

Water & Sanitation bulk infrastructure requirements



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD



CEMENT &
CONCRETE SA

Mike Killick
Director: Bulk Services
Water and Sanitation Directorate

Water and Sanitation Directorate

Annual O&M of R13 billion and approx. R50+ billion 10-20 year CAPEX programme

5 100 staff
in 4 Departments, 13 branches &
63 depots

R75 billion assets

Water

- 6 large dams
- 12 water treatment plants
- 24 reservoirs
- 10,800 km of pipelines
- 1,650 MLD peak production

Wastewater

- 9,400 km of sewers
- 23 wastewater treatment works (758 MLD capacity)
- 3 sea outfalls (60 MLD)
- 611 pump stations (water/sewer)
- Treated effluent reuse (6%)

Storm water

- 1900 km rivers,
- 480 km canals
- 893 retention ponds

Formal residential areas

3.9 million people, 631,000 connections



Informal settlements

570,000 people



**Businesses,
industry,
institutions**
40,800
connections



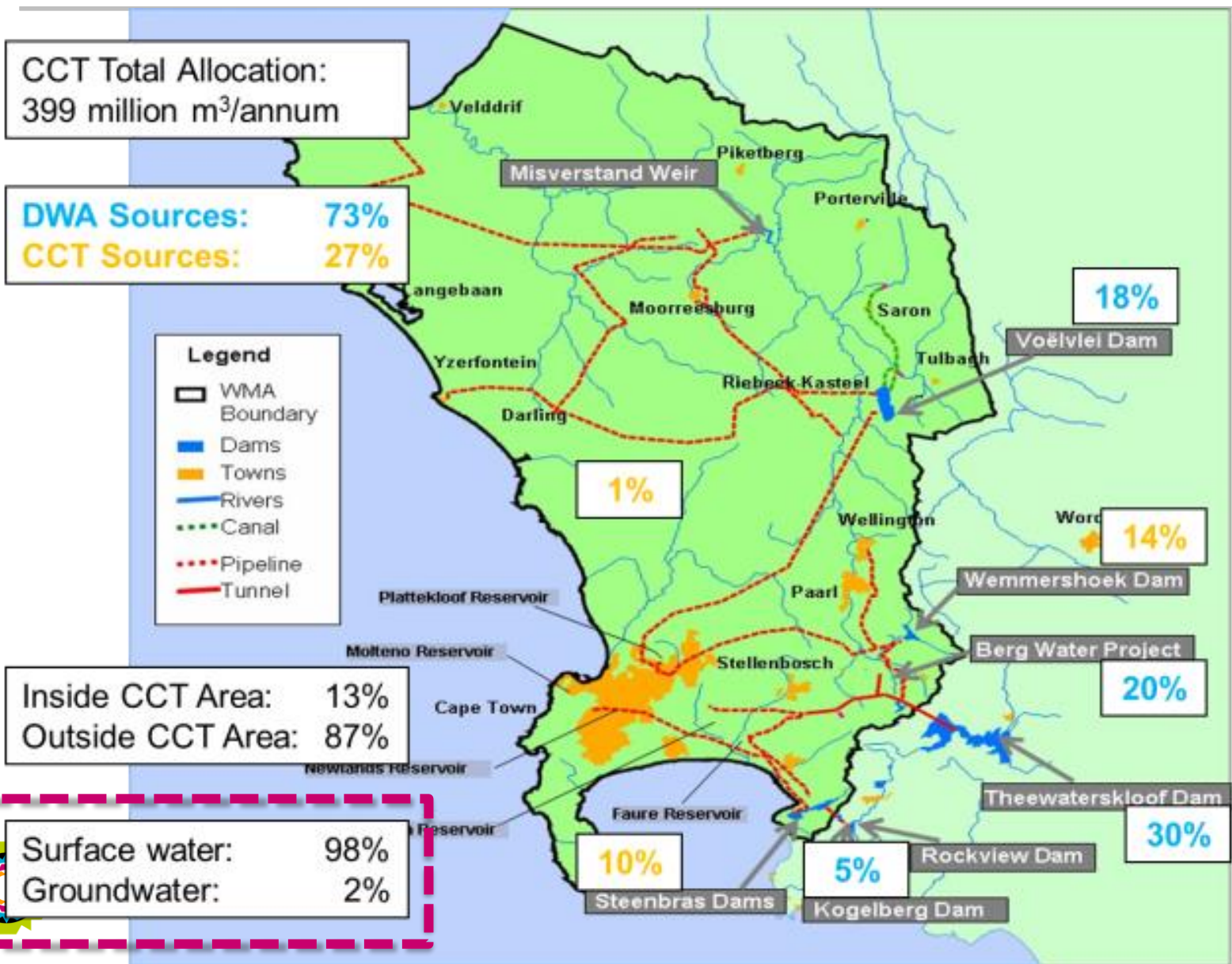
A 24/7 supply is maintained

www.capetown.gov.za/water

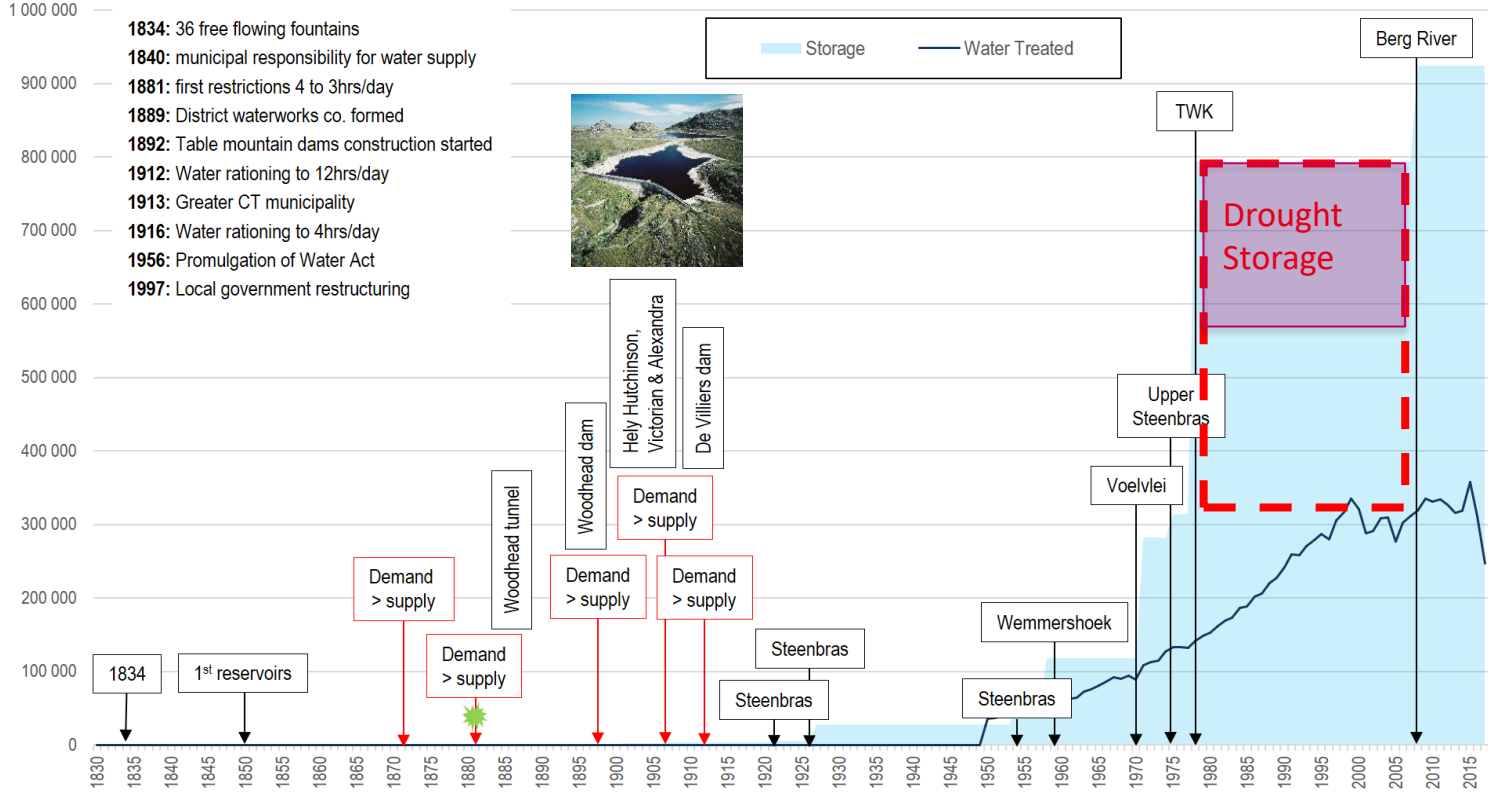


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Where does Cape Town get its water from?



200 years of reliance on surface water sources

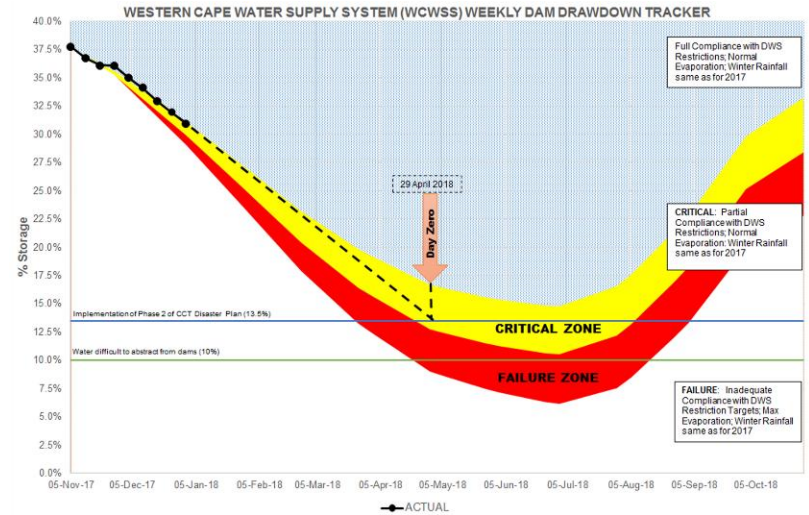


Day Zero was a possibility

Day Zero now likely to happen – new emergency measures

STATEMENT BY THE CITY'S EXECUTIVE MAYOR PATRICIA DE LILLE

18 January 2018



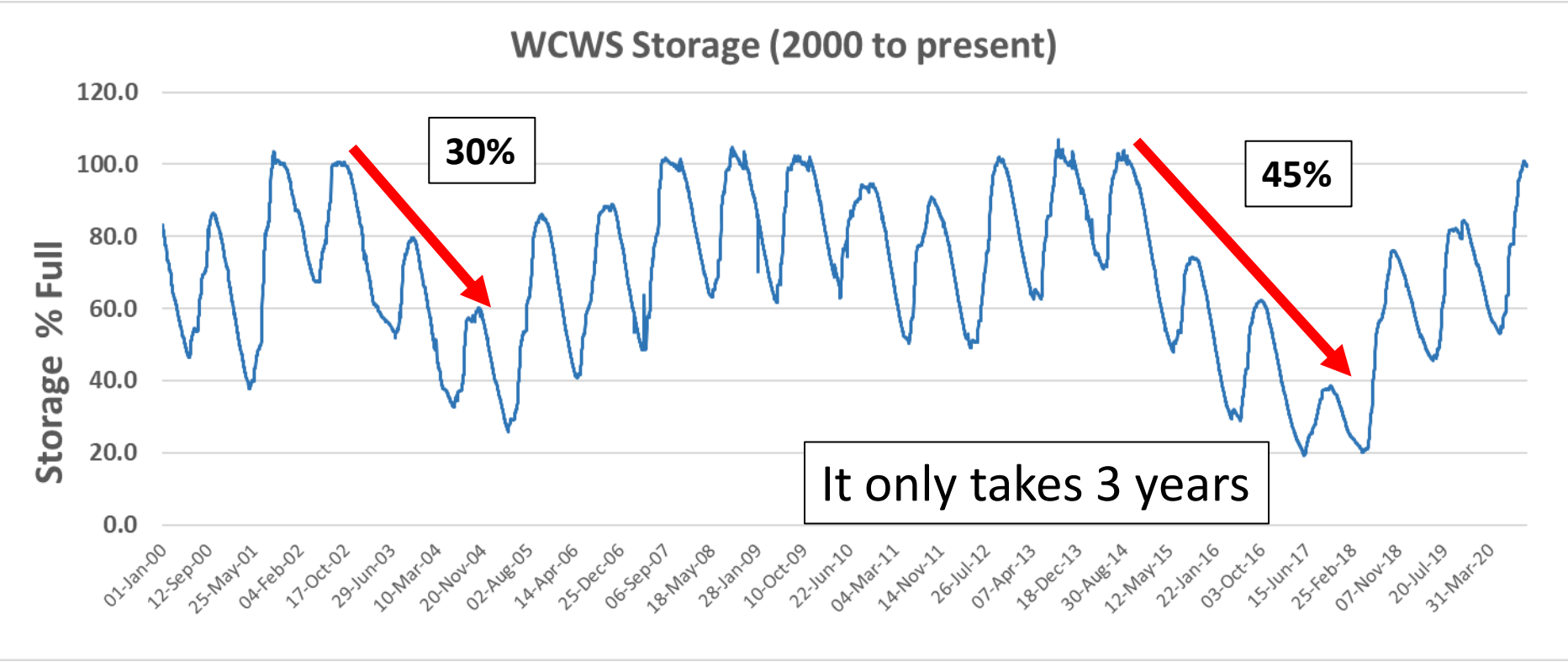
Wemmershoek Dam, 2017



Theewaterskloof 2017

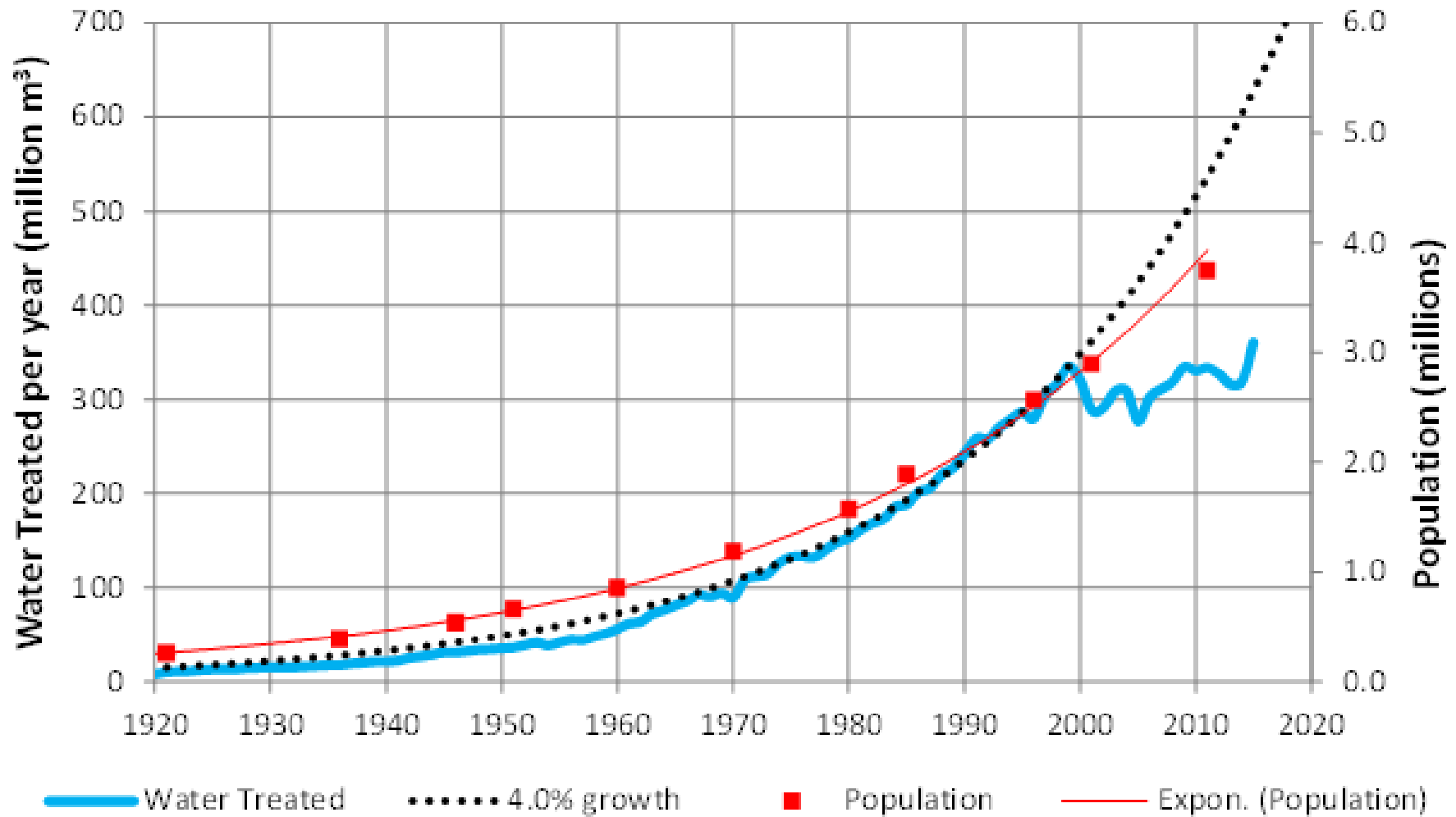


Our dams offer us only 2 years of security



Full dams in 2014 emptied to 38% full in just over three years.

