The Cape Town water ‘crisis’

Harbonim Camp, Hermanus, 23 Dec 2017

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SOUTH AFRICA

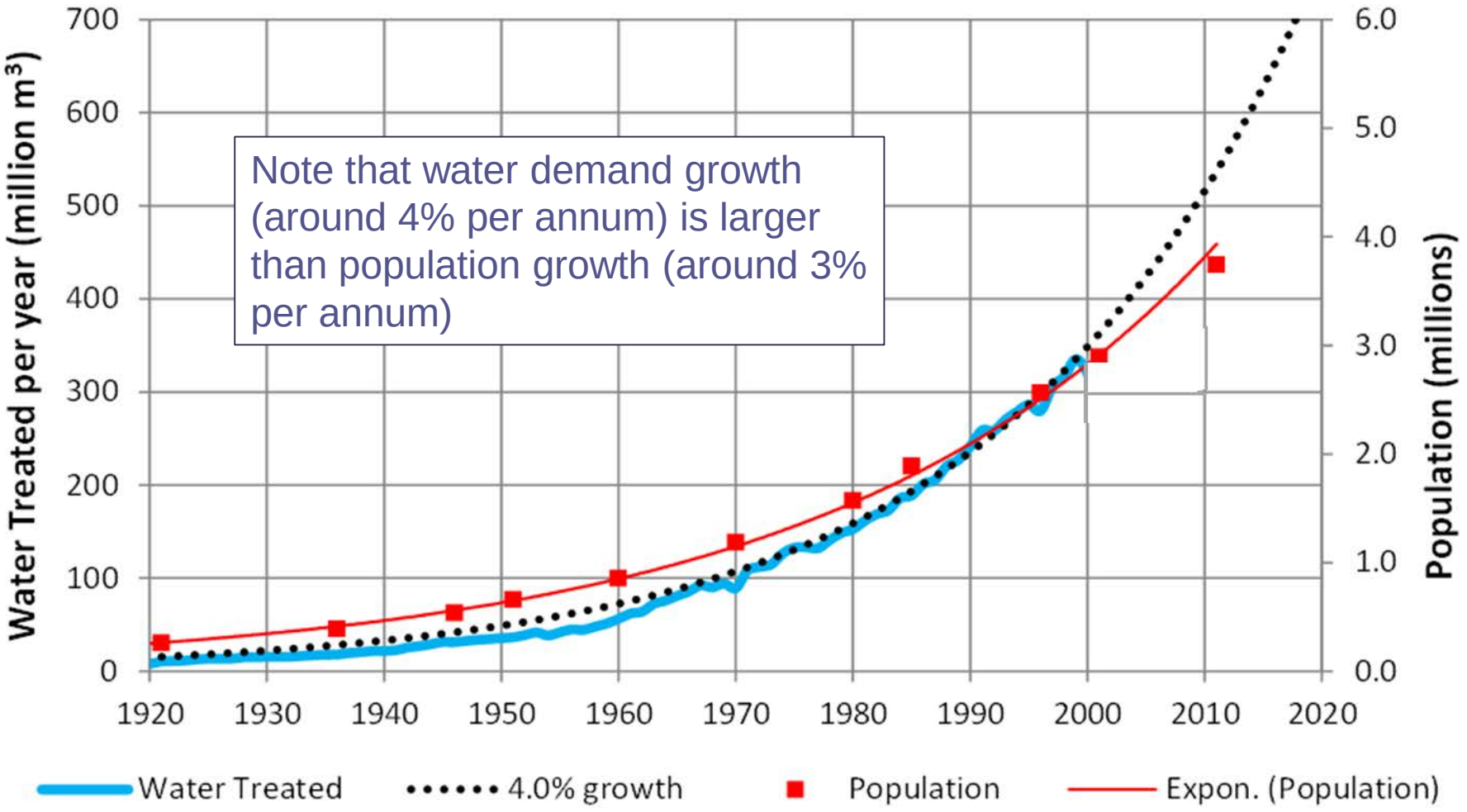
Format of presentation

- Why is there a ‘crisis’?
- What is the current situation?
- Is it climate change?
- What is ‘Day Zero’?
- What is the City of Cape Town doing?
- What about the future?

Why is there a crisis?

1. Population growth
2. Increasing water use
3. The worst drought on record
4. Inadequate storage
5. Underdeveloped alternatives

CT water demand and pop. growth



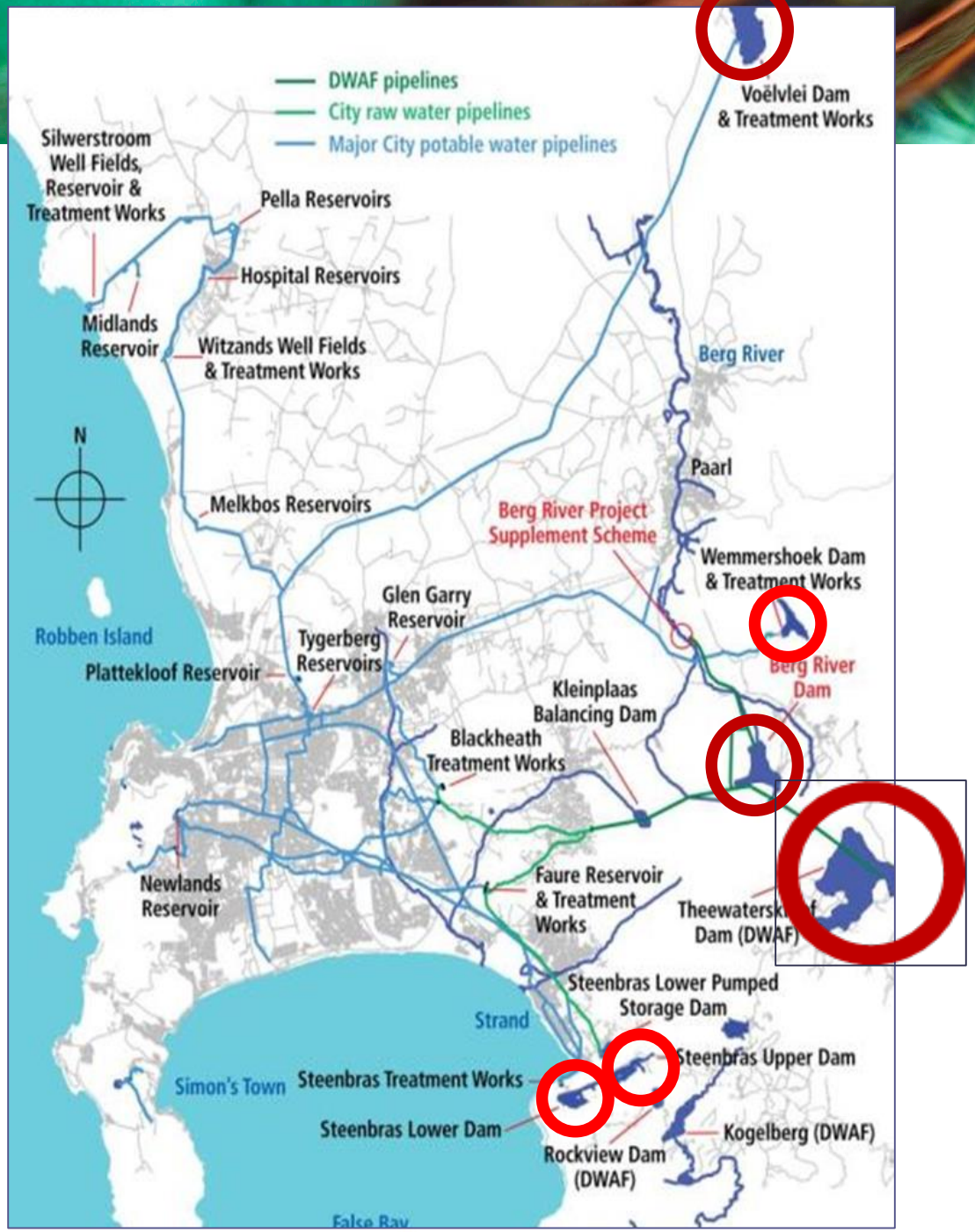
CCT, 2015; Singles, n.d.; StatsSA, n.d.

Western Cape Water Supply System 4

The management of the WCWSS comprises representatives from each of the municipalities and agricultural groups led by the National Department of Water and Sanitation (DWS) who own the bulk of the infrastructure including ±85% of the reservoir capacity.

Supplies:

- Cape Town: ± 60%
- Agriculture: ± 30%
- Other towns: ± 10%



Owned by CoCT

Owned by DWS

Western Cape Water Supply System and the 'Big Six' reservoirs

Xanthea Limberg, 2017

Four of the ‘Big Six’

Steenbras Upper (CoCT)

Wemmershoek (CoCT)

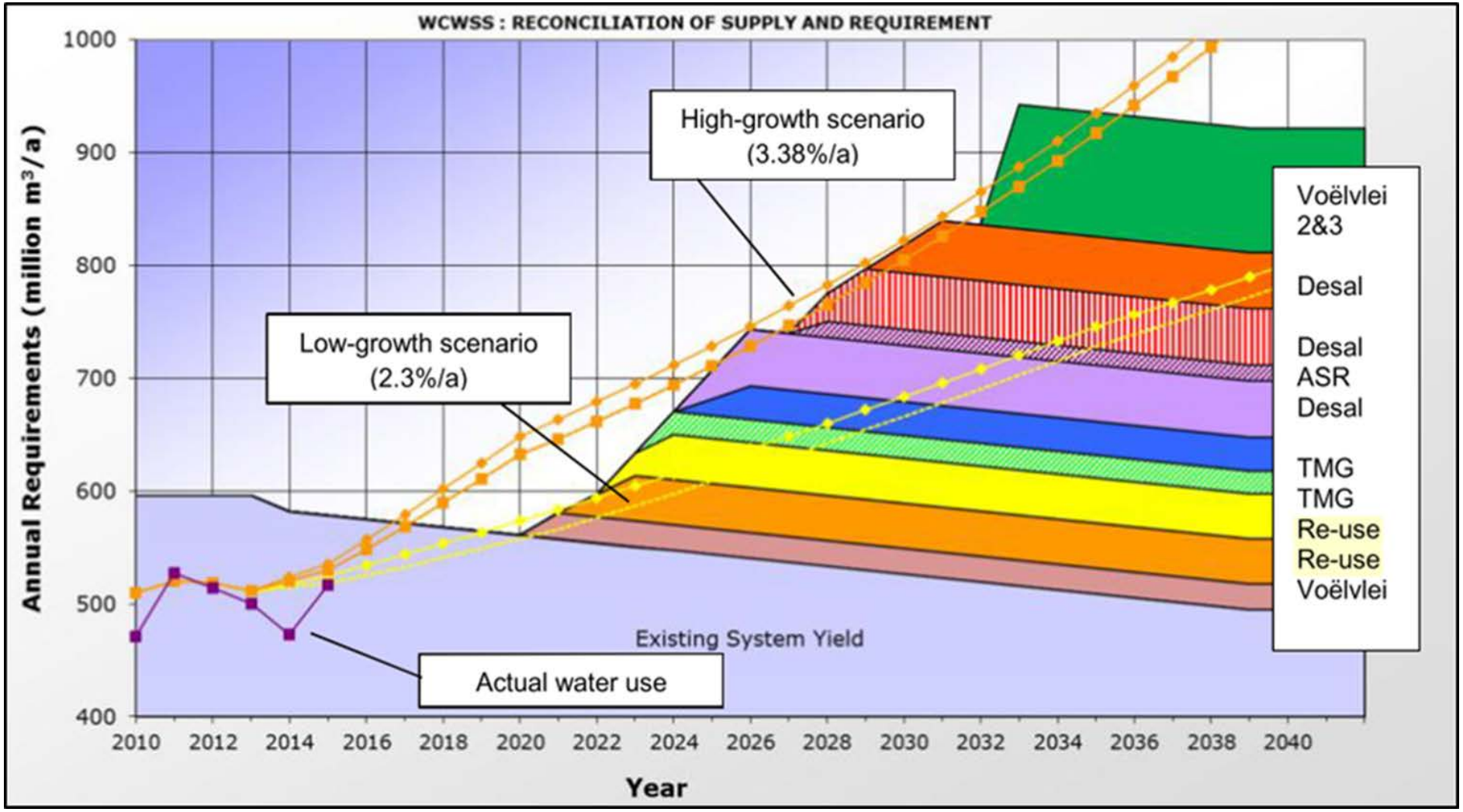
Voelvlei (DWS)

