Building Resilience in Water Supply Infrastructure in the face of Future Uncertainties

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Future Uncertainties

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Climate Change

Population Growth and Urbanisation

Aim of this Research

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How can policymakers build resilience into water supply systems when faced with the shocks and stresses that future uncertainties might bring?

Research Questions

1. What are the major driving forces which contribute to a water crisis?

2. How can water supply infrastructure be critically appraised to provide adaptive, resilient solutions to the issue?

Cape Town, South Africa

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- 4 million people
- GDP per capita of US$15,000
- 3rd Wealthiest City in Africa
- Constitution guarantees water as a human right

The Drought

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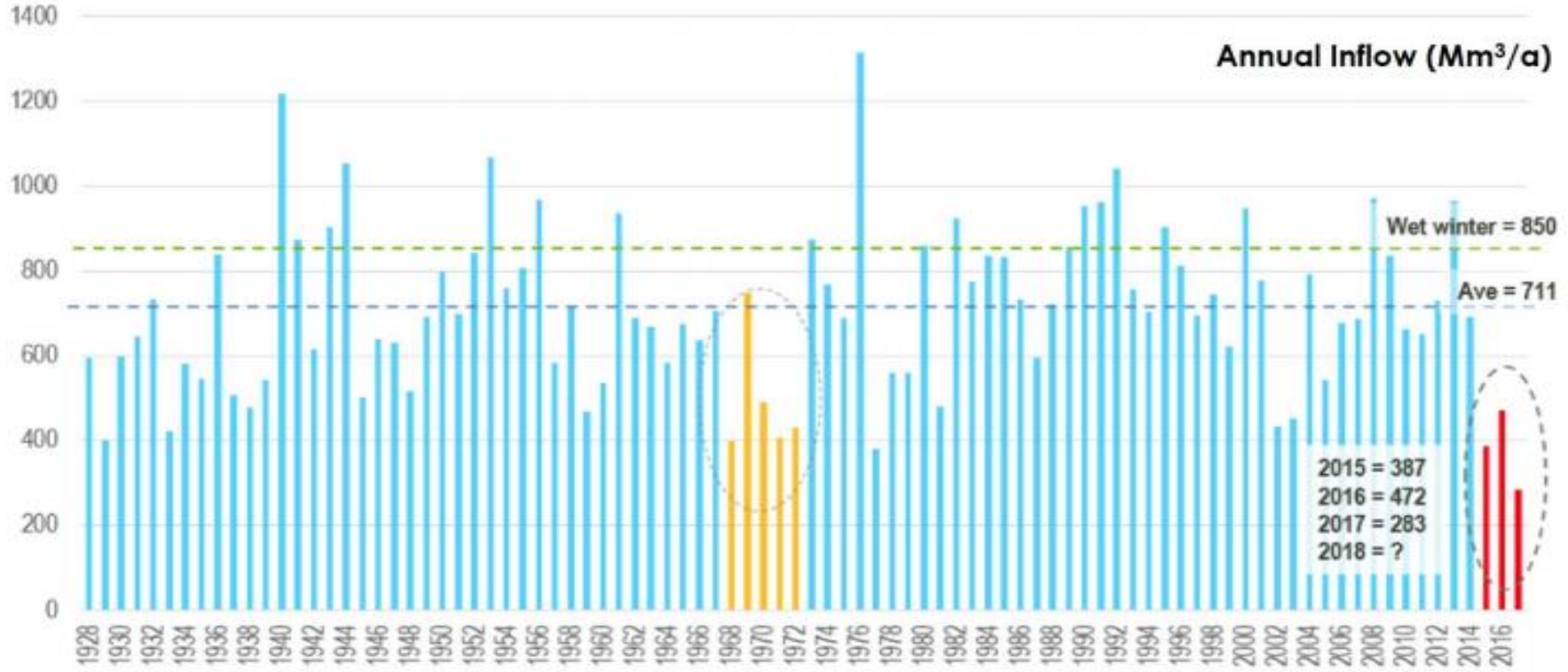
- 3 consecutive years of low rainfall (2015 – 2017)