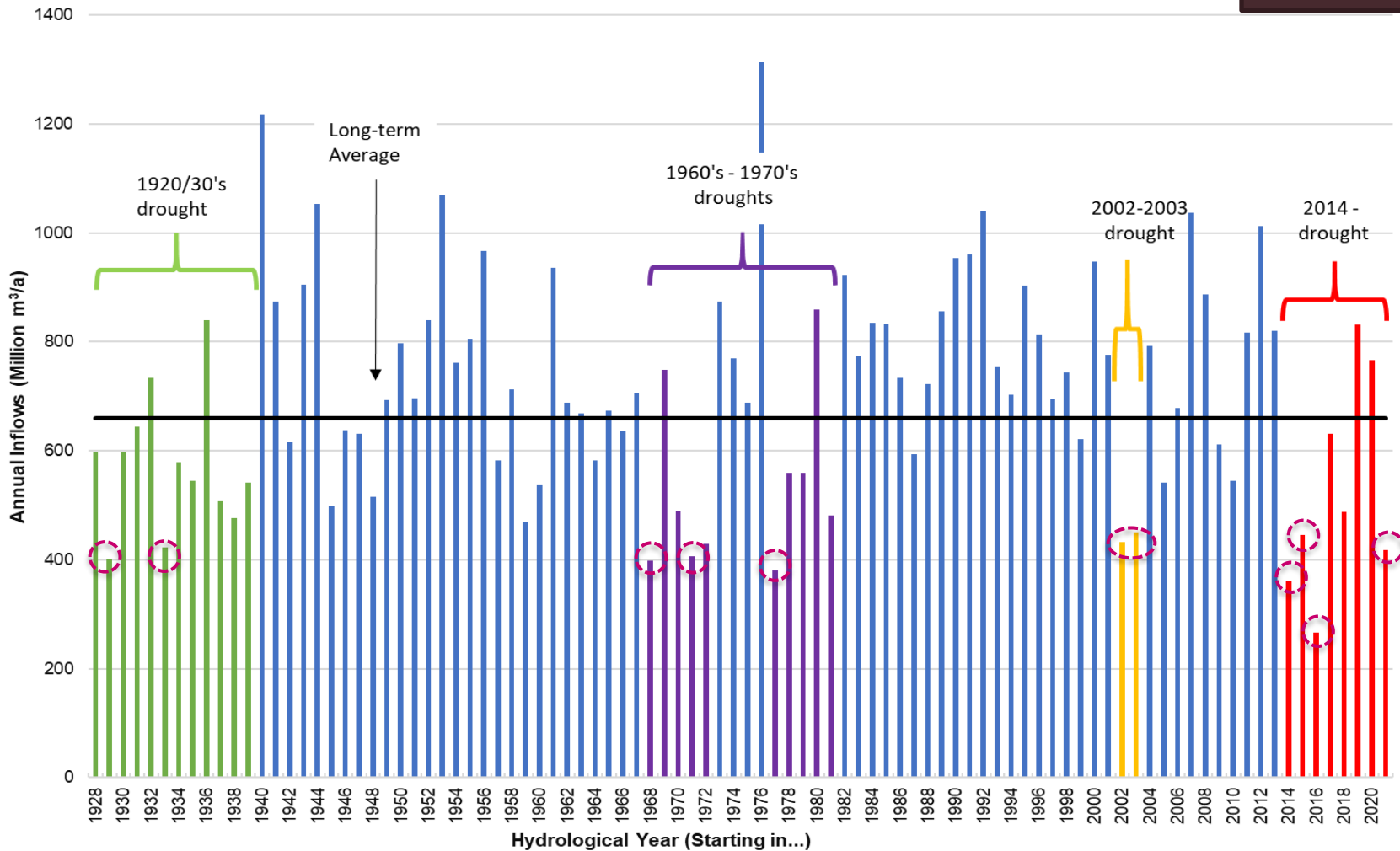
City of Cape Town Water Demand Projections



Runoff into the WCWSS dams

Cape Town is prone to droughts

Day zero was a wake-up call. Cape Town will experience this, and possibly worse, in future



2014-2018 drought a 1-in-590 year event

In response to the drought



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SHARED FUTURE, SHARED RESPONSIBILITY

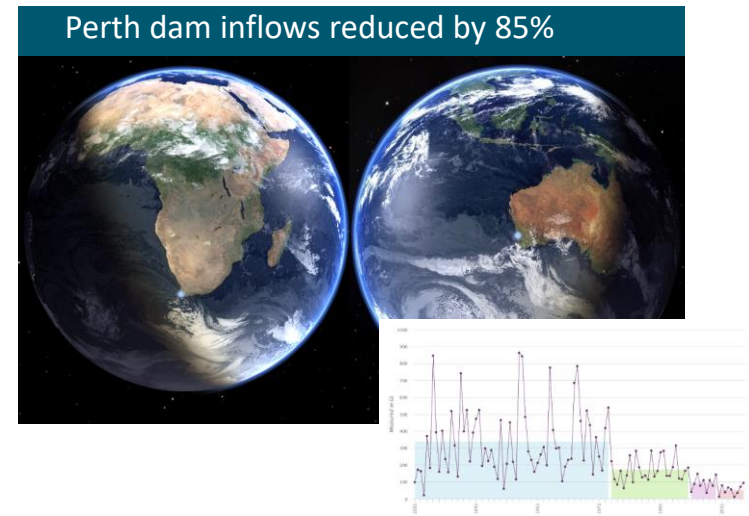
Climate uncertainty means we can't accurately predict water availability.

What we do know for certain is that relying on rainfall is no longer wise.

The Cape Town water crisis showed us that our collective relationship with water will have to change.

And that means the way we think about water and how we use it must change.

Water security is everyone's responsibility.



Five commitments in the Water Strategy

“Do the basics better”

1. Safe access to water and sanitation for all

Inclusion

2. **Wise water use** through pricing, regulation, active citizenship, network management

Resilience

(drought response)

3. **Sufficient, reliable water from diverse sources:** surface, ground, desalination, reuse (Water resilient by 2030)

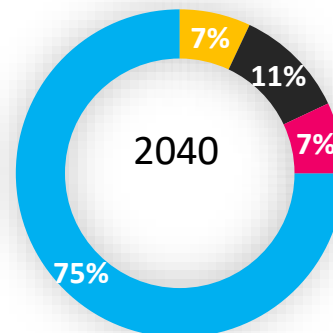
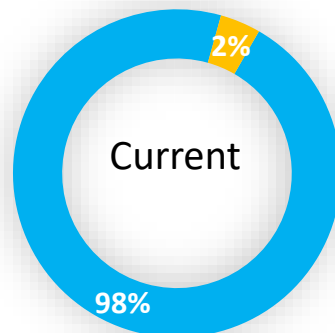
New Water Programme

4. **Shared benefits & managed risks** from regional water resources

5. **Water sensitive city by 2040**

Sustainability

Mayor's Priority Programme on Sanitation & Inland Water Quality



- Surface Water
- Groundwater
- Desalination
- Reuse

CAPE TOWN NEW WATER PROGRAMME


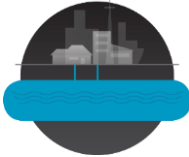










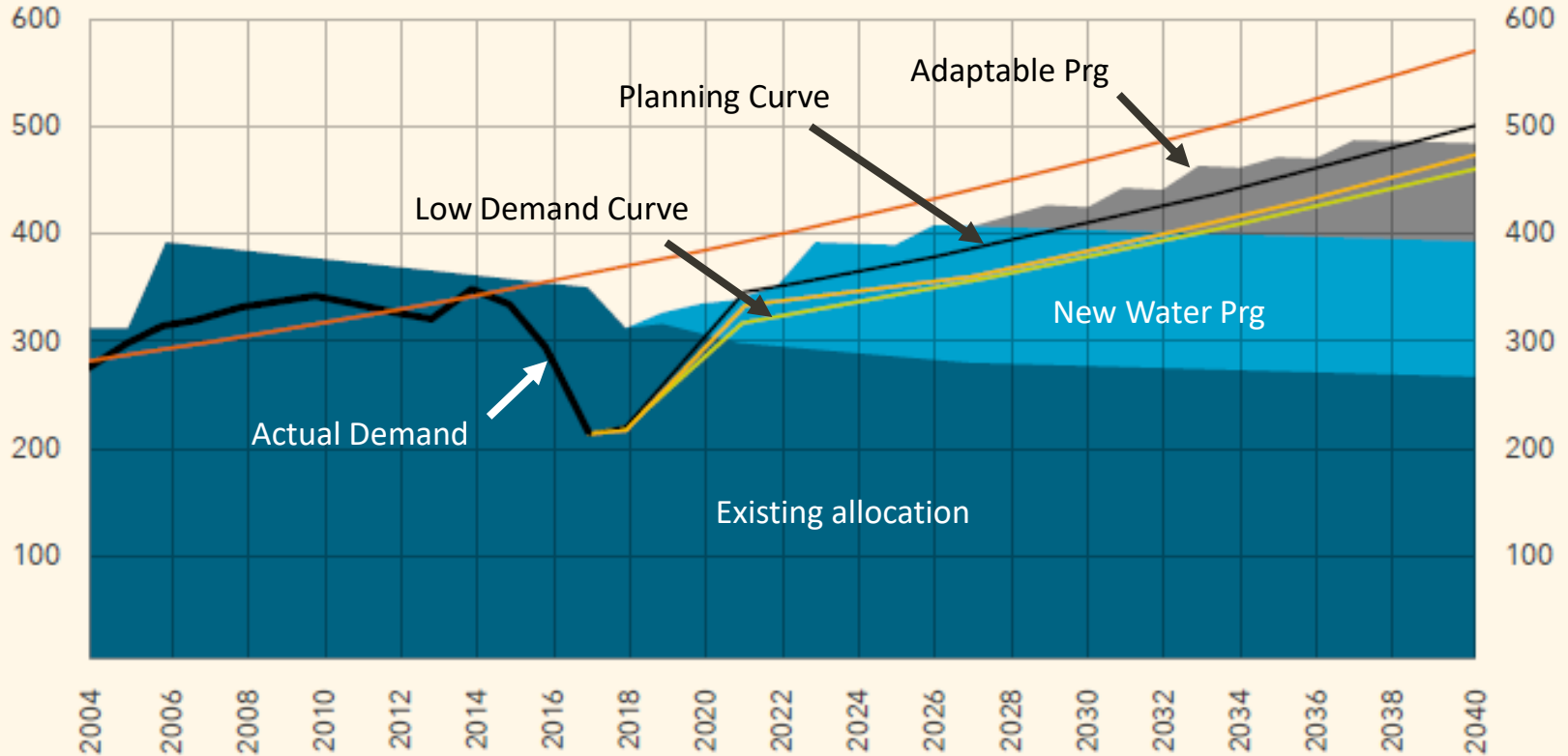
	Surface water	Groundwater	Desalination	Reuse
PROJECT	 BERG RIVER FLOW INTO VOELVLEI DAM	 SPRINGS & AQUIFERS - ATLANTIS, CAPE FLATS & TABLE MOUNTAIN GROUP	 LOCATION TBC	 FAURE NWS
PROGRESS / STATUS	 2025 PLANNING	 2020- 2035 CONSTRUCTION	 2030 PLANNING	 2027/8 DESIGN
CONTRIBUTION	 40ML/d	 100+ML/d	 50 – 70 ML/d scalable	 70 – 100 ML/d scalable
URV COST INDICATION	R5/m³ implemented by DWS/TCTA	TMG R9-12/m³ CFA R16-21/m³	R24/m³	R12/m³
DEMONSTRATION			DECOMMISSIONED	DECOMMISSIONED

FIGURE 8: THE SCALE AND TIMING OF THE NEW WATER PROGRAMME

Million kilolitres per year

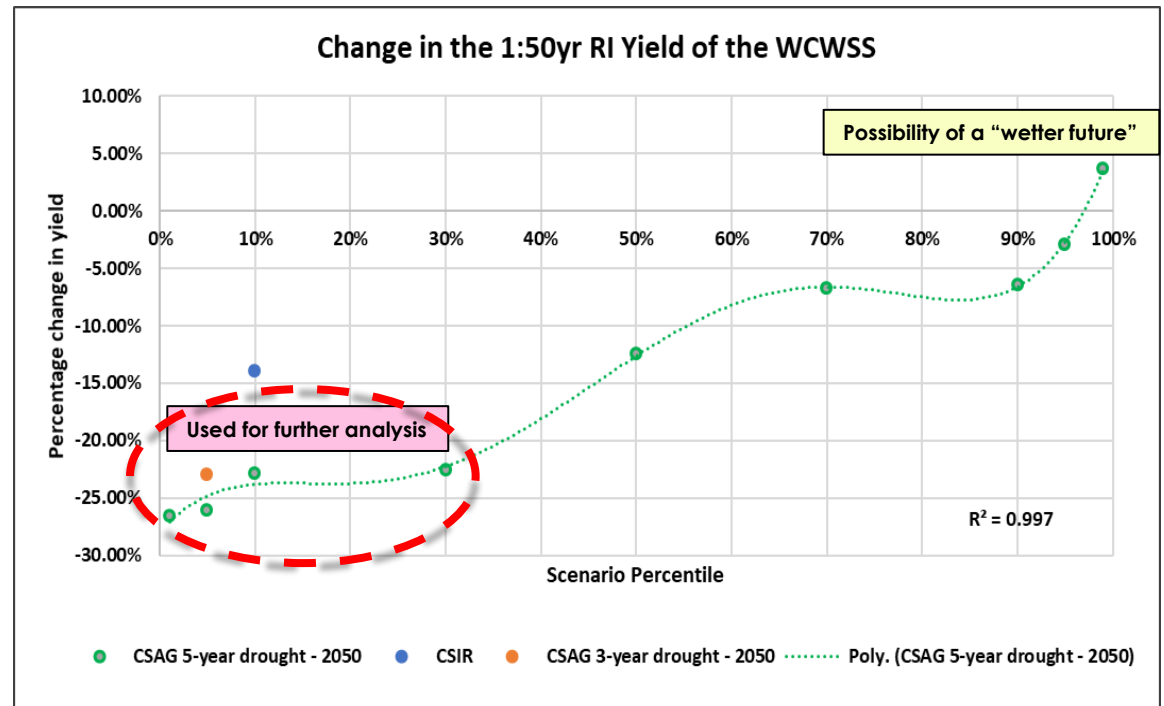


- Existing water resources
- Committed Augmentation Programme
- Adaptable Augmentation Programme
- Actual (historic) water demand
- Unconstrained water demand
- Base case water demand
- Base case water demand with WC/WDM
- Low water demand

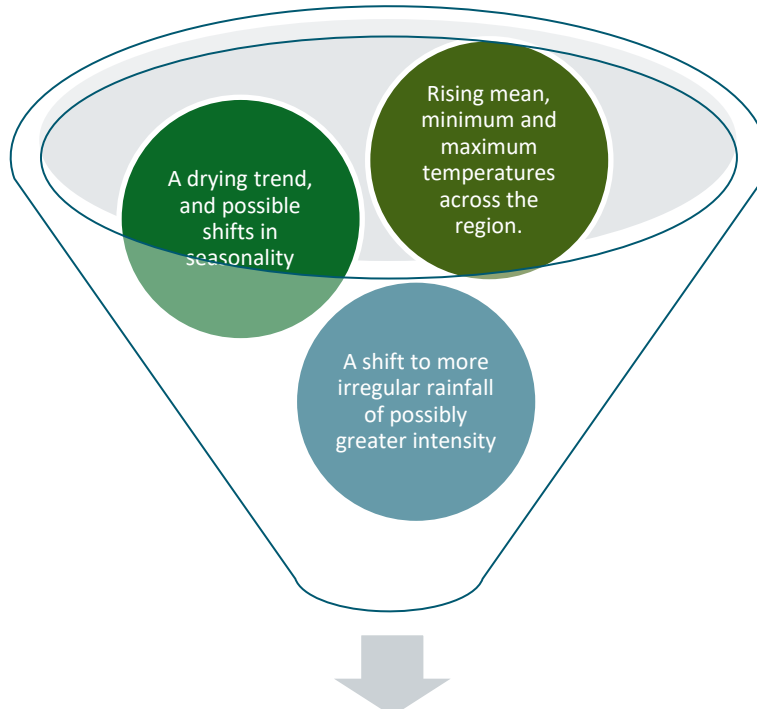


Understanding Climate Change Impact on WR Availability

Following a comprehensive study of potential long term climate change impacts, the City is assuming a reduction of 25% in water availability from both surface and groundwater sources over a 30 year planning horizon. This is marginally more than that originally assumed in the Water Strategy (2019) and has been based on an innovative calculation methodology.