Berg River (DWS)

https://resource.capetown.gov.za/documentcentre/Documents/Graphics%20and%20educational%20material/Water%20Services%20and%20Urban%20Water%20Cycle.pdf

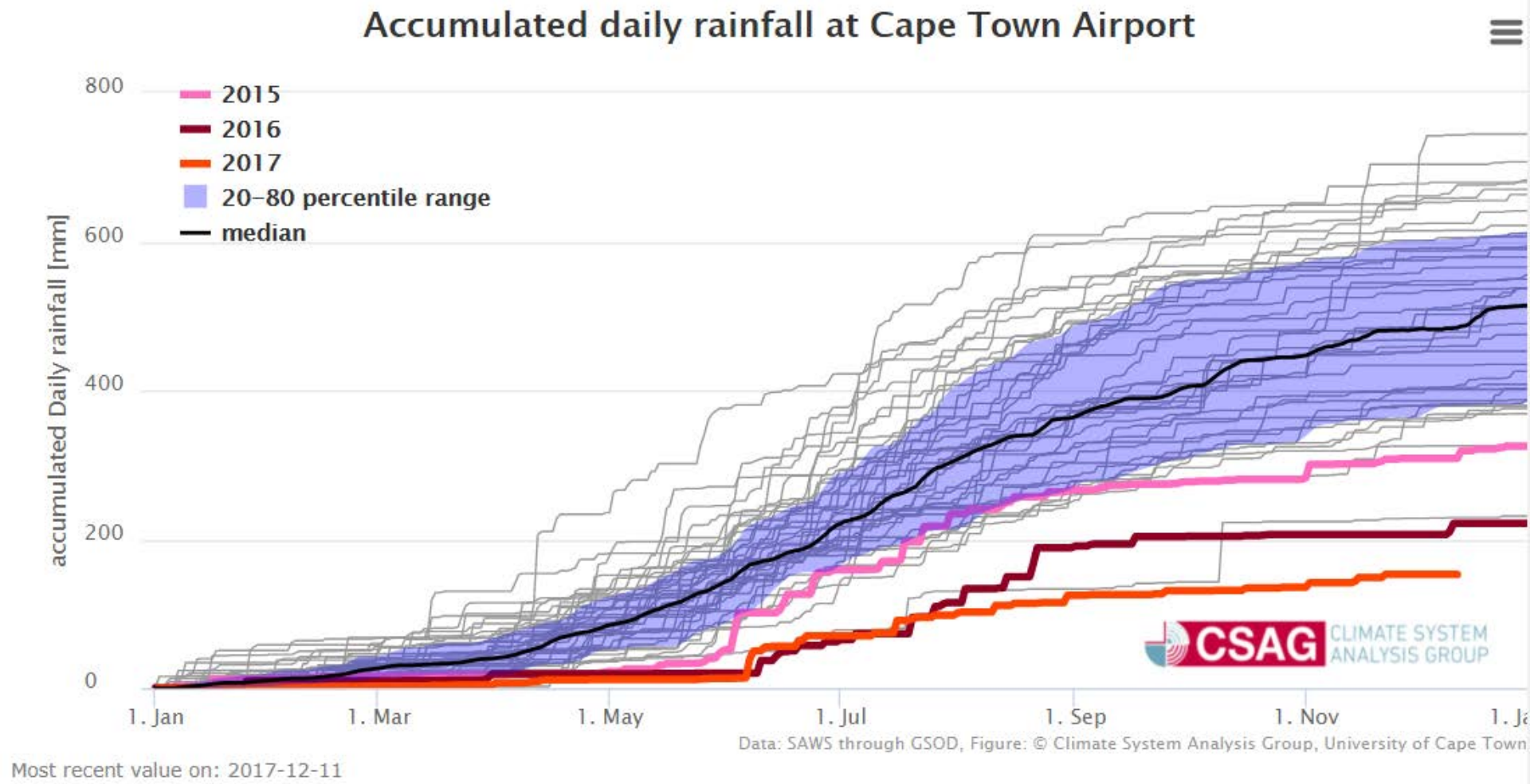
Theewaterskloof (DWS) in happier times

WC water planning before drought



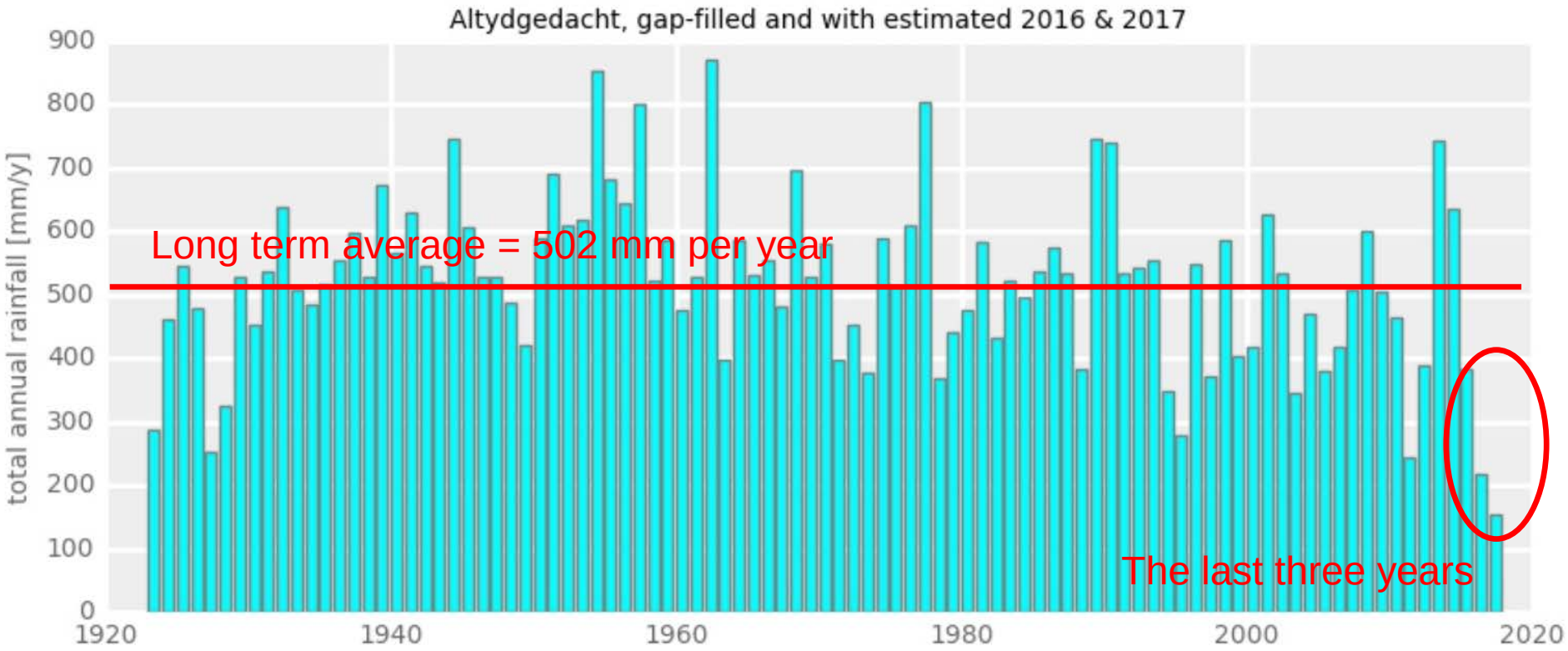
DWS, 2016

What happened to the rain (1)?



http://www.csag.uct.ac.za/current-seasons-rainfall-in-cape-town/

What happened to the rain (2)?



These are the resulting return intervals:

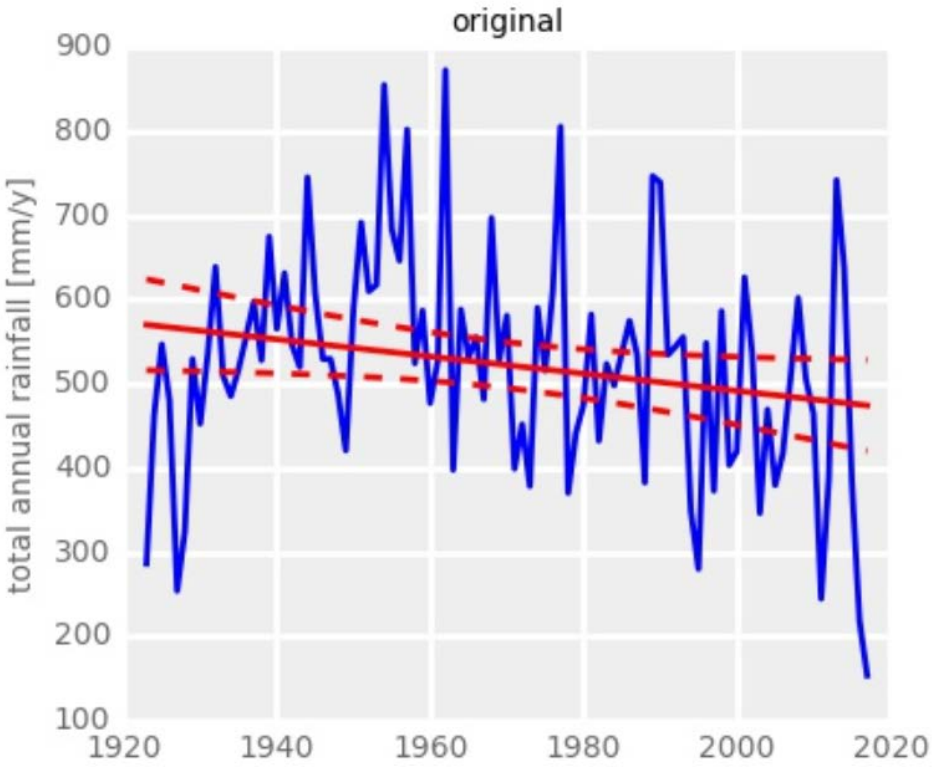
2-year (2016-2017) rainfall: 1150 years
3-year (2015-2017) rainfall: 628 years
4-year (2014-2017) rainfall: 63 years
5-year (2013-2017) rainfall: 10 years

Wow! Major trouble…

http://www.csag.uct.ac.za/2017/08/28/how-severe-is-this-drought-really/

Is it climate change?