The Drought

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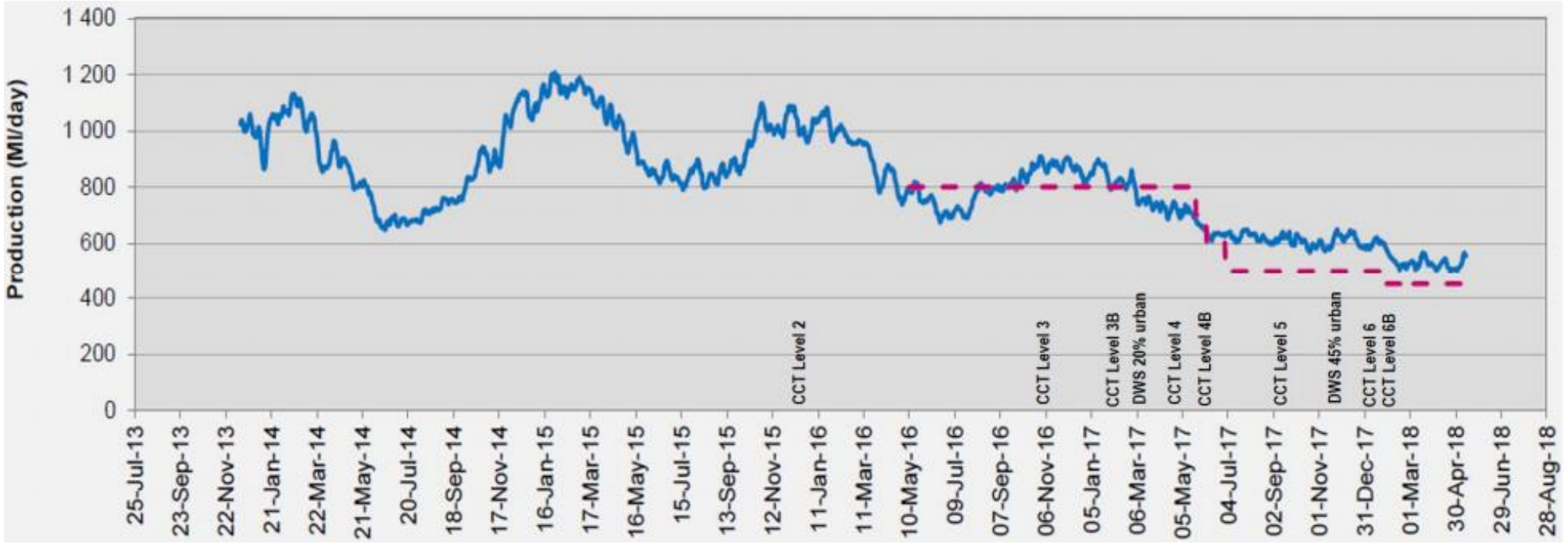
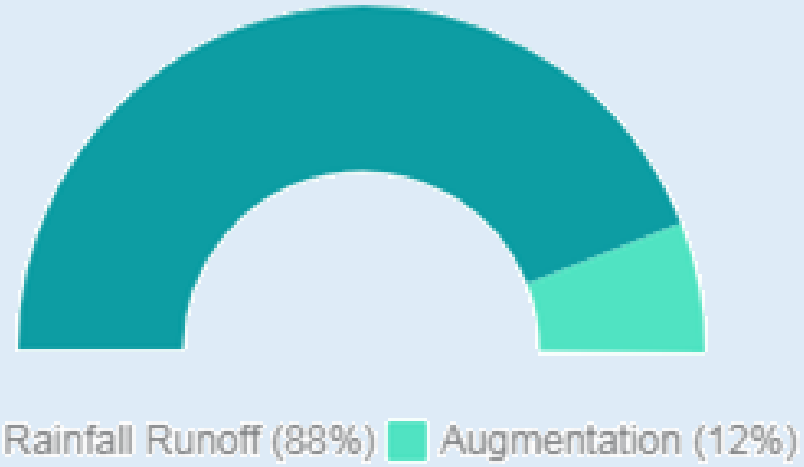
- 50 litres per capita daily restrictions (450MLD)
- Temporary augmentation measures were put in place to enhance supply

