework
WCSWMP	Western Cape Sustainable Water Management Plan
WCWSS	Western Cape Water Supply System
WMP	Water Master Plans
WSDP	Water Service Development Plan
WSLUM	Water and Sanitation Land Use Model
W&WW	Water and Wastewater
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works

1 Background and context

Water resources, and the availability of water in the Western Cape Province of South Africa, are known to be affected by climate change. Changes in rainfall and temperature translate into increased hydro-meteorological variability and uncertainty, and resultant in impacts on stream flows and certain demands e.g. irrigation. Within the Province, the likelihood of extreme events such as the 2015-2019 drought, is expected to considerably increase in the future under anthropogenic climate change. Water security and climate resilience is therefore a key concern for municipalities, farmers and industries, especially in light of the growth in population numbers and the economy.

International best practice dictates that drought planning and prioritisation of water resources development and management projects (measures/interventions) continue, even during years when drought seems unlikely. This suggests a) that more funding should be allocated to demand-side interventions and sustainable management of water resources; b) that there be a transition to a more water sensitive city approach which includes alternative water supply options and management; c) that strong planning and governance are key building blocks for sustainable water management; and d) that challenges related to governance, control and enforcement of allocations are addressed.

Considering the above, it is imperative to reflect on the lessons learnt during the 2015 to 2019 Western Cape drought, from a planning, operational and management perspective. Furthermore, it is imperative that alternative and new approaches to conventional water resources management (which will ensure water security and resilience under extreme weather conditions), are integrated in water resources planning. These could include:

- Diversifying water sources and water quality streams per water user needs
- Minimising water losses
- Enhancing effective metering and billing
- Minimising water consumption
- Water re-use
- Water cascading
- Innovation in water treatment
- Decentralisation of water supply and wastewater treatment
- Rainwater harvesting
- Stormwater harvesting
- Wastewater reclamation
- Alien vegetation clearing
- Protection of wetlands and ecosystem
- Investment in ecological infrastructure

Prior research has highlighted that it is necessary to intentionally engage with policy makers and/or individuals who can leverage their positions to ensure that the concept of water sensitivity is written into local and national policy. The success of such a shift depends on a deep understanding of current and projected water use and water resources availability; the adequacy and condition of water infrastructure; and the state of technical, institutional, and management capacity across all levels of government including municipalities.

Municipalities in the Western Cape urgently need water response plans to address issues of increasing water scarcity and declining water quality. Alternative approaches to conventional water management, which account for water supply and quality constraints as well as the impacts of extreme weather-related events, are thus required.

The main objectives of the **Western Cape Integrated Drought and Response Plan (WCIDWRP)** are to**:**

- allow timeous planning and implementation of interventions towards water security
- support integrated and coordinated provincial drought response and planning
- align short- and medium-term interventions with a long-term planning horizon of 15 years
- support WCSWMP Goal 2: Secure water availability / Build additional adaptive capacity / Improve water resilience
- manage and mitigate drought impacts and enhance resilience across sectors – municipal supply, agriculture, industries

At the beginning of the project, it was envisioned that the WCIDWRP would be delivered in three separate but linked, phases as detailed below (Figure 1-1).

- **PHASE 1:** Desktop phase - which aims to use existing plans and information to establish the context and background of the recent Western Cape drought and its 15-year outlook for the province; summarise best practice; clarify mandates, roles and responsibilities; and review, update or amend relevant plans, strategies and frameworks to ensure alignment with the WCIDWRP.
- **PHASE 2:** Development phase- which uses collated data to evaluate new development and growth scenarios and opportunities; assesses water availability and future demand projections; and identifies and evaluates water supply and demand interventions.
- **PHASE 3:** Consolidation phase- which considers sectoral challenges; synthesises information on existing water and wastewater infrastructure; evaluates alternative financing models; develops by-laws as necessary; and develops a decision support mechanism for setting of drought water tariffs and restrictions.

However, as the project developed, it became apparent that there were a few tasks which were the key outputs, whilst the others were all support tasks. All the tasks can be divided under the '3 pillars' of the WCIDWRP (Figure 1-2). The 3 pillars include:

- **Technical interventions** (infrastructure development, diversification of sources, water conservation demand management etc.) to be implemented mainly by local government with support from provincial and national departments
- **Programmatic interventions** (policy, pricing etc.), considering previous provincial planning, to be implemented by provincial and national government.
- **Implementation support** for the execution of the costed, prioritised sequenced action plan, to be implemented by all 3 spheres of government (local / provincial / national)

A workflow diagram showing how the tools and tasks relate to one another is shown in Figure 1-3 (technical interventions) and Figure 1-4 (programmatic interventions).

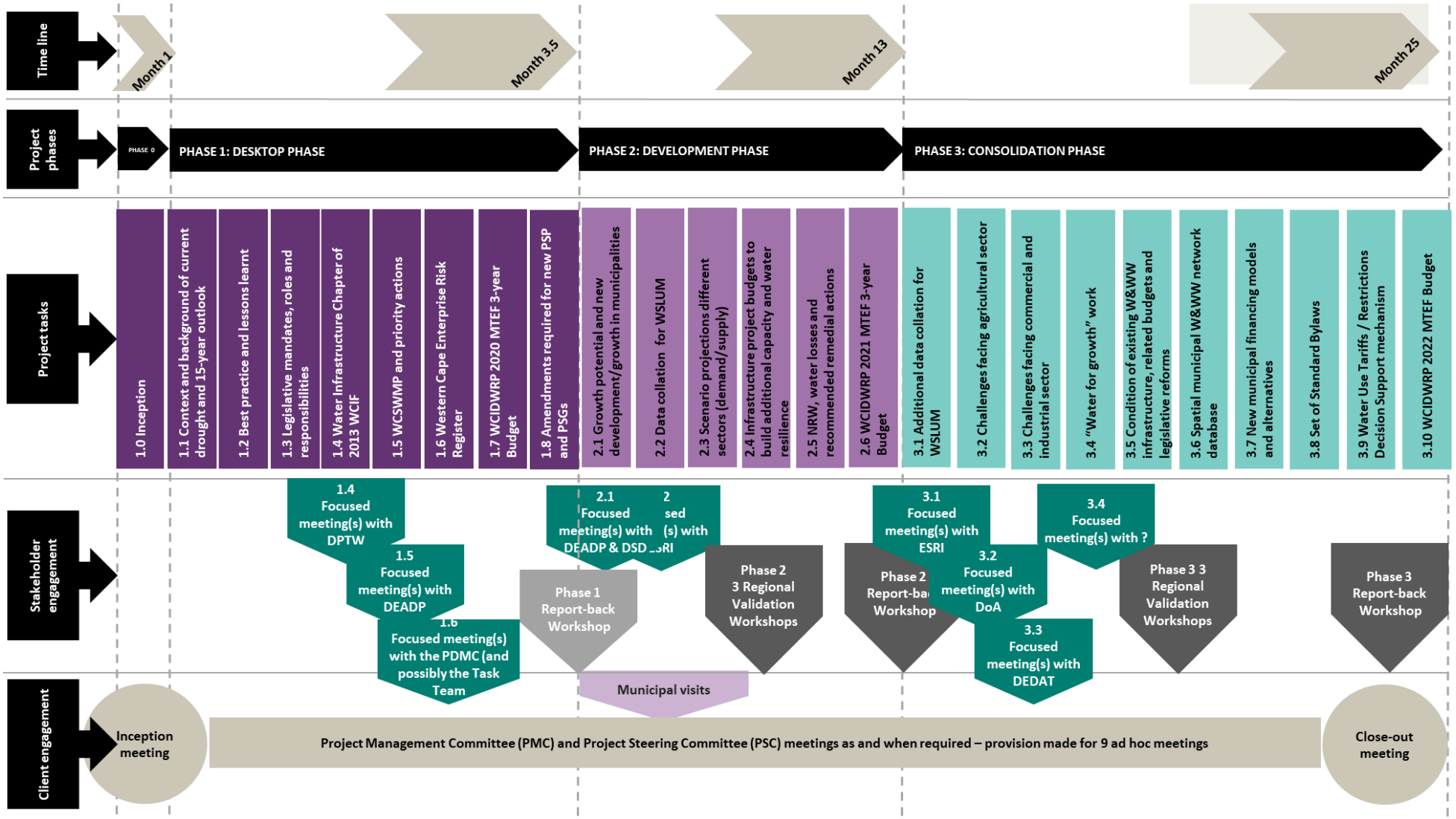


Figure 1-1: Initial project plan delivered in three separate but linked phases

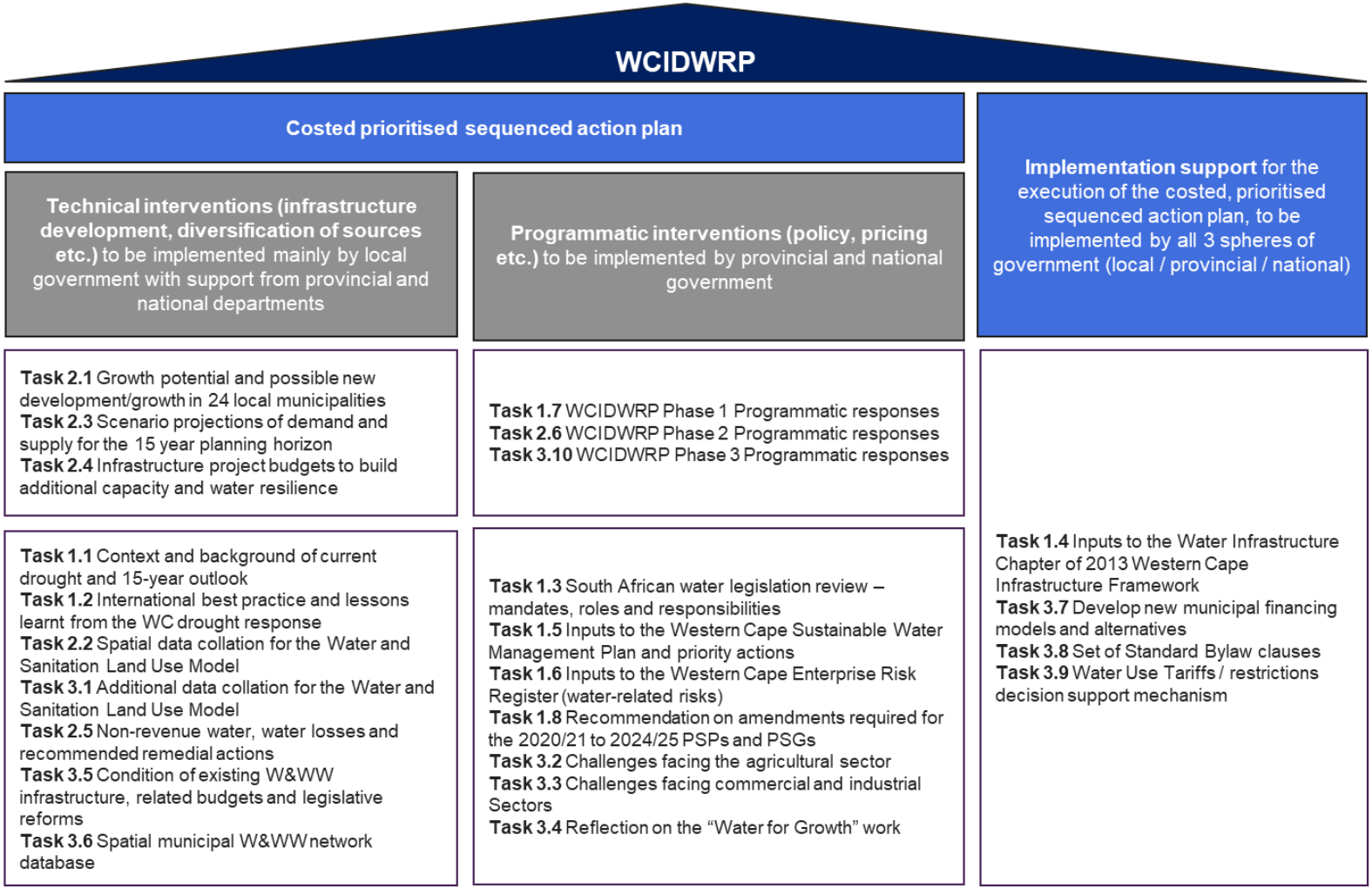


Figure 1-2: The final '3 pillars' of the WCIDWRP, and their relevant foundation and key output tasks