Altydgedacht gauge showing trend-lines



http://www.csag.uct.ac.za/2017/08/28/how-severe-is-this-drought-really/

The Arctic is melting with no turning back. Climate change increased rainfall during Hurricane Harvey by at least 15%. And several extreme weather events that occurred in 2016 would not have been possible without man-made global warming.

JUSTIN WORLAND, TIME Magazine, 15 December 2017 (*http://time.com/5064577/climate-change-arctic/?utm_source=time.com&utm_medium=email&utm_campaign=the-brief&utm_content=2017121517pm&xid=newsletter-brief*)

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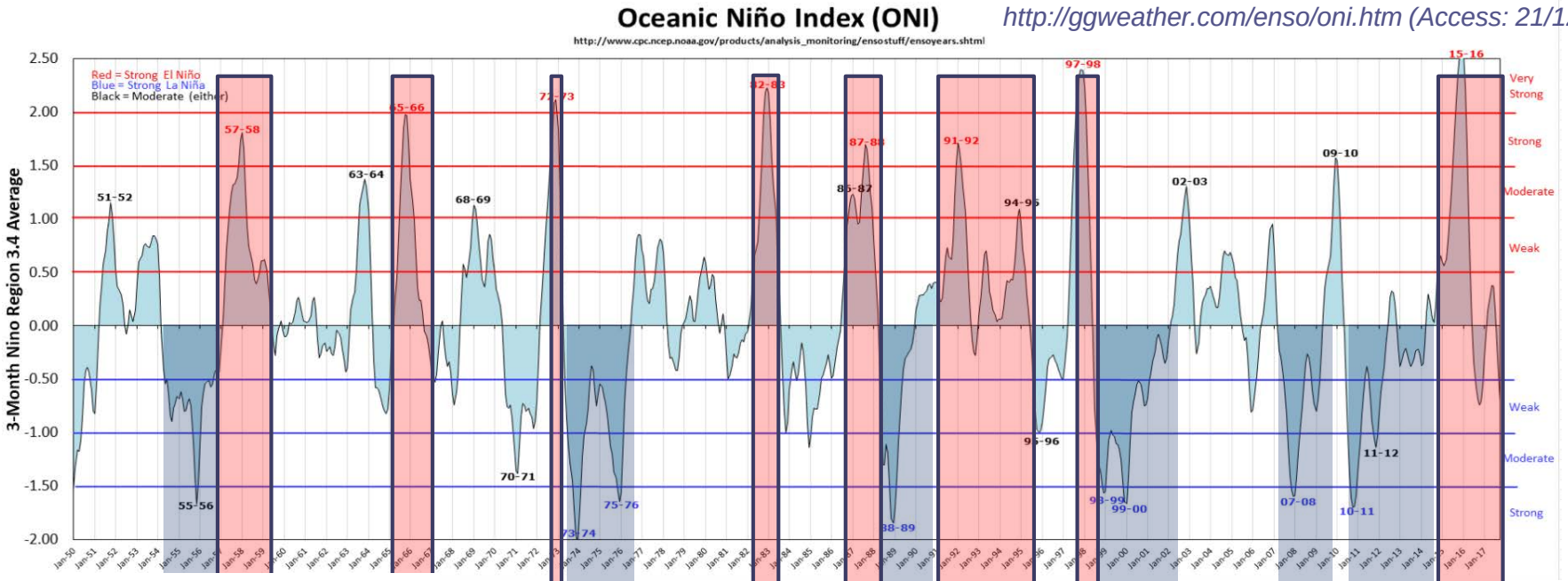
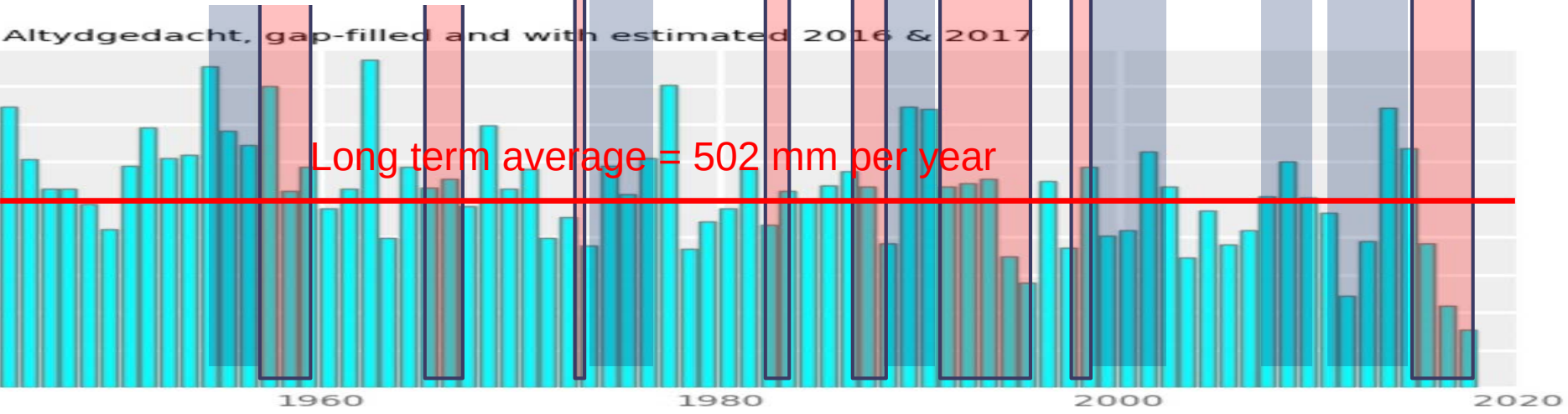
The ENSO (East Pacific temp.) connection



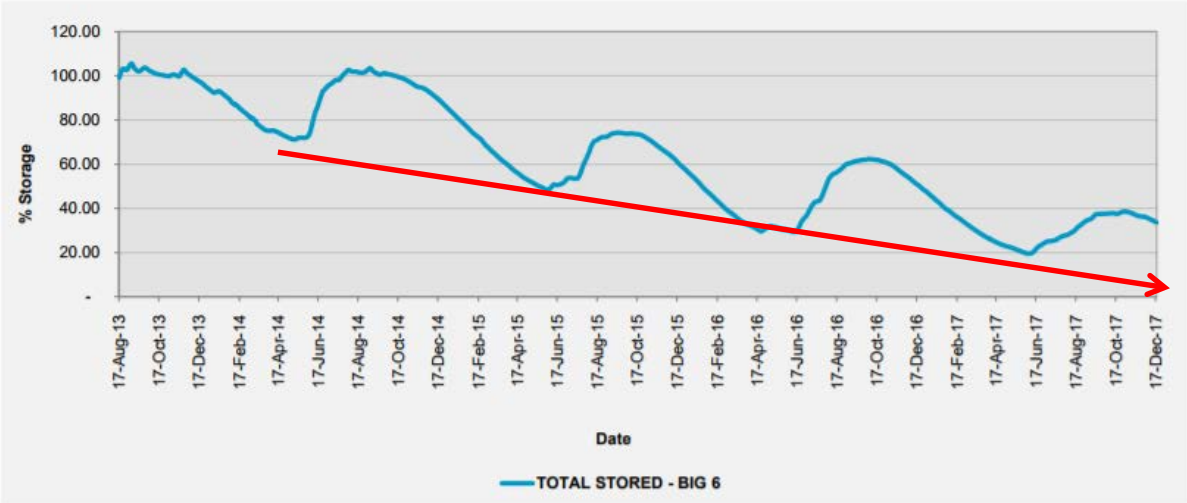
http://ggweather.com/enso/oni.htm (Access: 21/12/17)

http://www.csag.uct.ac.za/2017/08/28/how-severe-is-this-drought-really/



What happened to storage?

City of Cape Town Dams: Graph indicating % of water stored



Daily Average Water Production (7 Day Avg)

http://resource.capetown.gov.za/documentcentre/Documents/City%20research%20reports%20and%20review/damlevels.pdf

The impact of three very dry years (left above) – and the CoCT's response via increasingly draconian water restrictions (left below). Full storage volumes of the 'Big Six' (99.6% of total) below.

