

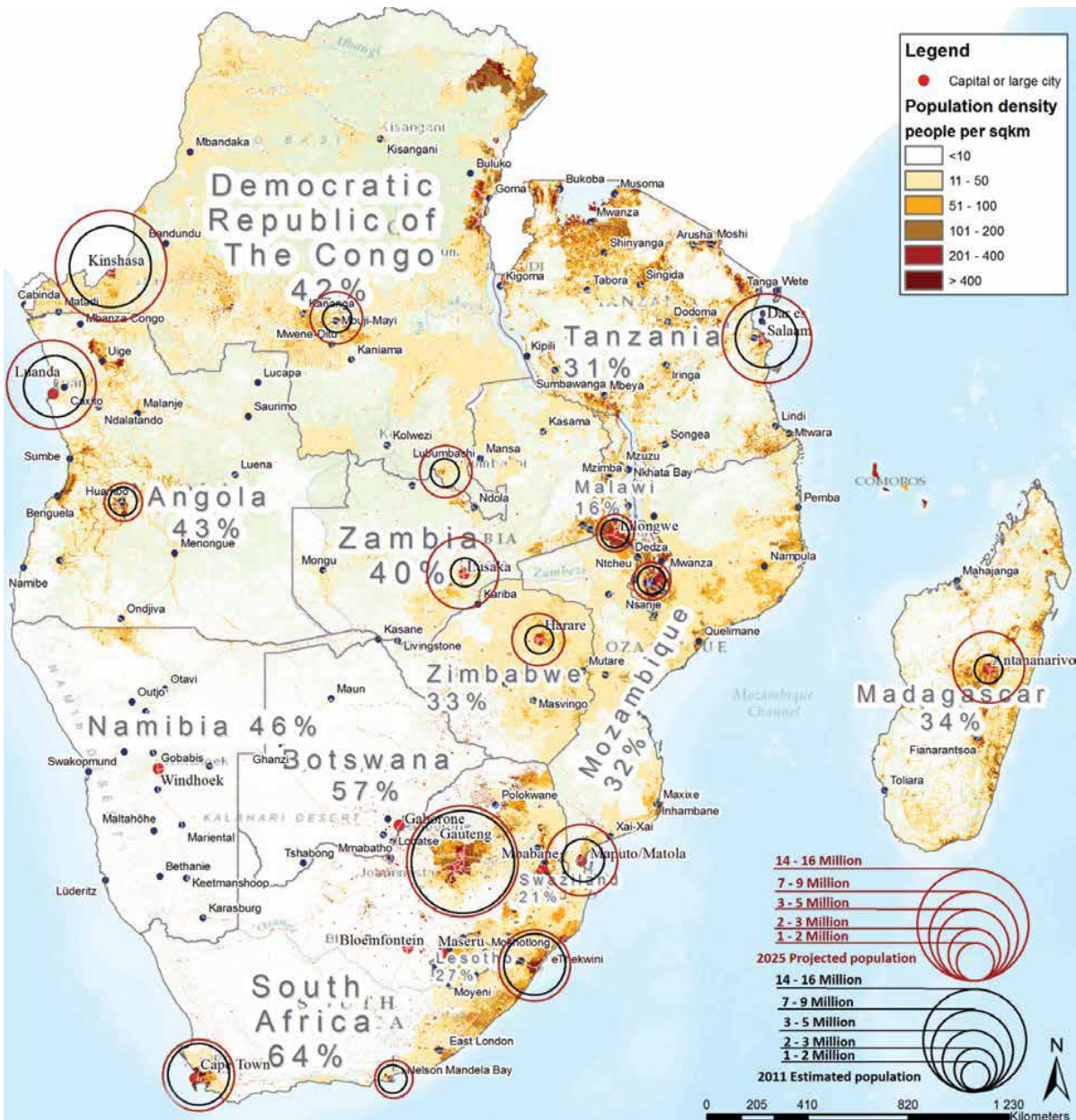


UNIVERSITY of the
WESTERN CAPE

Groundwater in urban water cycles: The Southern African Development Community experience

Kevin Pietersen and Thokozani Kanyerere
kpietersen@mweb.co.za

Rapid urbanisation



(Van Niekerk and Le Roux 2017)

SADC country	Percentage urban dwellers living in slums
Madagascar	76
Malawi	69
Angola	66
Tanzania	64
DRC	62
Zambia	57
Lesotho	54
Namibia	34
Zimbabwe	24
South Africa	23

(Van Niekerk and Le Roux 2017)

The urban population growth [in African Cities] is outpacing economic, social and institutional development

(Bello-Schünemann and Aucoin 2016)

The unplanned urban population growth remains a serious threat to water security in cities ...