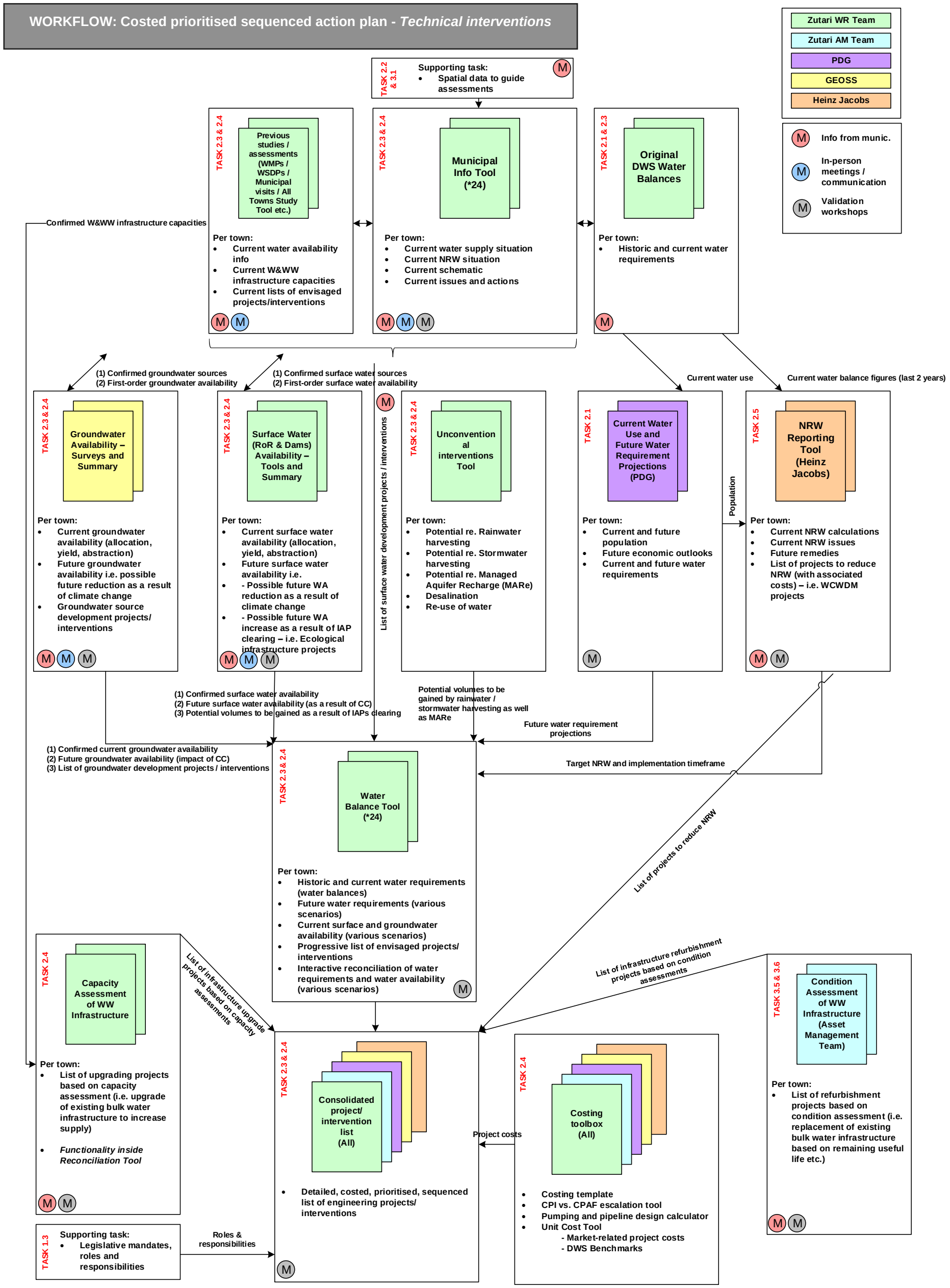


Figure 1-3: Workflow diagram for the technical interventions

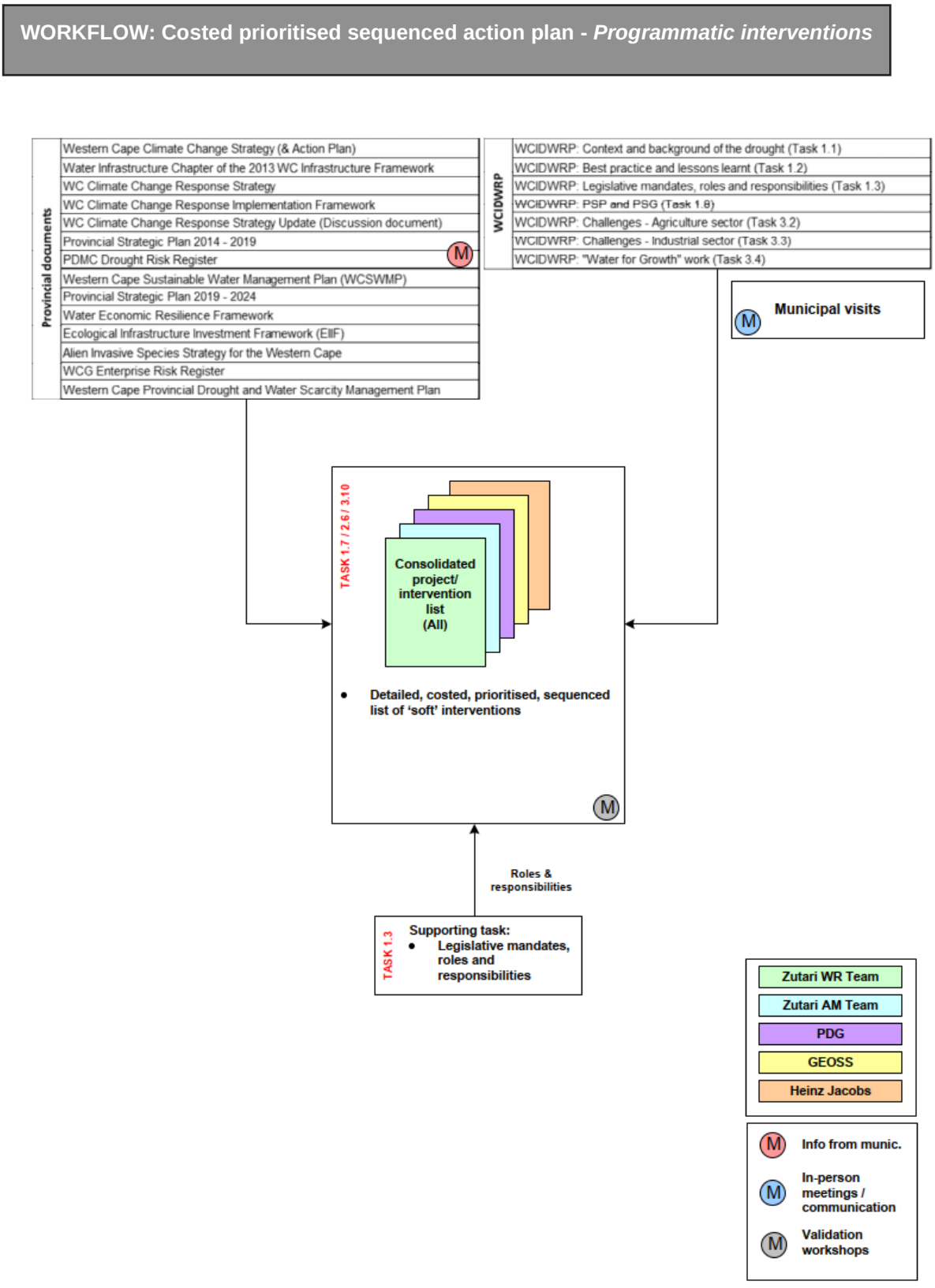


Figure 1-4: Workflow diagram for the programmatic interventions

2 List of reports and standalone appendices

The 24 project tasks were delivered as 28 deliverables/reports and their associated standalone tools/models/appendices, as shown in Table 2-1. The appendices included in the main reports has not been documented in this table.

Table 2-1: List of final reports and standalone appendices/tools/models

PHASE 1

Tasks	Report title	Report number	Standalone appendices/tools/models
1.1	Task 1.1: Context and background of the 2015 to 2019 drought in the Western Cape and the 15-year drought outlook	1000664-0000-REP-KS-00001	
1.2	Task 1.2: International best practice and lessons learnt from the Western Cape drought response	1000664-0000-REP-KS-00002	
1.3	Task 1.3: South African water legislation review – mandates, roles and responsibilities	1000664-0000-REP-KS-00003	
1.4	Task 1.4: Inputs to the Water Infrastructure Chapter of 2013 Western Cape Infrastructure Framework	1000664-0000-REP-KS-00004	• Updated WCIF 2022 model (MS excel)
1.5	Task 1.5: Inputs to the Western Cape Sustainable Water Management Plan and priority actions	1000664-0000-REP-KS-00005	
1.6	Task 1.6: Inputs to the Western Cape Enterprise Risk Register (water-related risks)	1000664-0000-REP-KS-00006	
1.7	Task 1.7: WCIDWRP Phase 1 Programmatic responses	1000664-0000-REP-KS-00007	• Provisional action plan for programmatic interventions, compiled for relevant provincial planning documents (MS excel)
1.8	Task 1.8: Recommendation on amendments required for the 2020/21 to 2024/25 PSPs and PSGs	1000664-0000-REP-KS-00008	

PHASE 2

Tasks	Report title	Report number	Standalone appendices/tools/models
2.1	Task 2.1 & 2.3: Growth outlook and future water demands in the domestic, business and industrial water sectors	1000664-0000-REP-KS-00009	• Population and water demand projections tool for each settlement in the Western Cape from 2020 – 2035, based on low, medium and high growth scenarios (MS excel)
	Task 2.1: Review of Water Master Plans (WMPs) for Western Cape municipalities	1000664-0000-REP-KS-00010	
	Task 2.1: Kannaland Water Master Plan (WMP)	1000664-0000-REP-KS-00011	• WMP Tables 2.1 to 7.1 for Kannaland local municipality (pdf)
	Task 2.1: Beaufort West Water Master Plan (WMP)	1000664-0000-REP-KS-00012	• WMP Tables 2.1 to 7.1 for Beaufort West local municipality (pdf)
2.2	Task 2.2: Data collation for Water and Sanitation Land Use Model (WSLUM)	1000664-0000-REP-KS-00013	• Shapefiles Register of all collated spatial data (MS excel) • Spatial data included in subfolder
2.3	Task 2.3: Current and future demands in the irrigation sector	1000664-0000-REP-KS-00014	• Competing demand between Domestic and irrigation in the WC (outside the WCWSS) (MS excel)
2.4	Task 2.4: Current groundwater availability and potential future supply within the Western Cape	1000664-0000-REP-KS-00015	• Populated groundwater surveys for each municipality (multiple MS excel files) • Legal abstraction, sustainable yield and current abstraction for each municipal groundwater source for each town in the WC (MS excel) • Potential groundwater development for each town in the WC (multiple MS excel files), including o Priority o Geological setting o Total borehole yields for target area (L/s) o Realistic no. of boreholes to be drilled at anticipated yield o Groundwater utilizable potential for target area (Mm3/a) o Managed Aquifer Recharge (MARe) Potential o Groundwater quality and comments o Location o Hydrogeological target o Possible challenges o High level Cost estimate (R): Development; Equipping; Conveyance; Treatment: CAPEX; Treatment: OPEX per annum o Comment

Tasks	Report title	Report number	Standalone appendices/tools/models

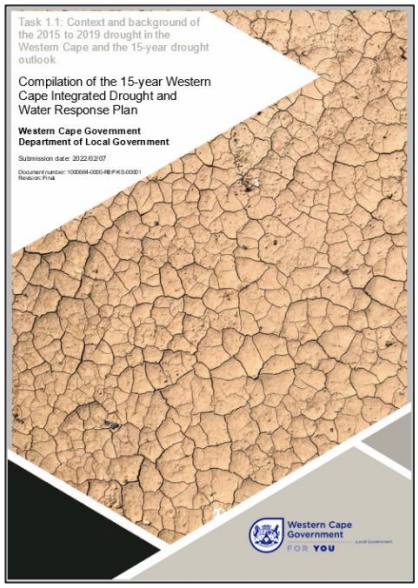
	Task 2.3 & 2.4: Water resource and infrastructure project budgets based on demand / supply projections	1000664-0000-REP-KS-00016	• **Annexure A** report for each local municipality (MS word):
			  ○ Key assumptions regarding water resource planning
			  ○ Key observations
			  ○ References for water resource planning
			  ○ Spatial layout of bulk water systems for each town
			• **Annexure B** report for each town in the WC (MS word)
			  ○ Water reconciliation graph until 2035 (supply vs demand)
			  ○ Required water resource project budgets to build additional capacity and water resilience up to 2035, including: priority, name, potential gain to system (kl/a), estimated cost (R), planning horizon and comment
			• **Annexure C** report for each town in the WC (MS word)
			  ○ Bulk water capacity assessment graph up to 2035
			  ○ Infrastructure project budgets to build additional capacity and water resilience up to 2035, including: priority, bulk water component, name, estimated cost (R) and planning horizon
			• Appendices F-P (MS excel)
			  ○ **Appendix F:** Summary of water availability per town in the WC (including source, legal use, WARMS registration, existing lawful use and sustainable yield)
			  ○ **Appendix G:** Qualitative bulk W&WW capacity assessment per town
			  ○ **Appendix H:** Quantitative bulk W&WW capacity assessment per town
			  ○ **Appendix I:** Qualitative bulk W&WW condition assessment
			  ○ **Appendix K:** Water resource capacity per town to meet 15-year demand (including current and 2035 supply deficits)
			  ○ **Appendix M:** Status of all WTWs in the WC, incl. total influent (Ml/d), capacity (Ml/d), current utilization (%), and state of infrastructure
			  ○ **Appendix N:** Status of all WWTWs in the WC, incl. technology, current inflow (Ml/d), capacity (Ml/d), current utilization (%), state of infrastructure, area discharged to, and 2022 Green Drop score
			  ○ **Appendix O:** Plans and strategies per local municipality
			  ○ **Appendix P:** Primary issues and interventions (water resources, infrastructure, or management) per town
			• **Appendix Q** (MS Excel): Summary of municipal MuSSA reports

2.5	Task 2.5: Scale of NRW and water losses with recommended actions required	1000664-0000-REP-KS-00017	
2.6	Task 2.6 WCIDWRP Phase 2 Programmatic responses	1000664-0000-REP-KS-00018	• Master list of programmatic interventions (MS excel) • Outcome of WCG interactive workshop (MS Powerpoint) • Updated list of programmatic interventions (MS Excel)

PHASE 3

Tasks	Report title	Report number	Standalone appendices/tools/models
3.1	Task 3.1: Additional data collation for Water and Sanitation Land Use model	1000664-0000-REP-KS-00019	• Relevant shapefile/spatial data
3.2	Task 3.2: Challenges facing the agricultural sector	1000664-0000-REP-KS-00020	
3.3	Task 3.3: Challenges facing commercial and industrial Sectors	1000664-0000-REP-KS-00021	
3.4	Task 3.4: Reflection of “Water for Growth” – PSG1 Economic Water Security Work Stream	1000664-0000-REP-KS-00022	
3.5	Task 3.5: Condition of existing water and wastewater infrastructure, related budgets and legislative reforms	1000664-0000-REP-KS-00023	• Updated financial asset registers for each local municipality (multiple MS Excel files)
3.6	Task 3.6: Spatial municipal water and wastewater network database aligned to the Western Cape Government’s ICT governance standards	1000664-0000-REP-KS-00024	• Updated and cleaned spatial asset registers for local municipalities (Multiple ESRI Geodatabases)
3.7	Task 3.7: Develop new municipal financing models and alternatives	1000664-0000-REP-KS-00025	
3.8	Task 3.8: Set of Standard Bylaws clauses	1000664-0000-REP-KS-00026	
3.9	Task 3.9: Water Use Tariffs / restrictions decision support mechanism	1000664-0000-REP-KS-00027	• Restriction Tariff Model (MS Excel)
3.10	Task 3.10: Inputs to the WC 2023/2024 Medium Term Expenditure Framework	1000664-0000-REP-KS-00028	• High level costing tool for programmatic interventions (MS Excel)

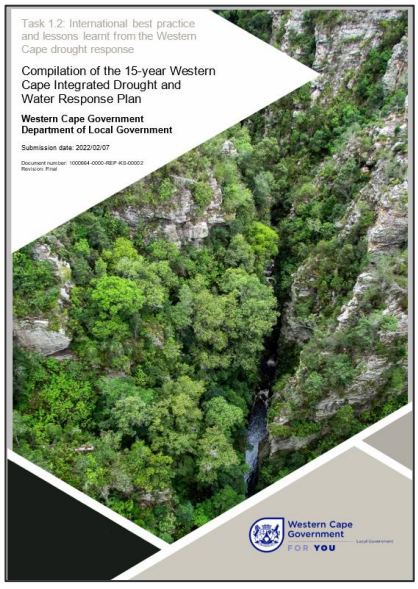
3 Overview of reports



1000664-0000-REP-KS-00001: Task 1.1 Context and background of the 2015 to 2019 drought in the Western Cape and the 15-year drought outlook

With the overall aim to provide a climatological context for the recent 2015 to 2019 drought event and its impact on water resources in the WC Province, this report presents a description of climatological characteristics and climatic drivers of the drought.

It also includes the outlook of future drought occurrence in time-frames relevant to planning (15 years) and in the long-term (80 years). This outlook is based on the analyses of scientific and grey literature describing drought and underlying climatic processes, as well as on the dedicated analyses of historical climatic data and simulations of historical and future climate with Global Climate Models. The focus of these analyses is on understanding the drought in the WC Province in the context of natural climate variability and man-made climate change.

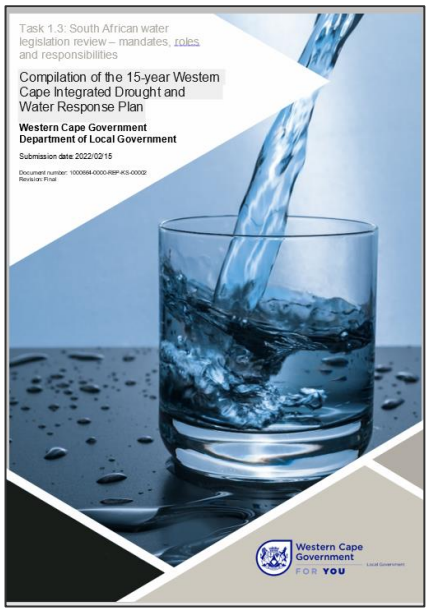


1000664-0000-REP-KS-00002: Task 1.2 International best practice and lessons learnt from the Western Cape drought response

The purpose of this report was to extract the international lessons learnt around water resource planning to inform the WCIDWRP. The following cities and countries were reviewed in terms of international best practice for drought planning:

- Six major river Basin Plans for Kenya
- Australian States, Victoria and Queensland
- Australian cities, Melbourne and Sydney
- Perth's water service provider, Water Corporation
- East of England and Hartlepool's water service provider, Anglian Water
- United States of America State, California
- South Africa, Cape Town

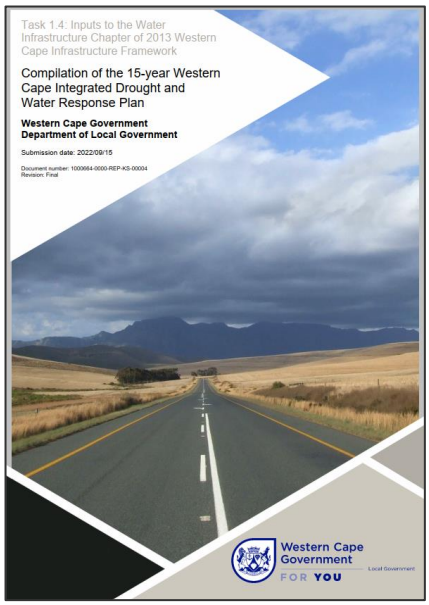
The report also examined the Drought Response Strategies implemented by the Department of Local Government from 2017 to 2020, and lists recommendations arising from this.