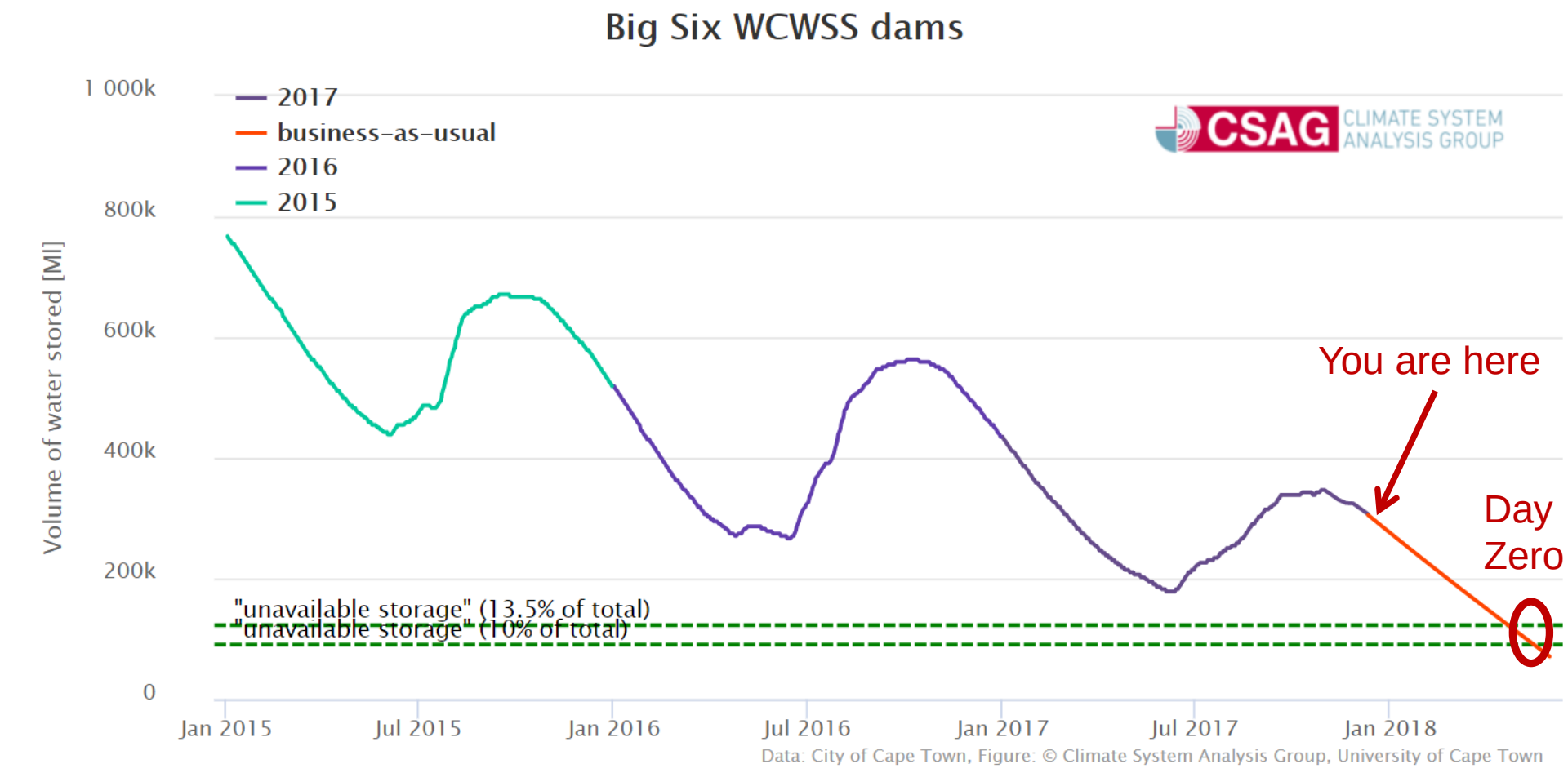
MAJOR DAMS	CAPACITY Ml
BERG RIVER	130 010
STEENBRAS LOWER	33 517
STEENBRAS UPPER	31 767
THEEWATERSKLOOF	480 188
VOËLVLEI	164 095
WEMMERSHOEK	58 644
TOTAL STORED	898 221

Theewaterskloof now

http://www.traveller24.com/Explore/Green/before-and-after-pics-western-capes-theewaterskloof-dam-looks-dire-20170517

Theewaterskloof Dam in June 2016. Photo: Masixole Feni

When is 'Day Zero'?



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http://cip.csag.uct.ac.za/monitoring/bigsix.html

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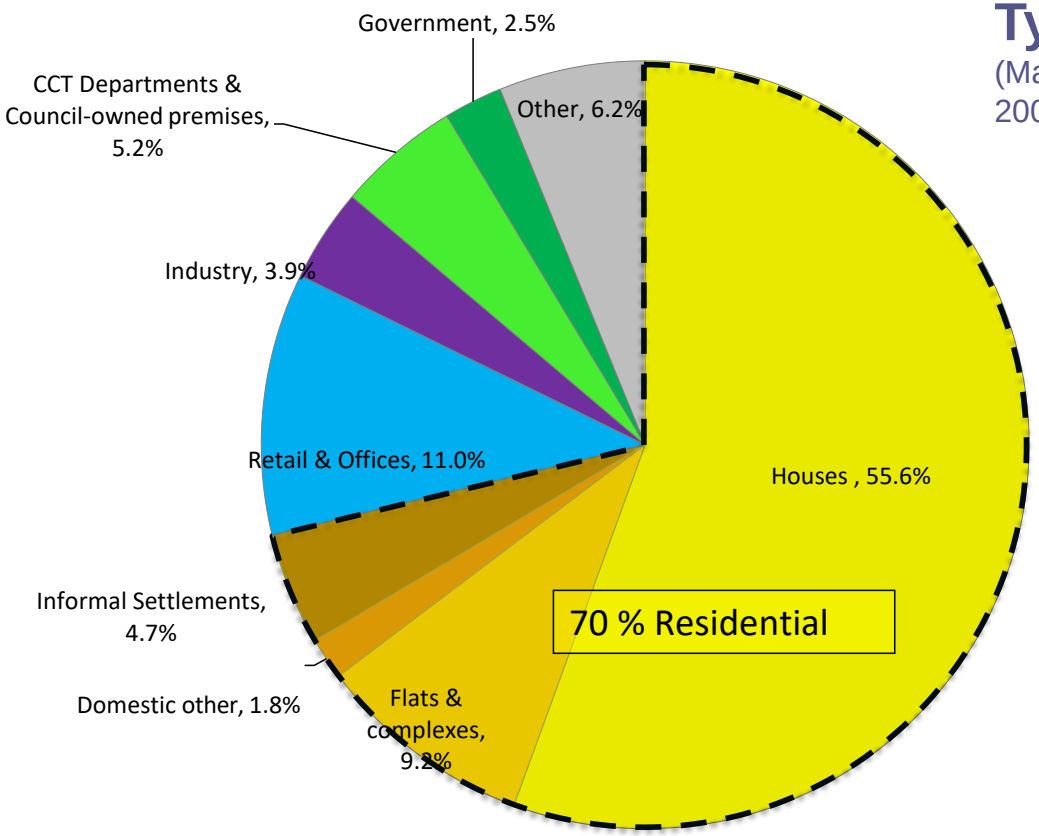
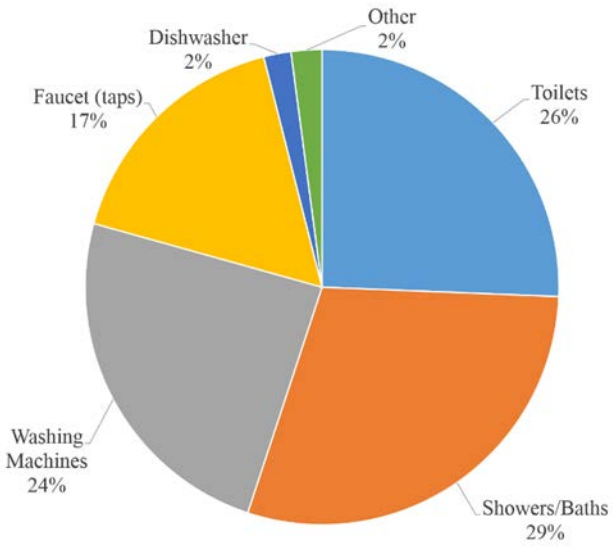
CT's 'normal' water demand

Water Use in Cape Town (2015/16) – mainly residential



Typical indoor end uses

(Mayer et al., 1999; Jacobs & Haarhoff, 2004; Roberts, 2005; Willis et al., 2010; Beal et al., 2011)



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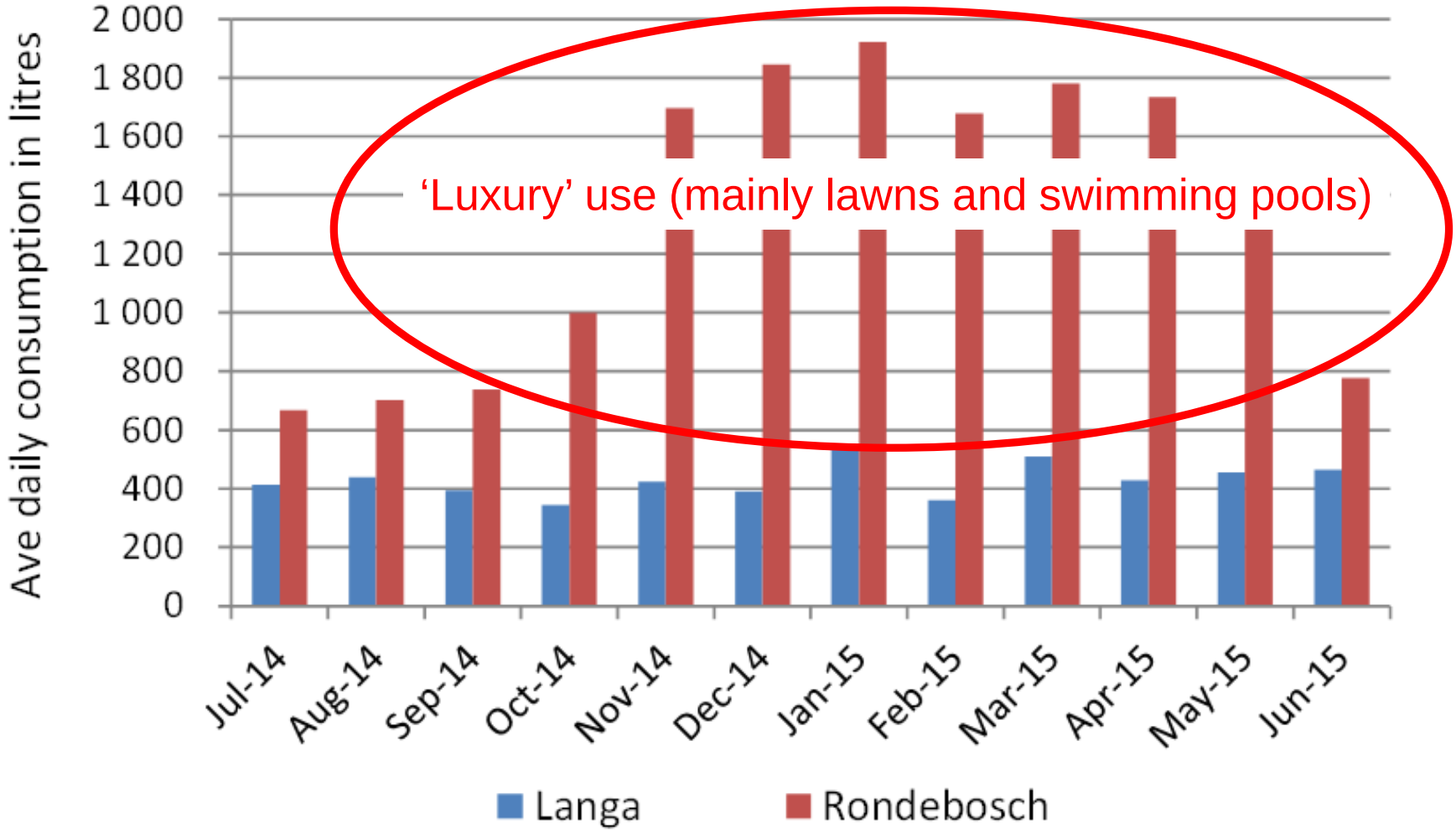
Ave daily use: ‘Rich’ versus ‘Poor’



CCT, 2015

CT's Critical Water Shortages Disaster Plan

1. Preservation restrictions: reduce daily use to 500Ml/day through pressure management and installation of water management meters on properties with excessive water use.
2. Disaster restrictions: water cut off to all except essential services. Water collection sites established across city.
3. Full-scale (extreme) disaster implementation: drinking water only.

http://resource.capetown.gov.za/documentcentre/Documents/City%20strategies%2C%20plans%20and%20frameworks/Critical%20Water%20Shortages%20Disaster%20Plan%20Summary.pdf

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CoCT Level 6 restrictions

CITY OF CAPE TOWN

PUBLIC NOTICE IN TERMS OF SECTION 36(1) OF THE CITY OF CAPE TOWN WATER BY-LAW, 2010

In view of the ongoing dire drought situation, the Director: Water and Sanitation of the City of Cape Town hereby gives notice of level 6 water restrictions and measures as detailed herein.