Message from Climate Change Studies



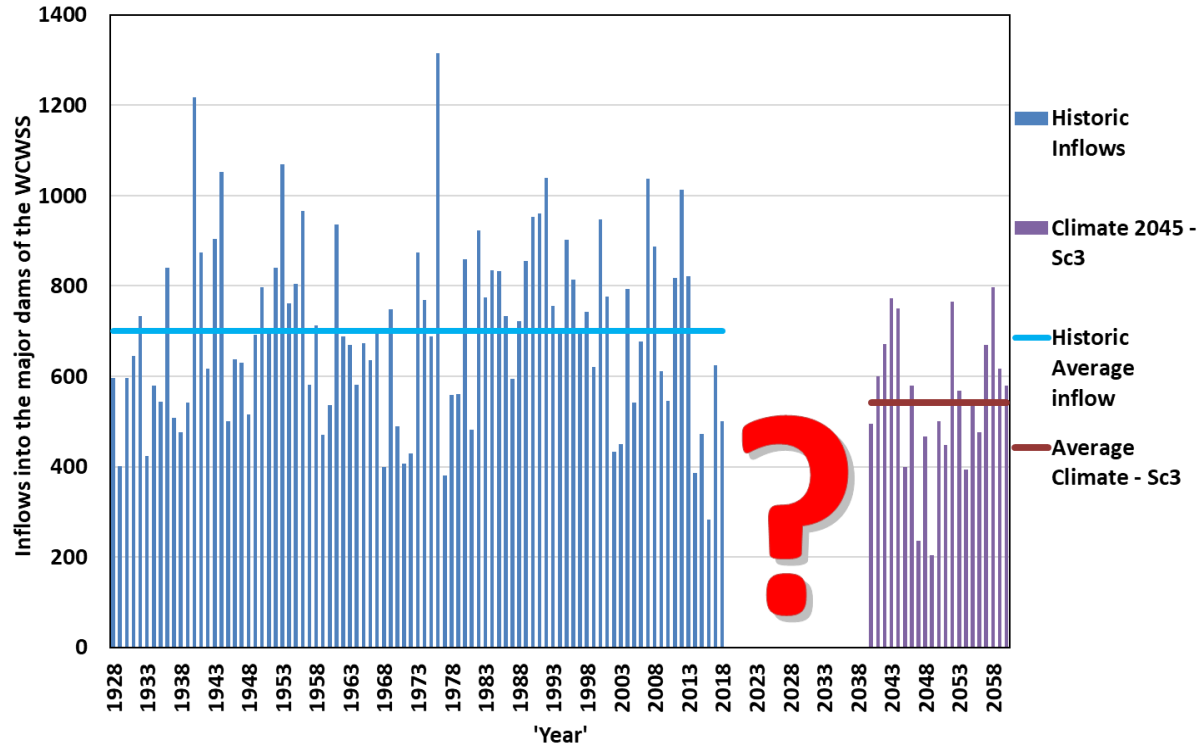
- Droughts will be more regular
- Droughts will be more severe
- Droughts will be of longer duration
- Less available water

BUT ?

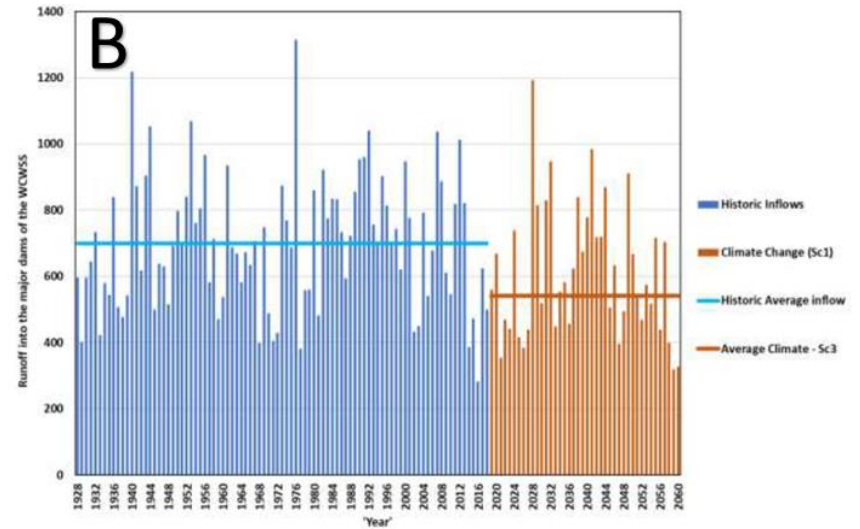
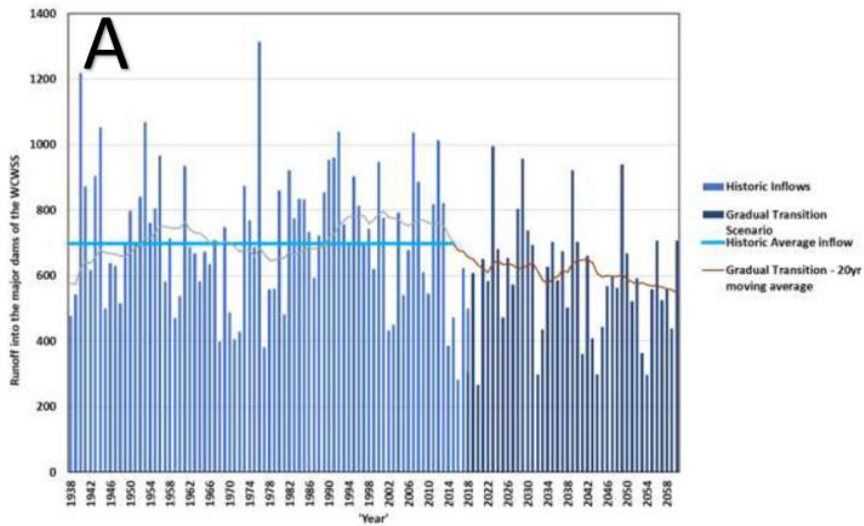
Need to monitor and plan for future augmentation

Understanding Climate Change Impact on WR Availability

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Understanding Climate Change Impact on WR Availability

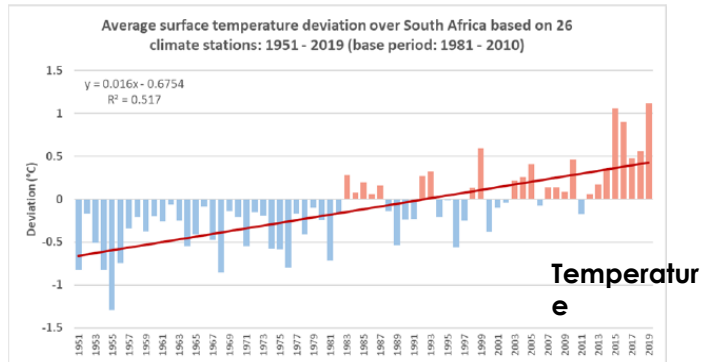
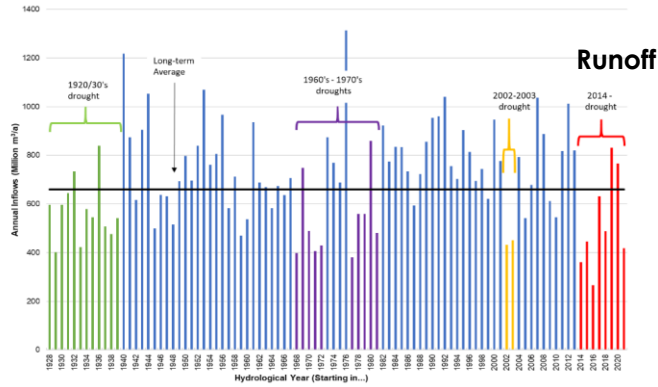


'The City continues to plan for a 25% reduction in yield (available water) by 2045

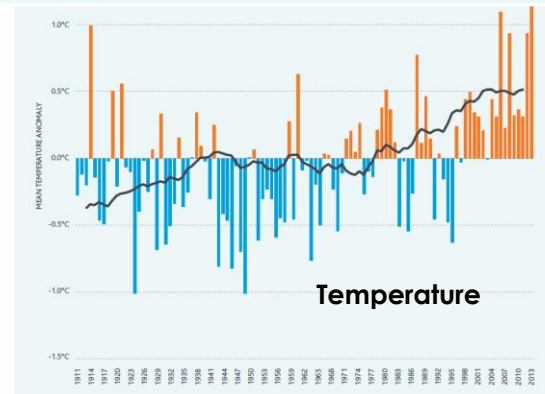
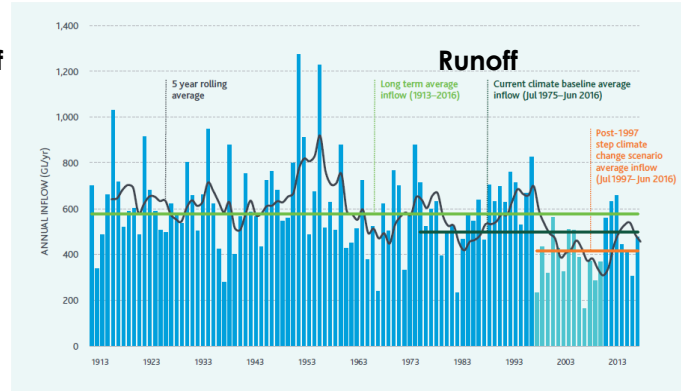


Climate Change: International Comparison

South Africa

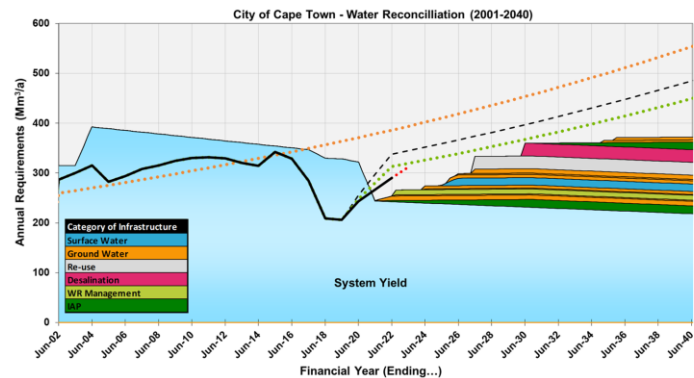
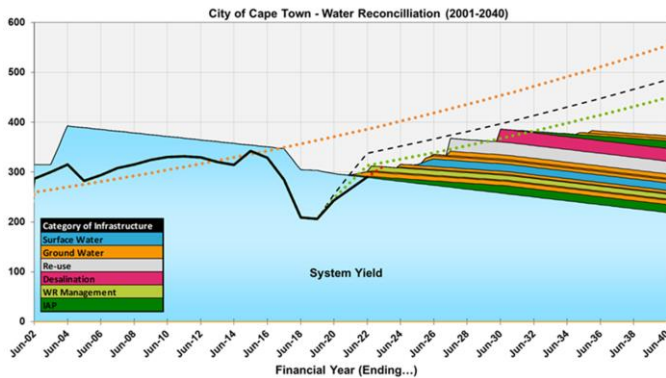


Melbourne

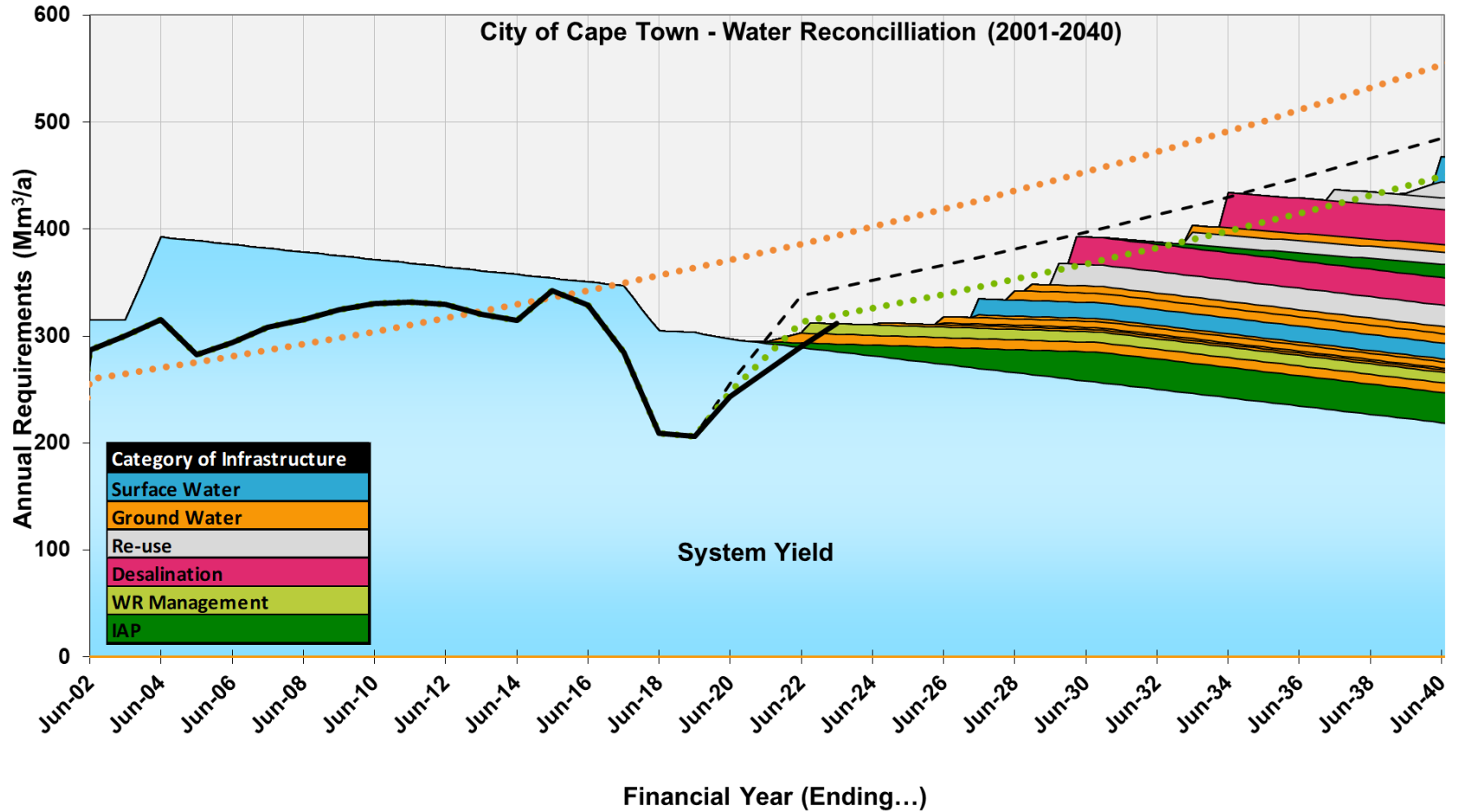


Risk of imposing restrictions

Scenario	Likelihood of any level of restrictions in next 10 years	Indicative maximum restriction that could be experienced in any given year									
		FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	
Gradual Climate Change	30 - 70%	25% to 30%						20	15	20	
Stepped Climate Change	75%	35% to 45%						25	25	30	