1000664-0000-REP-KS-00003: Task 1.3 South African water legislation review – mandates, roles and responsibilities

This report provides a summary of the current legislative mandates, roles and responsibilities in relation to water security and water resilience in the Western Cape. South Africa has a relatively mature system of water law and of legislation covering intergovernmental relations, but the mandates and relationship are complex, and in some cases, ambiguous. The report includes:

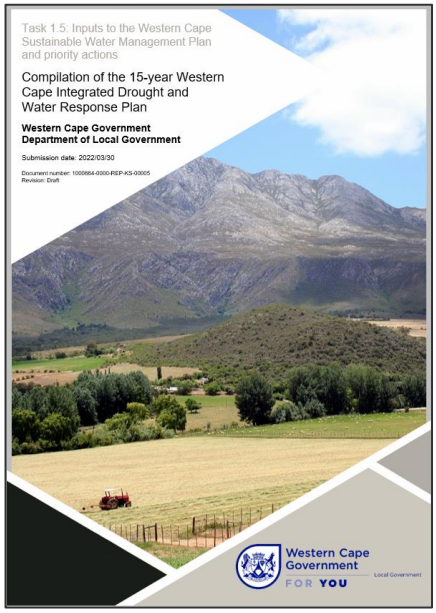
- A summary of the responsibilities of national, provincial and local government
- Areas of interface in responsibility between spheres of government for water security and water resilience
- Overlaps in mandates, which can create risk to water security and water resilience
- Cooperative governance risks and imperatives



1000664-0000-REP-KS-00004: Task 1.4 Inputs to the Water Infrastructure Chapter of 2013 Western Cape Infrastructure Framework

The 2013 Western Cape Infrastructure Framework (WCIF) modelling was revised, using the detailed demand projections and infrastructure costing undertaken in Phase 2 of this project. This work replaced the original proposal to re-run the seven 2013 WCIF models, as the Phase 2 work produced during this project has more accurate and nuanced projections. However, as was done for the 2013 WCIF, the projections were aggregated to the metro and district scales.

Recommendations were then made regarding how the revised water use sector projections and data is to be used by the custodian of the WCIF (i.e. DEDAT) in the WCIF Reboot process.

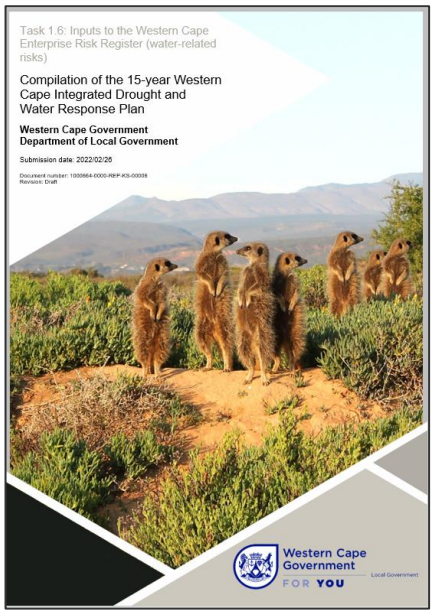


1000664-0000-REP-KS-00005: Task 1.5 Inputs to the Western Cape Sustainable Water Management Plan and priority actions

To ensure alignment between the WCIDWRP and the Western Cape Sustainable Water Management Plan (WCSWMP), this report interrogated the WCSWMP as well as the subsequent two (2) annual progress reports to:

- Identify the contributing factors which exacerbated drought response and water resources planning in the Western Cape Province.
- Categorise these under a set of Key Strategic Areas (KSAs) and themes and compare them with the focus areas of the WCSWMP to ensure that all areas are sufficiently covered within the WCIDWRP.

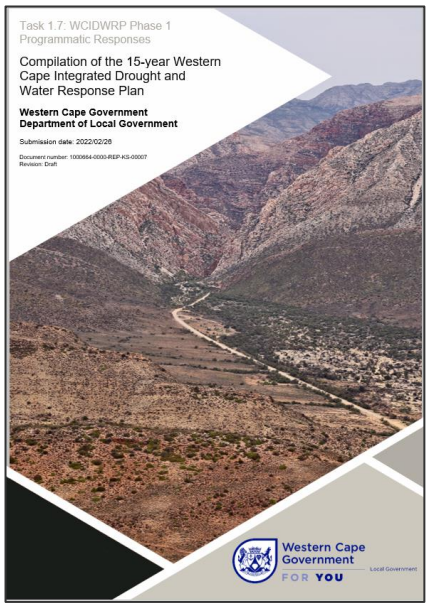
Initial and priority actions from the WCSWMP were extracted according to the KSA framework and then consolidated with interventions from a pre-defined set of Western Cape Government (WCG) plans, policies, strategies, and frameworks in Report No. 1000664-0000-REP-KS-00007.



1000664-0000-REP-KS-00006: Task 1.6 Inputs to the Western Cape Enterprise Risk Register (water-related risks)

The Western Cape Department of the Premier is responsible for updating the Western Cape Enterprise Risk Register (WCERR). As such, the scope of this task was to draft recommendations for the update of the WCERR. In line with this, recommendations were made on (1) additional mitigations currently in place to reduce the drought-related risks in the province (emanating from an interrogation of a pre-defined set of WCG plans, policies, strategies and frameworks) as well as (2) additional key risk indicators that could be used as early-warning indicators for both municipal and irrigation systems in the province.

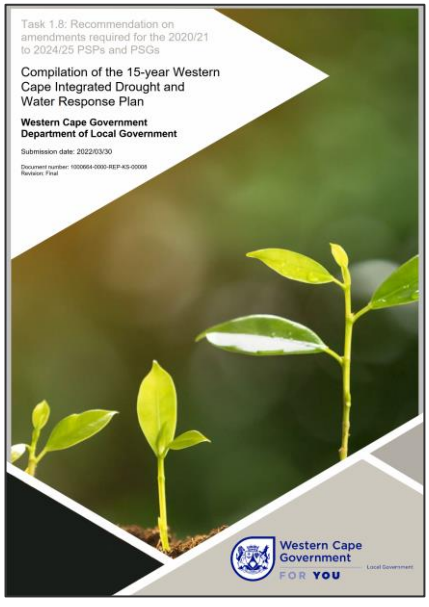
The water-related risk maps developed during this project are included in Section 7 of 1000664-0000-REP-KS-00016, and the spatial data has also been made available as part of Report No. 1000664-0000-REP-KS-00019.



1000664-0000-REP-KS-00007: Task 1.7 WCIDWRP Phase 1 Programmatic responses

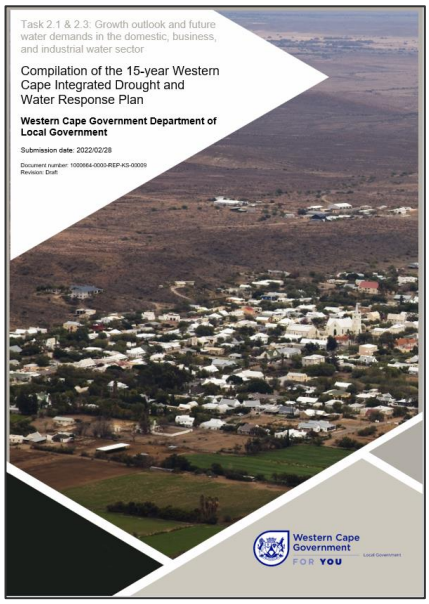
This report focuses on the identification of interventions, actions, programmes, plans or projects from a review of relevant provincial documents as listed in the ToR/SLA. This interrogation was conducted through the lens of the objectives, priorities and delivery targets of the WCIDWRP, and was done according to a grouping matrix of carefully selected KSAs and Themes.

The outcome of this interrogation is a spreadsheet-based list of 357 programmatic interventions stemming from relevant provincial documents. These interventions will be translated to programmatic responses and prioritised in collaboration with various WC Departments in Task 2.6, to ultimately lead to recommendations to inform the departments' contributions to the Western Cape Government's (WCG's) medium-term planning for the 2023 MTEF planning horizon in Task 3.10.



1000664-0000-REP-KS-00008: Task 1.8 Recommendation on amendments required for the 2020/21 to 2024/25 PSPs and PSGs

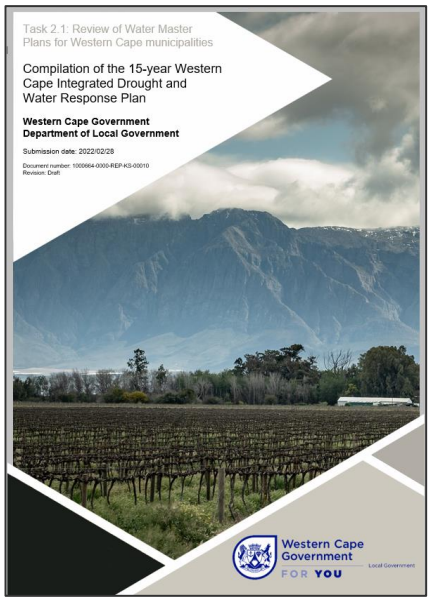
The WCIDWRP is a direct response to the threat to water security posed by the recent drought in the Western Cape. It is linked directly to the cross-cutting 2019-2024 Provincial Strategic Plan (PSP) themes of climate resilience and food security. However, for this to be strategically and institutionally embedded into the provincial administration, it needs to be clearly aligned with each of the five Vision Inspired Priorities (VIPs). The link between each of the VIPs and water security and water resilience, as well as how the WCIDWRP can contribute to achieving each VIP, is discussed in this report.



1000664-0000-REP-KS-00009: Task 2.1 & 2.3 Growth outlook and future water demands in the domestic, business, and industrial water sectors

This report provides an overview of the probable economic and population trajectories per settlement across the WC, and reports on associated impacts on future water demands in the domestic, business, and industrial water sectors of each settlement in the WC from 2020/2021 to 2034/2035.

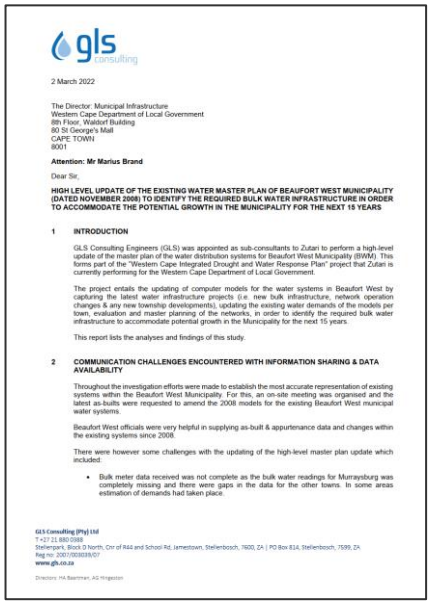
In addition to a baseline projection of water demand, high and low demand scenarios are also projected. Low demand scenarios factor in low demographic and economic growth projections and potential permanent behavioural changes that reduce domestic and non-domestic unit consumption, as well as the risk of losing large non-residential customers (either through them closing down or through them making use of alternative water sources). The high demand scenarios consider high demographic and economic growth potential as well as anticipated developments - residential and non-residential.



1000664-0000-REP-KS-00010: Task 2.1 Review of Water Master Plans (WMPs) for Western Cape municipalities

The objective of this report is to provide a high-level review of all existing WMPs for the 24 Local Municipalities within the Western Cape Province, and to identify any gaps. The results from this exercise are included in Appendices A to X. Appendices A to X therefore also provide a summary of the current water source and water supply infrastructure situation in every local municipality (based on the findings of this Study), compared to that of the last WMP update.

It was found that the current water source and water supply infrastructure situation within some local municipalities (as described in their WMPs) has changed since the last update, most probably due to the diversification of water sources as well as implementation of emergency upgrades to water infrastructure during the recent drought.


gls consulting

2 March 2022

The Director: Municipal Infrastructure
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CAPE TOWN
8001

Attention: Mr Marius Brand

Dear Sir,

HIGH LEVEL UPDATE OF THE EXISTING WATER MASTER PLAN OF BEAUFORT WEST MUNICIPALITY (DATED NOVEMBER 2008) TO IDENTIFY THE REQUIRED BULK WATER INFRASTRUCTURE IN ORDER TO ACCOMMODATE THE POTENTIAL GROWTH IN THE MUNICIPALITY FOR THE NEXT 15 YEARS

1 INTRODUCTION

GLS Consulting Engineers (GLS) was appointed as sub-consultants to Zutari to perform a high-level update of the master plan of the water distribution systems for Beaufort West Municipality (BWM). This forms part of the "Western Cape Integrated Drought and Water Response Plan" project that Zutari is currently performing for the Western Cape Department of Local Government.

The project entails the updating of computer models for the water systems in Beaufort West by capturing the latest water infrastructure projects (i.e. new bulk infrastructure, network operation changes & any new township developments), updating the existing water demands of the models per town, evaluation and master planning of the networks, in order to identify the required bulk water infrastructure to accommodate potential growth in the Municipality for the next 15 years.

This report lists the analyses and findings of this study.

2 COMMUNICATION CHALLENGES ENCOUNTERED WITH INFORMATION SHARING & DATA AVAILABILITY

Throughout the investigation efforts were made to establish the most accurate representation of existing systems within the Beaufort West Municipality. For this, an on-site meeting was organised and the latest as-builts were requested to amend the 2008 models for the existing Beaufort West municipal water systems.

Beaufort West officials were very helpful in supplying as-built & appurtenance data and changes within the existing systems since 2008.

There were however some challenges with the updating of the high-level master plan update which included:

- Bulk meter data received was not complete as the bulk water readings for Murraysburg was completely missing and there were gaps in the data for the other towns. In some areas estimation of demands had taken place.

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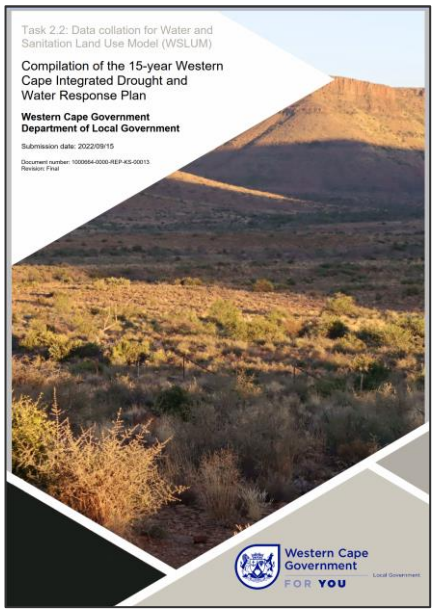
1000664-0000-REP-KS-00011: Task 2.1 Kannaland Water Master Plan (WMP)

1000664-0000-REP-KS-00012: Task 2.1 Beaufort West Water Master Plan (WMP)

GLS Consulting provided updated computer models for the water systems in Beaufort West and Kannaland local municipalities by capturing the latest water infrastructure projects (i.e. new bulk infrastructure, network operation changes & any new township developments), updating the existing water demands of the models per town, and updating the evaluation and master planning of the networks, in order to identify the required bulk water infrastructure to accommodate potential growth in the Municipality for the next 15 years. These reports list the high-level analyses and findings of this study, including relevant appendices and tables that usually accompany WMPs.

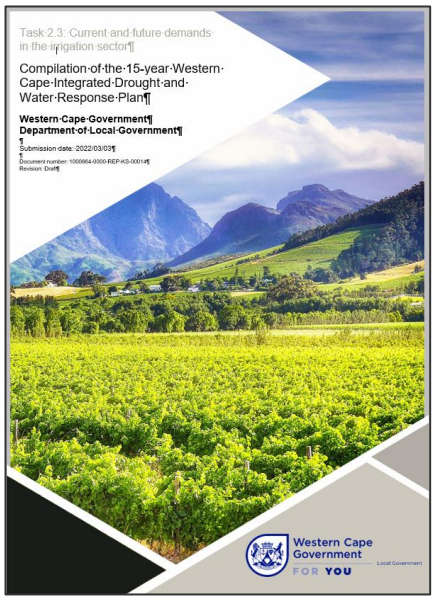


1000664-0000-REP-KS-00013: Task 2.2 Data collation for the Water and Sanitation Land Use Model

The Water and Sanitation Land Use Model (WSLUM) is to be developed by the WCG Department of the Premier in partnership with ESRI. The WSLUM will be used to undertake strategic planning and will form an essential tool for testing the impact of planned future land use scenarios, water and sanitation options, and to determine the future network investment and system requirements.