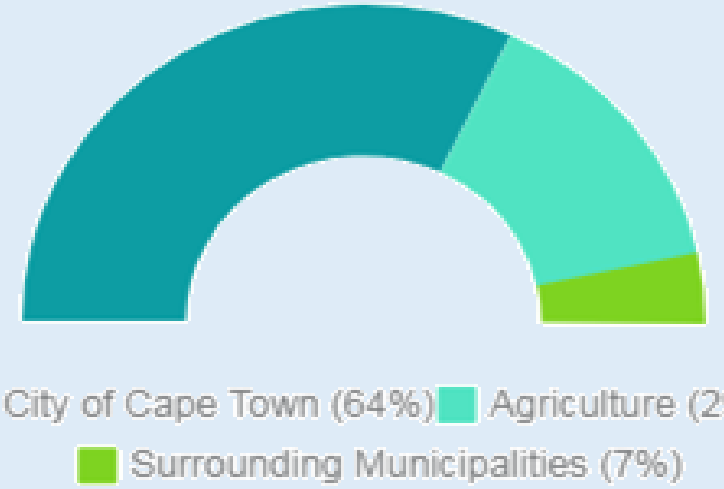


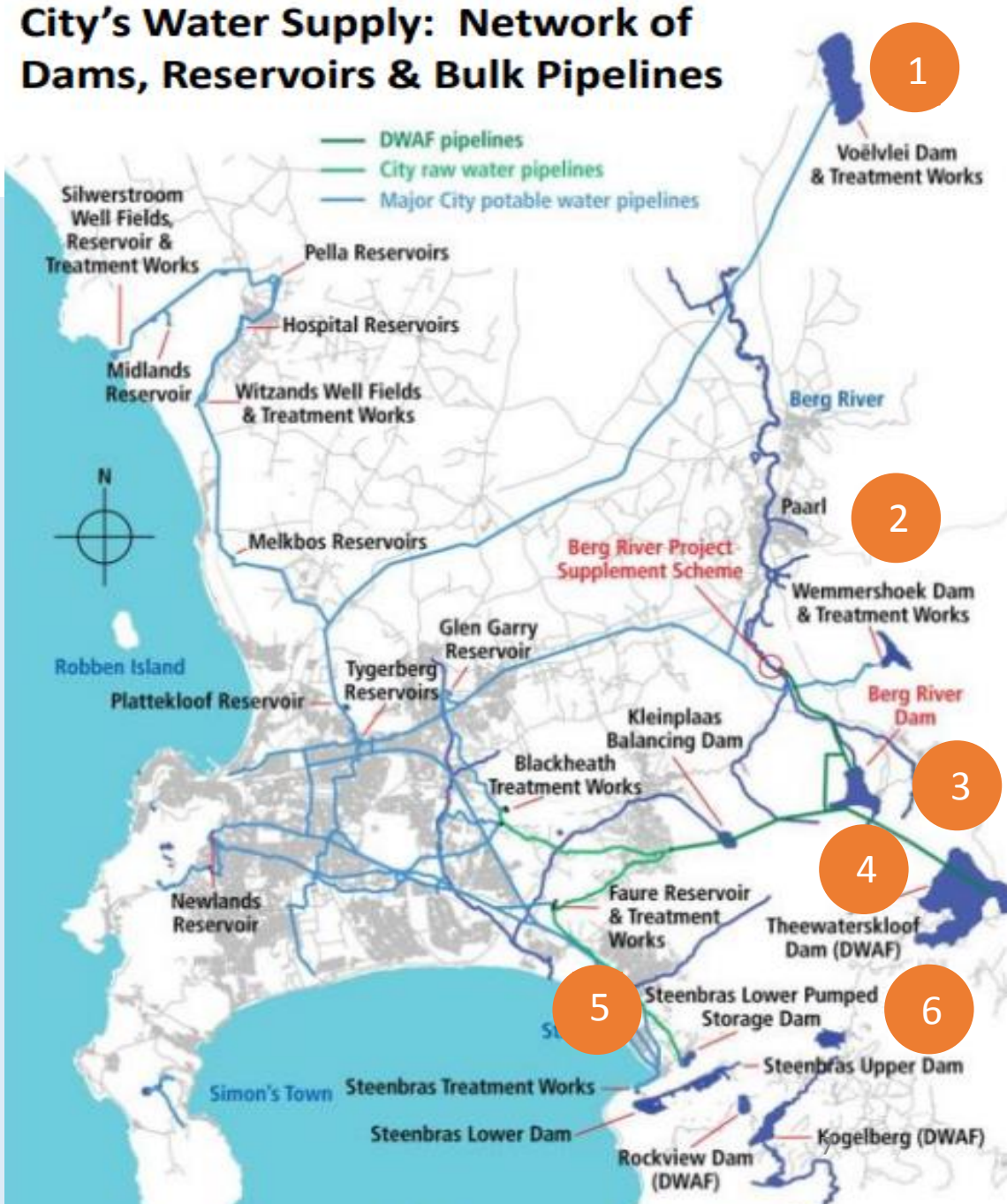
Water Supply System

SOURCE



DEMAND





Major Driving Forces

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DEMAND

Population growth by 79% between 1995 – 2018.

Increased agricultural and industrial usage.

SUPPLY

Climate change and variability.

Dam storage capacity has increased by 14% since 1995.

SOCIETAL

Social inequality with regards to access to water.

Only 5% of water is consumed by people living in townships.