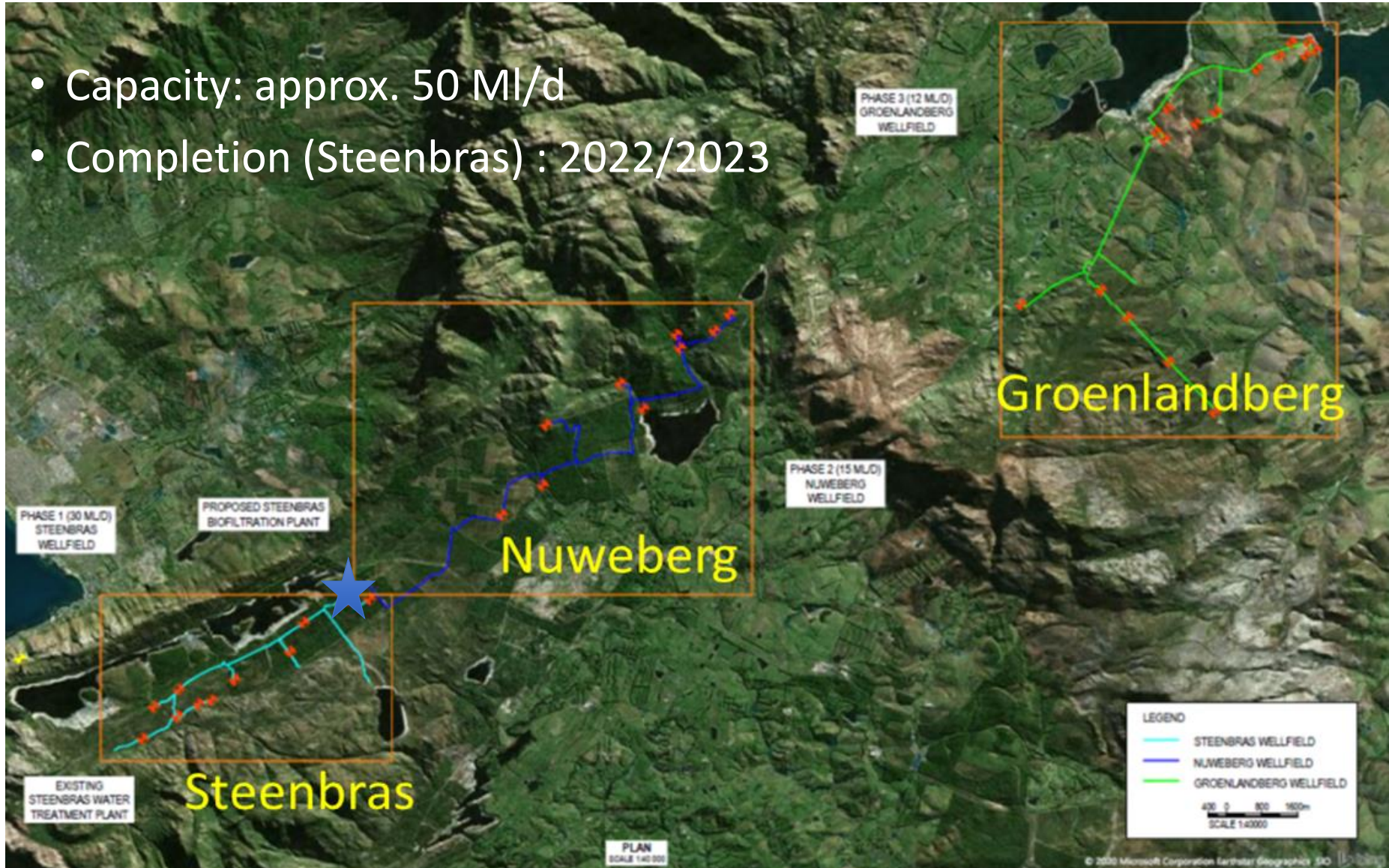


Current Water Balance

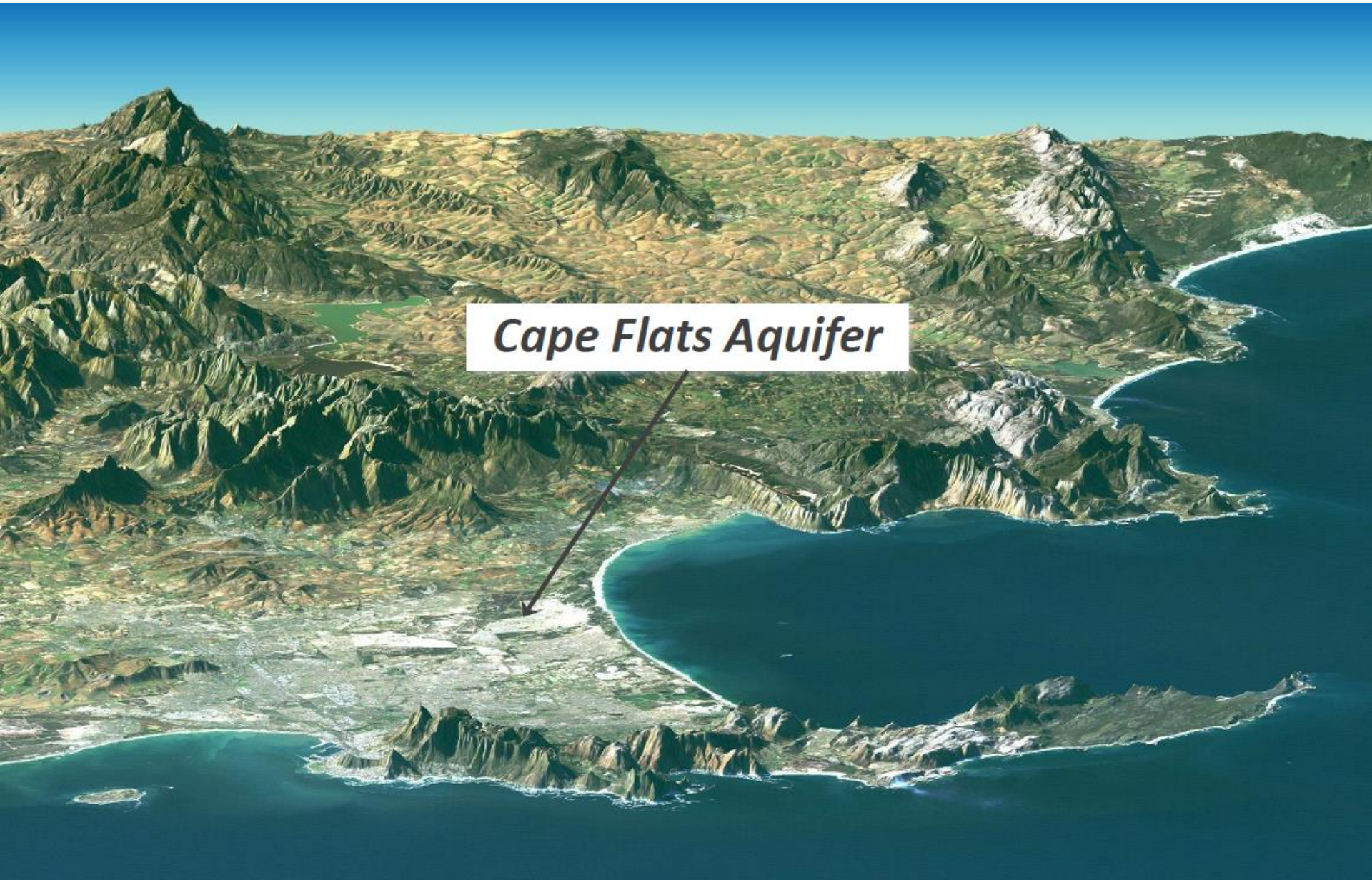


TMG Aquifer Scheme – General Arrangement

- Capacity: approx. 50 MI/d
- Completion (Steenbras) : 2022/2023



Cape Flats Aquifer



CFA MAR Scheme – General Arrangement

Scheme Components

- 2 Infiltration basins (blue)
- 5 Abstraction clusters (green)
- 4 Decentralized WTP's (Blue stars)
- Advanced WWTW to supply 3 recharge and 2 barrier clusters (red / yellow outline)



Cape Flats Aquifer Scheme: Strandfontein West WTP

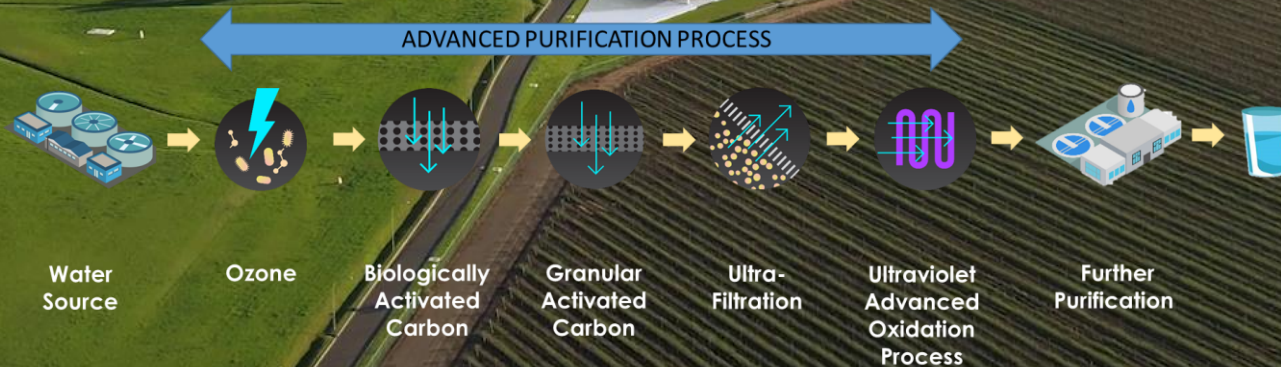


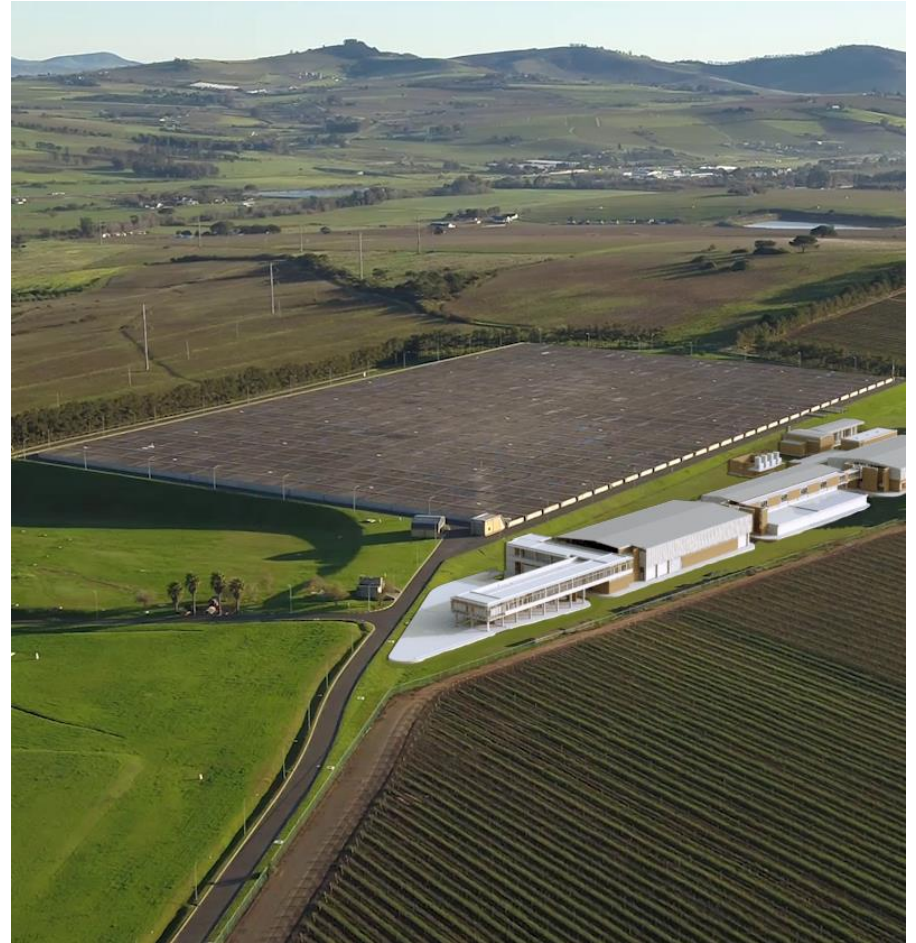
Cape Flats Aquifer Scheme: Advanced Reuse Plant

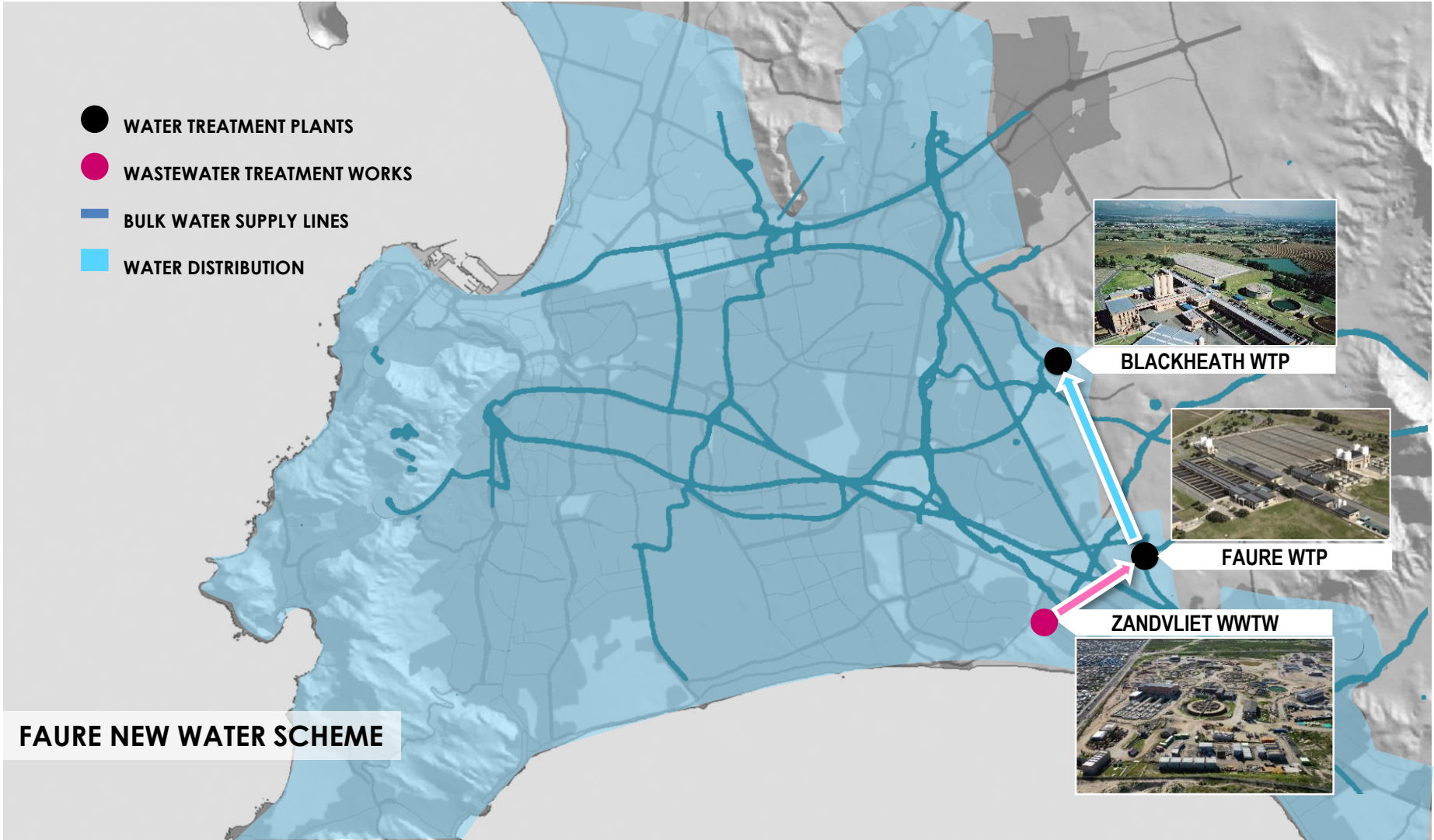


Faure New Water Scheme (Water Re-use)

- Capacity: approx. 70 to 100 MI/d
- Completion : approx. 2029/2030







Independent Advisory Panel appointed

Desalination

The Cape Town Water Strategy targets the development of a Permanent Desalination Plant of around **50 to 70 MLD** Capacity.