(Dos Santos et al 2017)

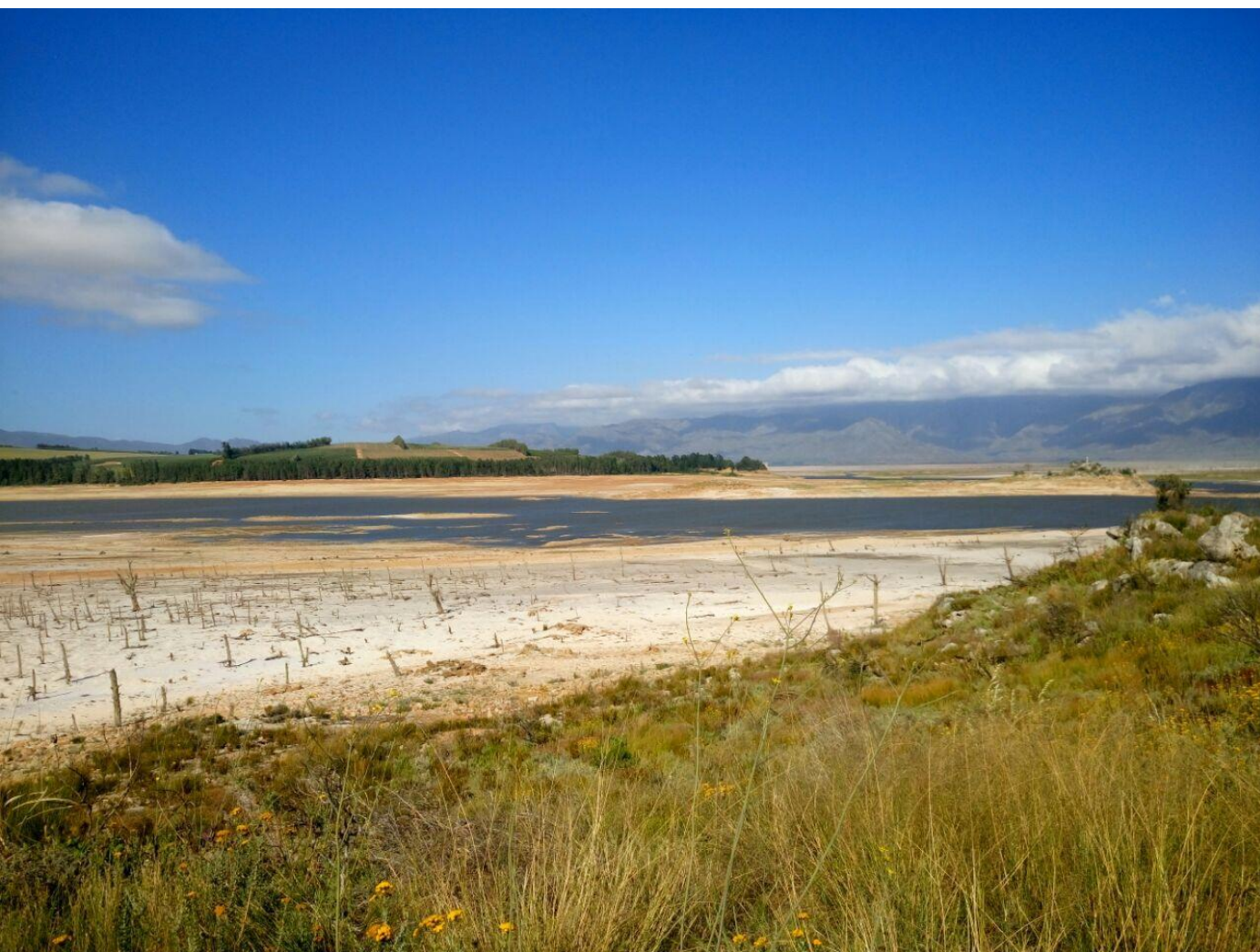
Water challenges in Southern African cities

Challenges	Consequences	Example of Cities in Southern Africa
Rising groundwater levels	flooding; groundwater quality	Cape Town (Bugan et al 2016, Mauck 2017); Johannesburg (Winde and Stoch 2010)
Declining groundwater levels	water scarcity; groundwater mining; land subsidence	Lusaka (Mpamba et al 2008); Windhoek (Murray et al 2018)
Water quality deterioration	health risks	Lusaka (Lapworth et al 2017); Johannesburg (Simate and Ndlovu 2014)
Saline intrusion	health risks	Dar es Salaam (Walraevens et al 2015)
Water scarcity	droughts; water restrictions	Cape Town (Mauck 2017; Muller 2017)