The WCIDWRP contains two deliverables which contribute to the WSLUM, i.e. Task 2.2 and Task 3.1. As part of Task 2.2, raw data (mainly spatial data) in relation to the spatial data listed in the ToR was collated. This deliverable included the following elements:

- Report outlining the methodology
- Accompanying shapefile register (excel document)
- GIS shapefiles and geodatabases ordered according to the shapefile register

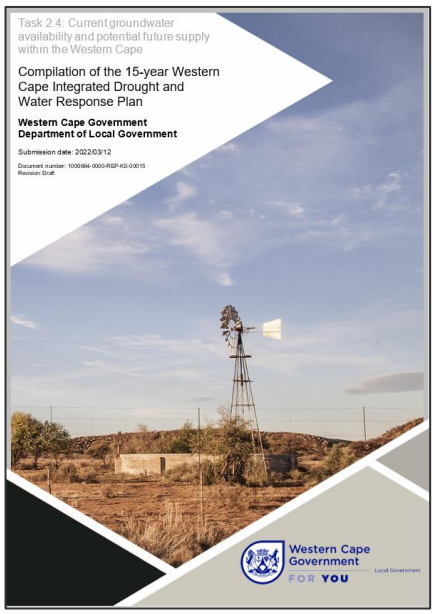


1000664-0000-REP-KS-00014: Task 2.3 Current and future demands in the irrigation sector

To quantify the current irrigation water requirements within the WC for input into the WCIDWRP, four possible information sources were interrogated as part of this report:

- Water Resources of South Africa (WR2012) (K5/2143/1, 2012);
- Validation and Verification of Lawful Water use in the Berg-Olifants WMA (DWS, Ongoing) and Breede-Gouritz WMAs (BGCMA, Ongoing)
- Unverified registered water use (i.e., WARMS registration as recorded in the latest version of the WARMS database) (DWS, Extracted on 2021/01/19);
- Crop census conducted by the Western Cape Department of Agriculture (DoA, 2017/2018)

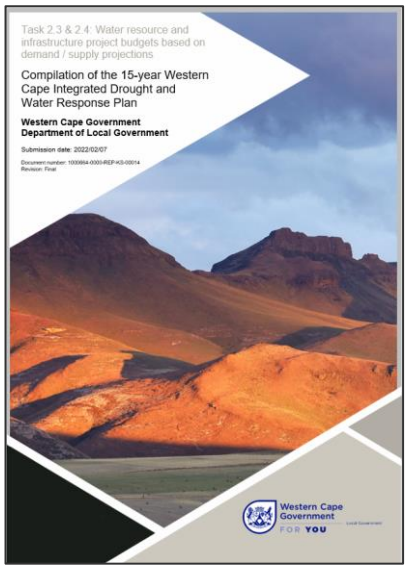
The calculated irrigation demands as per the WC DoA latest crop census data was incorporated into the Surface Water Availability Tools developed as part of this study (described further in Section 4).



1000664-0000-REP-KS-00015: Task 2.4 Current groundwater availability and potential future supply within the Western Cape

The objective of this report is three-fold:

- To provide a regional scale analysis of the groundwater status quo by untertaking groundwater surveys with each local municipality.
- To provide estimate drill targets for groundwater exploration in each town in the Western Cape Province through a desktop exploration exercise. The exercise aimed to provide relevant details which speak to the expected yield, water quality, implementation and operational challenges as well as associated costs.
- To assess future climate change impacts on groundwater water supply systems in the Western Cape Province, using the Mean Annual Precipitation forecast for 2050 along with the modelled probable changes at the 50th percentile.

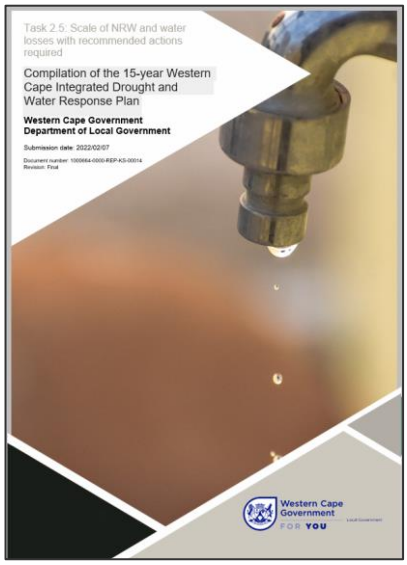


1000664-0000-REP-KS-00016: Task 2.3 & 2.4 Water resource and infrastructure project budgets based on demand / supply projections

The aim of Task 2.3 and 2.4 is to develop the infrastructure project budgets (per town and per municipality) required to build additional adaptive capacity and water resilience across within the WC, to be incrementally realised between 2020/2021 and 2035/2036, and to be maintained over the 15-year planning horizon of this study, i.e. up to 2035.

These projects were assumed to include augmentation projects both from a water resource and a water infrastructure point of view and were based on an interrogation of the demand and supply side of the water cycle in all towns in the 24 local municipalities.

Excel-based decision support tools were developed for the purpose of this study to assist with the identification of water resource augmentation and infrastructure needs and are described in Section 4. The main tools include a Municipal Information Tool (MIT) and a Water Balance Tool (WBT).

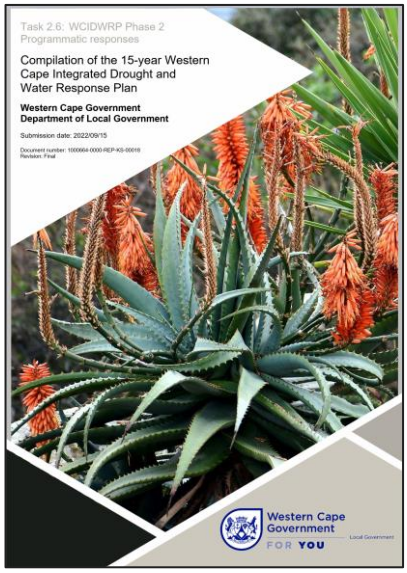


1000664-0000-REP-KS-00017: Task 2.5 Scale of NRW and water losses with recommended actions required

The purpose of this report is to report on the scale of non-revenue water (NRW) and water losses of all towns in all the local municipalities across the Western Cape Province and to make recommendations on the actions required to bring NRW to acceptable levels, based on work to date. This included

- investigating the extent of NRW for each town
- formulating and costing recommendations to reduce NRW and water losses for each municipality.

The scope of work was based on the system (town) level for evaluation of the NRW, with a more generic approach being followed when it came to addressing actions required to bring the NRW to acceptable levels, and definition of an acceptable NRW level.



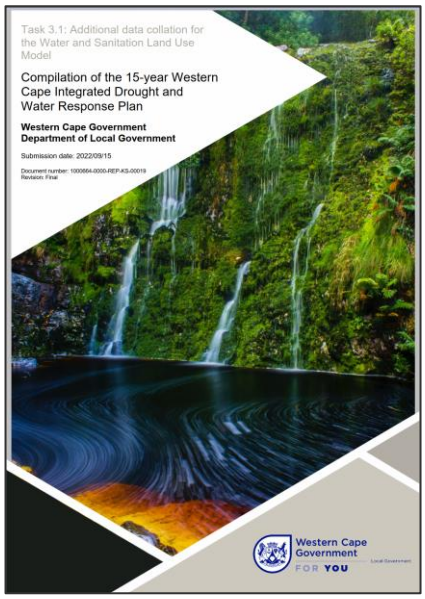
1000664-0000-REP-KS-00018: Task 2.6 WCIDWRP Phase 2 Programmatic responses

This report aims refine the interventions, actions, programmes, plans or projects extracted in Task 1.7, and workshop these with the relevant Western Cape Government Departments.

The outcome of this interrogation was

- An additional 71 programmatic interventions identified during the course of the WCIDWRP project, resulting in a total of 427 interventions
- An excel-based evaluation and short-listing, reducing the list to 75 programmatic interventions
- The 75 programmatic interventions workshopped with key WCG departments, resulting in an updated list of 223 programmatic interventions

These interventions will be further refined and translated to programmatic responses under Task 3.10.



1000664-0000-REP-KS-00019: Task 3.1 Additional data collation for Water and Sanitation Land Use model (WSLUM)

The WSLUM is to be developed by the Western Cape Government in partnership with ESRI. The WSLUM will be used to undertake strategic planning and will form an essential tool for testing the impact of planned future land use scenarios, water and sanitation options, and to determine the future network investment and system requirements.

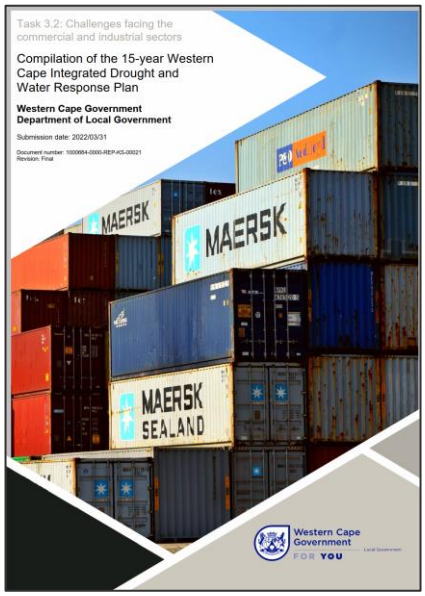
The WCIDWRP contains two deliverables which contribute to the WSLUM, i.e. Task 2.2 and Task 3.1. The output for Task 3.1 is relevant additional data that has been collated during the WCIDWRP project, to be used in conjunction with the spatial data collated in Task 2.2.

1000664-0000-REP-KS-00020: Task 3.2 Challenges facing the agricultural sector

This Report presents some of the primary drivers of future water security and drought risk for the agriculture sector in the Western Cape, over the next 10 to 15 years, including:

- Climate change – direct impacts
- Climate change – indirect/secondary impacts
- Water allocations
- Agriculture service towns
- Connecting infrastructure
- Markets
- Tenures security and land reform
- Innovation and adaptation

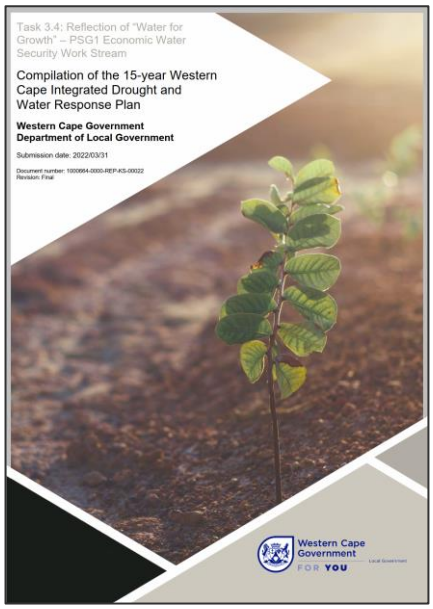
The discussion presented in the report is summarised in terms of the primary strengths, weaknesses, opportunities, and threats for the agriculture sector in the Western Cape with regards to current and future security and drought risks.



1000664-0000-REP-KS-00021: Task 3.3 Challenges facing commercial and industrial Sectors

This report provides a consolidated view of the challenges facing the commercial and industrial sectors in the Western Cape over the 15-year planning horizon with regards to the possible impacts of climate change and the support required to increase resilience in these sectors.

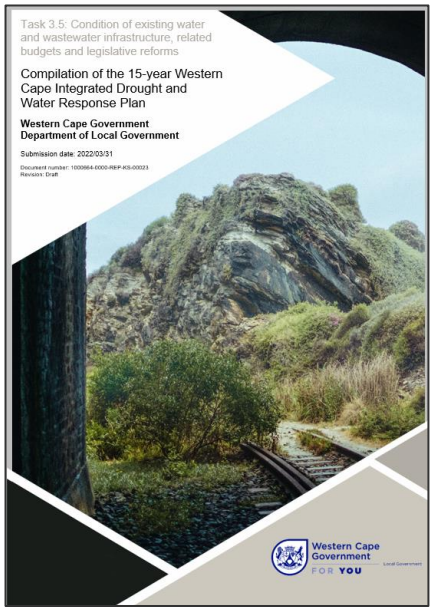
It includes a comprehensive assessment and recommendations for climate change-related challenges per sector and, where relevant, subsector, as it pertains to the Western Cape. This section additionally includes a summary of cross-cutting and sector-specific challenges, namely in the sectors of: Agriculture; Manufacturing; Energy production; Tourism (recreational and business); Trade, transport and logistics; Construction; Business and financial services; Health sector; and Retail sector.



1000664-0000-REP-KS-00022: Task 3.4 Reflection of "Water for Growth" – PSG1 Economic Water Security Work Stream

The purpose of this report is to present a review of the provincial policy development work stream which was upon inception referred to as the "Water for Growth" work as part of Provincial Strategic Goal 1. The work stream reviewed in this report has been re-packaged several times since its inception in 2014, from 'Working for Growth' to 'Economic Water Security', to 'Economic Water Resilience', and more recently as part of the 'Western Cape Economic Recovery'.

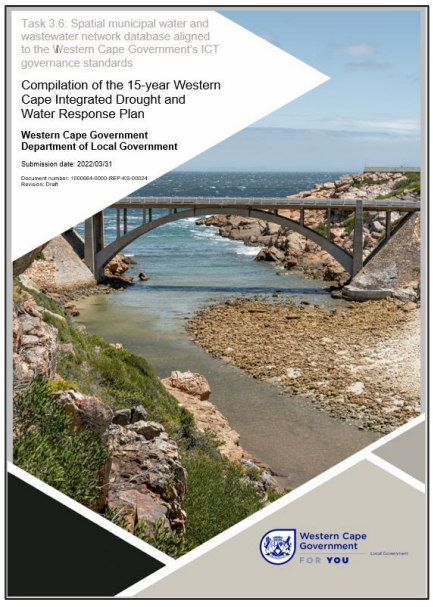
This review also provided an opportunity to recommend updates to the original "Water for Growth" work. Both the original and any additional related interventions will be prioritised in collaboration with the WC DEDAT, in furtherance of informing DEDAT's contributions to Tasks 1.7, 2.6 and finally 3.10.



1000664-0000-REP-KS-00023: Task 3.5 Condition of existing water and wastewater infrastructure, related budgets and legislative reforms

The purpose of this report is to report on the condition of existing water and wastewater (W&WW) infrastructure and related lifecycle budgets for the 24 local municipalities. This approach includes following:

- Condition assessment: Asset condition data from the Municipal Fixed Asset Registers was reviewed by assessing the expected useful life and remaining useful life to calculate the likely condition status.
- Quantify required expenditure: The revised Fixed Asset Register was incorporated in aggregated form into a simplified Long-Term Financial Planning model to generate the required capital (asset renewal) and O&M expenditure over the MTEF period using standard unit costing data. This was then used to assess the adequacy of the municipal budgets.
- Proposed legislative reforms relating to under-expenditure on O&M



1000664-0000-REP-KS-00024: Task 3.6 Spatial municipal water and wastewater network database aligned to the Western Cape Government's ICT governance standards

A gap analysis was conducted on all bulk W&WW asset data obtained from the 24 local municipalities, according to the GRAP 17 standards. Some municipalities do not maintain spatial asset registers, and these could not be analysed. The following methodology was followed:

- Data received or sourced per Local Municipality.
- Asset Register and GIS data was processed in preparation for loading into ArcGIS pro.
- A template feature class was configured to import the multiple datasets.
- Asset data was loaded into the final file geodatabase.
- A gap analysis was done using the asset register, GIS data and available Western Cape Government data.

The linked bulk W&WW spatial data for the available municipalities is included as a geodatabase.

1000664-0000-REP-KS-00025: Task 3.7 Develop new municipal financing models and alternatives

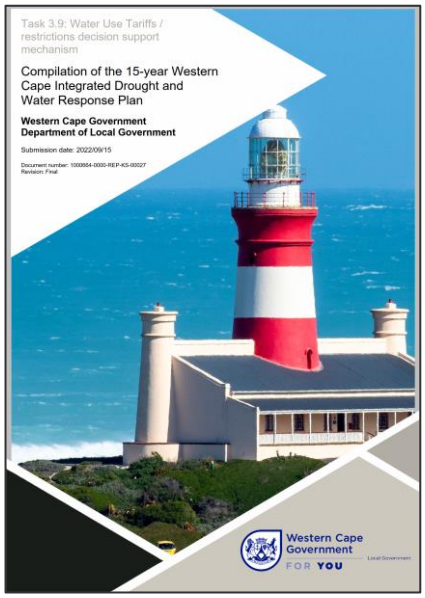
The purpose of this report is to provide a summary of current funding and financing mechanisms as well as considering new and alternative municipal funding and financing models to support drought resilience. This report aims to evaluate both alternative funding and financing models to ensure the availability of finances to ensure the sustainability of individual municipalities in the face of increasing drought risk.

