



Cape Town's Day Zero – Lessons for New Zealand

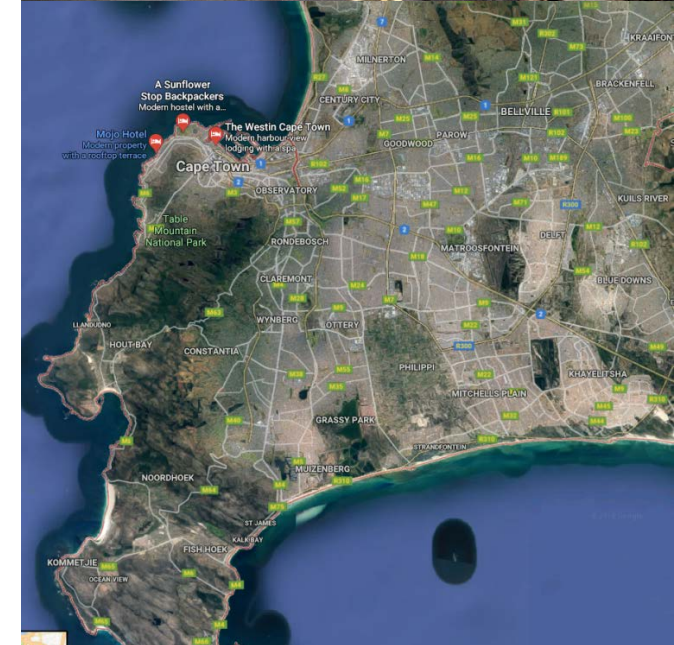
Wageed Kamish



OVERVIEW OF PRESENTATION

- Who am I?
- Before there was a problem
- But.....there were signs
- And in the background?
- Then the “unexpected” happened
- And now....
- Take-aways for the NZ context

WHO AM I?



University of Cape Town
"IKEYS"



University of Stellenbosch
"MATIES"

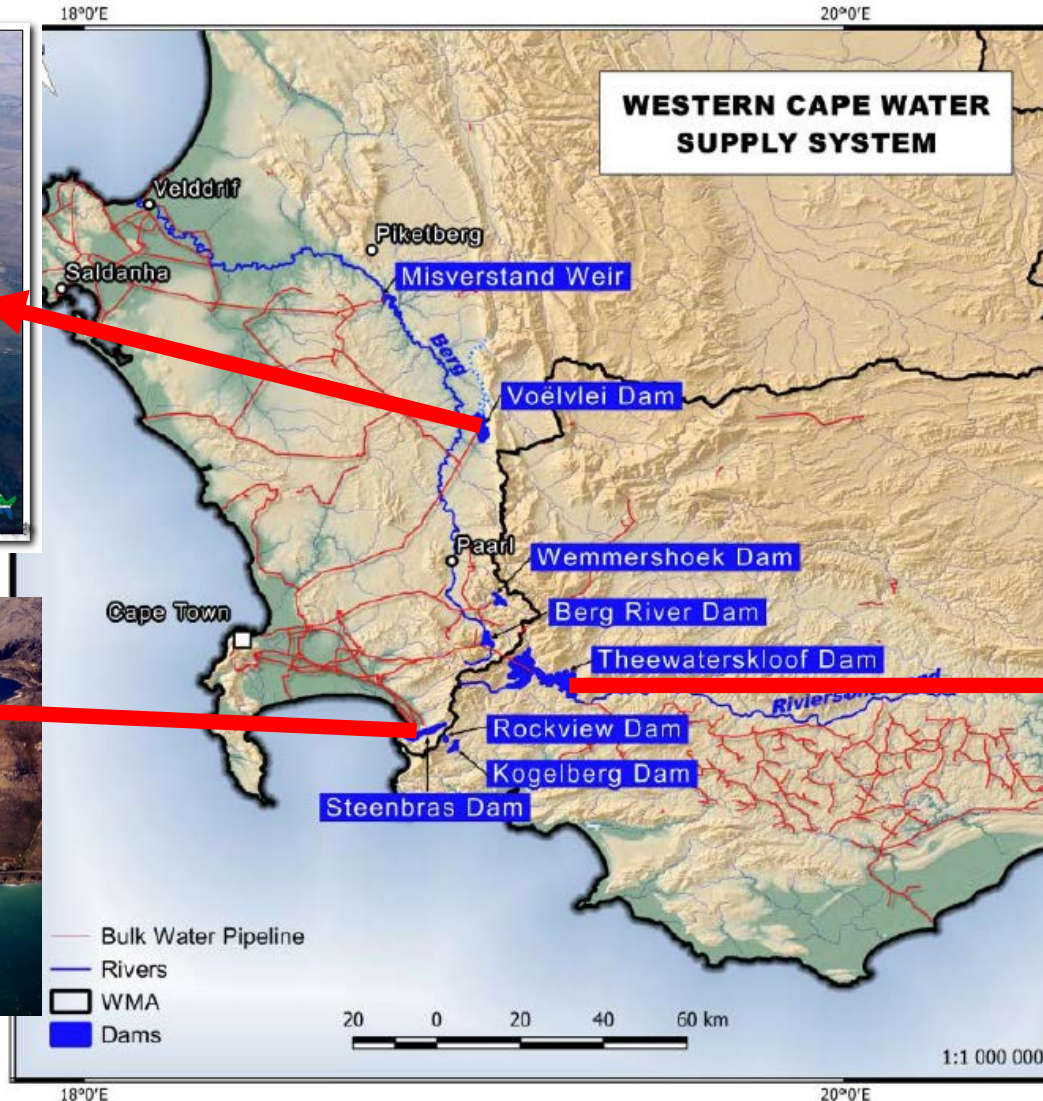
University of Stellenbosch
Lecturing + Research + Consulting
2009 – 2015