Solutions to the Problem

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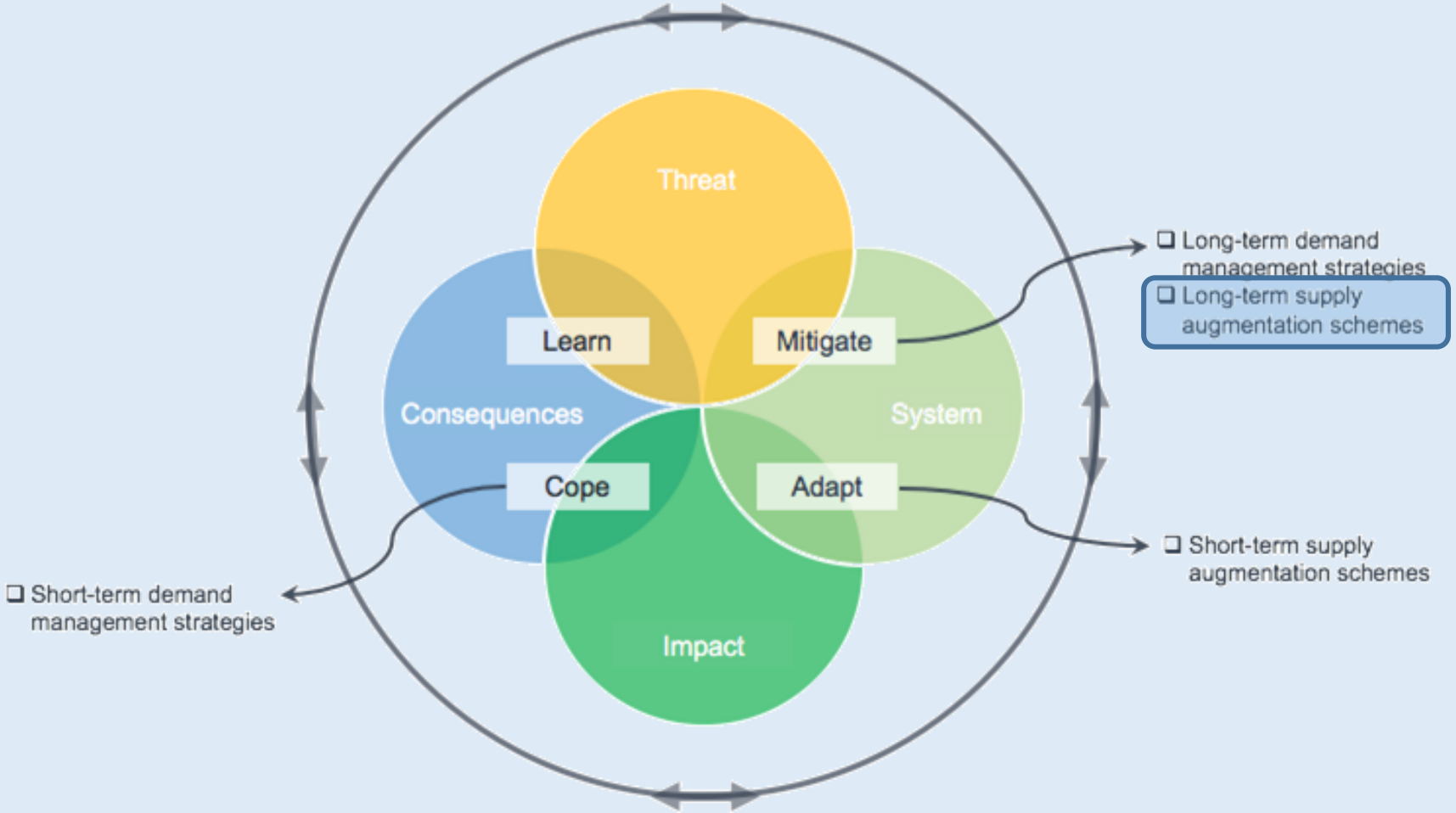

Butler et al. (2017) Safe and Sure Intervention Framework adapted for Cape Town's Water Management Strategy.

Comparing Supply-Side Options

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1. Desalination

Feasibility study into Seawater Reverse Osmosis (RO) desalination is being undertaken.

2. Surface Water Transfer

Bulk water transfer from Berg River catchment to Voe¨lvlei Dam.

3. Wastewater Reuse

Feasibility studies to build a plant at an existing water treatment plant is being undertaken.

4. Groundwater Extraction

Cape Flats Aquifer and Table Mountain Aquifer have storage capacity of 1600 $Mm^{3.}$