This report shows that there is no single solution to address the current and future challenges with regards to the lack of funding and financing to ensure future water security. Municipal revenues are fungible and so, unless the revenue base is increased, taking more money to fund water means less money to fund other services.

1000664-0000-REP-KS-00026: Task 3.8 Set of Standard Bylaws clauses

The purpose of this Report is to present a set of draft, standardised by-law clauses that address the main concerns relating to the use of alternative water sources, i.e. water sourced from a supply other than municipal drinking water, including greywater; rainwater; treated effluent; surface water; and groundwater.

The set of draft clauses presented in this report are based on a review of existing municipal by-laws, particularly the recommended by-laws specifically introduced by the City of Cape Town to address the concerns relating to alternative water sources. Instead of developing specific by-laws for each municipality, the individual municipalities will need to review these draft clauses and then amend them as necessary to be included in their existing by-laws. These will then need to go through the usual process of legal drafting and review before being fully implemented.

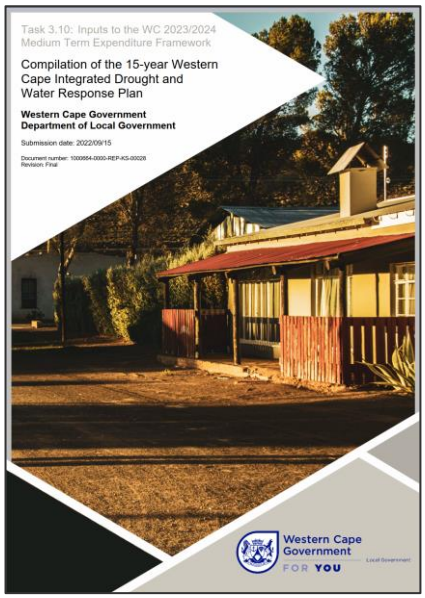


1000664-0000-REP-KS-00027: Water Use Tariffs / restrictions decision support mechanism

To assist municipalities with difficult decisions regarding punitive drought tariffs, a decision-support tool called the Restriction Tariff Model was developed to assist municipalities with the decision of when to implement, and how high to set, restriction tariffs.

The Restriction Tariff Model is a bespoke MS Excel spreadsheet model developed for this project. It has been designed as a generic model for use by municipalities in setting restriction triggers and restriction tariff levels. The tool was developed and tested using a single pilot municipality – George Local Municipality – but has the flexibility for each municipality to accommodate particularities in terms of its specific infrastructure and demands.

This report presents the background, methodology, user manual and key findings for the Restriction Tariff Model.



1000664-0000-REP-KS-00028: Task 3.10 Inputs to the WC 2023/2024 Medium Term Expenditure Framework

Task 3.10 constitutes the third and final of a series of three related programmatic response tasks (i.e. Tasks 1.7, 2.6 and 3.10).

Task 3.10 focuses on reviewing the interventions, actions, programmes, plans or projects extracted in Task 2.6, and identifying those that are critical for the success of the WCIDWRP. The outcome of this interrogation was a final list of 35 programmatic interventions that have been highlighted as critical during the WCIDWRP project. As part of this task, these are costed using a high-level simple MS Excel costing model, and allocated to the lead WCG departments, to ultimately lead to recommendations to inform the departments' contributions to the Western Cape Government's medium-term planning for the 2023 MTEF planning horizon. It will be the responsibility of the lead departments to incorporate the proposed budgets into their MTEF planning.

4 Overview of tools/models

Table 4-1: Summary of the key tools/models developed as part of the 15-year WIDWRP project

Task	Model/tool details	Model/tool name
Task 1.4: Inputs to the Water Infrastructure Chapter of 2013 Western Cape Infrastructure Framework	**Western Cape Infrastructure Framework 2022 Water Infrastructure Framework model** Data outputs from the WCIDWRP were used to update the WCIF model. Data outputs follow the same methodology of the original WCIF and include ► Potable and non-potable water demand ► Potable water demand by district ► Wastewater generation by district ► Capital requirements	***WCIF 2022 WIF model.xlsx*** Excel-based model. Included with report 1000664-0000-REP-KS-00004. Details on methodology included in the report.
Task 2.1 & 2.3: Growth outlook and future water demands in the domestic, business and industrial water sectors	**Residential and non-residential water demand projections for 135 settlements in the WC, per year between 2020 and 2035, for low, medium, and high growth scenarios** ► Population projections from 2020 – 2035, aligned with CSIR and All Towns settlements projections, and intra-municipal apportionment of WCG projections ► Residential demand projections, adjusting for drought restriction "bounce-back". ► Non-residential demand projection ► Low water demand scenario assumptions: low economic and population growth, permanent consumer behavioural change and uptake of alternative sources ► Upper water demand scenario assumptions: High ecopnomic and population growth, potential developments (new housing projects, institutions or new businesses) come online	***WC Projections workbook 20210930.xlsx*** Excel-based tool. Included with report 1000664-0000-REP-KS-00009. Details on methodology included in the report.
Task 2.3 & 2.4: Water resource and infrastructure project budgets based on demand / supply projections	**Surface water availability tool – dams** The model was built on the principle of a cascading water balance and investigated: ► The potential impact of climate change as informed by data obtained from the Green Book: Adapting South African settlements to climate change (CSIR, 2019); as well as	***1. SW availability tool_Dams_Final.xlsm*** Excel-based tool. Included with report 1000664-0000-REP-KS-00016. Details on methodology included in Appendix D of report.

Task	Model/tool details	Model/tool name
	► The potential impact of clearing of existing IAPs, and/or the risk associated with future spread of IAPs by factoring in the potential impact on MAR for the relevant catchments as informed by data obtained from other recent work	
	Surface water availability tool – Run of River (RoR) Built on the principle of a cascading water balance. This model incorporated monthly timeseries for runoff and landuse from the WR2012 study (CSIR, 2019), as well as water requirements – disaggregated from annual to monthly - from the latest version of the WARMS database (DWS, Extracted on 2021/01/19) (i.e. WARMS registrations) for the whole of the Berg-Olifants and Breede-Gouritz WMAs. For the purpose of determining run-of-river yields, the model calculated a flow duration curve at any required location in a river (whether on the mainstream or on a tributary of a mainstream within a quaternary catchment). The run-of-river yield at a 1:50 year recurrence interval was then taken as the resulting flow at an exceedance probability of 98% as reflected on the flow duration curve.	***1. SW availability tool_RoR_Final.xlsm*** Excel-based tool. Included with report 1000664-0000-REP-KS-00016. Details on methodology included in Appendix E of report.
	Unconventional interventions tool Calculates the potential yield from alternative water sources for each of the 121 settlements in the Western Cape. Alternative water sources include ► Rain water harvesting ► Storm water harvesting ► Managed aquifer recharge ► Re-use ► Desalination	***Unconventional interventions tool.xlsm*** Excel-based tool. Included with report 1000664-0000-REP-KS-00016. Details on methodology included in Section 4.8.3 of report.
	Costing toolbox – escalation tool Calculates the escalated cost of any project from when it was costed until 2021. Based on the Consumer Price Index (CPI) as well as the Construction Price Adjustment Factors (CPAF)	***Escalation tool_v2.xlsx*** Excel-based tool. Included with report 1000664-0000-REP-KS-00016. Details on methodology included in Section 4.10 of report.
	Costing toolbox – unit cost tool Calculates the unit CAPEX cost for the following interventions	***UC Tool_Various sources_esc. 2021_v1.xlsx***

Task	Model/tool details	Model/tool name
	► Invasive Alien Plant (IAP) clearing ► Water Conservation and Demand Management (WC/WDM) ► Surface water source development ► Desalination ► Groundwater source development ► Managed aquifer recharge schemes ► Re-use of water ► Rainwater harvesting ► Stormwater harvesting ► Upgrade of existing infrastructure - based on capacity assessments ► Refurbishment of existing infrastructure - based on condition assessments	Excel-based tool. Included with report 1000664-0000-REP-KS-00016. Details on methodology included in Appendix J of report.
	Municipal Infrastructure tool (MIT) The objective of the MIT is to provide a status quo of the current water supply situation within each of the towns/systems in the 24 municipalities in the Western Cape. These tools were populated with available information from existing documents (W&SMP, WSDPs and others) and validated during the one-on-one contact sessions with each municipality, and captures for each town: ► A basic system layout diagram ► The current issues experienced by the specific municipality in terms of water supply ► The current actions/interventions foreseen by the specific municipality in terms of water supply ► The availability of the water resources supplying each town (i.e. yield, allocation, current abstraction) ► The capacities of the bulk water infrastructure within each town (Raw bulk storage / Pump stations / Water treatment plants / Reservoirs / Wastewater treatment plants) ► The current extent of non-revenue water (NRW) for the 2019/2020 year	***Named after the relevant municipality*** 24 excel-based tools. Included with report 1000664-0000-REP-KS-00016. Details on how to use the tool included in this report.
	Water balance tool (WBT) The objective of the WBT is to provide an interactive platform that incorporates all the information needed to make decisions regarding water resource augmentation and water infrastructure projects for each of the towns within the 24 municipalities in the Western Cape, up to 2035. The WBT includes the following information for each town: ► Historic and current water requirements	***Named after the relevant municipality*** 24 excel-based tools. Included with report 1000664-0000-REP-KS-00016.

Task	Model/tool details	Model/tool name
	► Future water requirements (for a high, medium and low water requirement projection with and without WC/WDM) ► Current water availability (i.e. yield and allocation) ► Functionality to conduct a reconciliation exercise to determine water resource augmentation ► Functionality to conduct a capacity assessment to determine water infrastructure augmentation ► Costed and prioritised list of both water resource and water service augmentation projects needed up to 2035	Details on how to use the tool included in this report.
Task 3.9: Water Use Tariffs / restrictions decision support mechanism	**Restriction Tariff Model** The model seeks to answer the following two questions: ► When should a municipality impose restrictions (including tariff restrictions)? ► How high should tariff restrictions be set? To do this the model needs to project supply and demand in the municipality under drought conditions, as well as the municipal revenue implications of any demand and price changes. The key output of the model is a set of restrictions tariffs that would need to be charged to sustain the available water resources during a 1:200 drought. Secondary outputs are the total revenue achievable at the different restriction tariff levels, and the restriction tariffs required to achieve the required revenue target.	***Restriction Tariff Model 20220808.xlsm*** Excel-based tool. Included with report 1000664-0000-REP-KS-00027. Details on methodology and use of the tool included in report.

4.1 Municipal Infrastructure Tool (MIT)

An MIT has been developed for each town in the Western Cape Province and provides a snapshot of the current water resources, the infrastructure status quo, and issues of the bulk water supply system of all towns (see example for the town of Lambert's Bay in Figure 4-1).

Information for this tool was sourced and validated as follows:

- Water Master Plans, Water Service Development Plans and Water Audit Reports of each municipality were interrogated
- Town/municipality specific planning documents were interrogated (e.g. Drakensburg bulk water supply project)
- An in-person visit with each municipality was conducted in early 2021.
    - Both technical and financial municipal staff were present.
    - Bulk infrastructure capacity and condition concerns were identified with the technical manager. Bulk Infrastructure highlighted in red indicates a serious cause for concern, while green indicates that no major bottle necks are limiting the system
- Surface Water abstraction, yield and license values were provided by specialist consultant Zutari.
- Groundwater abstraction, yield and license values were provided by specialist consultant GEOSS.
- Non revenue water values were calculated by specialist Prof Heinz Jacobs.
- All water resource abstraction, yield and license values were verified with John Roberts from DWS.
- The system layout and infrastructure components were further verified with the municipality's technical directors in late 2021/early 2022.

ISSUES FOR WHOLE MUNICIPALITY
- *Big issues with getting permission to drill boreholes on private land, where many of the good GW spots are. The municipality is losing housing development projects because water services must first be in place, and farmers will not allow development. DWS has not assisted with this enagement*
- *GW agreements with farmers only last for 3 years*
- *Limited funding*
- *Illegal connectors in informal settlements with high leakage. Department of rural development must step in.*
- *Drinking water used for farming in most informal settlements*
- *Illegal dams further up the Olifants river*

Lamberts Bay

ISSUES:
- *Lamberts Bay farmer is taking the Municipality to court to have municipal BH infrastructure removed - need a framework for exploring GW potential on private land.*
- *The farmer wants R3 million per year for the GW abstraction on the farm, to be included in the contract.*
- *Cannot drill additional BHs on the same land*
- *No filtration or lime added anymore - need to build a WTW (issues with Brackish water)*
- *Need to drill another 2 BHs to take the pressure off the existing 3*
- *Need to repair and upgrade 750 kl reservoir to 1,000 kl*
- *Upgrade asbestos pipe to PVC (not critical)*

5 Water Treatment Works

WTW 1	Unit		WTW 2	Unit		
Name	Lamberts Bay WTW		Name			
Type	Chlorination (not proper WTW)		Type			
Total Influent	0.762007	million m3/a	2.09 Total Influent		Excess m3/a	0.0
Capacity	4.8	Ml/d	1.75 Capacity		Excess	0.0
Current Utilisation (%)	43%		Current Utilisation (%)			
Condition			Condition			
Blue Drop (%BDRR/BDRR max)	17.7	2022	Blue Drop Statuses (%)		Year	
			Planned Upgrade (Date)			

WTWs

6

Total Potable Water to other Neighbours	0	million m3/a
Total Treated Water	0.711429	million m3/a

Potable Infrastruct

7 Reservoirs

Potable Water Infrastructure	Description	Capacity	Unit
Potable Bulk Water Mains	GOOD capacity, FAIR condition		kl
Potable Reservoirs	FAIR capacity, FAIR condition	6385	kl
Potable Supply Line	FAIR capacity, FAIR condition		kl

Water towers

Name	Capacity	Unit
		kl
		kl
		kl

11 Waste Water Treatment Works

WWTW 1	Unit				
Name	Lamberts Bay WWTW		Name		
Type	lined oxidation ponds		Type		
Total Influent	0.599929	Ml/d	Excess Ml/d		
Capacity	3	Ml/d	Excess		
Current Utilisation (%)	20%				
Condition					
Green Drop (CRR as %CRRmax)	64.7	2021	Green Drop Statuses (%)	Year	Status
Planned Upgrade (Date)			Planned Upgrade (Date)		

WWTWs

4 Total Inflow to WTW 0.762007 million m3/a

3

Bulk Water Infrastructure	Description	Capacity
Raw Water Mains	FAIR capacity, FAIR condition	
Pump Stations	FAIR capacity, POOR condition (will not need to upgrade if they bypass the raw water reservoirs)	
Raw Bulk Storage	FAIR capacity, POOR condition (will likely not fix as it is low lying, and no pumps are needed if it goes straight to the next reservoir)	

Bulk Infrastruct

8

Total System Input Volume (Including GW etc. that enters directly into the distribution system)	0.711429	million m3/a
What volume from additional water resources enters directly into distribution system (GW, desalination) ?	0	million m3/a

9

Total Authorised Consumption	0.496825	million m3/a
Billed metered	0.495403	million m3/a
Billed unmetered	0	million m3/a
Unbilled metered	0	million m3/a
Unbilled unmetered	0.001422	million m3/a

Billed Unmetered Components (million m3/a)	
Flat Rate	Free Basic Water

NRW

NRW	0.216026	million m3/a	30%
Total NRW	0.955147	million m3/a	66%

10

Total Losses	0.265181	million m3/a
Apparent Losses	0	million m3/a
Real Losses	0.265181	million m3/a

Apparent Losses Components (million m3/a)		
Illegal Connections	Inaccurate Meters	Date Errors

2 Total Current Water Supply measured at source 1.45055 million m3/a

0.762007

Weir (Run of River)
In-channel Storage Dam
Borehole(s) — BHs
River (Specified)
Ocean as source for desalination
In-River Sump
Spring/ Fountain (Specified)
Well (Specified)
Canal (In use)
Canal (Temp./ Alternative)
Off take from Source (In use)
Off take from Source (Temp./ Alternative)
Off take from Source (Not in use/ Future use)
Off-channel Storage/ Balancing Dam
Reservoir/Tanks (In use) — Storage
Reservoir/Tanks (Not in use/ Future use) — Storage
Supply/ Reticulation line(s) (In Use)
Supply/ Reticulation line(s) (Not in use/ Future use)
Water Treatment Works — WTW
Desilination Plant(s) — Desalination
End User(s)/ consumer(s) (Specified) — End Users
Conservancy/ Septic Tanks (Specified) — Tanks
Waste Water Treatment Works — WWTW

HOW TO NAVIGATE THIS WORKSHEET:

1) Follow the numbers from 1 to 11
2) Greyed out areas are not applicable to the specific town's water supply system
3) Cells with red text and light red background have calculations which automatically update.
4) Any extra information is added to comments which should be addressed by the municipalities.
5) Cells with red border should be populated and checked by the municipality

Conditions of infrastructure is highlighted with green, orange or red.