Consulting
1996 – 2009



Before there was a problem...(mid 1990s)



- Water Treatment Plants 12
- Bulk Reservoirs 24
- 655 km bulk pipeline
- 11 000 km reticulation pipelines
- 821 staff fixing leaks daily
- 800+ service requests daily
- 650,000 service connections



Population in 1995 : 2.5 million
Population in 2010 : 3.7 million

Before there was a problem...(mid 1990s)

MAJOR DAMS	CAPACITY	
	MI	%
		08 January 2018
BERG RIVER	130 010	58.0
STEENBRAS LOWER	33 517	49.2
STEENBRAS UPPER	31 767	94.5
THEEWATERSKLOOF	480 188	16.8
VOËLVLEI	164 095	20.6
WEMMERSHOEK	58 644	52.3
TOTAL STORED	898 221	266 931
% STORAGE		29.7

898.221 Mm³

360 000 Olympic Swimming pools

244 m³/person in 2010

Water Stored in Minor Dams Within Cape Town

MINOR DAMS	CAPACITY	
	MI	%
		08 January 2018
ALEXANDRA (Table Mountain)	126	45.7
DE VILLIERS (Table Mountain)	243	79.9
HELLY-HUTCHINSON (Table Mountain)	925	97.3
KLEINPLAATS (Simon's Town)	1 368	54.2
LAND-EN-ZEEZICHT (Helderberg)	451	100.0
LEWIS GAY (Simon's Town)	182	95.0
VICTORIA (Table Mountain)	128	93.5
WOODHEAD (Table Mountain)	954	92.5

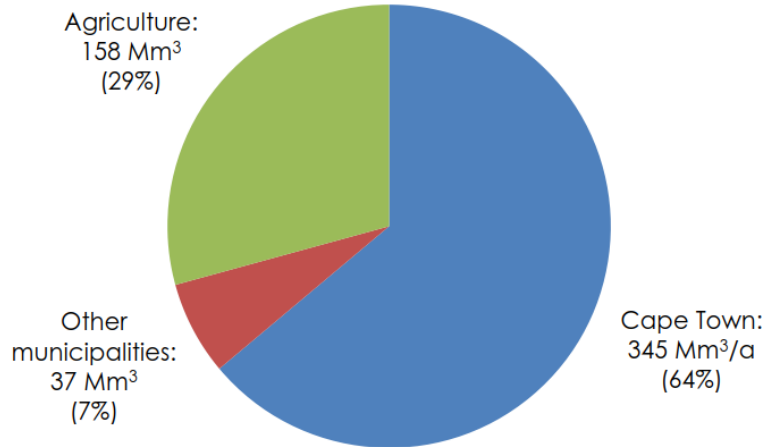
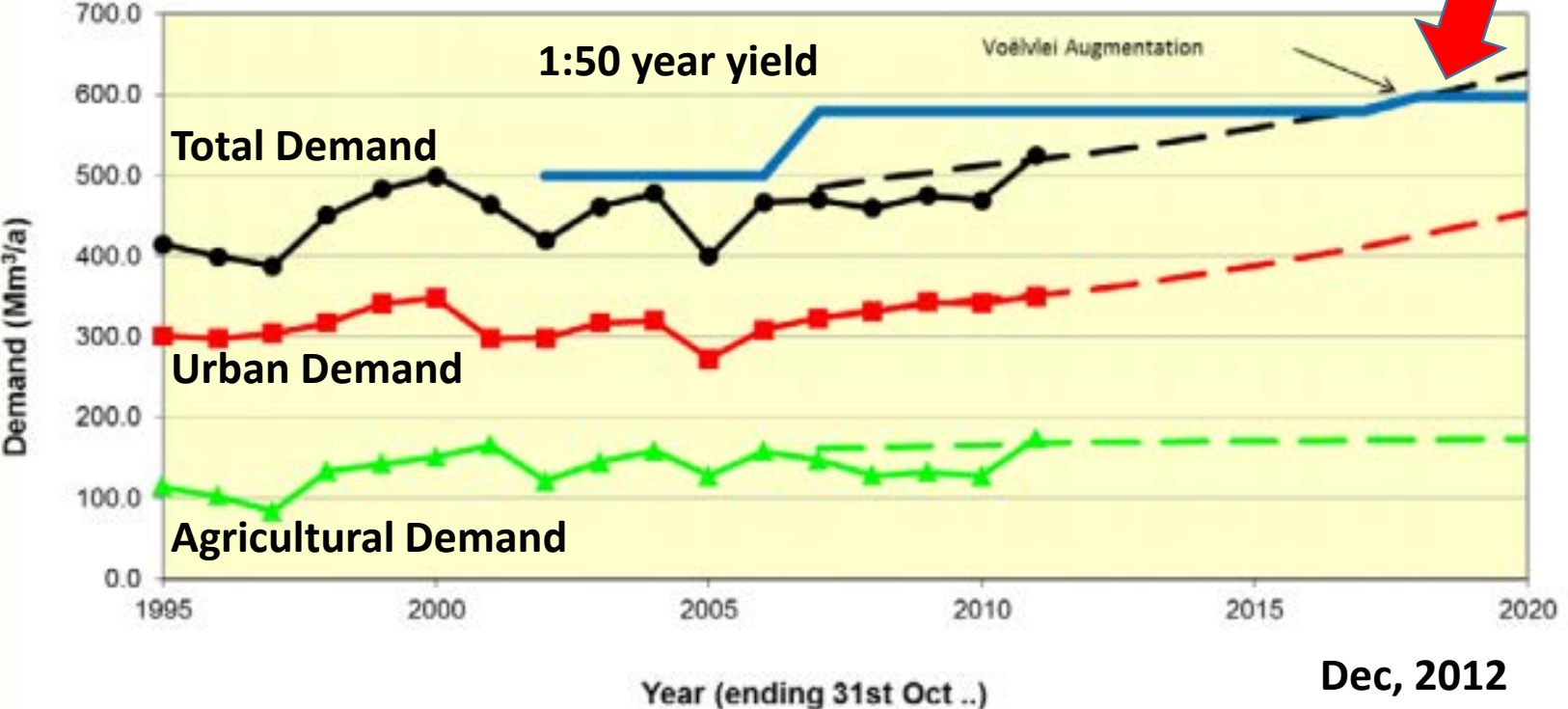
4.377 Mm³