Resilience of Supply-Side Options

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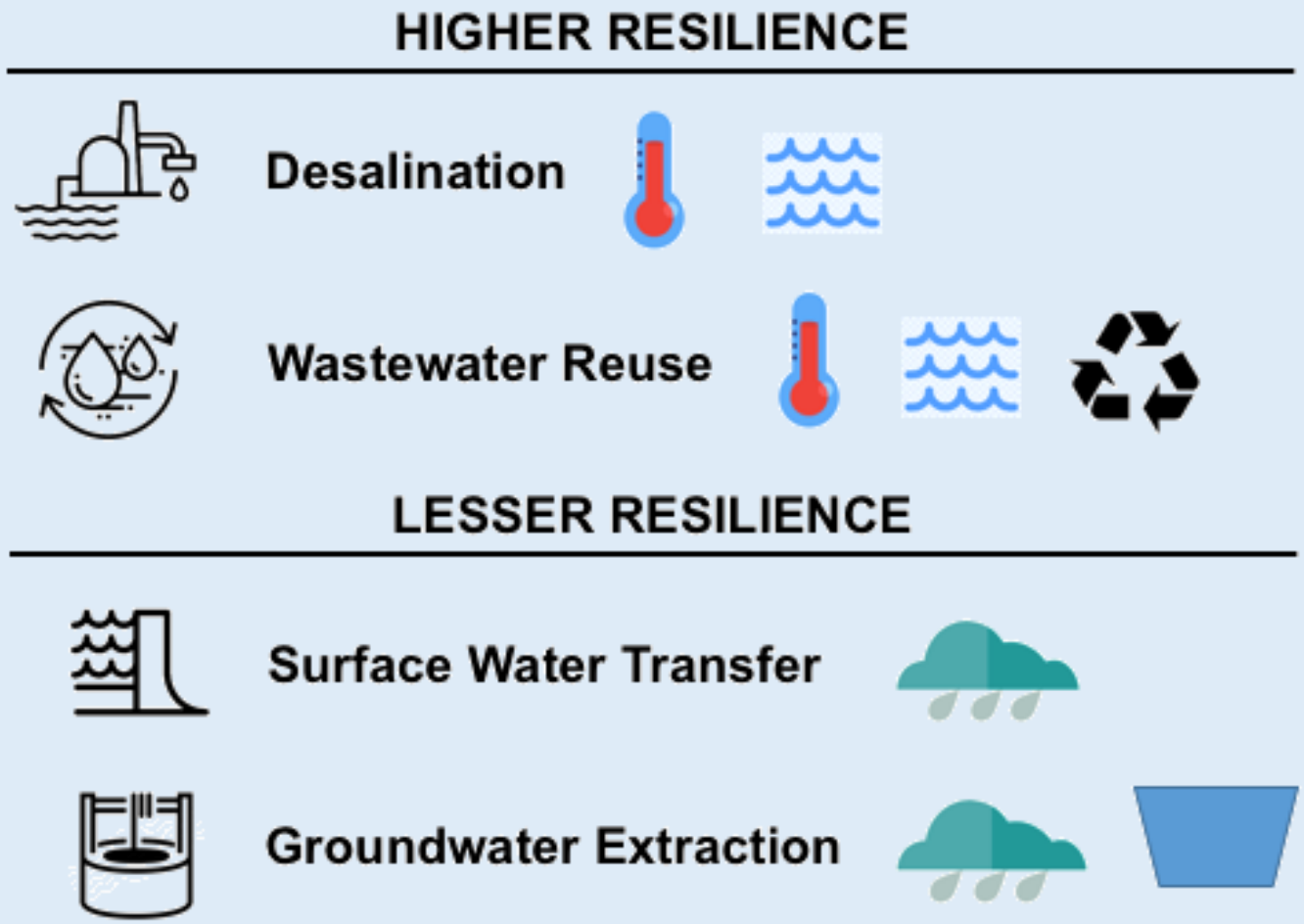
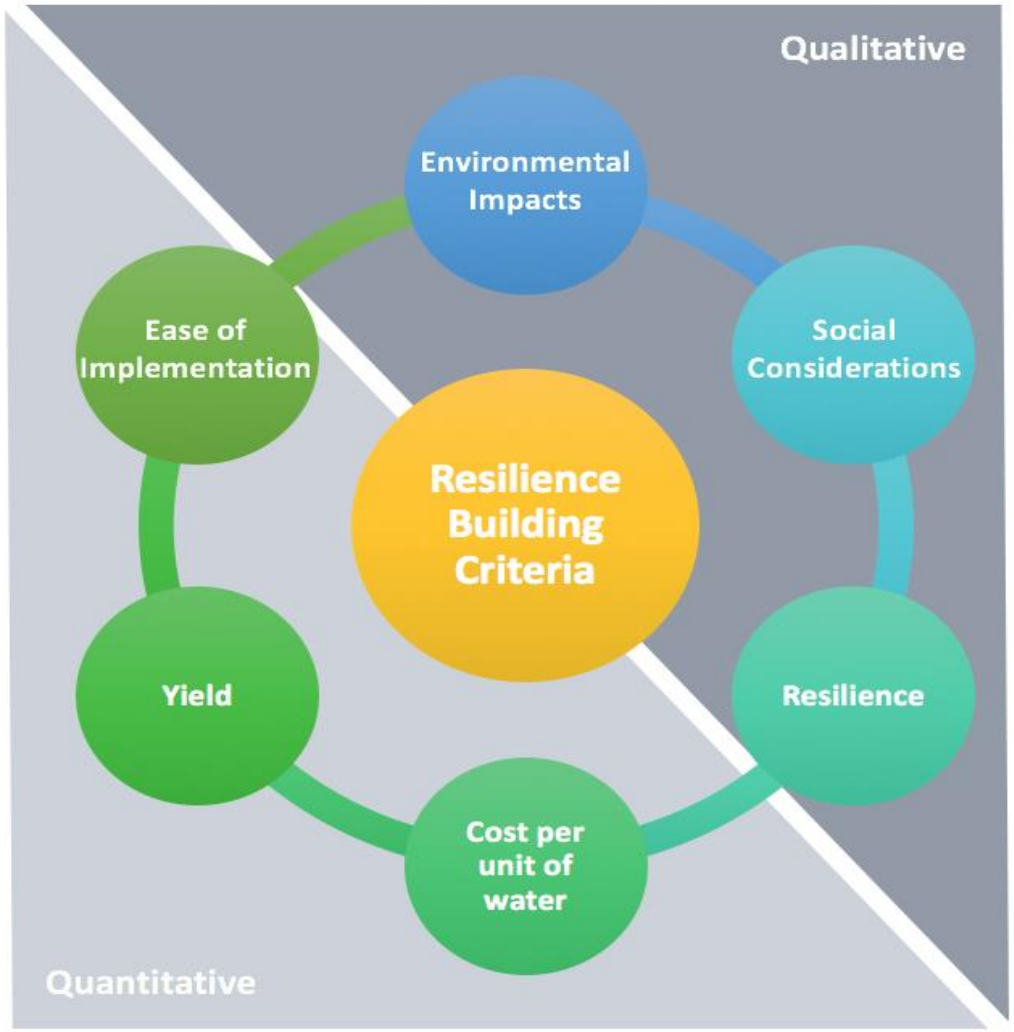