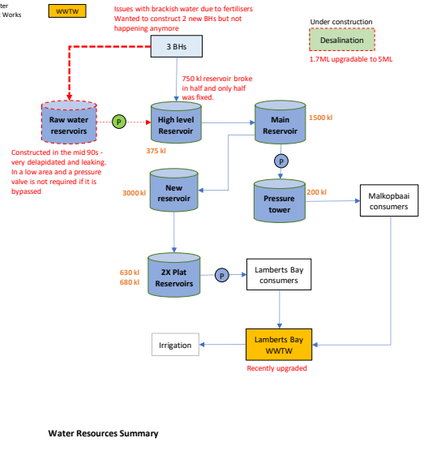
Infrastructure Condition

CONDITION / CAPACITY of infrastructure **GOOD**
CONDITION / CAPACITY of infrastructure **FAIR**
CONDITION / CAPACITY of infrastructure **POOR**

Information Sources

	WMP
	WSDP (for the 2017 - 2022 cycle)
	All Towns
	Water balance spreadsheet
	Water availability summary sheet
	Municipal visits
	GEOSS surveys
	WWTW Summary - DLG
	2022 Blue Drop / Green Drop

BASIC SYSTEM LAYOUT DIAGRAM



Water Resources Summary

1 Water Resources

∑ of Volumes

∑ Abstraction	0
∑ Yield	0
∑ Pipe Capacity	0
∑ License	0

Run of River	River 1	Unit	River 2	Unit	River 3	Unit	River 4	Unit	River 5	Unit

∑ Dam Capacity	0
∑ Abstraction	0
∑ Yield	0
∑ Infra Capacity	0
∑ License	0

Reservoirs/Dams	Dam/Reservoir 1	Unit	Dam/Reservoir 2	Unit	Dam/Reservoir 3	Unit	Dam/Reservoir 4	Unit	Dam/Reservoir 5	Unit

∑ Abstraction	0
∑ License	0
∑ Infra Capacity	0

Bulk Water Purchase	Bulk Purchase 1	Unit	Bulk Purchase 2	Unit	Bulk Purchase 3	Unit	Bulk Purchase 4	Unit	Bulk Purchase 5	Unit

∑ Abstraction	0.829625
∑ Yield	0.567648
∑ Infra Capacity	0
∑ License	0.567648

Groundwater Boreholes	Borehole 1	Unit	Borehole 2	Unit	Borehole 3	Unit	Borehole 4	Unit	Borehole 5	Unit
Registration Number of Borehole/Location of BHs	*O000514*		*LR1*		KKLS					
Is this borehole in use?	Yes		Yes		Yes					
Abstraction Volume	0.197077	million m3/a	0.472978	million m3/a	0.15957	million m3/a				
Sustainable yield of the boreholes	0.23652	million m3/a	0.220752	million m3/a	0.110376	million m3/a				
Abstraction pump/pipeline Capacity		million m3/a		million m3/a		million m3/a				
License	Yes/No		Yes/No		Yes/No					
Allocation Volume	0.567648	million m3/a		million m3/a		million m3/a				
Groundwater Quality (For what is it treated bfr drinking)										
Condition										
Planned Upgrade (Date)										

Groundwater Springs	Spring 1	Unit	Spring 2	Unit	Spring 3	Unit	Spring 4	Unit	Spring 5	Unit

∑ Abstraction	0
∑ Yield	0
∑ Infra Capacity	0
∑ License	0

Sea Water Desalination		Unit
Desalination Name	Lamberts Bay desal	
Current Volume	0.620925	million m3/a
Allocation		million m3/a
Abstraction pump/pipeline capacity		million m3/a

∑ Abstraction	0.620925
∑ Allocation	0
∑ Infra Capacity	0

Effluent		Unit

∑ Abstraction	0
∑ Allocation	0
∑ Infra Capacity	0

Leiwater		Unit

∑ Abstraction	0
∑ Allocation	0
∑ Infra Capacity	0

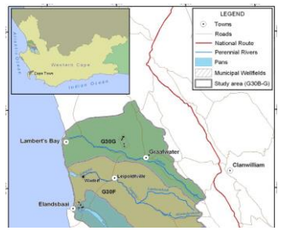


Figure 4-1: Municipal Info Tool for Lambert's Bay

4.2 Water Balance Tool (WBT)

A WBT has been developed for each town in the Western Cape Province and consists of the following components:

4.2.1 Water balance for each town

(see example for the town of Lambert's Bay in Figure 4-2).

- The tool contains historical water use data for each town from 2005 to present. The tool is set up in the exact same format that municipalities are mandated to report their water use values to the DWS. It will therefore be a simple transition for the municipalities to adopt this tool for reporting purposes (red outline).
- The non-revenue water data has been cleaned and corrected where applicable by specialist Prof Heinz Jacobs (yellow outline).
- Water use projections have been estimated by specialist subconsultant PDG (green outline)
    - These have been developed for low, medium and high growth scenarios, and consider behavioural changes (as a consequence of the drought) and the impact of industrial water use. E.g. what would Ladismith's water demand look like if Parmalat's water supply went off grid.
    - These projections are based on WCG population data and are therefore uniform for the province and can be used for comparison. This is a first, as each municipality traditionally determines their own future water demand through different approaches.
- Current water supply allocations and yields were taken from the MIT (orange outline)
    - These include projections of the impact of climate change on long-term river, dam and groundwater yields
- Possible water supply interventions (blue outline) are discussed in Section 4.2.4,
- Current bulk W&WW infrastructure capacities (purple outline) were taken from the MIT

District Municipality	West Coast DM	Contact Person	Ben Schippers
Municipality	Cederberg LM	Contact Details	Tel: 027 4822581/3
Settlement	Lamberts Bay		Email: bens@cederbergraad.co.za

12 MONTH DATA

Month	Surface water dam abstraction	Run-of-River abstraction	Groundwater abstraction	Water re-use for Potable System	Desalination (Sea Water)	Other Raw Water Resource / Purchased	Total Raw Water Abstraction	Total Raw water input to all WTWs	Raw water not treated	Total bulk water prior to treatment	Treated water (after all WTWs)	Bulk treated water purchased	System Input Volume	Billed Metered Consumption	Billed Un-Metered Consumption	Billed Consumption	Un-Billed Metered Consumption	UnBilled UnMetered Consumption
285	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m	kl/m
Annual Totals																		
2005	0	0	0	0	0	0	#N/A	0	0	#N/A	724,482	0	724,482	621,419	0	621,419	0	1,449
2006	0	0	0	0	0	0	#N/A	0	0	#N/A	702,953	0	702,953	573,449	0	573,449	0	1,406
2007	0	0	0	0	0	0	#N/A	0	0	#N/A	757,372	0	757,372	652,404	0	652,404	0	1,515
2008	0	0	0	0	0	0	#N/A	0	0	#N/A	748,836	0	748,836	603,863	0	603,863	0	1,498
2009	0	0	0	0	0	0	#N/A	0	0	#N/A	41,220	0	#N/A	121,551	0	#N/A	0	#N/A
2010	0	0	0	0	0	0	#N/A	0	0	#N/A	0	0	#N/A	0	0	#N/A	0	#N/A
2011	0	0	0	0	0	0	#N/A	0	0	#N/A	679,670	0	679,670	468,570	0	468,570	0	1,359
2012	0	0	0	0	0	0	#N/A	0	0	#N/A	463,655	0	463,655	269,492	0	269,492	0	927
2013	0	0	407,751	0	0	0	#N/A	407,751	0	#N/A	719,854	0	719,854	689,869	0	689,869	0	1,440
2014	0	0	860,090	0	0	0	860,090	860,090	0	860,090	837,613	0	837,613	732,497	0	732,497	0	1,675
2015	0	0	846,127	0	0	0	846,127	846,127	0	846,127	816,431	0	816,431	548,546	0	548,546	0	1,633
2016	0	0	846,672	0	0	0	846,672	846,672	0	846,672	774,534	0	774,534	636,067	0	636,067	0	1,549
2017	0	0	816,483	0	0	0	816,483	816,483	0	816,483	853,909	0	853,909	646,328	0	646,328	0	1,708
2018	0	0	585,268	0	0	0	585,268	585,268	0	585,268	810,619	0	810,619	566,214	0	566,214	0	1,621
2019	0	0	762,007	0	0	0	762,007	762,007	0	762,007	711,429	0	711,429	495,403	0	495,403	0	1,423
2020	0	0	635,922	0	0	0	635,922	635,922	0	635,922	648,727	0	648,727	490,204	0	490,204	0	1,297
2021																		
2022																		
2023																		
2024																		
2025																		
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District Municipality		Contact Person	Ben Schippers
Municipality		Contact Details	Tel: 027 4822581/3
Settlement			Email: bens@cederbergr

Non-revenue Water / Water losses (Annual Totals)

Month	Bulk transmission losses (12 month)	Bulk transmission losses (12 month)	Treatment losses (12 month)	Reticulation Water Loss (12 Month)	Reticulation Water Loss (12 Month)	Non-Revenue Water (12 Month)	Non-Revenue Water (12 Month period)	Total non-revenue water (12 month)	Total non-revenue water (12 month)
	kl/y	%	kl/y	kl/y	%	kl/y	%	kl/y	%
Annual Totals									
2005	#N/A	#N/A	#N/A	101,614	14.0%	103,063	14.2%	#N/A	#N/A
2006	#N/A	#N/A	#N/A	128,098	18.2%	129,504	18.4%	#N/A	#N/A
2007	#N/A	#N/A	#N/A	103,453	13.7%	104,968	13.9%	#N/A	#N/A
2008	#N/A	#N/A	#N/A	143,475	19.2%	144,973	19.4%	#N/A	#N/A
2009	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
2010	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
2011	#N/A	#N/A	#N/A	209,741	30.9%	211,100	31.1%	#N/A	#N/A
2012	#N/A	#N/A	#N/A	193,236	41.7%	194,163	41.9%	#N/A	#N/A
2013	#N/A	#N/A	#N/A	28,545	4.0%	29,985	4.2%	#N/A	#N/A
2014	0	0.0%	22,477	103,441	12.3%	105,116	12.5%	127,593	14.8%
2015	0	0.0%	29,696	266,252	32.6%	267,885	32.8%	297,581	35.2%
2016	0	0.0%	72,138	136,918	17.7%	138,467	17.9%	210,605	24.9%
2017	0	0.0%	-37,426	205,873	24.1%	207,581	24.3%	170,155	20.8%
2018	0	0.0%	-225,351	242,784	30.0%	244,405	30.2%	19,054	3.3%
2019	0	0.0%	50,578	214,603	30.2%	216,026	30.4%	266,604	35.0%
2020	0	0.0%	-12,805	157,226	24.2%	158,523	24.4%	145,718	22.9%
2021									
2022									
2023									
2024									
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2026									
2027									
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District Municipality		Contact Person	Ben Schippers
Municipality		Contact Details	Tel: 027 4822581/3
Settlement			Email: bens@cederbergraad.co.za

PROJECTIONS (adjusted to 2019/2020 RWA) / CURRENT WATER SUPPLY ALLOCATIONS

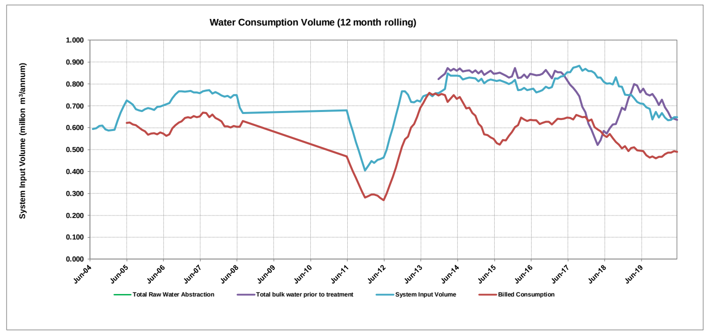
Year	Low	Medium	High	Surface water dam abstraction	Run-of-River abstraction	Groundwater abstraction	Water re-use	Desalination	Other water resource / purchased	Total allocation
	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y
2005	#N/A	#N/A	#N/A							
2006	#N/A	#N/A	#N/A							
2007	#N/A	#N/A	#N/A							
2008	#N/A	#N/A	#N/A							
2009	#N/A	#N/A	#N/A							
2010	#N/A	#N/A	#N/A							
2011	#N/A	#N/A	#N/A							
2012	#N/A	#N/A	#N/A							
2013	#N/A	#N/A	#N/A							
2014	860,090	860,090	860,090							
2015	846,127	846,127	846,127							
2016	846,672	846,672	846,672							
2017	816,483	816,483	816,483							
2018	585,268	585,268	585,268							
2019	762,007	762,007	762,007							
2020	635,922	635,922	635,922			567,648				567,648
2021	617,173	644,512	645,309	0	0	567,648	0	0	0	567,648
2022	599,404	654,126	655,523	0	0	567,648	0	0	0	567,648
2023	581,734	664,095	666,115	0	0	567,648	0	0	0	567,648
2024	583,339	674,738	677,404	0	0	567,648	0	0	0	567,648
2025	583,482	684,098	687,428	0	0	567,648	0	0	0	567,648
2026	586,052	697,231	701,975	0	0	567,648	0	0	0	567,648
2027	588,453	710,518	716,741	0	0	567,648	0	0	0	567,648
2028	590,800	724,094	731,863	0	0	567,648	0	0	0	567,648
2029	593,090	737,966	747,352	0	0	567,648	0	0	0	567,648
2030	595,320	752,142	763,219	0	0	567,648	0	0	0	567,648
2031	596,879	765,810	778,543	0	0	567,648	0	0	0	567,648
2032	598,370	779,770	794,233	0	0	567,648	0	0	0	567,648
2033	599,790	794,030	810,300	0	0	567,648	0	0	0	567,648
2034	601,135	808,597	826,754	0	0	567,648	0	0	0	567,648
2035	602,402	823,479	843,606	0	0	567,648	0	0	0	567,648
2036	608,761	833,018	856,324	0	0	567,648	0	0	0	567,648
2037	615,120	842,557	869,043	0	0	567,648	0	0	0	567,648
2038	621,479	852,096	881,761	0	0	567,648	0	0	0	567,648
2039	627,839	861,634	894,480	0	0	567,648	0	0	0	567,648
2040	634,198	871,173	907,198	0	0	567,648	0	0	0	567,648
2041	640,557	880,712	919,917	0	0	567,648	0	0	0	567,648
2042	646,916	890,251	932,635	0	0	567,648	0	0	0	567,648
2043	653,276	899,790	945,354	0	0	567,648	0	0	0	567,648
2044	659,635	909,329	958,072	0	0	567,648	0	0	0	567,648
2045	665,994	918,867	970,790	0	0	567,648	0	0	0	567,648
2046	672,353	928,406	983,509	0	0	567,648	0	0	0	567,648
2047	678,712	937,945	996,227	0	0	567,648	0	0	0	567,648
2048	685,072	947,484	1,008,946	0	0	567,648	0	0	0	567,648
2049	691,431	957,023	1,021,664	0	0	567,648	0	0	0	567,648
2050	697,790	966,562	1,034,383	0	0	567,648	0	0	0	567,648