Scoping & Pre-feasibility Stage

Feasibility and Conceptual Design Stage

Project Tasks

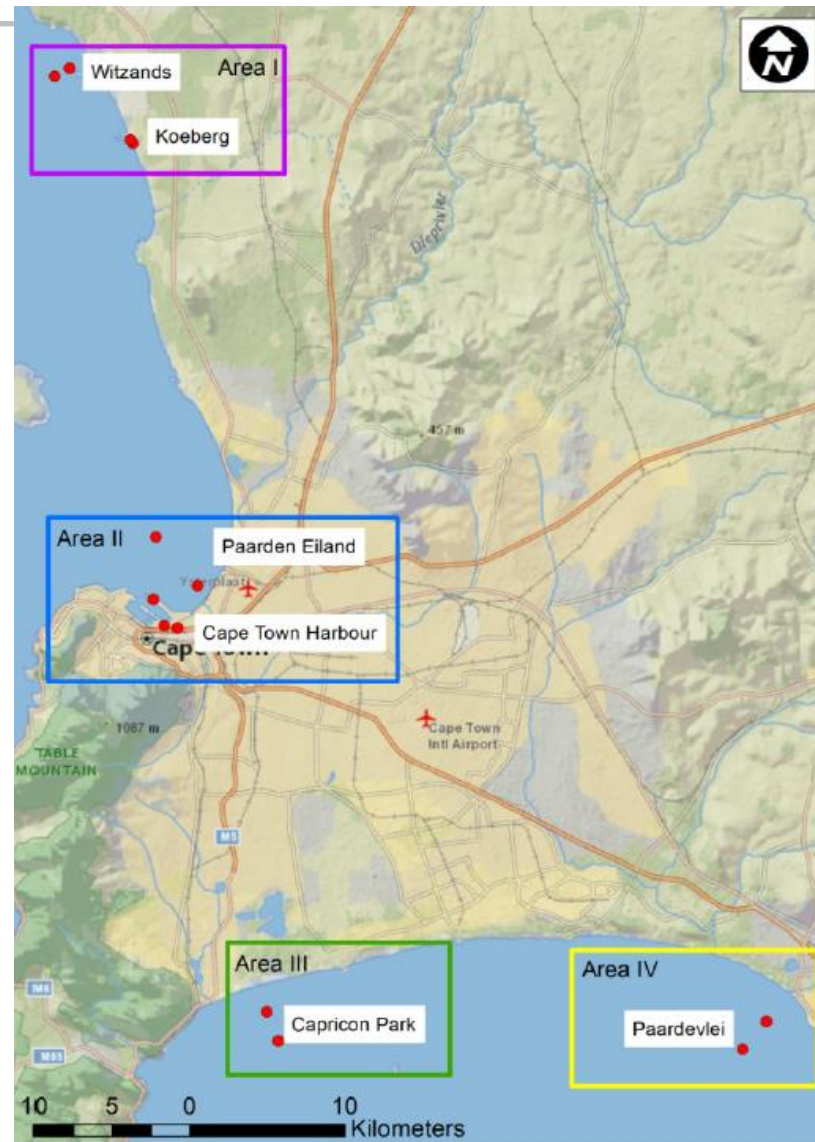
• Strategic Alignment and Scoping

• **TASK 1:** Site Selection Investigations & Screening

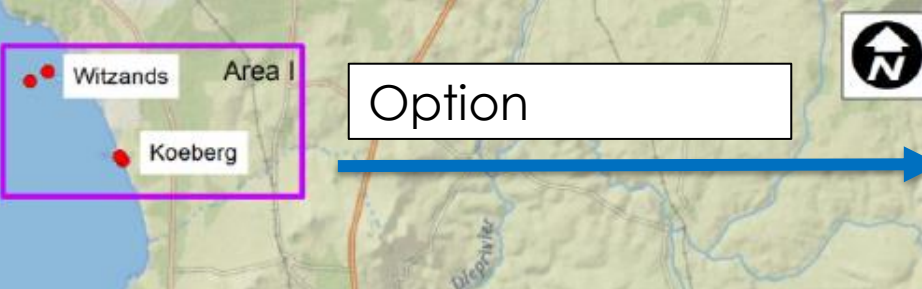
• **TASK 2:** Detailed Investigations and Conceptual Design (ie: Technical Feasibility)

• **TASK 3:** Determine the optimal Project Finance, Procurement and Delivery Method.

• **TASK 4:** Environmental and Heritage Impact Assessment



Desalination



Witzands Area I
Koeberg

Option

Capacity: approx. 70 to 150 MI/d
Completion : approx. February 2030

This block features a map of the Witzands area with two red dots labeled 'Witzands' and 'Koeberg' enclosed in a purple box. A white box labeled 'Option' is positioned to the right, with a blue arrow pointing from the map towards the right. Below this, a larger white box contains text about capacity and completion date. A north arrow icon is also present.




Witsands

Proposed Witsands Desalination Scheme
Site Location: West Coast, on the
Intersection of the R27 and
Dussenberg Drive

Estimated Yield: 50 to 150MLD

This block shows a satellite view of the Witsands coastline. A white circle highlights a specific location on the coast, with a white line pointing to the text 'Site Location'. A black text box at the bottom provides details about the proposed desalination scheme, including its location at the intersection of R27 and Dussenberg Drive and an estimated yield of 50 to 150 MLD.



Area II Paarden Eiland
Cape Town Harbour

Strategic Advantages

Area III Capricon Park
Area IV Paardevlei

This block displays a map of Cape Town Harbour and surrounding areas. A blue box highlights 'Area II' which includes Paarden Eiland and Cape Town Harbour. A red box labeled 'Strategic Advantages' is placed to the right of Area II, with a red arrow pointing from the map towards the right. Below, two more areas are highlighted: Area III (Capricon Park) in a green box and Area IV (Paardevlei) in a yellow box.



CT Harbour

Site Location

Proposed CT Harbour Desalination Scheme
Site Location: Port of Cape Town, Port
Industrial Park Side at the
Intersection of the Marine
Drive and the N1
Estimated Yield: 50 to 70MLD

This block shows a satellite view of the Port of Cape Town. A white circle highlights a location at the intersection of Marine Drive and the N1, with a white line pointing to the text 'Site Location'. A black text box at the bottom provides details about the proposed desalination scheme, including its location in the Port Industrial Park and an estimated yield of 50 to 70 MLD.

Proposed Site Layout

Transnet Truck Staging Area Bridge Alignment



Independent Advisory Panel appointed

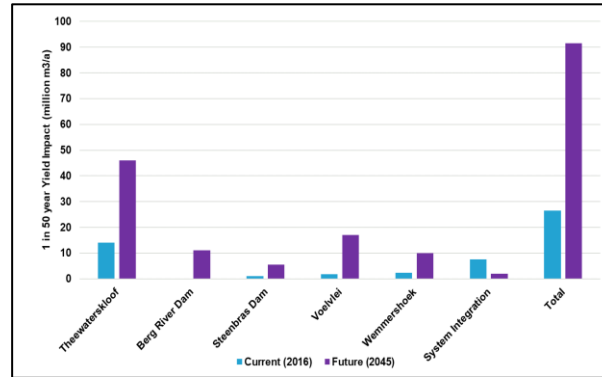
GTAC undertaking Bankable Feasibility Study

Berg Voelvlei Regional Water Augmentation Scheme

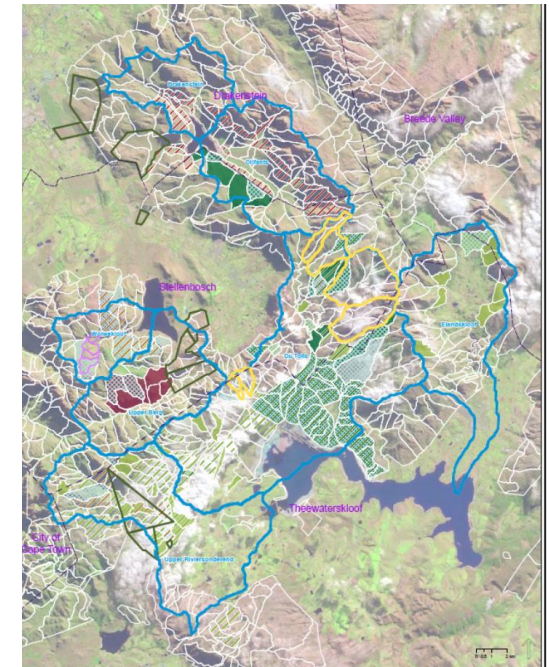
- DWS/TCTA Scheme
- City allocation: approx. 40 MI/d
- Completion : approx. 2026/7 (to be confirmed)
- 20 yr supply agreement approved by Council in Oct 2022



Source Water Protection and Invasive Alien Plant (IAP) Control



- **Current Impact on Yield: 24 Mm³/a**
- **Future Potential Impact: 85 Mm³/a**
- Currently using the Greater Cape Town Water Fund as a vehicle to assist with the clearing of IAPS over the next 2- 3 years (through The Nature Conservancy)
- R 50 million over FY21/22 and FY22/23
- R 75 million FY 23/24 to FY25/26 Agreement under review (to be submitted to Council)

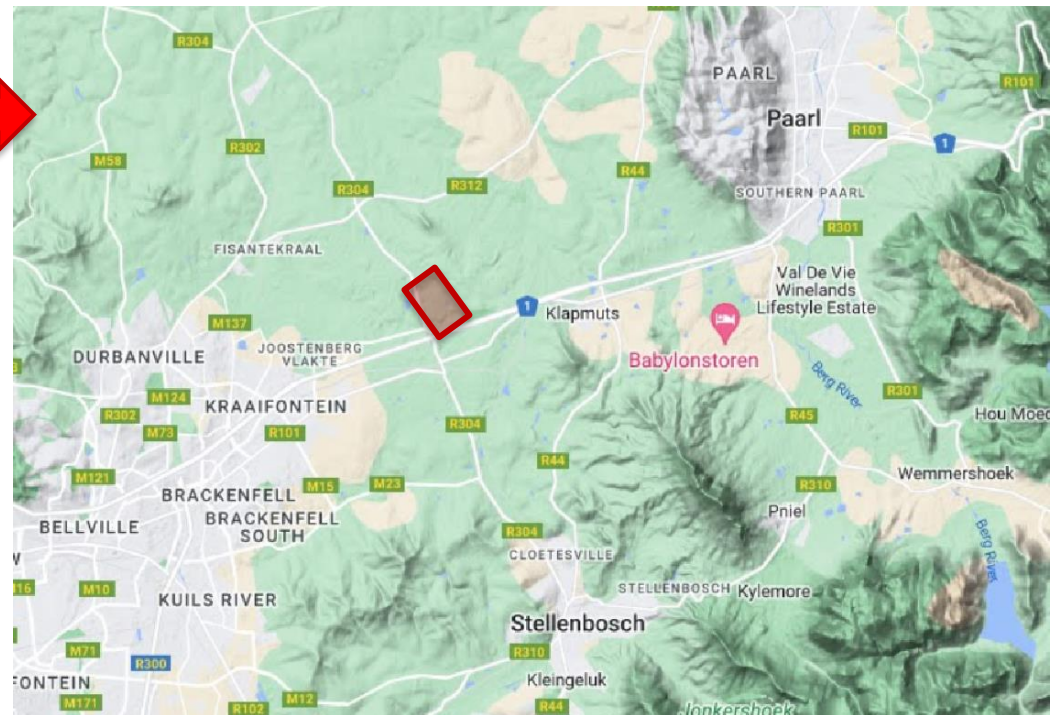
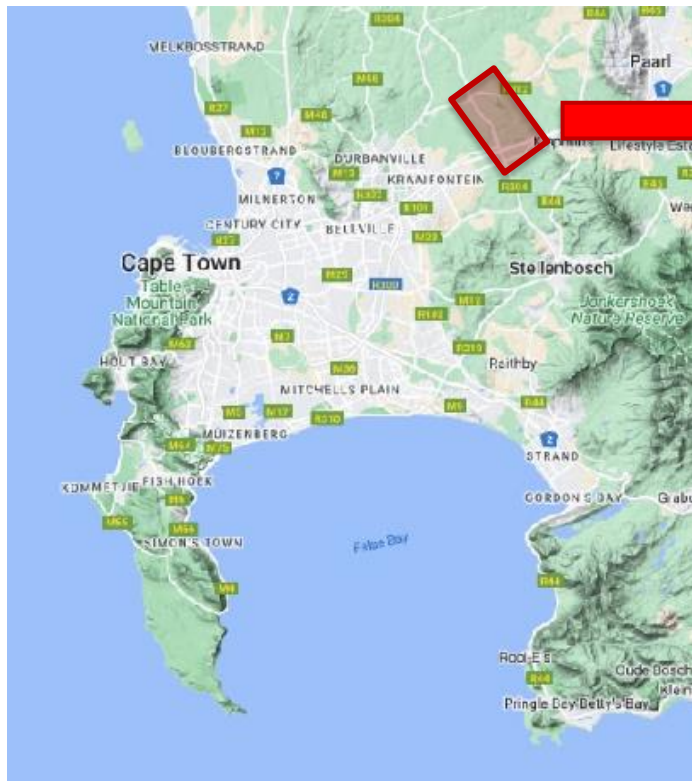


Muldersvlei Reservoir

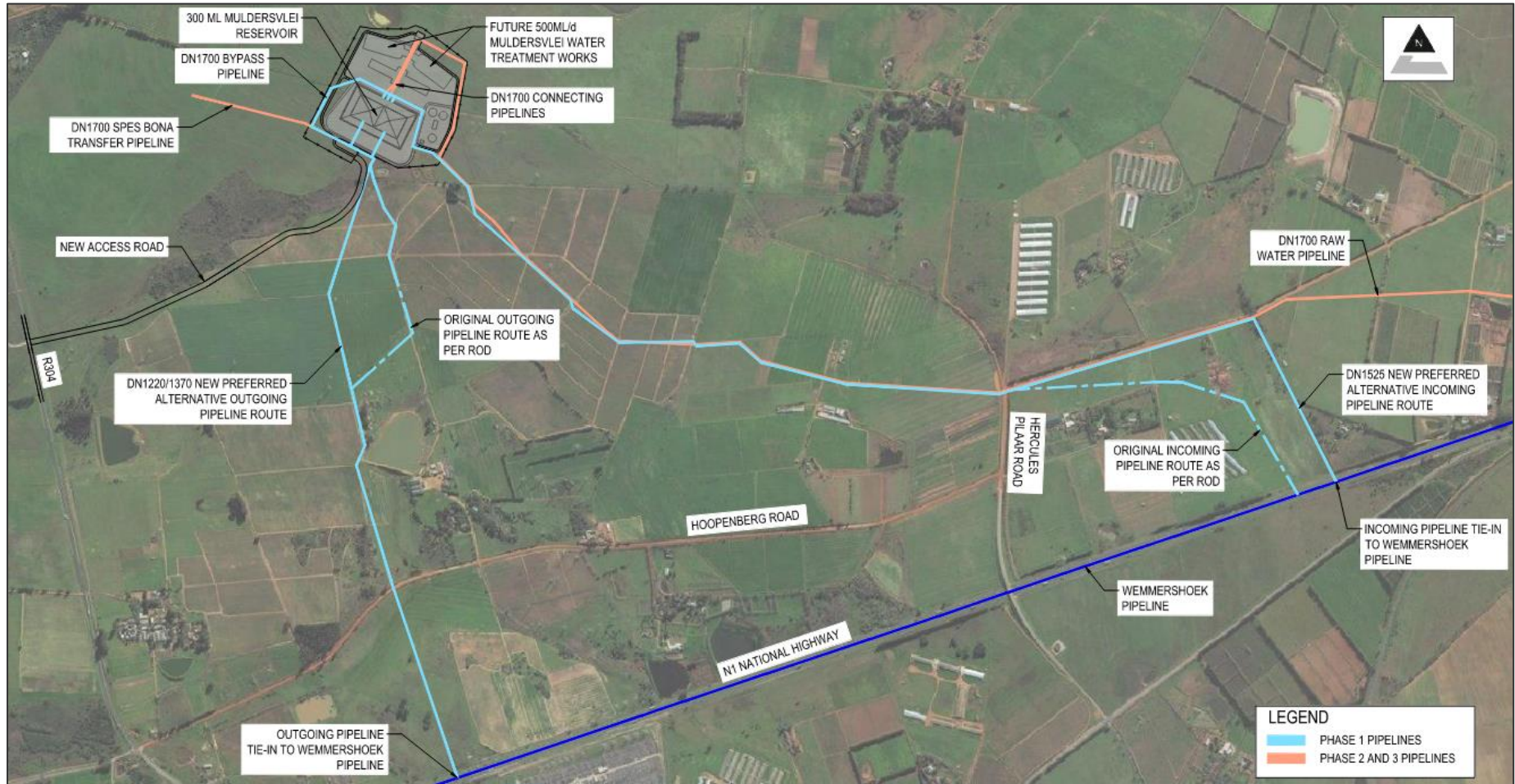
Location : The Muldersvlei reservoir and future WTWs site is located north of the N1 national highway and east of the R304 provincial arterial, approximately 6km west of Klapmuts.

Capacity: 300 MI

Tender date: Second half of 2024

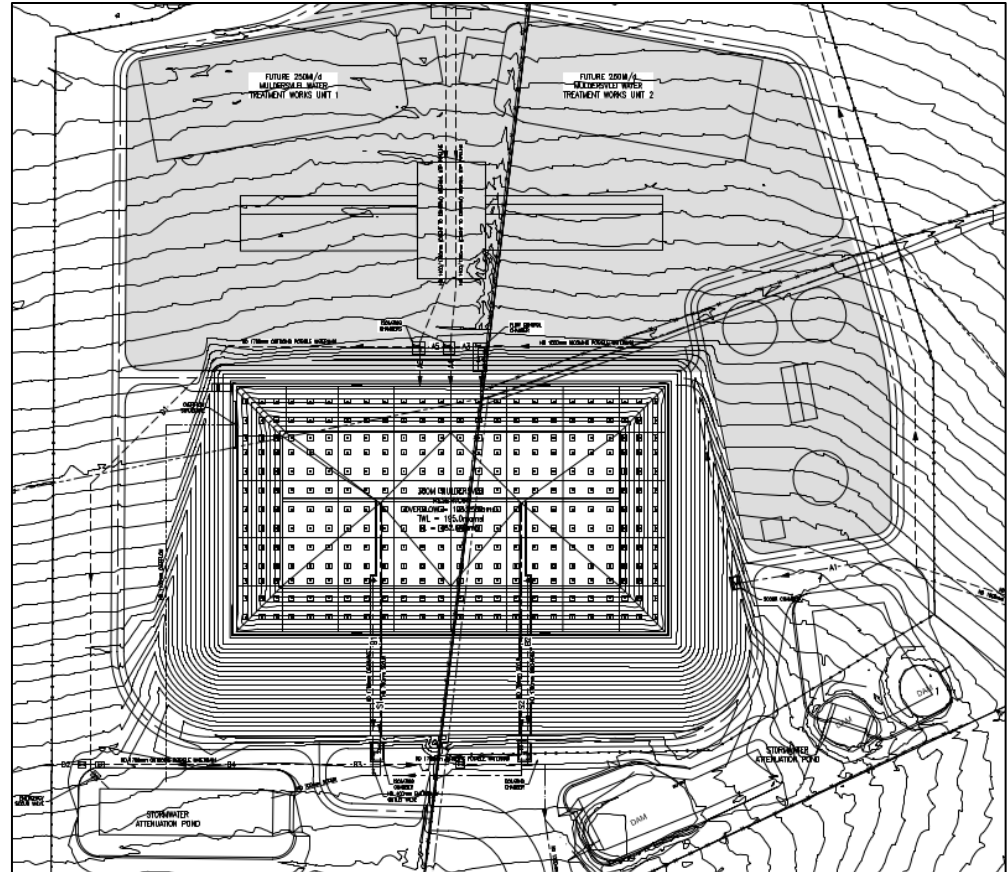


Project Overview (Cont.)