Key:

- Resilience to temperature extremes
- Resilience to flood events
- Includes recycling of water
- More reliant upon rainfall
- Includes storage of water

Holistic Options Evaluation Framework



Analytic Hierarchy Process

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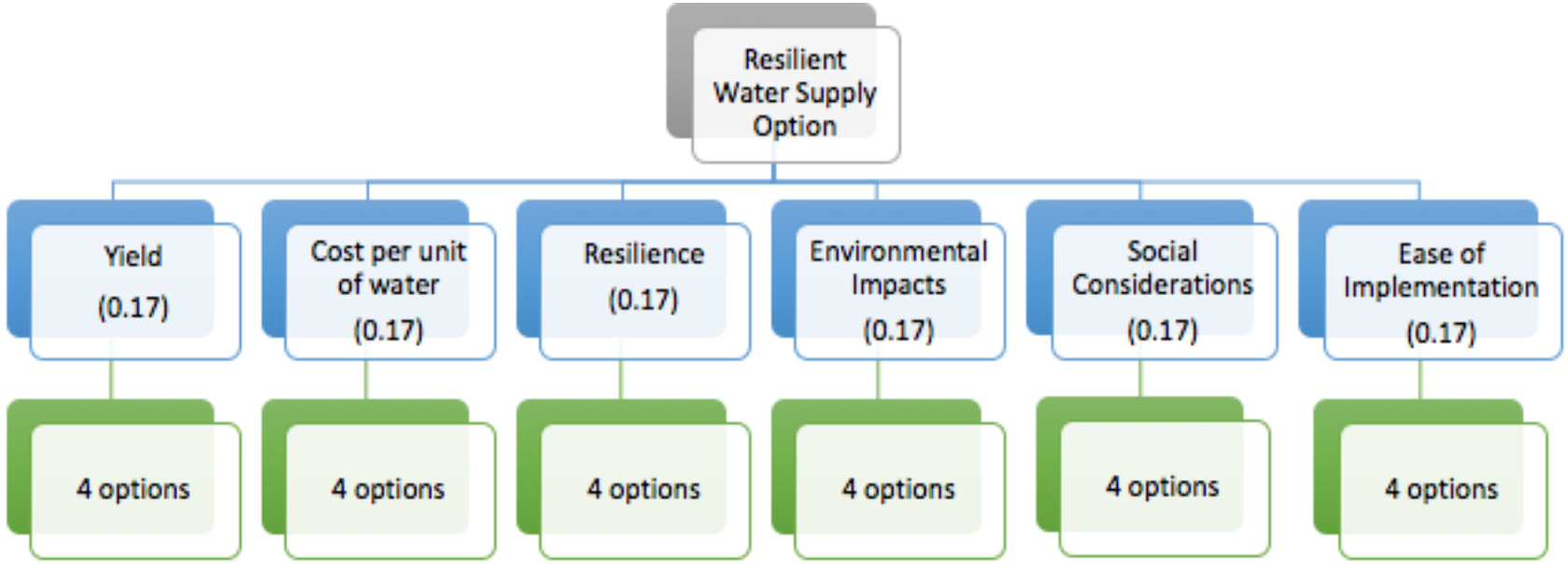
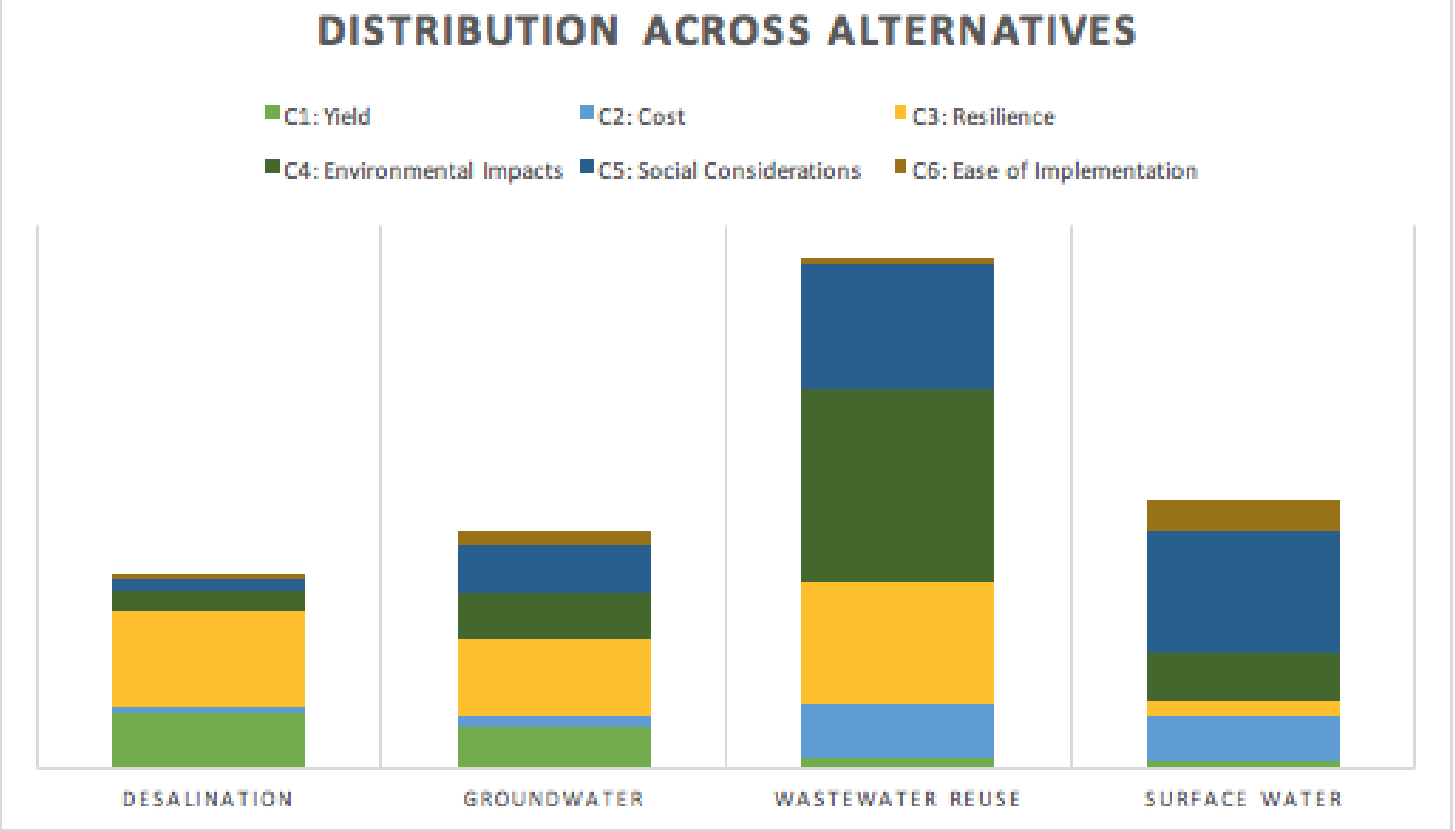