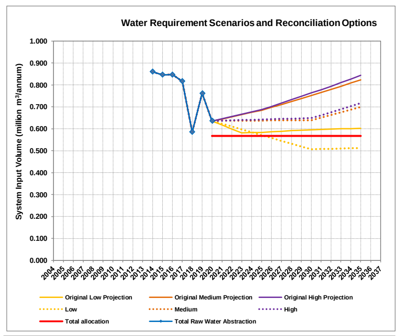
CURRENT WATER YIELDS / POSSIBLE INTERVENTIONS

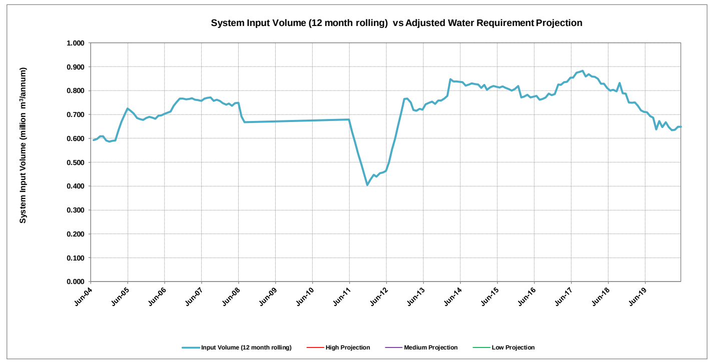
Year	Surface water dam abstraction	*Surface water dam abstraction with probable climate change impact*	Run-of-River abstraction	*Run-of-River abstraction with probable climate change impact*	Groundwater abstraction	*Groundwater abstraction with probable climate change impact*	Water re-use	Desalination	Other water resource / purchased	Total system yield	*Total system yield with probable climate change impact*	SELECTED WATER AVAILABILITY SCENARIO	Completion of Lamberts Bay Desalination plant (1.7 Ml/d) - can be upgraded to ML/d	5 BHs in the Wadrif alluvial Aquifer	Re-use (direct or indirect for MARe) - 0.81 ML/d plant	Urban stormwater harvesting (for MARe)	POSSIBLE TOTAL AVAILABILITY
	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y
2005										567,648	567,648	567,648					
2006										567,648	567,648	567,648					
2007										567,648	567,648	567,648					
2008										567,648	567,648	567,648					
2009										567,648	567,648	567,648					
2010										567,648	567,648	567,648					
2011										567,648	567,648	567,648					
2012										567,648	567,648	567,648					
2013										567,648	567,648	567,648					
2014										567,648	567,648	567,648					
2015										567,648	567,648	567,648					
2016										567,648	567,648	567,648					
2017										567,648	567,648	567,648					
2018										567,648	567,648	567,648					
2019										567,648	567,648	567,648					
2020					567,648	567,648				567,648	567,648	567,648					
2021	0	0	0	0	567,648	564,397	0	0	0	567,648	564,397	564,397	620,925	0	0	0	620,925
2022	0	0	0	0	567,648	561,145	0	0	0	567,648	561,145	561,145	620,925	0	0	0	620,925
2023	0	0	0	0	567,648	557,894	0	0	0	567,648	557,894	557,894	620,925	0	0	0	620,925
2024	0	0	0	0	567,648	554,642	0	0	0	567,648	554,642	554,642	620,925	0	0	0	620,925
2025	0	0	0	0	567,648	551,391	0	0	0	567,648	551,391	551,391	620,925	0	0	0	620,925
2026	0	0	0	0	567,648	548,139	0	0	0	567,648	548,139	548,139	620,925	0	0	0	620,925
2027	0	0	0	0	567,648	544,888	0	0	0	567,648	544,888	544,888	620,925	0	0	0	620,925
2028	0	0	0	0	567,648	541,637	0	0	0	567,648	541,637	541,637	620,925	0	0	0	620,925
2029	0	0	0	0	567,648	538,385	0	0	0	567,648	538,385	538,385	620,925	0	0	0	620,925
2030	0	0	0	0	567,648	535,134	0	0	0	567,648	535,134	535,134	620,925	0	0	0	620,925
2031	0	0	0	0	567,648	531,882	0	0	0	567,648	531,882	531,882	620,925	0	0	0	620,925
2032	0	0	0	0	567,648	528,631	0	0	0	567,648	528,631	528,631	620,925	0	0	0	620,925
2033	0	0	0	0	567,648	525,379	0	0	0	567,648	525,379	525,379	620,925	0	0	0	620,925
2034	0	0	0	0	567,648	522,128	0	0	0	567,648	522,128	522,128	620,925	0	0	0	620,925
2035	0	0	0	0	567,648	518,877	0	0	0	567,648	518,877	518,877	620,925	0	0	0	620,925
2036	0	0	0	0	567,648	515,625	0	0	0	567,648	515,625	515,625	620,925	0	0	0	620,925
2037	0	0	0	0	567,648	512,374	0	0	0	567,648	512,374	512,374	620,925	0	0	0	620,925
2038	0	0	0	0	567,648	509,122	0	0	0	567,648	509,122	509,122	620,925	0	0	0	620,925
2039	0	0	0	0	567,648	505,871	0	0	0	567,648	505,871	505,871	620,925	0	0	0	620,925
2040	0	0	0	0	567,648	502,619	0	0	0	567,648	502,619	502,619	620,925	0	0	0	620,925
2041	0	0	0	0	567,648	499,368	0	0	0	567,648	499,368	499,368	620,925	0	0	0	620,925
2042	0	0	0	0	567,648	496,117	0	0	0	567,648	496,117	496,117	620,925	0	0	0	620,925
2043	0	0	0	0	567,648	492,865	0	0	0	567,648	492,865	492,865	620,925	0	0	0	620,925
2044	0	0	0	0	567,648	489,614	0	0	0	567,648	489,614	489,614	620,925	0	0	0	620,925
2045	0	0	0	0	567,648	486,362	0	0	0	567,648	486,362	486,362	620,925	0	0	0	620,925
2046	0	0	0	0	567,648	483,111	0	0	0	567,648	483,111	483,111	620,925	0	0	0	620,925
2047	0	0	0	0	567,648	479,860	0	0	0	567,648	479,860	479,860	620,925	0	0	0	620,925
2048	0	0	0	0	567,648	476,608	0	0	0	567,648	476,608	476,608	620,925	0	0	0	620,925
2049	0	0	0	0	567,648	473,357	0	0	0	567,648	473,357	473,357	620,925	0	0	0	620,925
2050	0		0		567,648	470,105	0	0	0	567,648	470,105	470,105	620,925	0	0	0	620,925

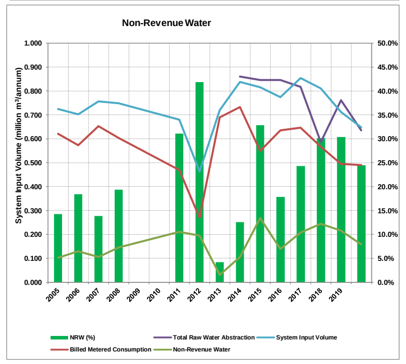
INFRASTRUCTURE CAPACITIES

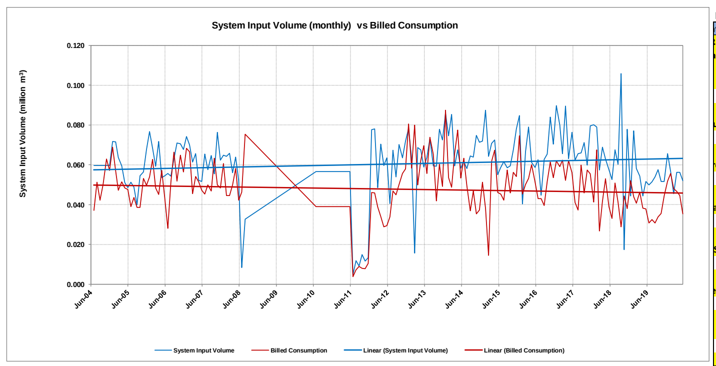
Year	Source (in limited cases – where it is the municipality's asset)	Raw bulk storage	Pump stations	Raw water mains	Water purification works (WPW)	Potable bulk water mains	Potable reservoirs	Potable water towers	Required WWTW Treatment Capacity (2035 60% billable consumption)	Wastewater Treatment Works (WWTW)	Required WPW Treatment Capacity (2035 raw water abstraction)
	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y	kl/y
2005	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2006	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2007	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2008	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2009	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2010	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2011	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2012	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2013	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2014	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2015	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2016	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2017	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2018	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2019	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2020	0	0	0		1,753,200		1,166,061	0	381,878	1,095,750	823,479
2021	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2022	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2023	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2024	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2025	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2026	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2027	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2028	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2029	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2030	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2031	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2032	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2033	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2034	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2035	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2036	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2037	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2038	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2039	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2040	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2041	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2042	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2043	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2044	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2045	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2046	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2047	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2048	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2049	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
2050	0	0	0	0	1,753,200	0	1,166,061	0	381,878	1,095,750	823,479
					4.80		6,385.00		1.05	3.00	2.25
	million m3/a	kl	l/s		Ml/d		kl	kl	Ml/d	Ml/d	Ml/d
		0	0		4,800		3,193	0	1,046	3,000	2,255
		kl/d	kl/d		kl/d		kl/d	kl/d	kl/d	kl/d	kl/d











Extende Municipal financial year ending June

ter resou	Reticulation	Consumption	Billed / un-billed
aw wate	System Input	Authorised	Billed metered
bstracted		Consumption	490,204
	WTW		
Dam	648,727	491,501	Billed unmetered
-			-
	No treatment		
un-of-Riv	-		Unbilled metered
-			-
	Purchased		
roundwat	-		Unbilled unmetered
#####			1,297
	Total treated		
ated efflu	648,727	Reticulation losses	Apparent losses
-			
	Total system input	157,226	
Seawater	648,727	24%	Real losses
-			157,226
er / purch	Treatment losses	Bulk supply losses	Apparent bulk loss
-	-12,805		
		-	
Total	Bulk reticulation losses	0%	Real bulk losses
#####	-		-

Figure 4-2: Water Balance data for Lambert's Bay

4.2.2 Water Resource reconciliation graph for each town

(see example for the town of Lambert's Bay in Figure 4-3).

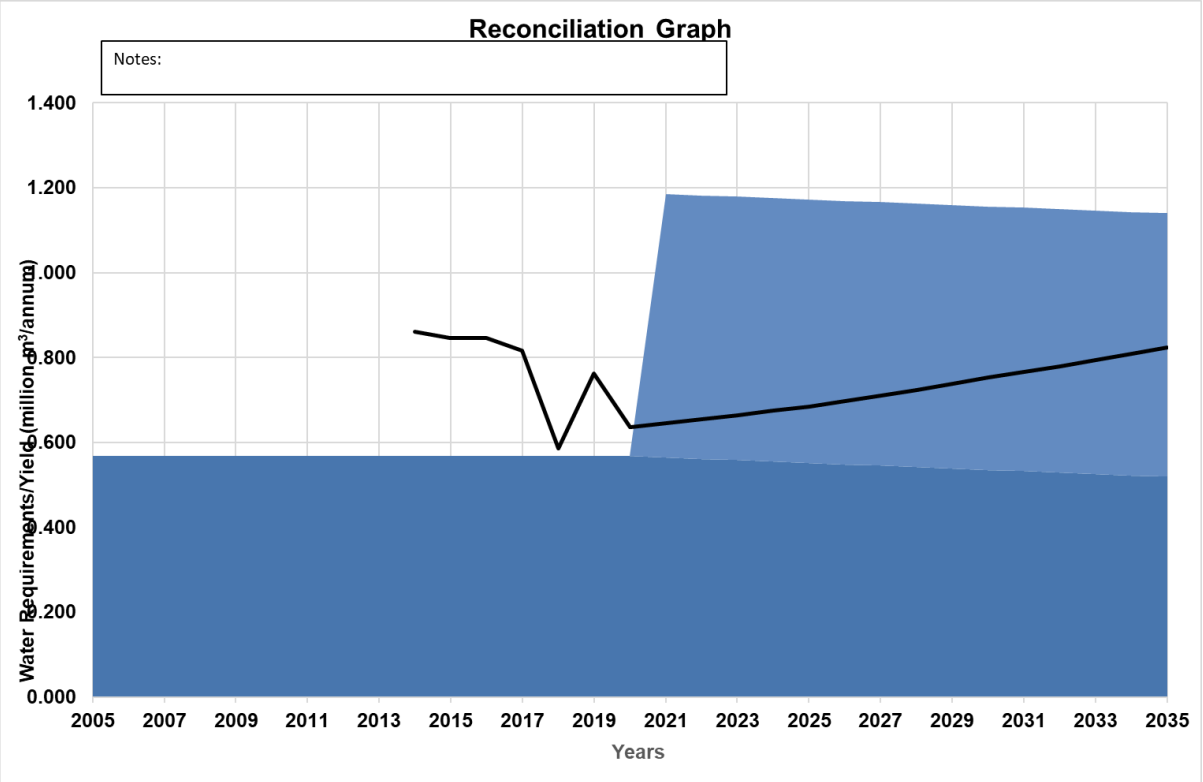


Figure 4-3: Water reconciliation graph for the town of Lambert's Bay. Existing water supply sources are shown in dark blue, and proposed water supply interventions to meet the future demand is shown in a lighter blue. The future water supply intervention is selected in the input sheet, discussed further under Section 4.2.5.

4.2.3 Water Infrastructure Capacity Assessment

(see example for the town of Lambert's Bay in Figure 4-4).

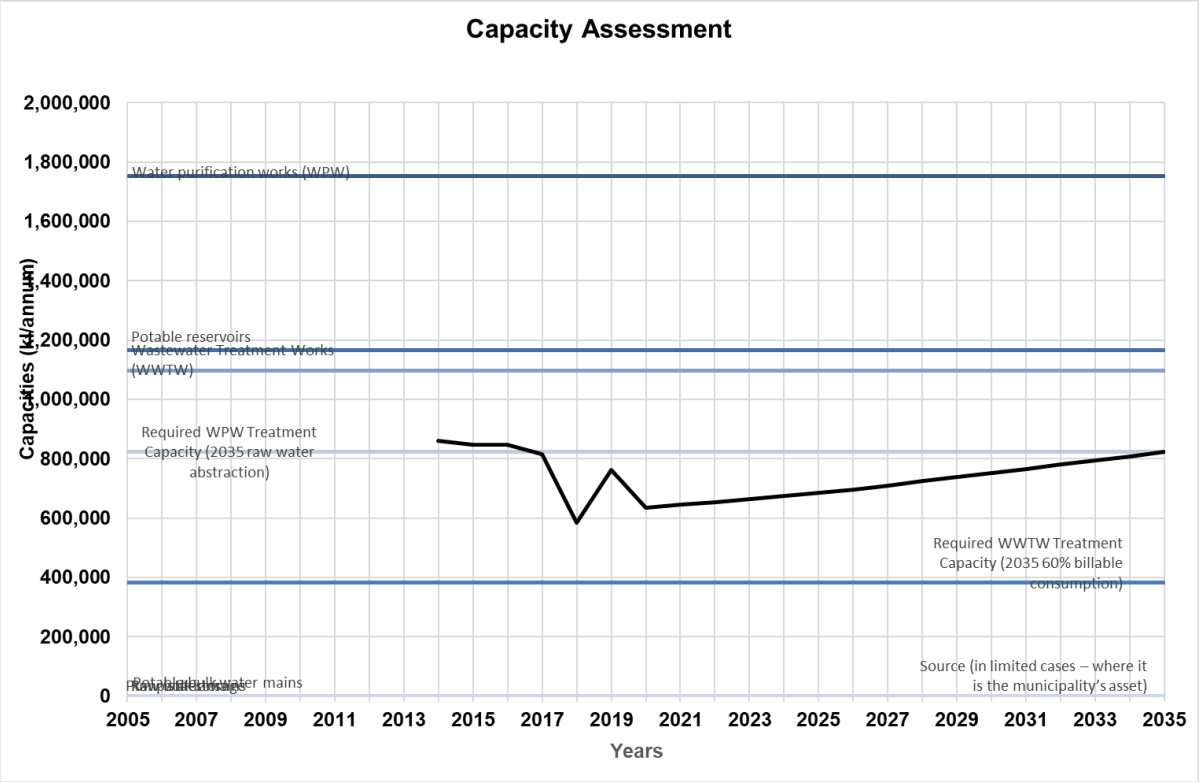


Figure 4-4: Water infrastructure capacity assessment for the town of Lambert's Bay.