Cape Town contends with worst drought in over a century

By Derek Van Dam, CNN Meteorologist

🕒 Updated 1735 GMT (0135 HKT) June 1, 2017



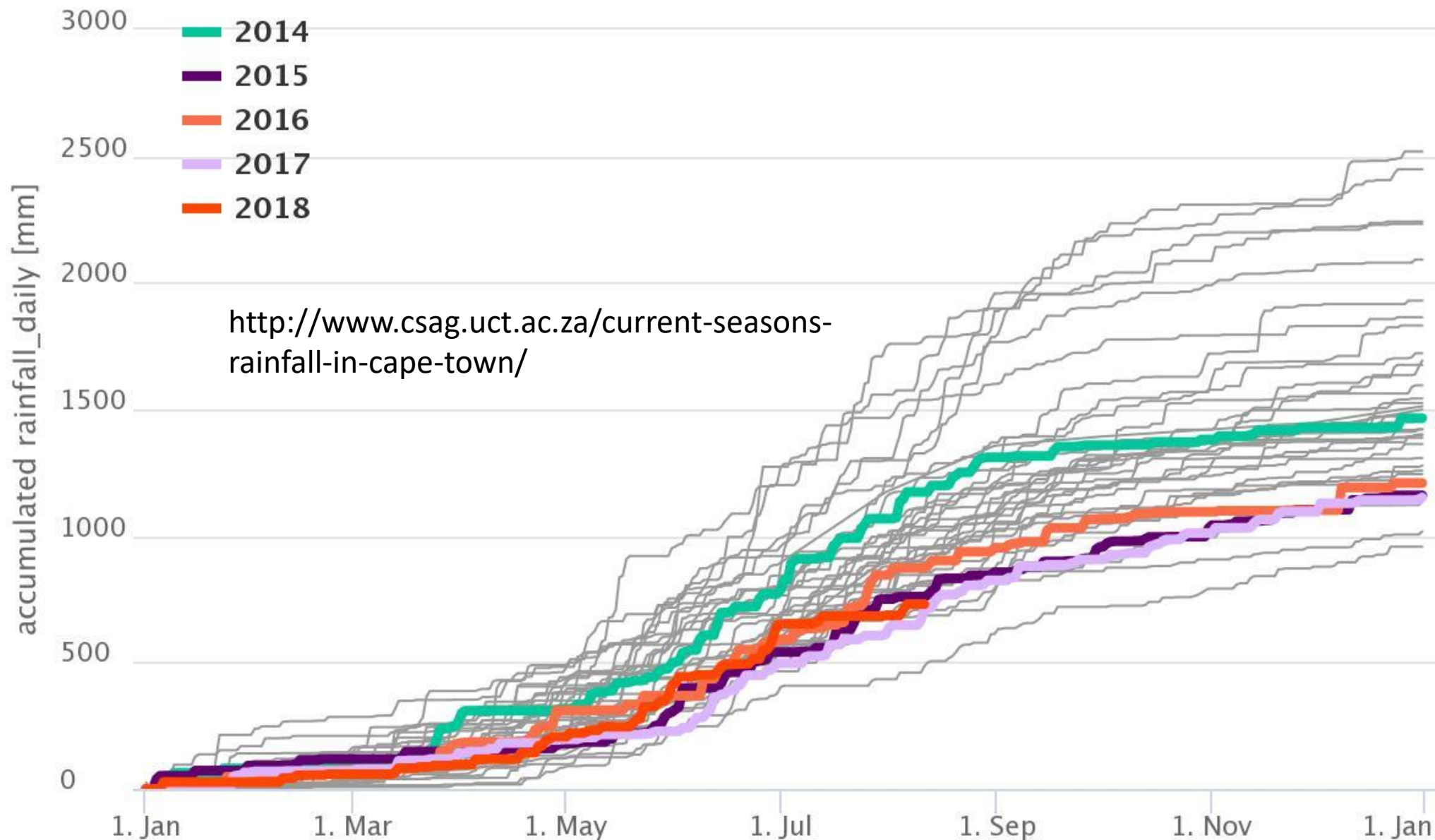
Theewaterskloof Dam

**54% of total dam
capacity**

480 188 ML

**End 2017
13%**

Accumulated daily rainfall at Woodhead



Drought-stricken Cape Town counts the cost

19 March 2018 - 06:42

BY AFP.COM



Alan Cameron
Independent Consultant

Relief as dam levels in Cape Town rise above 50%

THE BLOG

Monday 23 July 2018 - 1:14pm

Will Day Zero Rain On Cape Town's Parade Again?

Cape Town's drought has broken, and the city appears safe from Day Zero through 2019. But we are very far from being out of the woods regarding water...