Results of Analysis



Conclusions

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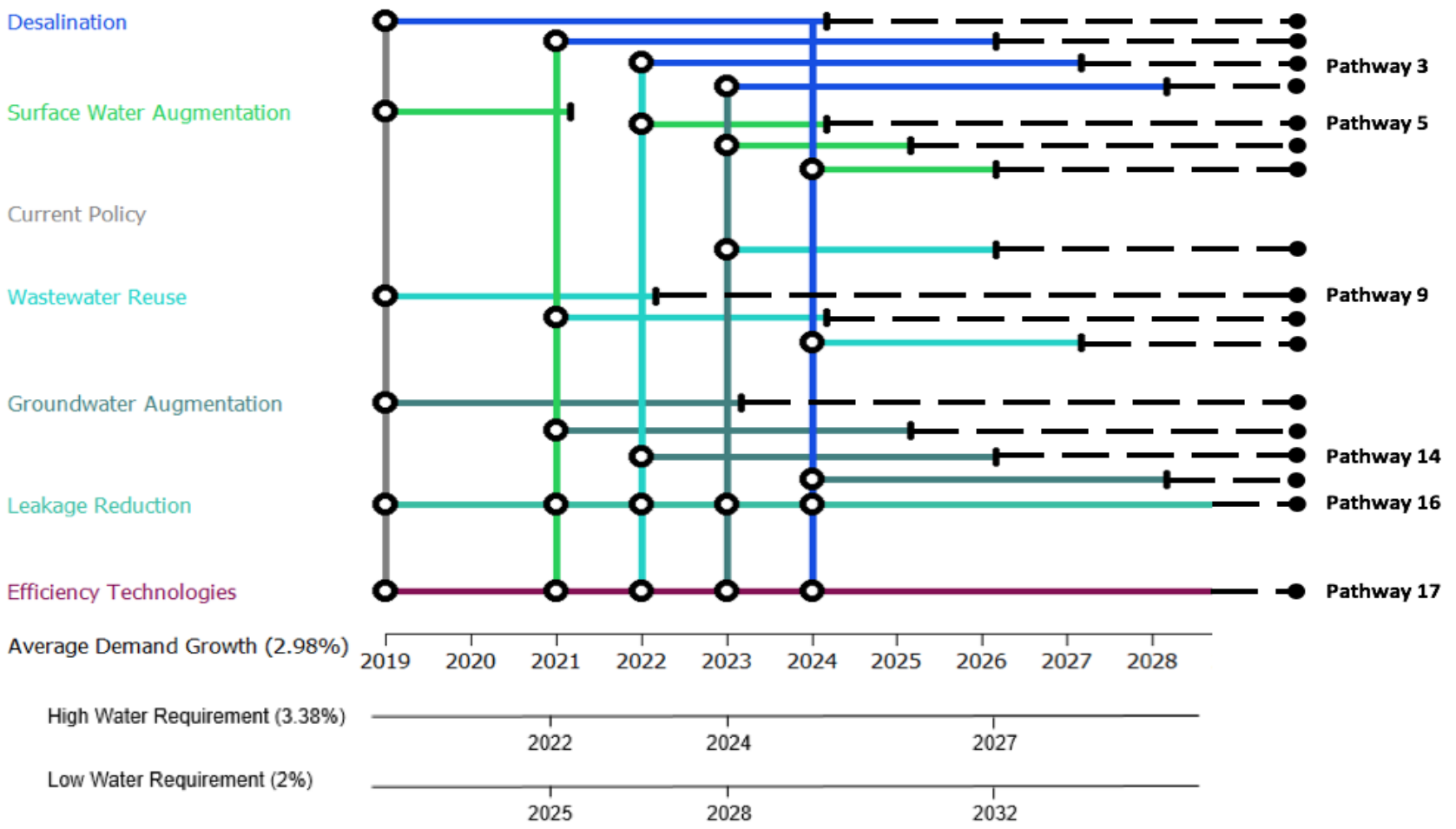
- Cape Town currently depends heavily on rainfall – it is important that they invest in alternative sources of water to diversify their supply.

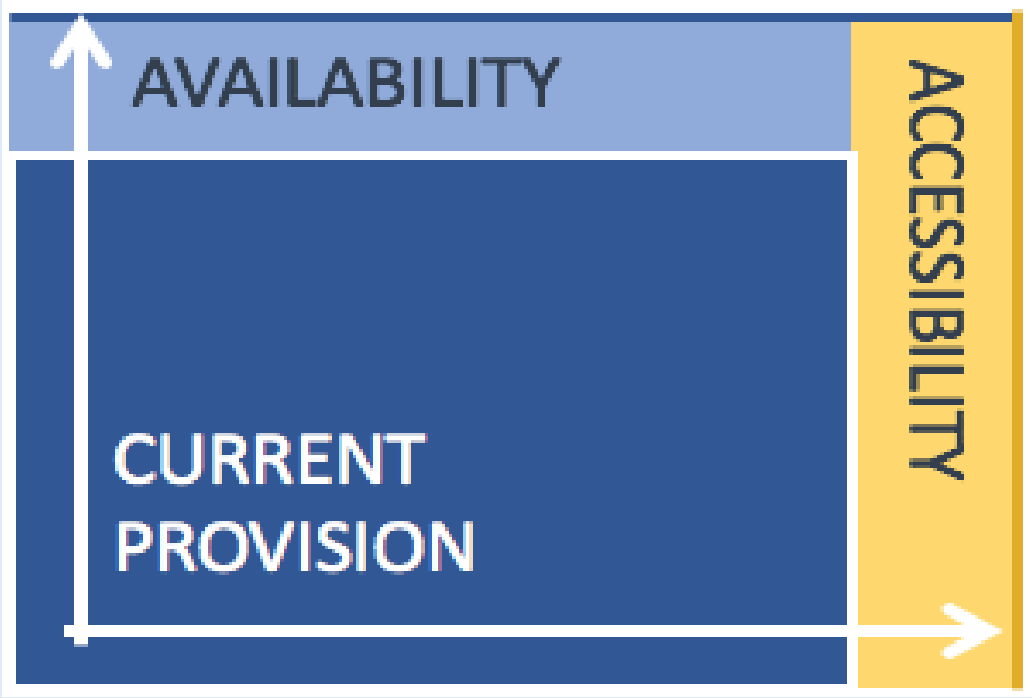
- The Analytic Hierarchy Process (AHP) adopts a more traditional, ‘predict then build’ approach, which is static and linear in nature.

- It is recommended that a more dynamic approach such as Adaptation Pathways, which allows strategies to be developed and compared across future scenarios, be used as a precursor to the AHP.

Adaptation Pathways



Conclusions



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