In summary, key new restriction measures include:

- residential units consuming more than 10 500 litres per month will be prioritised for enforcement
- non-residential properties to reduce consumption by 45%
- agricultural users to reduce consumption by 60%
- the use of borehole water for outdoor purposes is discouraged in order to preserve groundwater resources

Please note that permission from the National Department of Water and Sanitation is required in order to sell or buy borehole/wellpoint water.

Failure to comply with this notice may constitute an offence in terms of the aforementioned By-Law (or as amended) and the accused will be liable to an admission of guilt fine and, in accordance with Section 36(4) of the Water By-Law, 2010 (or as amended), an installation of a water management device(s) at premises where the non-compliance occurs. The cost thereof will be billed to the relevant account holder.

This notice is effective from 1 January 2018.

5-6 people @ ± 50 / day each!

The City is getting tough…

WATER (Period 03/11/2017 to 02/12/2017 - 30 Days) (Actual reading)

At 6 KELVIN ROAD, BERGVLIET / Erf 456
Meter no: 38323621 Consumption 8.000 kl / Daily average 0.267 kl
* Consumption charge (domestic)
(1) 5.9180 kl @ R 4.0000 (2) 2.0820 kl @ R 15.5700 56.09
56.09

REFUSE (Period 08/11/2017 to 06/12/2017) 29 Days

At 6 KELVIN ROAD, BERGVLIET / Erf 456
* Refuse charge (1 X 240lBIN X 1 Removals) 119.47
119.47

SEWERAGE (Period 03/11/2017 to 02/12/2017 - 30 Days) (Actual reading)

At 6 KELVIN ROAD, BERGVLIET / Erf 456
* Disposal charge
(1) 4.1420 kl @ R 3.8500 (2) 1.4580 kl @ R 13.1400 35.11
35.11

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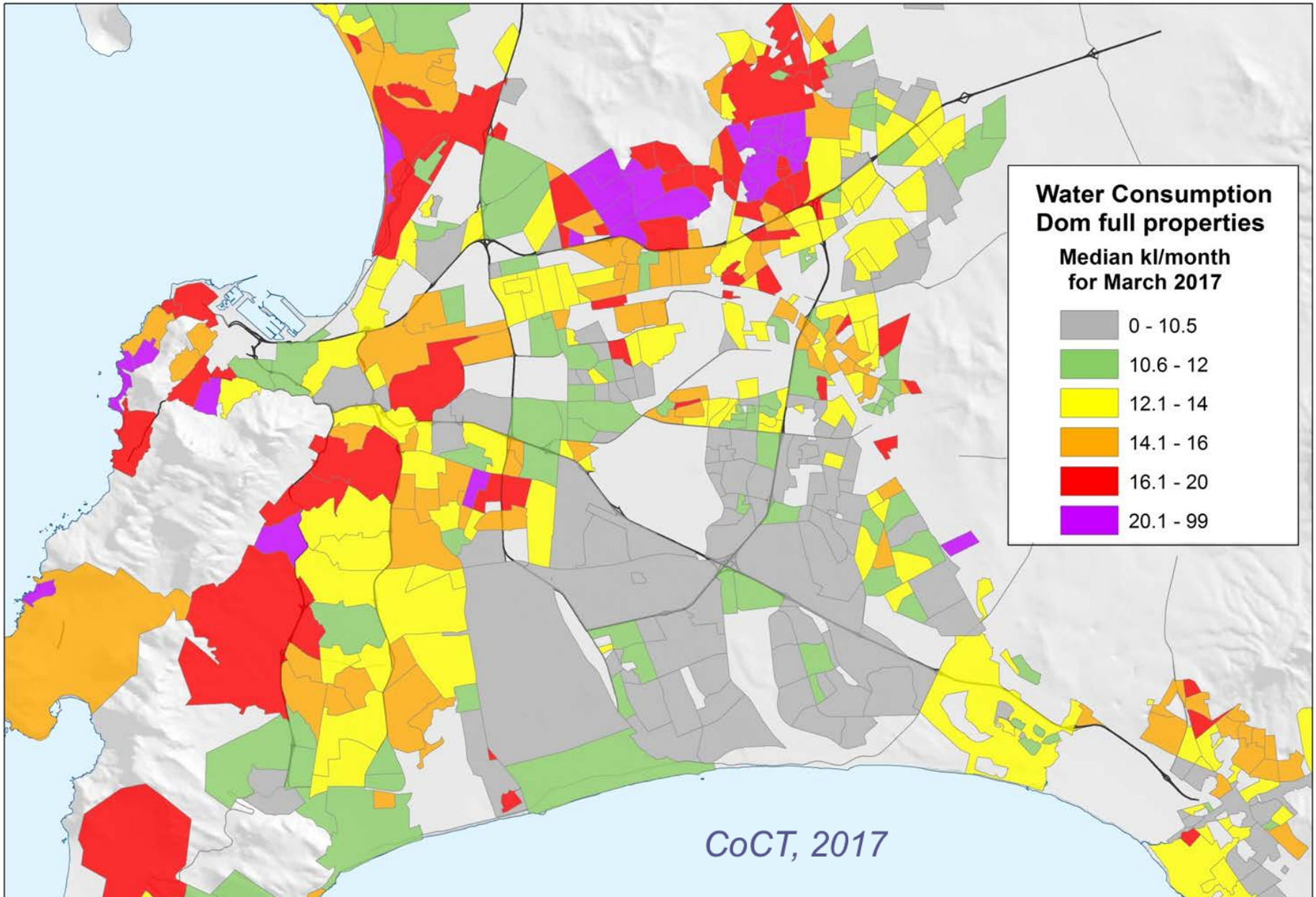
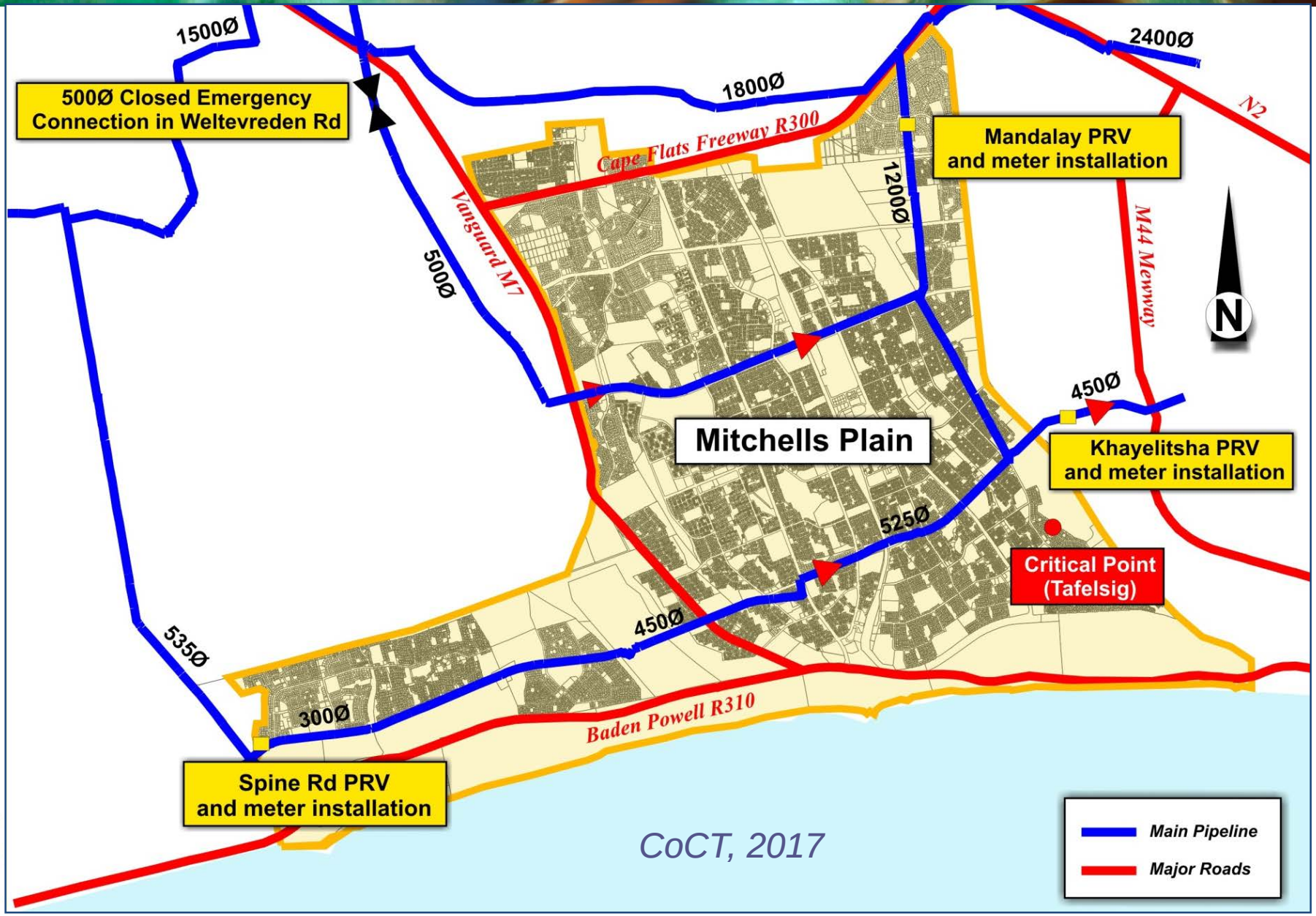
Where are the ‘water wasters’?