4.2.4 Infrastructure and water resource interventions for each town

(see example for the town of Lambert's Bay in Figure 4-5).

- All possible water resource and infrastructure interventions were compiled from the afore mentioned reports and engagements with municipalities. Each intervention included
  - An accompanying budget, either from a planning document or estimated by the consultants
  - A planning horizon (short-term, medium-term, long-term and after 2035)
  - Potential gain to system (for water resource projects)
  - Priority rating
- The list of interventions was workshopped and prioritised with each municipality at the end of 2021. Interventions were discarded based on recommendations from the municipality.
- Water resource interventions included the following:
  - Water Conservation Water Demand Management: System gains and high level costing done by Prof Heinz Jacobs
  - Groundwater projects: A list of groundwater projects with associated costs, system gains, associated risks and other notes were compiled by GEOSS in a separate annexure (see Figure 4-6).
  - Surface Water Projects: based on the possibility of further allocation or development of a surface water source compiled by Zutari.
  - Re-use (direct for potable or indirect for Managed Aquifer Recharge): Calculated based on % of future demand. High level costing done by Zutari specialists.
  - Rainwater harvesting (for domestic or municipal wide use): Calculated based on the rainfall in the area. High level costing done by Zutari specialists.
  - Stormwater harvesting for Managed Aquifer Recharge: Calculated based on the paved area of the town. High level costing done by Zutari specialists.
  - Desalination: Considered for coastal towns with a 2035 water shortage. If not already considered by the municipality, high level costing was done by Zutari specialists.
- Water infrastructure projects were sized and costed based on the following
  - Costs in existing planning documents (such as WMPs)
  - If no planning documents exist, this was costed and sized by Zutari experts based on capacity shortfalls by 2035.

Source	Town	No	Project reference number (if existing project)	Project name	Project description	Project driver	Project type	Component type	Key Strategic Area (KSA)	Potential gain to system (i.e. yield / capacity / target %)	Unit	Potential gain to system (kl/a)	Unit	Original planned implementation date	Revised implementation date	Original cost	Revised cost	Responsible organisation	Implementing agency	Best fit grants (granting mechanisms/funding agencies)	Select/Discard	Reason for discarding	Recon Interventi on	Project impact	Commen st	Priority	Planning horizons
				0		Select from drop down list	Select from drop down list	Select from drop down list	Select from drop down list		Select from drop down list		kl/a							Select from drop down	Select from drop down list	Select from drop down list	No				
~~Proposed~~		~~R~~		~~Desalination~~		~~Increase water availability~~	~~Desalination~~	~~Source~~	~~8-Implementation~~	~~255831.1169~~	~~kl/a~~	~~255831.1~~	~~kl/a~~				-				~~Discard~~	Sufficient water supply	~~No~~	~~Long-term water security~~			
Consolidated Project List		R		Completion of Lamberts Bay Desalination plant (1.7 Ml/d) - can be upgraded to ML/d		Increase water availability	Desalination	Source	8-Implementation	1.7	Ml/d	620925	kl/a	2018		R 6,000,000	R 7,618,932			Municipal Drought Relief Grant	Select		Yes	Long-term water secu	2	After 2035	
~~Consolidated Project List~~		~~R~~		~~Lamberts Bay Desalination plant~~	Augmentation of bulk	~~Increase water availability~~	~~Desalination~~	~~Source~~	~~8-Implementation~~							~~R 88,308,314~~	~~R 112,135,835~~			~~RBIG~~	~~Discard~~	Other	~~No~~	~~Long-term water security~~			
~~Consolidated project list table - RBIG~~		~~R~~	~~WCR 001~~	~~Lamberts Bay Desalination plant~~		~~Increase water availability~~	~~Desalination~~	~~Source~~	~~8-Implementation~~							~~R 88,308,314~~	~~R 112,135,835~~				~~Discard~~		~~No~~	~~Long-term water security~~			
Proposed		R		Re-use (direct or indirect for MARe) - 0.81 ML/d plant		Increase water availability	Reuse	Source	8-Implementation	297241.8	kl/a	297241.8	kl/a				R 24,414,111				Select		Yes	Long-term water secu	4	After 2035	
Proposed		R		Rainwater harvesting (supplementing domestic use)		Reduce water requirement	Rainwater	Source	8-Implementation	0.017610135	million m3/a	17610	kl/a				R 2,558,812				Select	Rainwater harvesting is a suit	No	Increased livelihoods resilience			
Proposed		R		Urban stormwater harvesting (for MARe)		Increase water availability	Stormwater	Source	8-Implementation	0.005111077	million m3/a	5111	kl/a				-				Select		Yes	Long-term water secu	5	After 2035	
GEOSS		R		5 BHs in the Wadrif alluvial Aquifer	Roodeklipheuwel Farm	Increase water availability	Groundwater development	Source	8-Implementation	1.26	million m3/a	1260000	kl/a				R 9,005,520				Select		Yes	Emergenc The Lambe	3	Short-term	
~~Site visit - Other~~		~~R~~		~~Drill another 2 BHs to take the pressure off the existing 3~~		~~Increase water availability~~	~~Groundwater development~~	~~Source~~	~~8-Implementation~~								~~-~~				~~Discard~~	~~included above~~	~~No~~	~~Long-term water security~~		~~After 2035~~	
~~Site visit – Capacity/condition assessment~~		~~I~~		~~Construction of a WTW~~		~~Capacity~~	~~O&M - capacity assessments~~	~~Water purification works (WPW)~~	~~8-Implementation~~								~~-~~				~~Discard~~	~~Dependent on the finalisation~~	~~No~~	~~Long-term water security~~			
WMP (2014)		I	PRJ-CLW-001	Lambertsbaai booster PS upgrade		Condition	Currently planned infrastructu	Raw bulk: Pump stations	8-Implementation	105	l/s			2015		R 948,780	R 1,204,782				Select		No	Long-term water secu	1	Short-term	
Site visit – Capacity/condition assessments		I		Refurbish high level reservoir from 375 kl to 750 kl		Condition	O&M - condition assessments	Potable bulk: Reservoirs	8-Implementation												Select		No	Long-term LM: Storag	3	Long-term	
Site visit – Capacity/condition assessments		I		Asbestos bulk pipeline to be replaced		Condition	O&M - condition assessments	Potable bulk: Water mains (conveyance)	8-Implementation												Select		No	Long-term water secu	2	Medium-te	
Proposed		WC/WDM		WC/WDM interventions		Reduce water requirement	WC/WDM	Other	8-Implementation	123522	kl/a	123521.9	kl/a				R 800,000				Select		No	Long-term water secu	1	Short-term	

VALIDATION WORKSHOP NOTES

Rassie: Does not agree with the GEOSS yields for the Wadrif aquifer, and thinks that the WQ is deteriorating. It is not sustainable because the farmers abstract a huge amount - the sustainable yield is therefore not realistic. The farmers do not report on their abstraction because they believe that they own the land and the GW. The aquifer is fed by the Langvlei River that is under huge pressure

Rassie: Should rather look at the Graafwater GW control area that runs to Lambert's Bay. It has WQ risks (i.e. Mn and Fe), but the western side GW quality is better than the eastern side.

Capacity assessment

Infrastructure type	Future demand description	2035 demand (kl/a)	Current capacity (kl/a)	Probable 2035 deficit (kl/a)	Required infrastructure upgrade	Unit
Raw bulk storage	2035 raw water abstraction	823,479	0	823,479	Insufficient information	kl
System input PS	2035 raw water abstraction	823,479	0	823,479	Insufficient information	l/s
WPW	2035 raw water abstraction	823,479	1,753,200	-929,721	No upgrade needed	Ml/d
Reservoirs	2035 system input volume	840,061	1,166,061	-326,000	No upgrade needed	Ml
Water tower	2035 system input volume	840,061	0	840,061	Insufficient information	Ml
WWTW	2035 50% water sales (billable + unbillable consumption)	318,232	1,095,750	-777,518	No upgrade needed	Ml/d

Figure 4-5: Water resource and infrastructure interventions for the town of Lambert's Bay.

GEOSS SOUTH AFRICA (Pty) Ltd

WCIDWRP Groundwater potential per town - Lambert's Bay (Cederberg Municipality)

ZUTARI IMPACT. ENGINEERED.

Priority	Geological setting	Total borehole yields for target area (L/s)	Realistic no. of boreholes to be drilled at anticipated yield	Groundwater utilizable potential for target area (Mm3/a)	Managed Aquifer Recharge (MARe) Potential	Groundwater quality	Water quality comments	Location	Hydrogeological target	Possible challenges	Cost (R)					Comment
											Development	Equipping	Conveyance	Treatment: CAPEX	Treatment: OPEX per annum	
1	The major primary aquifer that occurs in the area is the Wadrif aquifer. The aquifer consists of unconsolidated sands which were deposited in an east – west palaeo-channel varying in thickness from 25 m near the coast to approximately 100 m in the Wadrif valley. Yields of up to 20 L/s can be expected in the coarser grained sand deposits, whilst limited yields of around 3 L/s are common in the finer sand deposits. In general, the high porosity and extreme horizontal permeability of this primary aquifer greatly enhances flow dynamics over that of hard rocks. The regional aquifer directly underlying the site is classified by the Department of Water Affairs and Forestry as a "intergranular" (borehole yield >5 L/s) aquifer, representing the paleochannel.	40	5	1.26	No	Good (TDS = 280 mg/L or EC = 38 mS/m and pH = 5.0)	Good quality water - no treatment required	Wadrif Aquifer - a longitudinal wellfield needs to be developed, extending up-gradient from the existing production boreholes (in a south-westerly direction), with 1 production borehole being drilled every 2 km.	Alluvial aquifer - making sure paleo-channels are targetted.	There is a lot of resistance from the agricultural sector to further development of groundwater resources within this Wadrif area. However the wadrif area has been declared a Government Subterranean Water Control Area, thus the allocation of a town supply within such an area is top priority.	R1,725,000.00	R1,100,000.00	R6,180,520.00	R0.00	R0.00	The Lamberts Bay water supply situation is very precarious. The current two dedicated production boreholes (with a third one on standby and used when required in the summer months) are being over-abstracted significantly above the GEOSS recommendations; resulting in the water levels dropping. In addition the agreements the municipality had in place to make use of the groundwater with the local land owners have long expired. They only had a validity period of 3 years, as it was anticipated the sea water desalination plant at Lamberts Bay would be fully operational within this period. The RO plant to this day has not come on-line, as there is an issue with the brine discharge. Meanwhile the water requirement for Lamberts Bay keeps increasing the boreholes are being pushed beyond their sustainable yields. Either the RO plant must be brought on-line or the wellfield extended however the current situation is not sustainable.

Figure 4-6: Groundwater interventions identified by GEOSS for the town of Lambert's Bay.

4.2.5 Input sheet

(see example for the town of Lambert's Bay in Figure 4-7).

- The input sheet allows the user to toggle between using the water allocation or the water yield (with or without climate change) (green outline)
- It allows the user to toggle between low, medium and high water demand scenarios, which will impact the recon graph (blue outline)
- It allows the user to prioritise the water resource interventions that will appear on the reconciliation graph (red outline).

	WATER AVAILABILITY															
	ALLOCATION			0												
	Allocation volume (Registered water use / Lawful allocation)	No		*Note: A user may only select one "yes" for rows 3, 6 and 7*												
	YIELD															
	Total system yield (combined sources)	No														
	Total system yield (combined sources) with probable climate change impact	Yes														
	WATER REQUIREMENTS															
	SCENARIOS (based on growth perspectives and growth outlook)															
	Low water requirement scenario	No		*Note: A user may only select one "yes" for rows 11, 12 and 13*												
	Medium water requirement scenario	Yes	1.5%													
	High water requirement scenario	No														
	WATER CONSERVATION WATER DEMAND MANAGEMENT (based on target WCWDM)															
	Implement	No		*Note: A user may only select one "yes" for rows 16 and 23*												
	Target % Total NRW	5%														
	Planned implementation date	2030														
	where Target % Total NRW = Total NRW / Total Raw Water Abstraction															
	and Total NRW = Total Raw Water Abstraction - Billed Consumption															
	INTRODUCTION OF ARTIFICIAL LOSSES (BETWEEN WATER SALES (BILLED&UNBILLED CONSUMPTION) AND RAW WATER ABSTRACTION)															
	Implement	No														
	% Loss	10%														

POSSIBLE INTERVENTIONS

Priority	Project name	Project description	Project driver	Project type	Component type	Key Strategic Area (KSA)	Potential gain to system (i.e. yield / capacity / target %)	Unit	Original planned implementation date	Revised implementation date	Original cost	Revised cost
1	Completion of Lamberts Bay Desalination plant (1.7 Ml/d) - can be upgraded to ML/d	0	Increase water a	Desalination	Source	8-Implementation	620925	kl/a	2018	0	##########	##########
3	Re-use (direct or indirect for MARe) - 0.81 ML/d plant	0	Increase water a	Reuse	Source	8-Implementation	297241.8	kl/a	0	0	R -	##########
4	Urban stormwater harvesting (for MARe)	0	Increase water a	Stormwater	Source	8-Implementation	5111.077374	kl/a	0	0	R -	-
2	5 BHs in the Wadrif alluvial Aquifer	Roodeklipheuwel Farn	Increase water a	Groundwater	Source	8-Implementation	1260000	kl/a	0	0	R -	##########
	Intervention 5	0	0	0	0	0	0	0	0	0	R -	R -
	Intervention 6	0	0	0	0	0	0	0	0	0	R -	R -
	Intervention 7	0	0	0	0	0	0	0	0	0	R -	R -
	Intervention 8	0	0	0	0	0	0	0	0	0	R -	R -
	Intervention 9	0	0	0	0	0	0	0	0	0	R -	R -
	Intervention 10	0	0	0	0	0	0	0	0	0	R -	R -

Cells in blue should be selected by a user
Cells in green should be populated by the Zutari study team
Cells in yellow may be populated by the PDG study team

Figure 4-7: Input Sheet in the Water Balance Tool for Lambert's Bay.

5 Way forward

The deliverables of the WCIDWRP cover many different themes relating to water resilience planning, from water resource augmentation options to the development of by-laws for alternative water use. It therefore provides a powerful toolkit to inform and support long term resilience planning in the province.

Considering this, the following recommendations are made regarding the way forward.

- The WCIDWRP to be renamed to the Western Cape 'Water Resilience Strategy'.
- All additional water resilience projects and work in the Western Cape, such as the development of the Water and Sanitation Land Use Model, should build on the outputs and work done as part of this project. This project involved the collation of a large amount of information and this should be leveraged.
- This project has clearly shown the importance of long-term water resilience planning, and not only reactive planning during a drought. The WCIDWRP should therefore be both regularly updated and reviewed, and implemented to ensure long-term resilience planning.
- Regular review of the WCSWMP and WCERR (water-related risks) through the lens of the WCIDWRP, to ensure alignment between the provincial strategic planning documents.
- Inclusion of relevant elements of the WCIDWRP in any further Western Cape plans (such as the Jobs for Growth work).
- The various recommendations and suggestions made in the deliverables should be considered for updates to the relevant provincial planning documents (such as the WCIF update in Task 1.4).
- The final output for Task 3.10 only included the programmatic interventions to be implemented over the 3-year MTEF planning horizon, and therefore focused on interventions that would ensure the sustainability of the WCIDWRP. There is however the need to also consider longer term water resilience actions and budgets for WCG departments to implement over the 15-year planning horizon, to ensure that water resilience is managed in a transversal way. It is recommended that all WCG departments meet to further refine and prioritise the long-term required programmatic responses emenating from Tasks 1.7, 2.6 and 3.10.
- The project has produced a number of DSS tools that could prove extremely useful for water resilience planning in both the province and local municipalities. For these tools to be effective however, they do require a custodian to update the information and support the local municipaltiies with the use of the tools. The following is therefore recommended:

    - MIT and WBT tools: It is recommended that the DLG become the custodian of these municipal planning tools, and support the local municipalities with the update and use of these tools. The WBT has been developed in such a manner that it could easily replace the monthly water use reporting submitted to DWS.
    - Water tariff model: It is recommended that the DLG become the custodian of the Water Tariffs Model and roll out training on the use of the model to municipal managers.

In diversity there is beauty and there is strength.

MAYA ANGELOU

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