Cape Town dams filling up, but drought not broken

2018-06-25 21:28

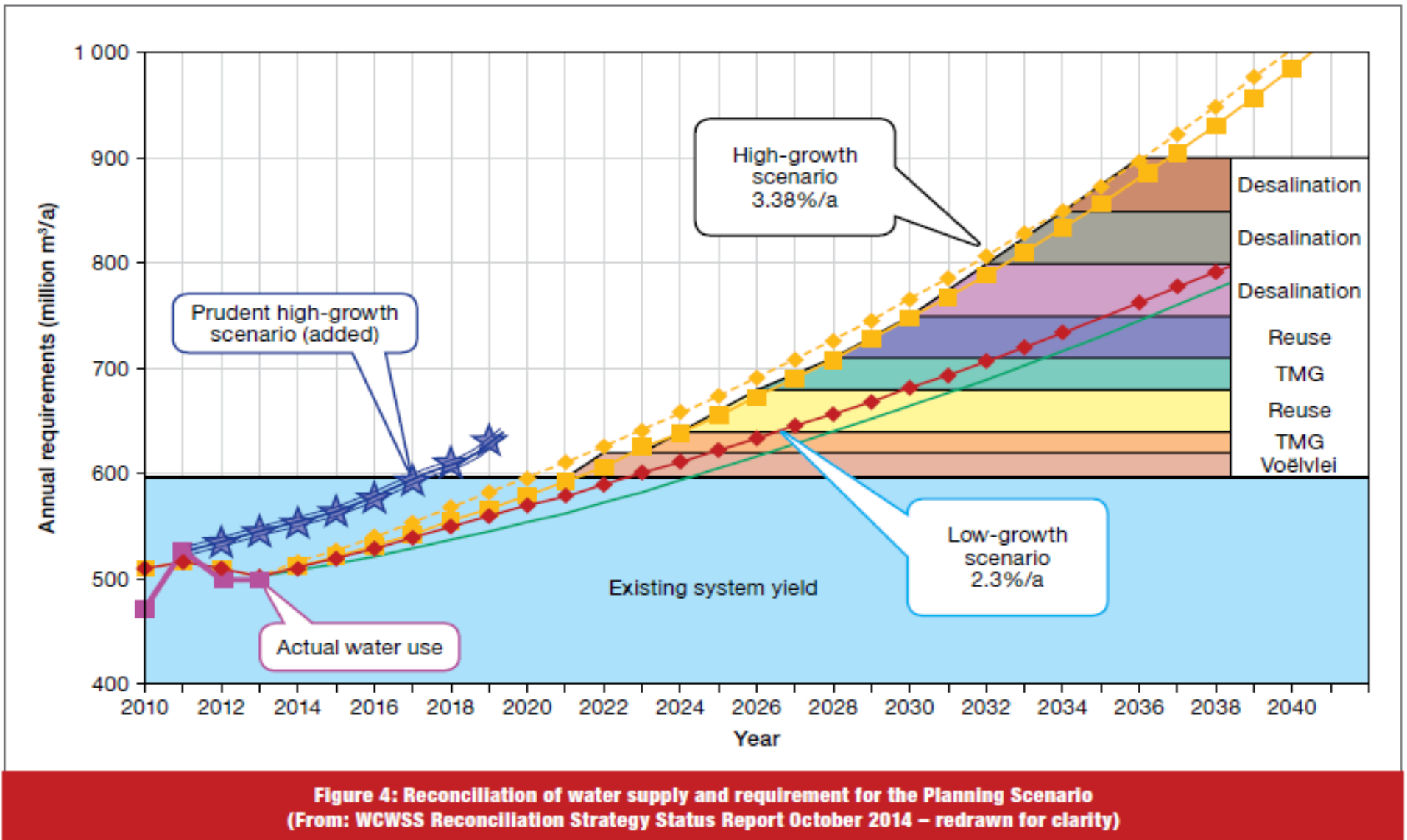
Melanie Gosling

news24

CAPE TOWN FACES SEVERE ECONOMIC TROUBLES OVER DROUGHT - MOODY'S

A severe drought afflicting South Africa's Western Cape province is expected to cut agricultural output by 20% in 2018.





#WaterCrisis: Warning that borehole water could run out

NEWS / 2 FEBRUARY 2018, 10:57AM / ATHINA MAY

Cape Town's untapped water source explored

Feb 14, 2017 | City of Cape Town, News, Water, Water management, Water supply



City drilling for groundwater on the Plain



BY PATRICIA DE LILLE JANUARY 11, 2018

Aquifer alert: are we drilling to water disaster?