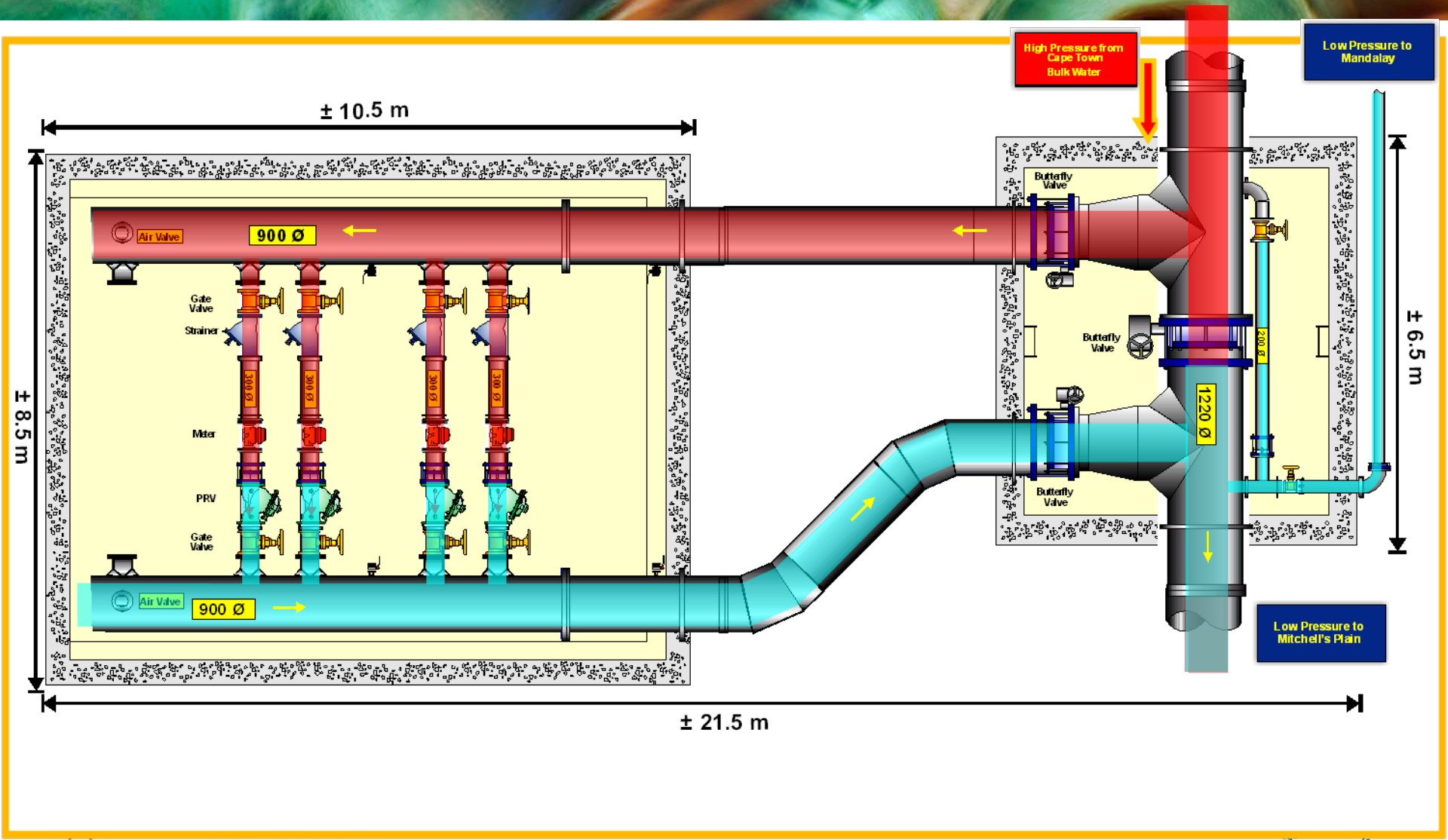
What is CT doing about leakage?

"Lucky we decided to build Skuifraam Dam."

A typical pressure management area 22



A typical pressure reduction chamber



Constructing a PRV chamber

CoCT, 2017

Unaccounted for water (Twort, 2000)

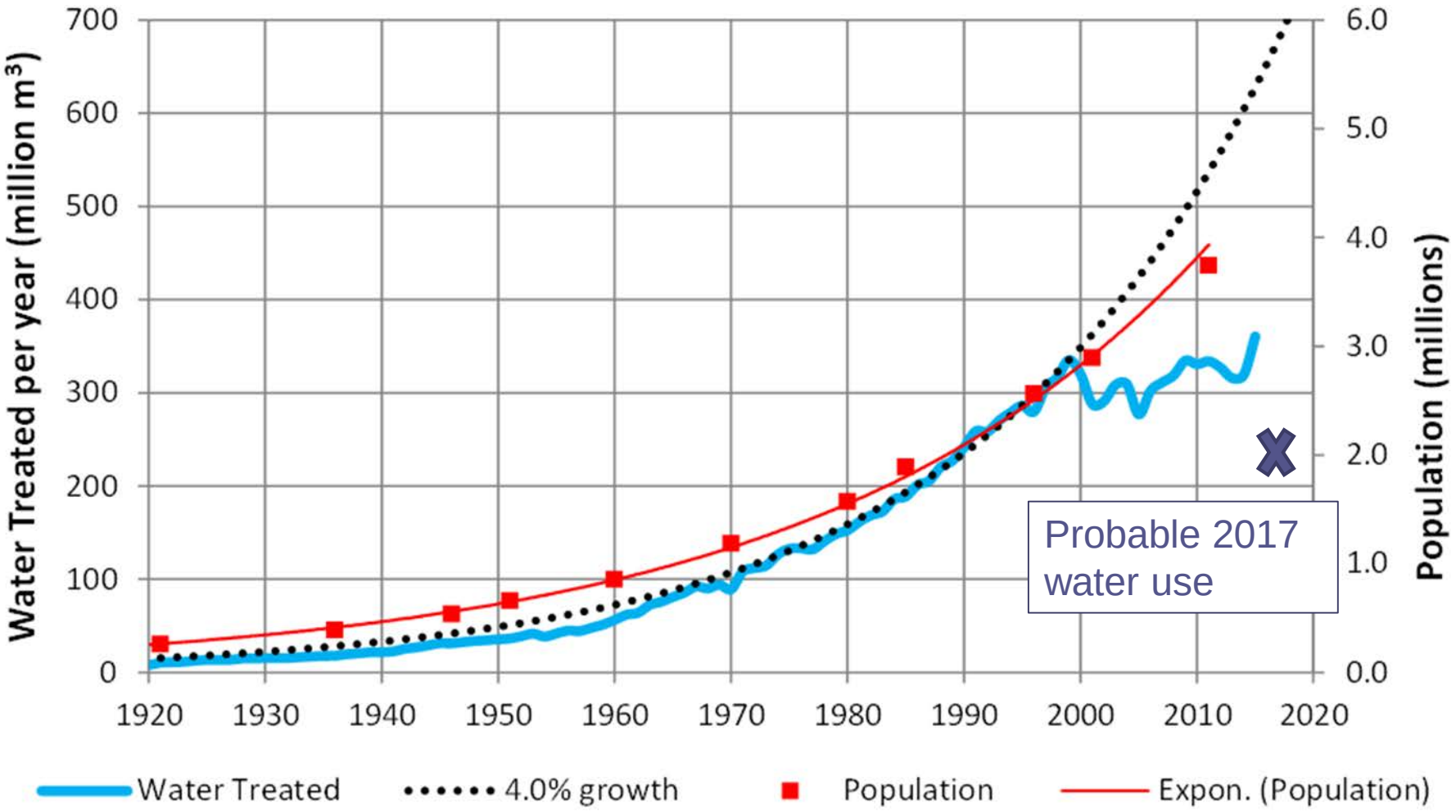
Mainly leaks and theft; a low figure indicates good water management

Table 1.11 Typical figures of unaccounted for water

	Typical circumstances applying
Singapore!	
6–9%	Small residential areas with no leakage and all supply meters in good condition
10–13%	Small systems with little leakage; residential parts of large systems with little leakage
Cape Town!	Usual lowest reported for whole cities, often immediately following some intensive leak eradication programme
20–22%	Achievable in large systems with reasonably efficient leakage and waste control methods
25%	The average level attained by large systems with mains and service pipes in moderate condition
26–35%	Systems with old mains or where ground conditions are poor; poorly metered systems; systems needing attention
Most of RSA!	Systems with many old mains and service pipes in poor condition; systems with inefficient metering and lack of attention to leaks and consumer wastage

The percentages include both distribution leakage and leakage on consumers' supply pipes and plumbing systems.

CT water demand and pop. growth



CCT, 2015; Singles, n.d.; StatsSA, n.d.

CT's supplemental schemes

1. Desalination of sea water: small scale plants to be installed in various places around the coast. Desalination barges to be moored in CT harbour
2. Large production boreholes to tap groundwater to be drilled in key spots both within and immediately outside the city – to be linked to the water treatment works. Schools, hospitals and similar operations encouraged to drill their own.
3. A pilot treated sewage 'reclamation' to potable water plant to be commissioned.

Desalination…?

‘Desalination - this sounds an obvious solution, but its real challenge is cost. It could cost a minimum capital amount of R15 billion for a desalination plant for Cape Town with operational costs potentially running between R350 million and R1 billion per year. This would translate into very expensive water. There are encouraging signs that new technologies can provide a cheaper solution.’

Premier Helen Zille, State of the Province Address, 17 February 2017

http://www.politicsweb.co.za/documents/wcape-sopa-good-governance-starts-a-domino-effect-?utm_source=Politicsweb+Daily+Headlines&utm_campaign=8a80957a1a-EMAIL_CAMPAIGN_2017_02_19&utm_medium=email&utm_term=0_a86f25db99-8a80957a1a-140214625

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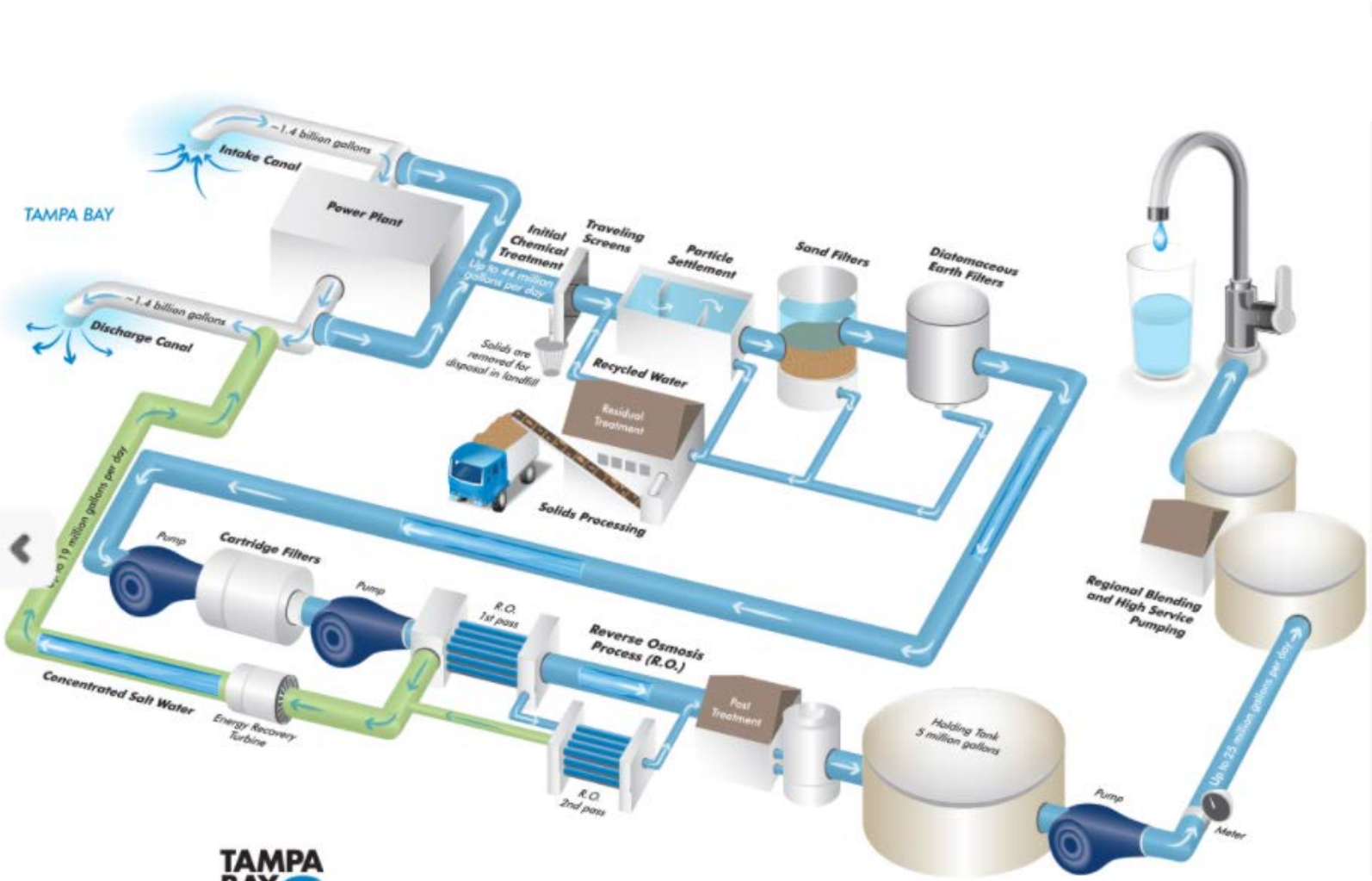
Typical seawater desalination plant