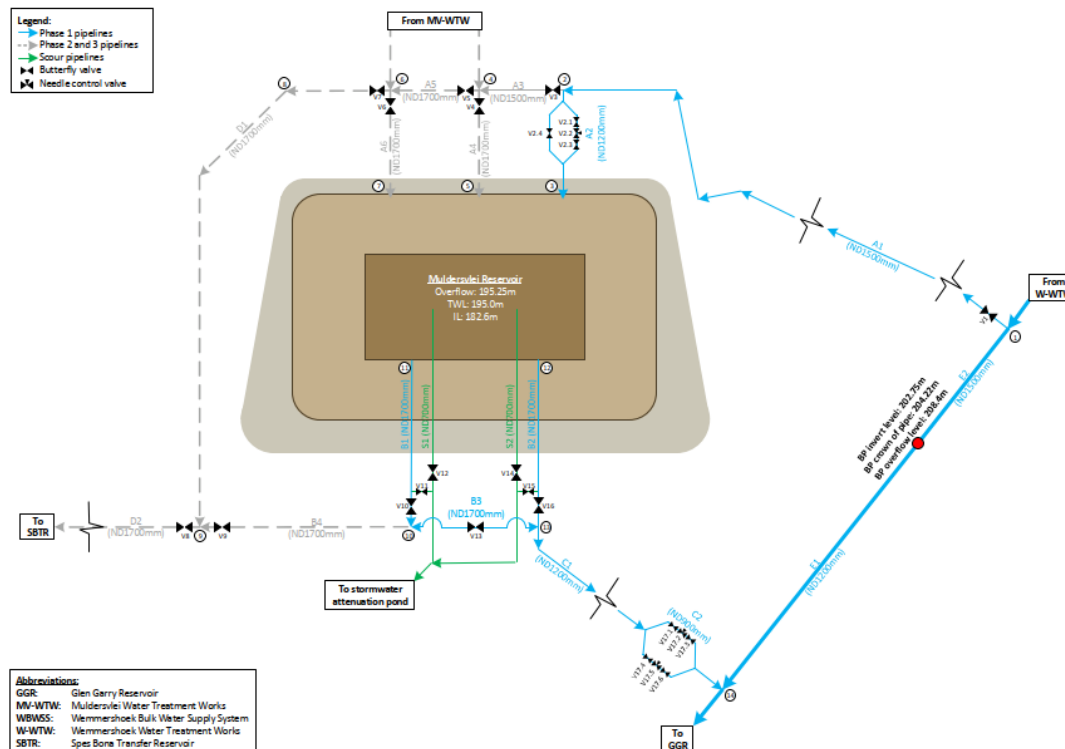
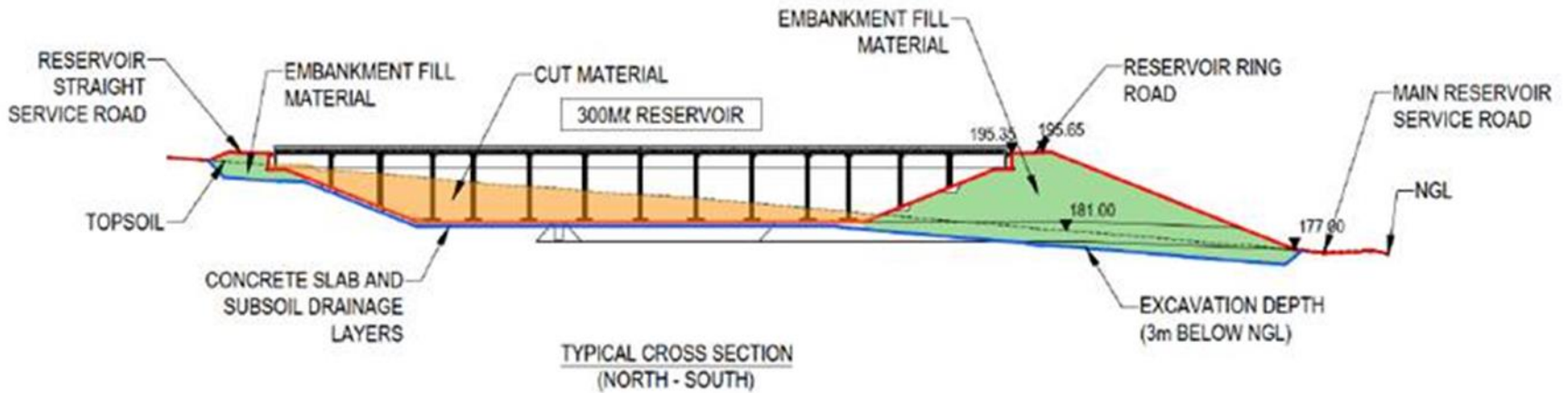


Muldersvlei Reservoir

- Classified as a Category II Dam was designed to be a cut-to-fill embankment dam reservoir;
- It has a highly weathered rock foundation;
- Concrete lining and concrete roof supported by concrete columns;
- The roof area is very large (approximately 240m x 140m)
- Depth: approx. 12.5 m



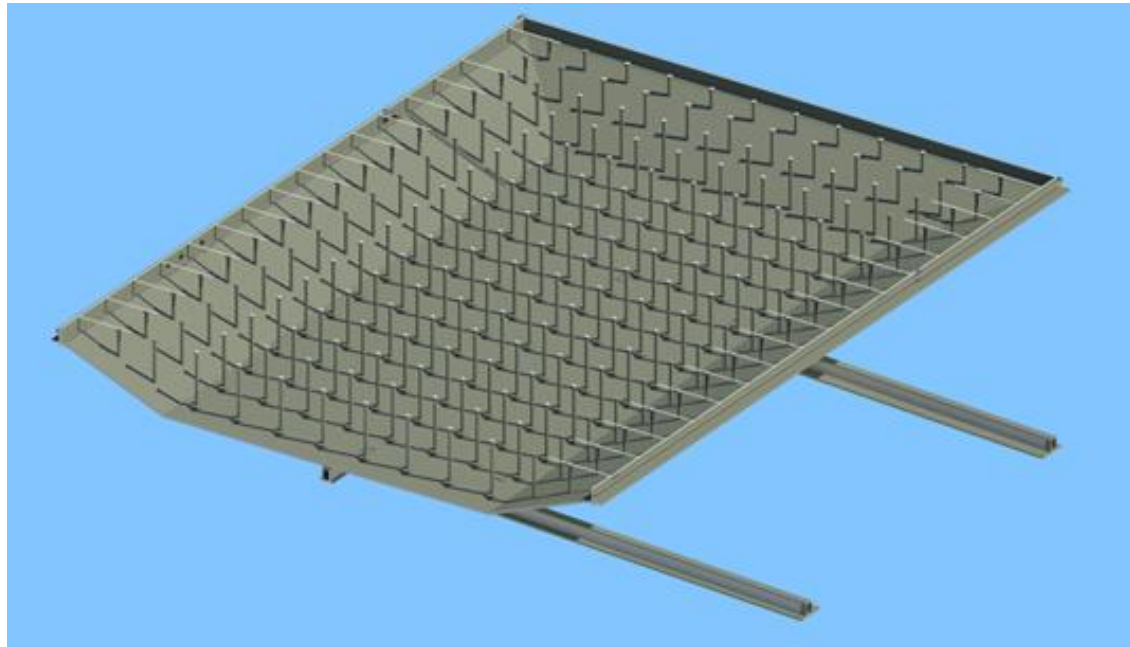
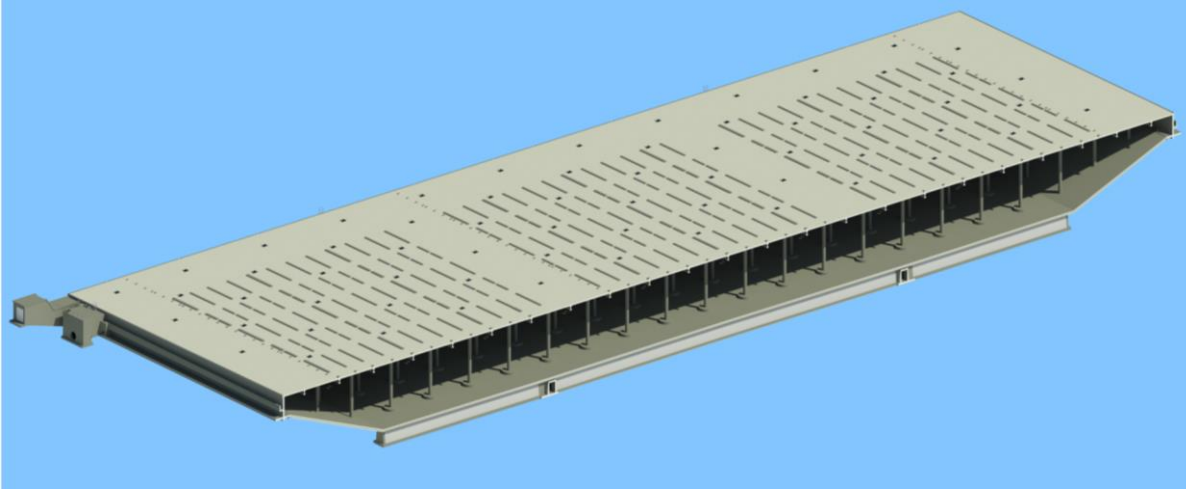
Schematic Representation



Muldersvlei Reservoir: 3 D Visualisation



Muldersvlei Reservoir: 3 D Visualisation



Wastewater Treatment Works

- 25 Wastewater Treatment Plants:
 - 2 x Pond systems
 - 3 x Marine outfalls
 - 1 x Trickling Filter Plant
 - 4 x Rotating Bio-Contactors (Package Plants)
 - 16 x Activated Sludge Plants
- Combined design capacity of 765 million liters per day (Mℓ/d)
- Currently treating approximately 542 Mℓ/d (drought peak 444 Mℓ/d, pre-drought 680 Mℓ/d)

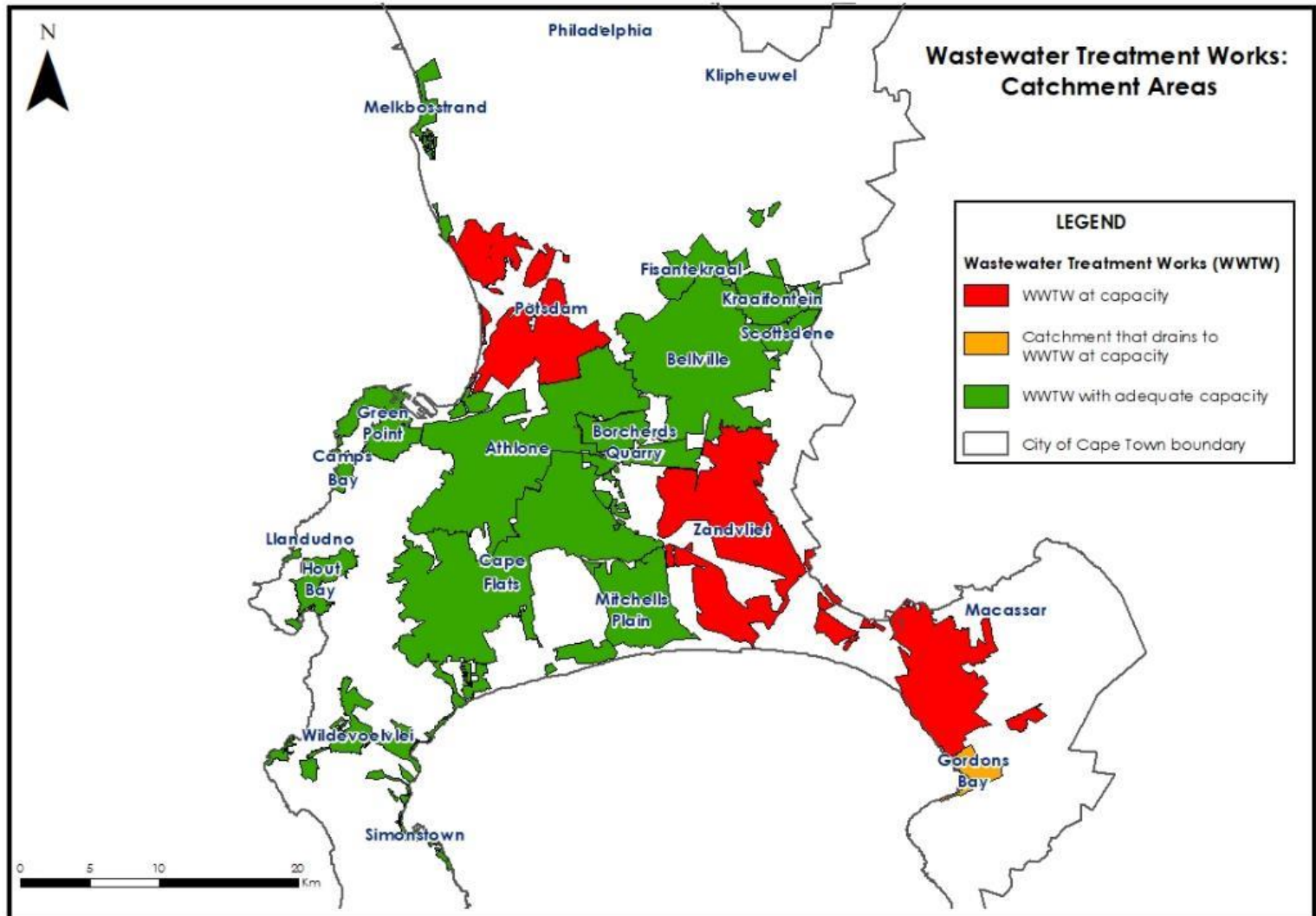




Location of WWTWs



WWTW CATCHMENTS AT CAPACITY



Priority WWTPs

- 0 yrs
- 1-4 yrs
- 5-10 yrs
- No capacity ext reqd
- ▼ Process upgrade required



Capacity Upgrade Requirements

3 0 3 6 Kilometers



Challenges at Wastewater Treatment Works

Challenges

Load shedding



WWTW very energy intensive. Generator capacity unable to run the whole process 24/7 as is limited to key processes. Impacts on treated effluent compliance.

Historical underinvestment in WwTW

Capacity challenges, aging infrastructure

Mechanical equipment maintenance, availability and failures



Equipment failures may cause spills, reduce treatment capacity or cause increased wear / breakdowns on downstream infrastructure

Ingress into the sewer network



The WwTW has to accept all the flow it receives as there is no way of bypassing flow elsewhere. This can cause flooding at the inlet works (pollution incident) or overload conditions within other unit treatment processes.

Challenges at Wastewater Treatment Works

Challenge

Sewer misuse



Large objects find their way into the sewer network, and can cause serious damage to inlet works lifting screw pumps. Screw pump failure can cause wastewater to spill from the Works inlet sump or back up into the sewer network and spill at the lowest manholes.

Illegal dumping / discharges






Industries illegally dump / discharge substances to sewer that either overwhelm screens / grit removal infrastructure or poison the biology that effects the treatment process.

Corrosive environment






The wastewater treatment environment can be very corrosive to civil infrastructure as well as mechanical and electrical equipment, resulting in premature failure of infrastructure.




Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Zandvliet</p> 	<p>Capacity upgrade (72 Mℓ/d to 90 Mℓ/d) and process upgrade / refurbishment.</p> <p><i>Increase Capacity; Extend life of existing treatment modules; Improve Treated Effluent Quality</i></p> <p>(Under construction)</p>	<p>23/24</p>
<p>Bellville</p> 	<p>Final Phase of process upgrade for 54 Mℓ/d 'DA' Treatment Module: Bioreactor process reconfiguration and replacement of aeration, mixing and pumping equipment.</p> <p><i>Extend life of existing treatment modules; Improve Treated Effluent Quality</i></p> <p>(Under Construction)</p>	<p>25/26</p>
<p>Cape Flats</p> 	<p>Provision of new inlet works.</p> <p><i>Improve treated effluent quality; Address risk of catastrophic failure of existing Inlet Works.</i></p> <p>(Detail Design)</p>	<p>PPP process to commence</p>




Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Potsdam</p> 	<p>Capacity upgrade (47 Mℓ/d to 100 Mℓ/d) and process upgrade / refurbishment.</p> <p><i>Increase capacity; Extend life of existing treatment modules; Improve Treated Effluent Quality</i></p> <p>(Under construction)</p>	<p>26/27</p>
<p>Wesfleur</p> 	<p>Replacement of industrial blowers and replacement of fine bubble aeration equipment for industrial and domestic bioreactors.</p> <p><i>Extend life of existing treatment modules; Address deteriorating aeration performance to avoid deterioration in treated effluent quality</i></p> <p>(Detail Design)</p>	<p>26/27</p>
<p>Wildevölvlei</p> 	<p>Refurbishment of existing and additional capacity for the sludge dewatering process.</p> <p><i>Improved treated effluent quality and address risk of further deterioration of treated effluent quality</i></p> <p>(Detail Design)</p>	<p>26/27</p>




Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned Prelim Completion dates
<p>Macassar</p> 	<p>Capacity upgrade (34 Mℓ/d to 80 Mℓ/d) and process upgrade / refurbishment.</p> <p>Increase capacity; Treatment process upgrade; Improve Treated Effluent Quality</p> <p>(Design)</p>	<p>27/28</p> <p>Tender advert: March / April 2024</p>
<p>Mitchells Plain</p> 	<p>Capacity upgrade (35 Mℓ/d to approx. 55 Mℓ/d), associated upgrade to inlet works, dewatering and disinfection processes.</p> <p>Increase capacity; Improve Treated Effluent Quality</p> <p>(Concept)</p>	<p>29/30</p>
<p>Simons Town</p> 	<p>New treatment process to enable Works to produce compliant treated effluent quality</p> <p>Upgrade treatment process; Improve treated effluent quality</p> <p>(Concept)</p>	<p>TBD</p>


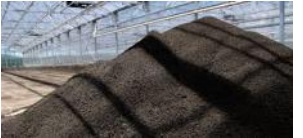

Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Wesfleur</p> 	<p>Capacity upgrade (Industrial 6 Mℓ/d to 9 Mℓ/d, Domestic 8 Mℓ/d to 12 Mℓ/d), associated upgrade to inlet works and disinfection process. Provision of mechanical dewatering.</p> <p>Increase capacity; Treatment process upgrade; Improve Treated Effluent Quality</p> <p>(Concept)</p>	<p>TBD</p>
<p>Wildevoëlvelei</p> 	<p>Capacity upgrade (35 Mℓ/d to approx. 55 Mℓ/d), associated upgrade to inlet works, dewatering and disinfection processes.</p> <p>Increase capacity; Improve Treated Effluent Quality</p> <p>(Concept)</p>	<p>TBD</p>
<p>Athlone</p> 	<p>PH 1: Refurbishment and process upgrade of existing treatment infrastructure.</p> <p>PH 2: Capacity upgrade (105 Mℓ/d to 155 Mℓ/d), new inlet works, tertiary treatment and mechanical dewatering.</p> <p>Extend life of existing treatment process; Increase capacity; Upgrade treatment process; Improve treated effluent quality</p> <p>(PH 1 under construction, PH 2 Concept)</p>	<p>PH 1: 24/25 PH 2: TBD</p>




Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Borcherds Quarry</p> 	<p>Provision of new inlet works.</p> <p><i>Process upgrade, protect downstream infrastructure, address risk of catastrophic failure of existing inlet works</i></p> <p>(Planned)</p>	<p>TBD</p>
<p>Southern BBF</p> 	<p>Regionalised Biosolids Beneficiation Facility located at Cape Flats WwTW. PH1: Mechanical pre-thickening and dewatering, anaerobic digester installation refurbishment and upgrade.</p> <p>PH 2: Import facility, sludge pre-treatment, sludge liquor treatment, combined heat & power.</p> <p><i>Sludge treatment, compliance with current and future legislation</i></p> <p>(PH1 Design, PH 2 Concept)</p>	<p>PPP Process to Commence</p>
<p>Fisantekraal</p> 	<p>Various process additions and upgrades to existing treatment infrastructure.</p> <p><i>Extend life of existing treatment process</i></p> <p>(Concept)</p>	<p>TBD</p>

Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Zandvliet</p> 	<p>PH 2 capacity expansion (90 Mℓ/d to 120 /150 Mℓ/d)</p> <p>Increase capacity (Planned)</p>	<p>Approx 34/35</p>
<p>Northern BBF</p> 	<p>Second regionalised biosolids beneficiation facility (Greenfields – not located at existing WwTW).</p> <p>Sludge treatment, compliance with current and future legislation (Planned)</p>	<p>TBD</p>
<p>Cape Flats</p> 	<p>Capacity expansion (200 Mℓ/d to 250 Mℓ/d) and upgrade to all associated infrastructure.</p> <p>Increase capacity; Upgrade treatment process; Improve treated effluent quality (Planned)</p>	<p>38/39</p>

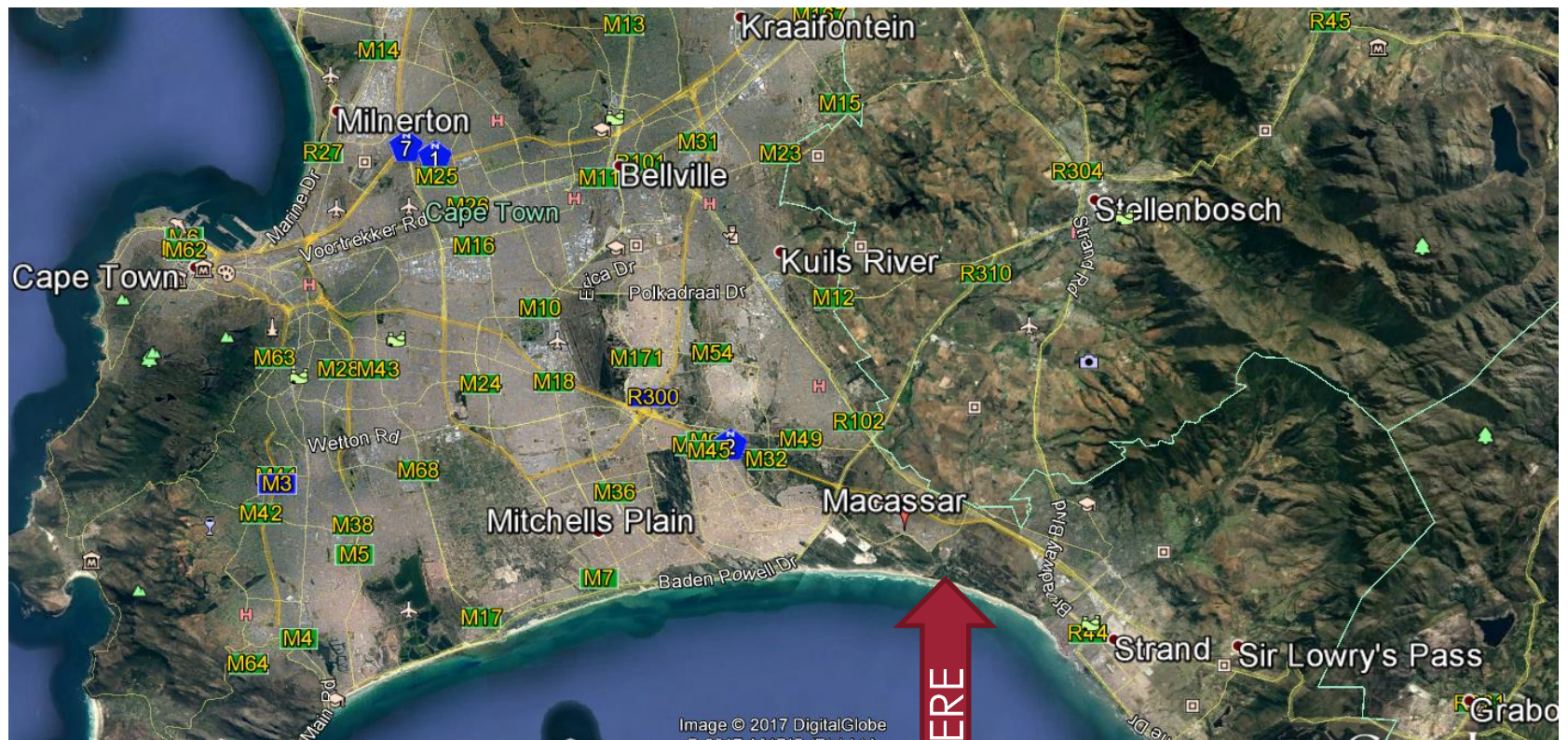
Capital Program (20 Year) - Provisional

WwTW	Type / Detail	Planned / Required Completion
<p>Scottsdale</p> 	<p>Capacity expansion (12.5 Mℓ/d to approx. 22.5 Mℓ/d)</p> <p>Increase capacity (Planned)</p>	<p>38/39</p>
<p>Eastern BBF</p> 	<p>Third regionalised biosolids beneficiation facility, located at either the Zandvliet or the Macassar WwTW.</p> <p>Sludge treatment, compliance with current and future legislation (Planned)</p>	<p>40/41</p>
<p>Fisantekraal</p> 	<p>Capacity expansion (24 Mℓ/d to 48 Mℓ/d) and upgrade to all associated infrastructure.</p> <p>Increase capacity (Planned)</p>	<p>41/42</p>

Upgrade to Macassar WWTW

The Macassar Wastewater Treatment Works (WWTW) is located between Khayelitsha and Strand, along the False Bay coastline.

Process Upgrade and extension of the treatment capacity **to 80 Mℓ/day**



Macassar WWTW: Layout

Site layout

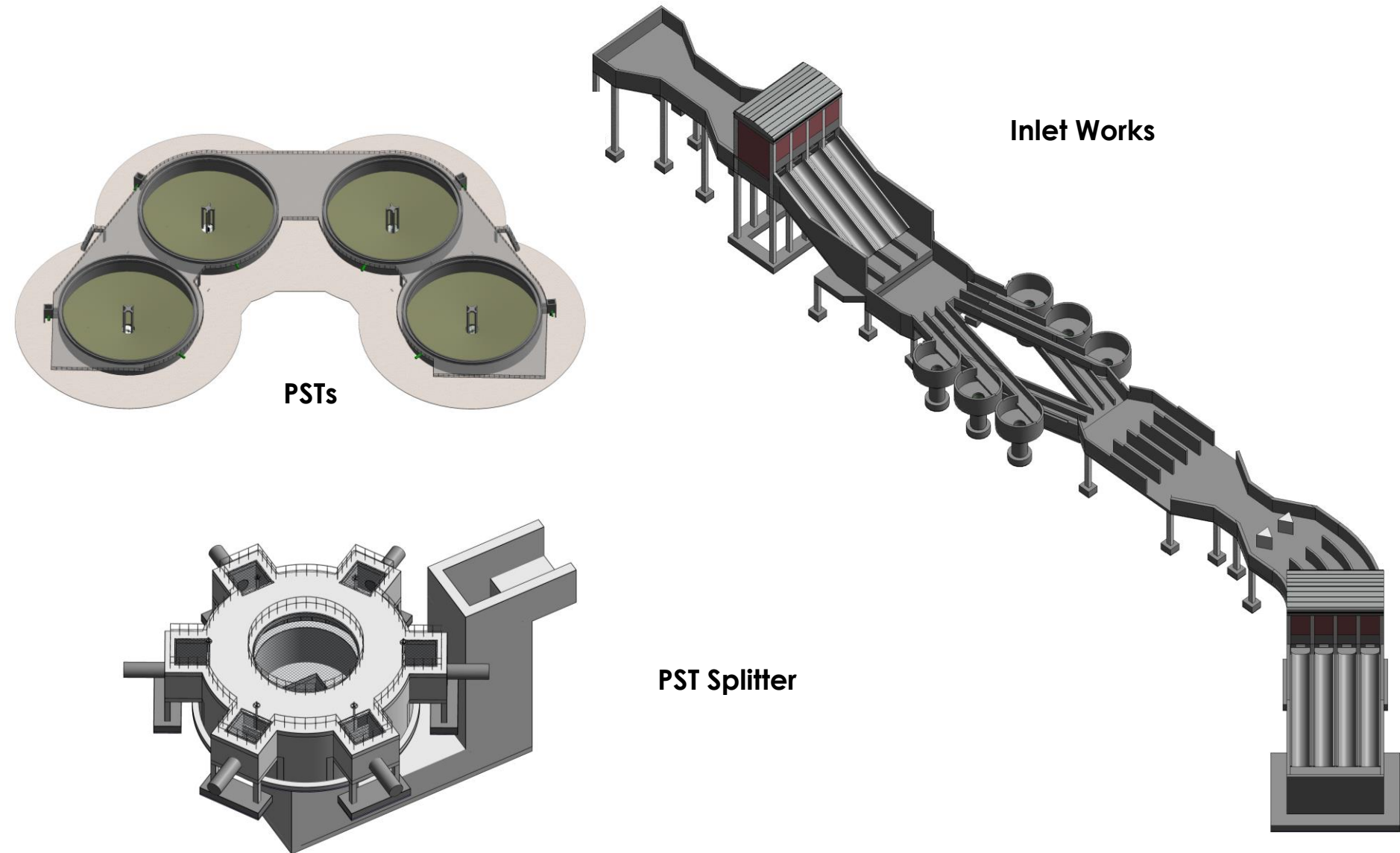


Case 7: Technical Engineering

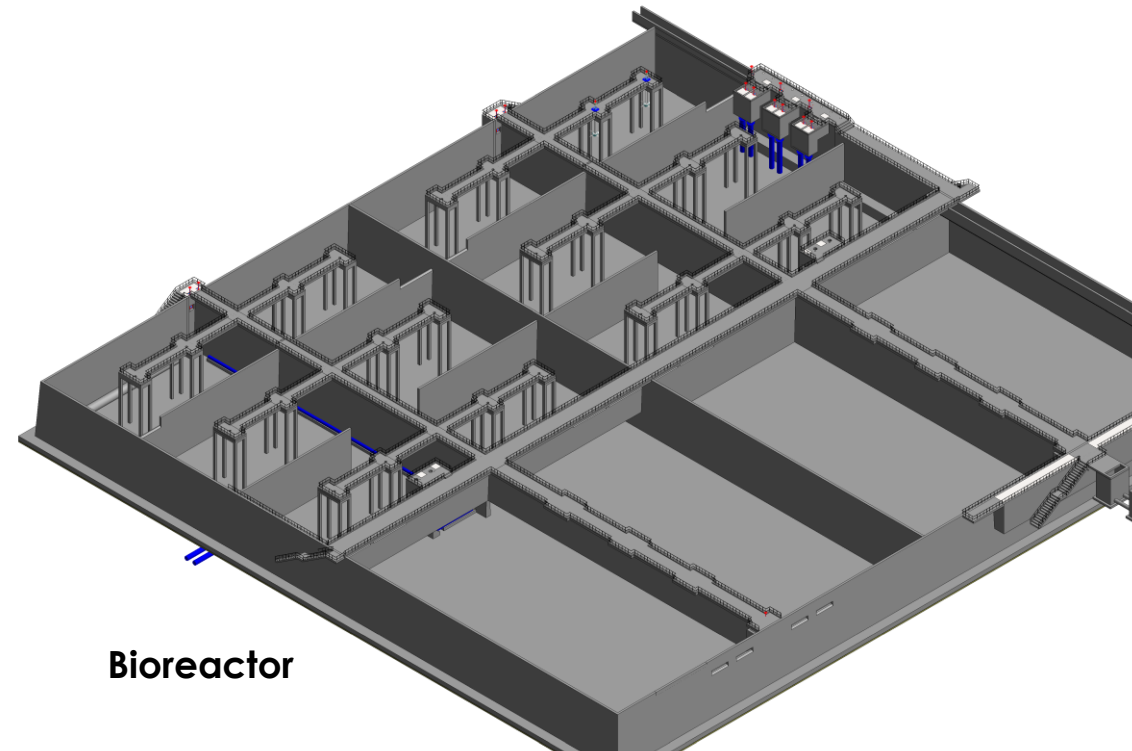
Site layout (3d Model)