Nov 18 2017 09:00 Mandl Smallhorne

#WaterCrisis: Warning that borehole water could run out

NEWS / 2 FEBRUARY 2018, 10:57AM / ATHINA MAY

#WATERWATCH 1 Comment

'First groundwater from the Cape Flats Aquifer about six weeks away'

12 January 2018 12:54 PM

WHERE TAGLINES GO TO DIE.
14 FEBRUARY 2018 14:16 (SOUTH AFRICA)

DAILY MAVERICK

SOUTH AFRICA

Op-Ed: Cape Water Crisis – Setting the record straight on aquifers and saline intrusion

ROGER PARSONS SOUTH AFRICA 27 NOV 2017 01:21 (SOUTH AFRICA)

85 Reactions

Op-Ed: Cape Town's water future is bleak – it's time to call in the groundwater experts

ROGER PARSONS SOUTH AFRICA 14 AUG 2017 11:32 (SOUTH AFRICA)

234 Reactions

NATIONAL

Western Cape – boreholes made illegal

Phillip de Wet 18 Jan 2018 08:06

**Groundwater as part of
the water supply mix**

**It is not either/or.
It's both.**

CAPE TOWN NEEDS GROUNDWATER

**A Note on the Potential of the Cape Flats Aquifer Unit
to Supply Groundwater for Domestic Use in the Cape Town Metropolitan Area**

By: L.G.A. Maclear

Geohydrology Directorate, Department of Water Affairs and Forestry, CAPE TOWN
Technical Report No. Gh3868, August 1995.

**Daily consumption average of
526ML/day**

CoT website accessed 15/02/2018

Short term : 100 ML/day

Barry Wood CoT

**Cape Flats aquifer yield (12
month cycle): 50 ML/day**



**Adopt peak water supply
approach**



**Cape Flats aquifer yield (4
month cycle): Perhaps > 150
ML/day**

**Groundwater as part of
the water supply mix**

**It is not either/or.
It's both.**

Atlantis aquifer yield: 27 ML/day

Review

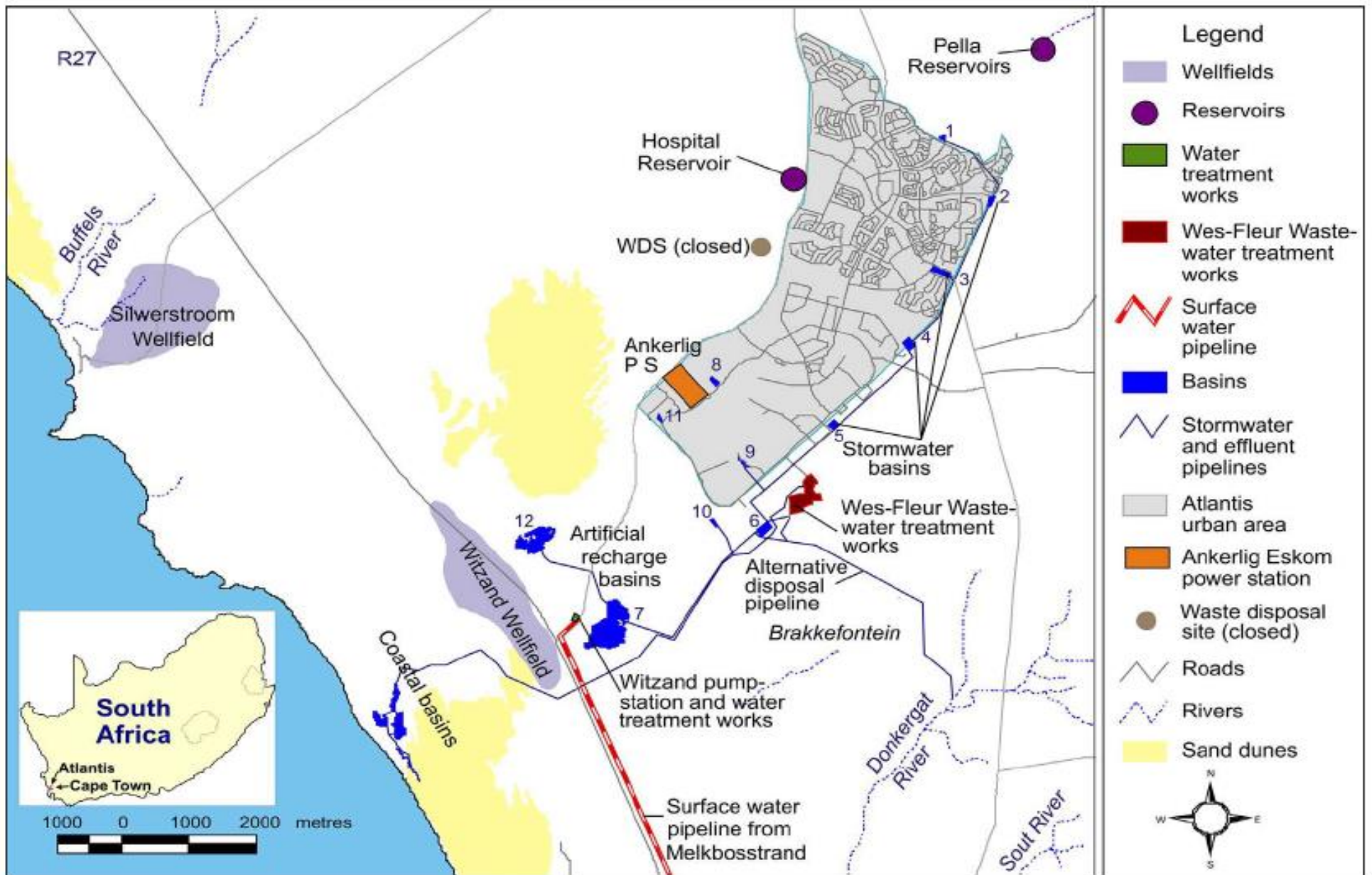
**Four decades of water recycling in Atlantis
(Western Cape, South Africa): Past, present and future**