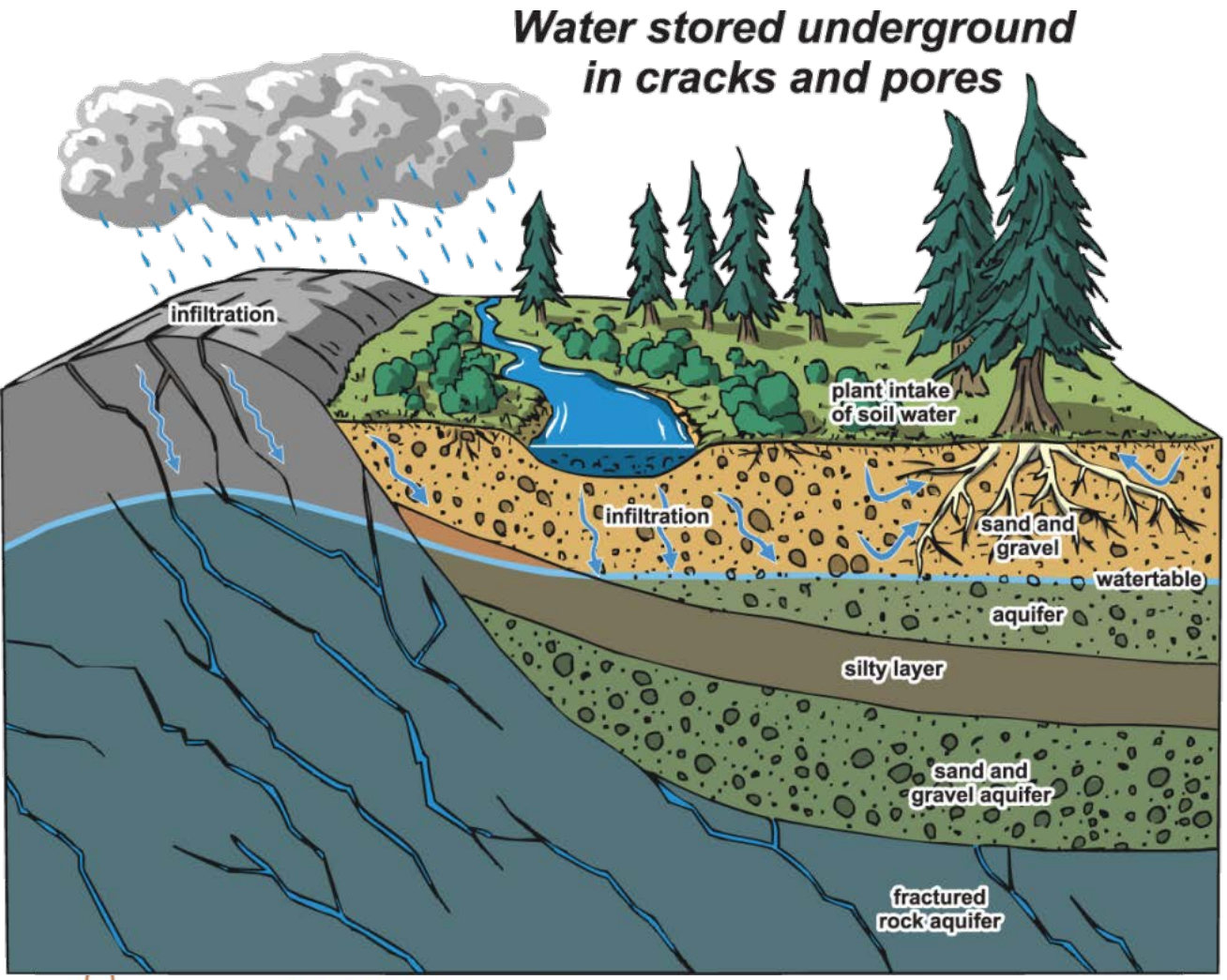


TAMPA BAY WATER

Tampa Bay Seawater Desalination Plant
Process Diagram

https://www.tampabaywater.org/tampa-bay-seawater-desalination-plant

What is groundwater?

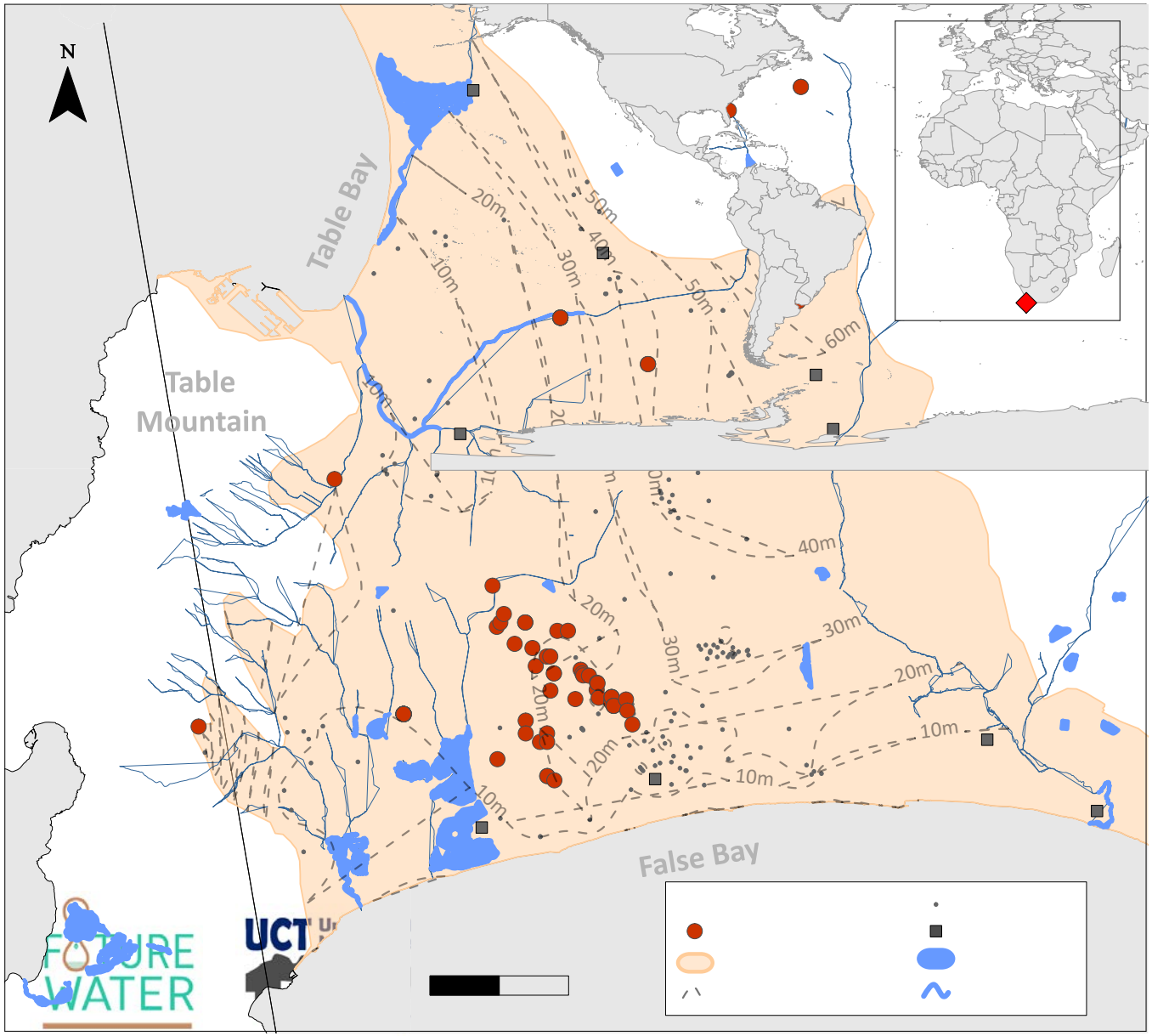


An aquifer is the area underground where spaces between gravel, sand, clay, or rock fill with water.