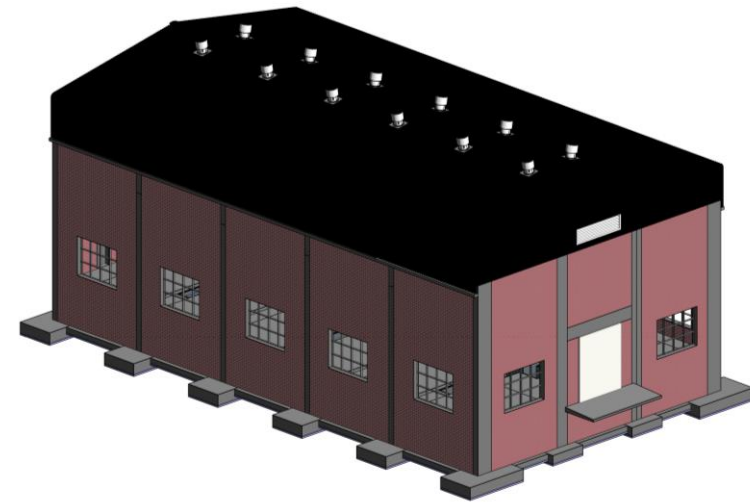
Case 7: Technical Engineering



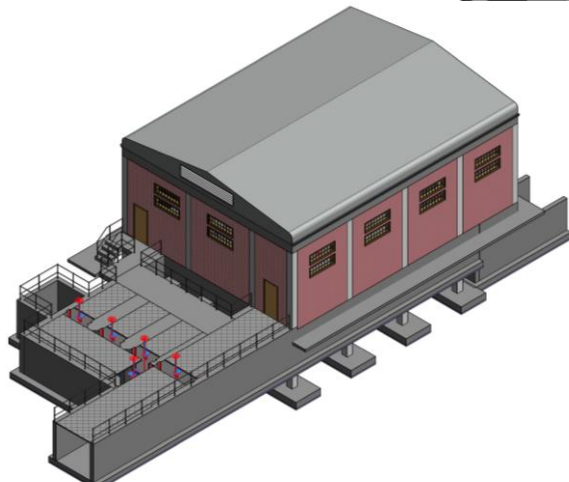
Case 7: Technical Engineering



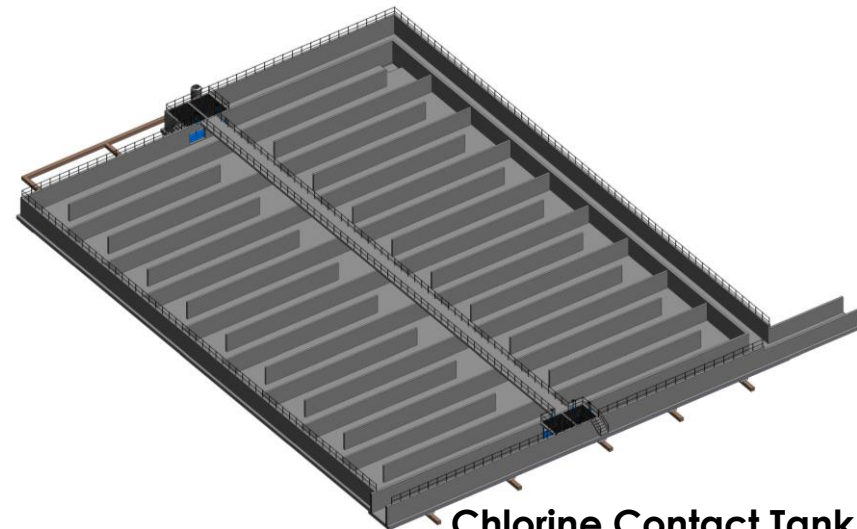
Bioreactor



Blower Building



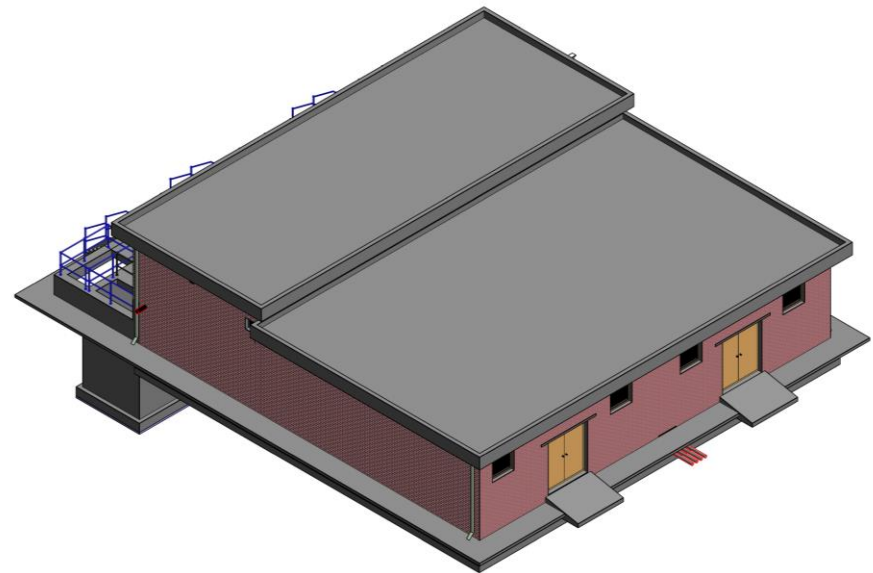
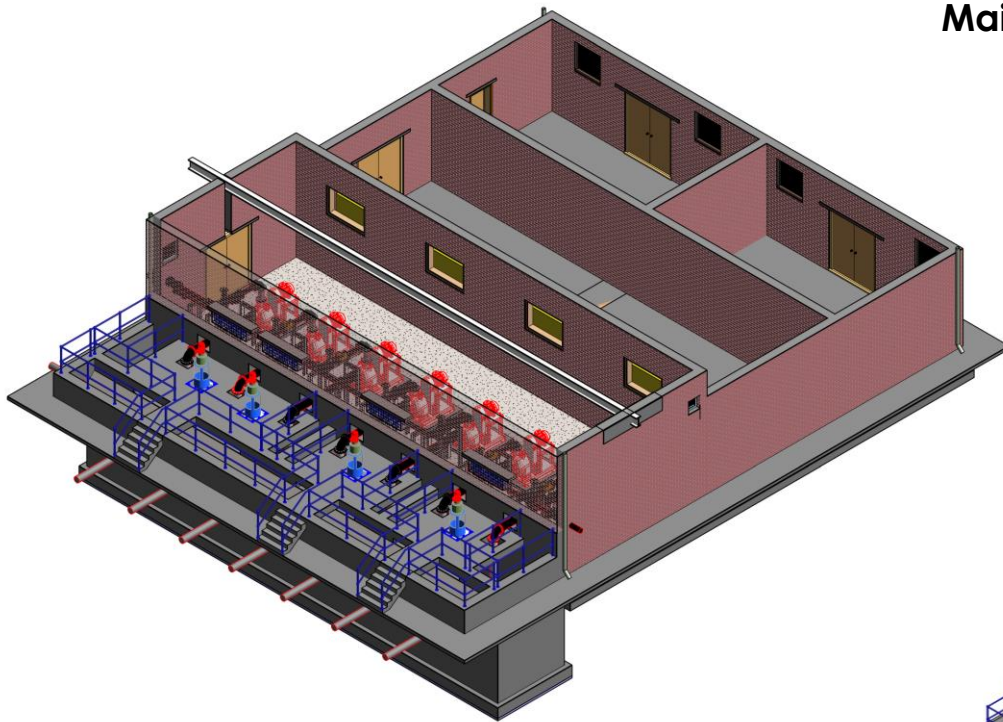
UV Facility



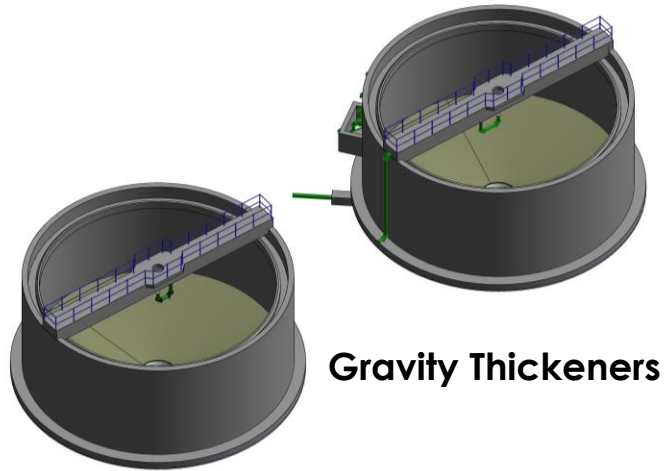
Chlorine Contact Tank

Case 7: Technical Engineering

Main Sludge Pump Station

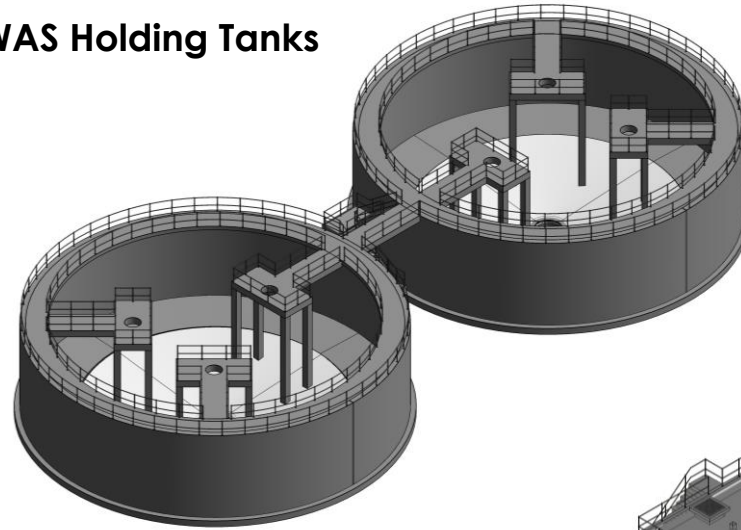


Case 7: Technical Engineering

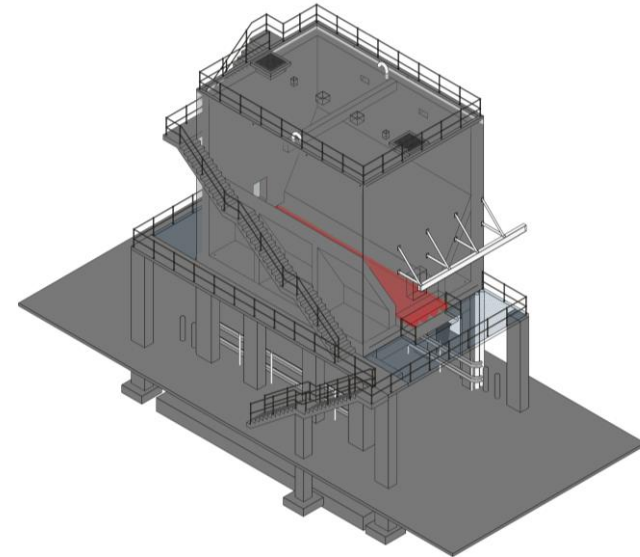
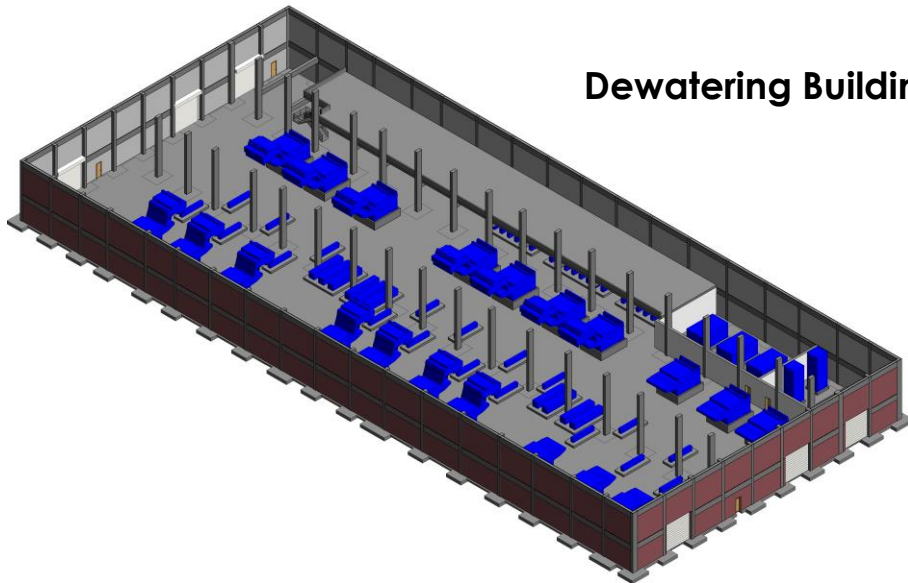


Gravity Thickeners

WAS Holding Tanks



Dewatering Building



Sludge Silo

Potsdam WWTW (currently under construction)

146Q/2021/22: Mechanical / Electrical Component

- Project commencement on 21 April 2023

295Q/2021/22: Civil Project Component

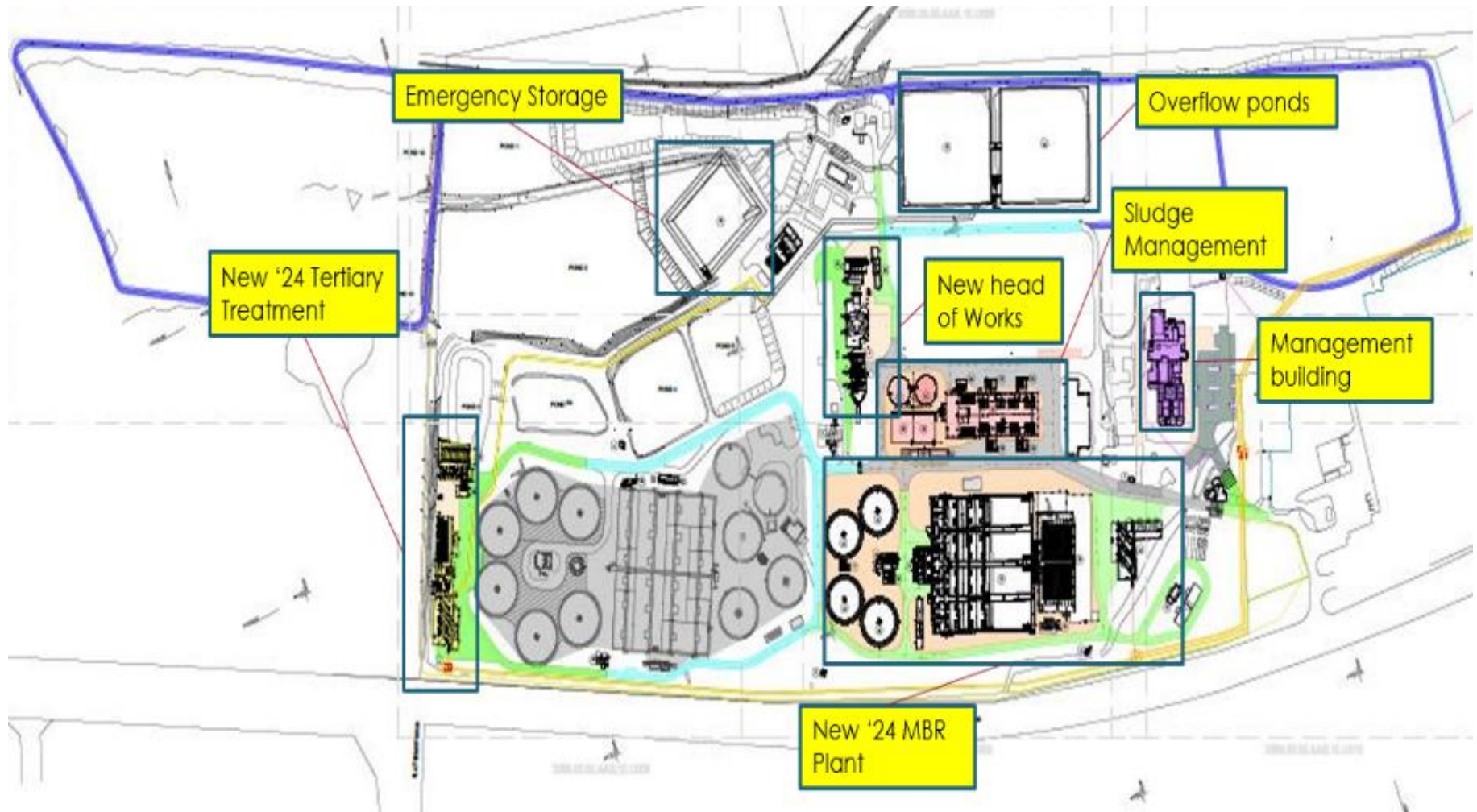
- Project commencement on 21 April 2023

Construction Value: Approximately R 5 billion

Capacity Increase : 47 MI/d to 100 MI/d



Layout of Upgrade



Concrete plinths for the 14 x New Belt Filter Presses



New Secondary Sludge (WAS) Holding Tanks



New Raw Sewage Pump Station



Overview of New Dewatering Facility





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ISIXEKO SASEKAPA
STAD KAAPSTAD

THANK YOU | ENKOSI | DANKIE

Making progress possible. **Together.**