**Richard DH Bagan¹, Nebo Jovanovic¹, Sumaya Israel¹, Gideon Tredoux¹, Bettina Genthe¹, Maronel Steyn¹,
David Allpass², Rodney Bishop² and Vernon Marinus²**

¹CSIR, Natural Resources and Environment, PO Box 320, Stellenbosch 7599, South Africa

²City of Cape Town, PO Box 1694, Cape Town 8000, South Africa

Indirect recycling of water at Atlantis started shortly after development of the town commenced in the mid-1970s. This was inspired by the pilot-scale testing in the Cape Flats of artificial groundwater recharge as a means of recycling treated domestic wastewater (Tredoux et al., 1980)



Bugan R D H, Jovanovic N, Israel S, Tredoux G, Genthe B, Steyn M, Allpass D, Bishop R and Marinus V (2016) Four decades of water recycling in Atlantis (Western Cape , South Africa): Past , present and future *Water SA* 42 577–94

Managed Aquifer Recharge

Sustainable Water Resources Management (2018) 4:217–223
<https://doi.org/10.1007/s40899-018-0213-0>

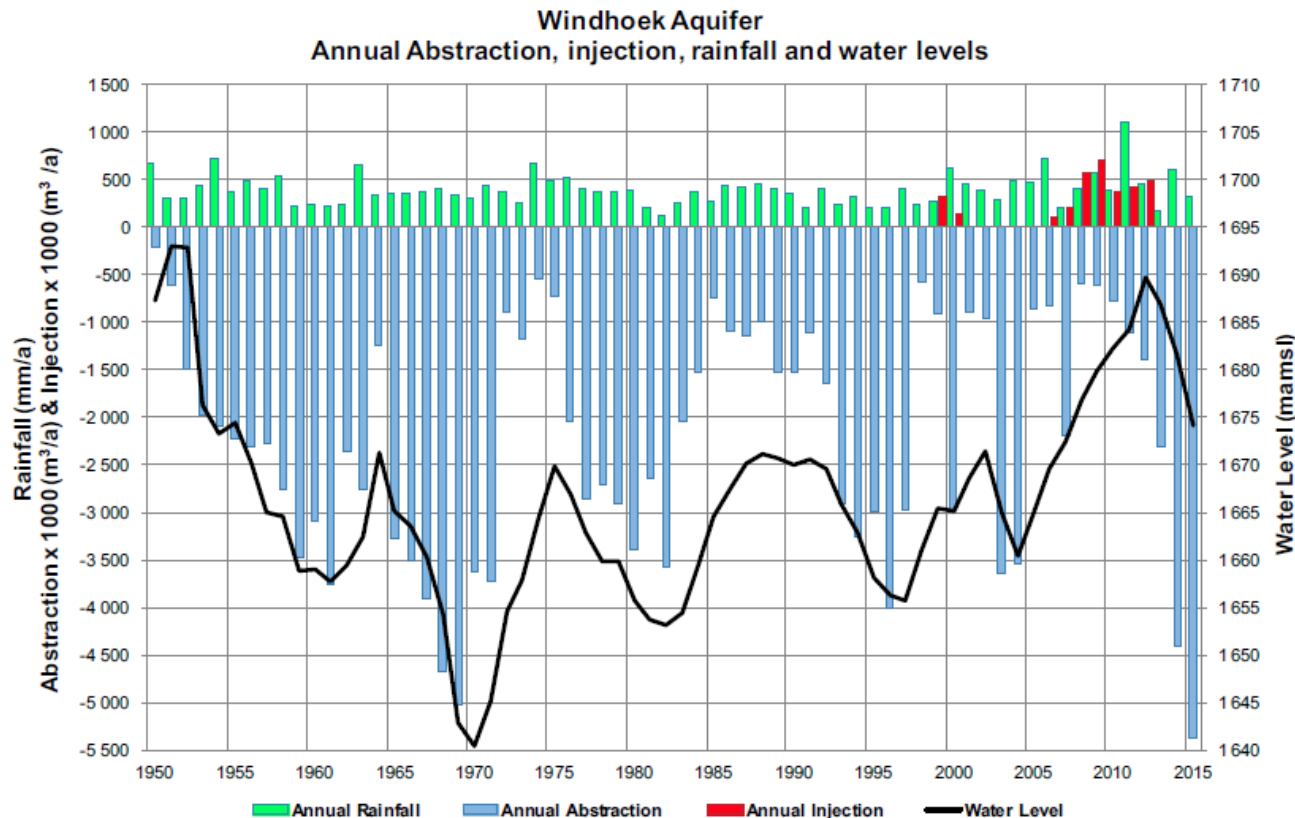
ORIGINAL ARTICLE



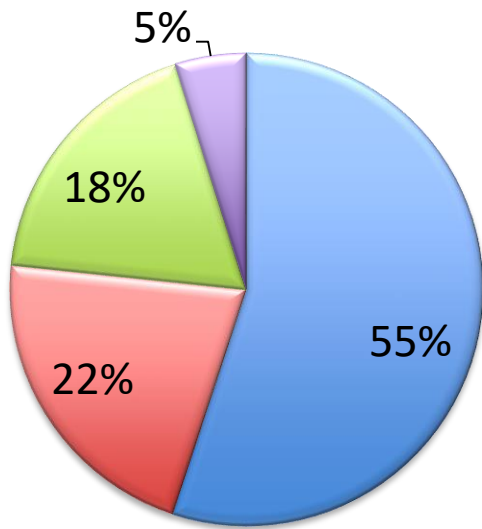
Windhoek, Namibia: from conceptualising to operating and expanding a MAR scheme in a fractured quartzite aquifer for the city's water security

Ricky Murray¹ · Don Louw² · Ben van der Merwe³ · Immo Peters⁴

The injectant is treated potable water with very strict water quality guidelines that were developed to prevent the deterioration of groundwater quality and to minimize clogging of the boreholes and aquifer. The injectant is blended at a ratio of 3 to 1 from dam water (3 parts) with reclaimed/reused water that has been treated to drinking quality standards (1 part)



When fully developed, it is expected that the city's water bank will be able to provide security for 3 years as the sole water resource during drought conditions.