Water stored underground is called groundwater.

http://rdnwaterbudget.ca/water-101/aquifers-groundwater/

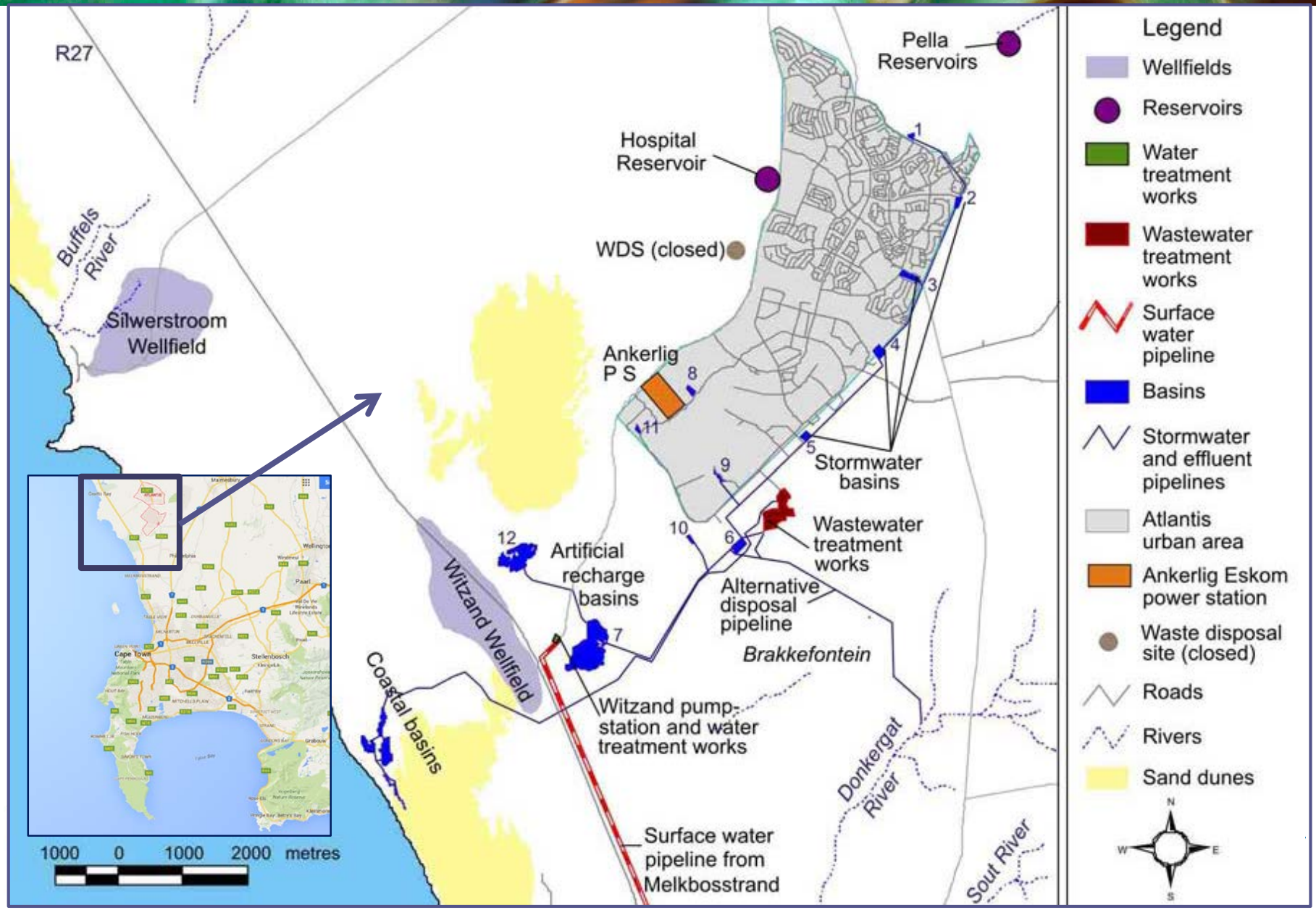
The Cape Flats Aquifer (CFA)



- Shallow water table
- Surface water interaction
- Connected to sea

Hugman (2017)

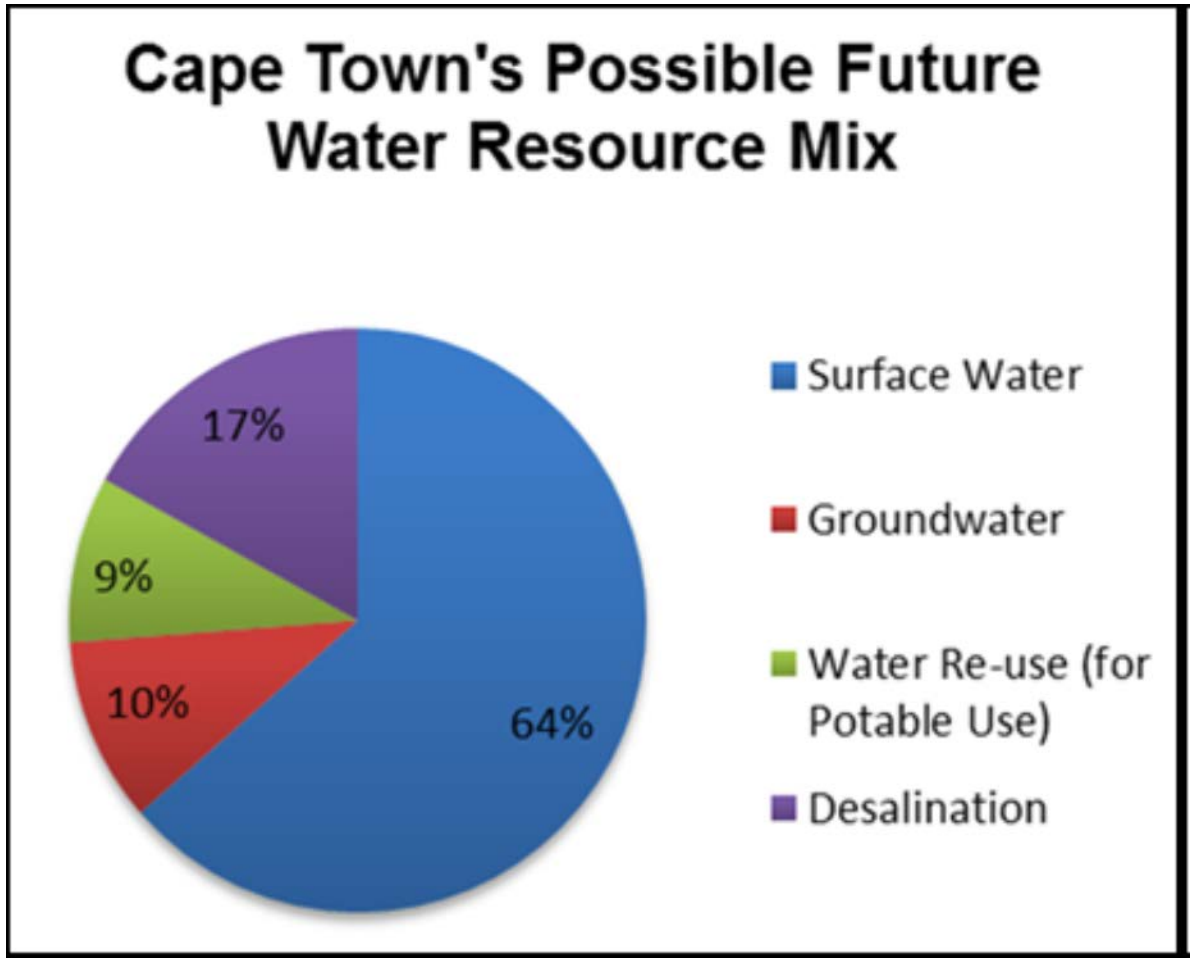
The Atlantis Water Resource Management Scheme



Sewage ‘Reclamation’ Part 1 (Windhoek)

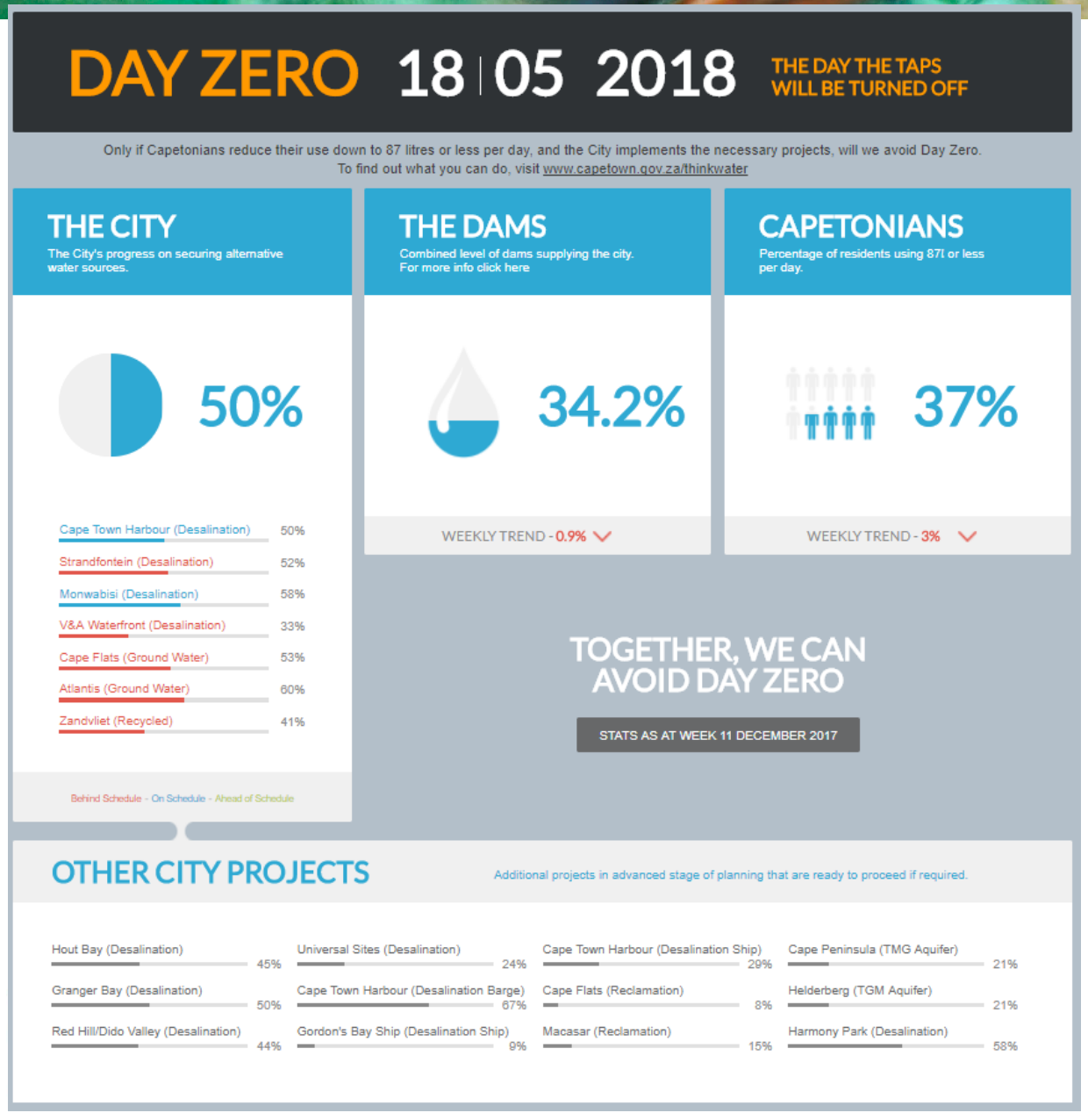
Sewage ‘Reclamation’ Part 2 (Windhoek)

CT's possible future water 'mix'



Xanthea Limberg, 2017

The CoCT 'Water Dashboard'



http://coct.co/water-dashboard/?ca_source=Website&ca_medium=affiliate&ca_campaign=Home%20page%20trends%20-%20Day%20Zero%20Dashboard&ca_term=Day%20Zero%20Dashboard&ca_content=Day%20Zero%20Dashboard

Questions?

http://www.futurewater.uct.ac.za/