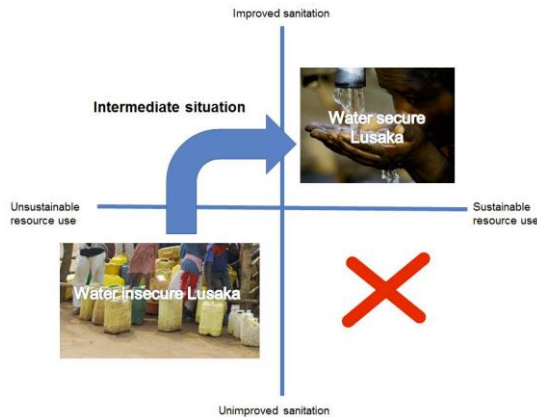


- Public water supply
- Private abstractions
- Agriculture
- Industry

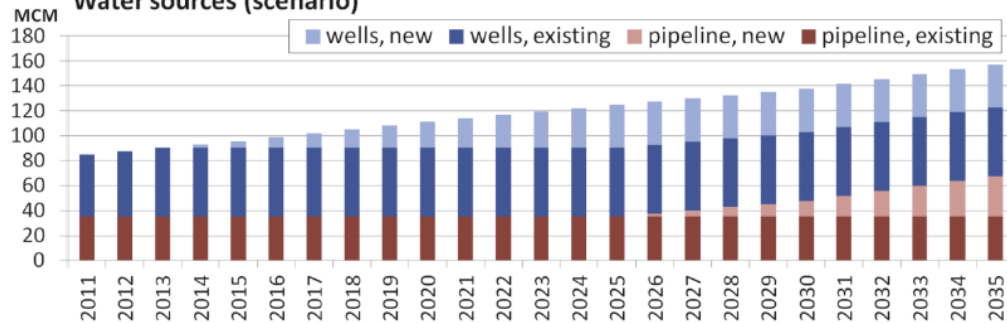


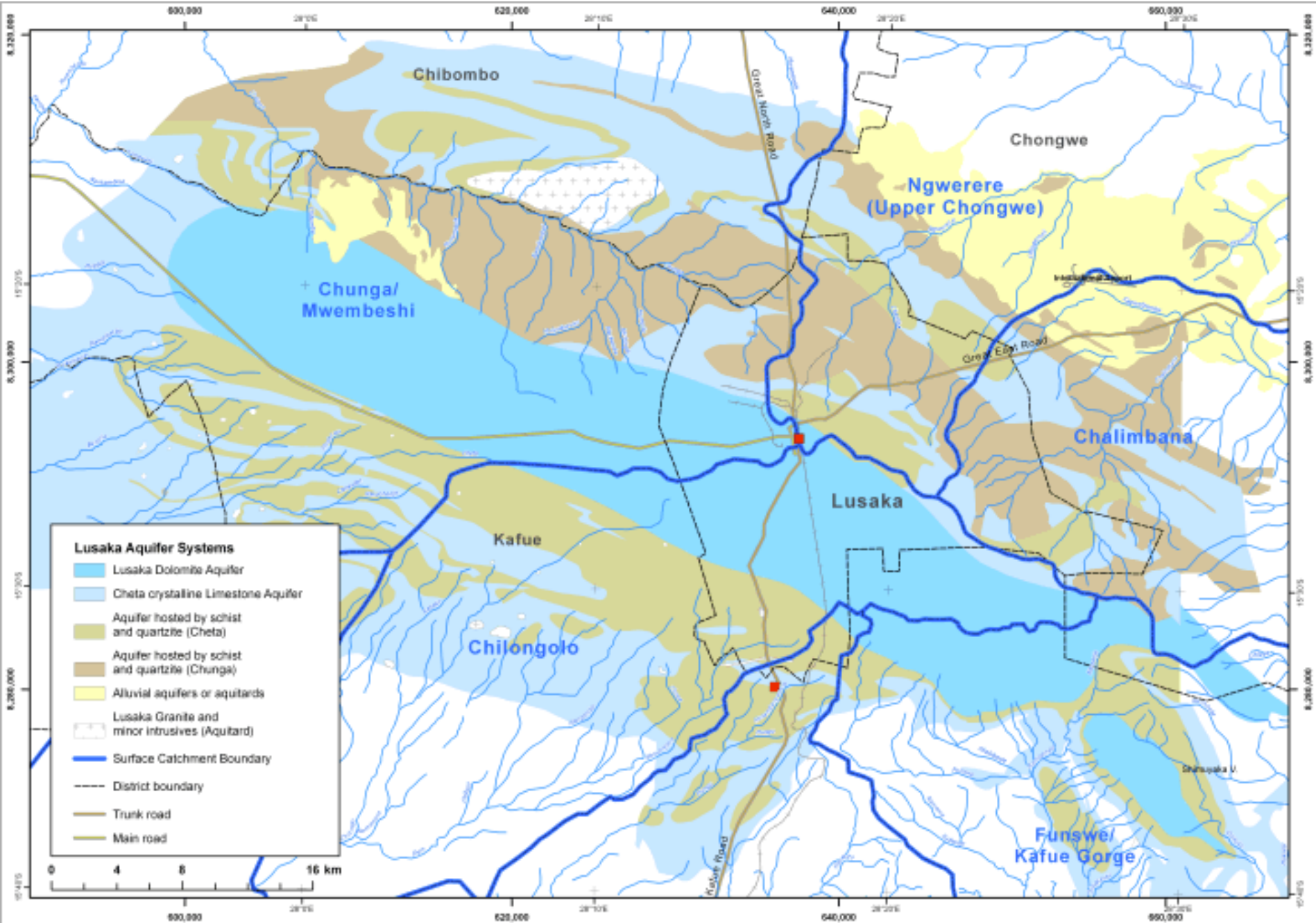
Groundwater quality hazards

- Lack of a sewer network (especially in the city's industrial area)
- Lack of sanitation and/or improper sanitation technologies
- Poor or inexistent solid waste management
- Sub-optimal planning and land allocation; and
- Improper crude oil management and leaking underground petrol-tanks



Water sources (scenario)





Groundwater as local option for water security at urban hospitals



Most case enough water for the facilities and more

Hospital requirement = 190 000 litres per day

Borehole yield = 690 000 litres per day

Water treatment



Closing urban water cycles transforming urban water solutions: The role of groundwater

- Conjunctive surface and groundwater use
- Local water supply
- Drought buffer
- Groundwater reuse and recycling
- Managed aquifer recharge
- Flood prevention and mitigation
- Ecosystem services, biodiversity and amenity value