- **Auckland storage 100 Mm³**
- **80% of supply from surface water**
- **68m³/person**

Before there was a problem...(mid 1990s)

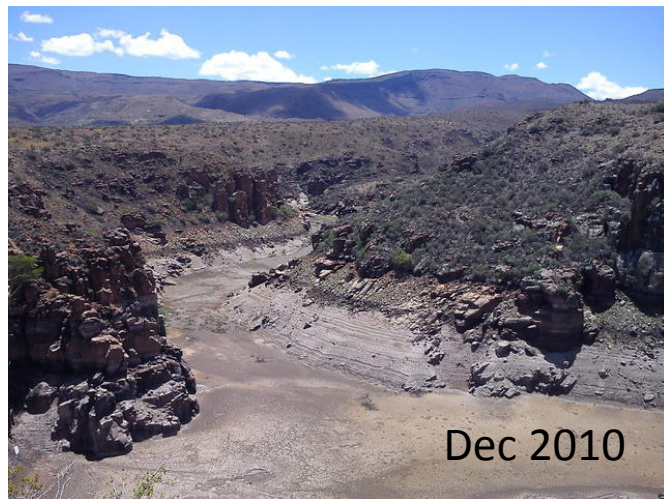
Western Cape Water Supply System
Historical and projected water demands

At risk of restrictions from November 2018



But...there were signs

Not too far from home



news24 archives
Breaking News. First.

Beaufort West rations its water

2010-11-24 10:31
Tisha Steyn, Die Burger
Outshoom - The drought in the Central Karoo has become so severe that the Beaufort West municipality has introduced a water sharing scheme.

The town has been divided into 12 areas, in which people will be unable to bath, shower or do laundry for 36 hours at a time.

"Residents in Hospitaalheuwel, Newton and Hooyvlakte were warned on Monday that the water pressure will be low (on Monday) and that they have to make provision by filling up buckets and water containers in advance," said Hein Rust, head of disaster management in the Central Karoo district municipality.

"As the water table of the boreholes, which provide the town's water, is so low, we have to lower the water pressure of the residential areas as a temporary emergency measure to decrease water use.

Water pressure

But...there were signs

at home as well - "the canary in the coal mine"

First water restrictions imposed in Cape Town

SOUTH AFRICA / 17 JULY 2003, 00:41AM / MELANIE GOSLING



As the Western Cape drought bites deeper, the authorities have banned the watering of gardens between 10am and 4pm in the Cape Town metropole - but that is the only water restriction for now.

At a meeting on Wednesday of representatives of the department of water affairs and forestry, local authorities, water boards and agriculture, it was agreed that a range of water restrictions would be applied next summer **only if the dams were less than 85 percent full by the end of October.**

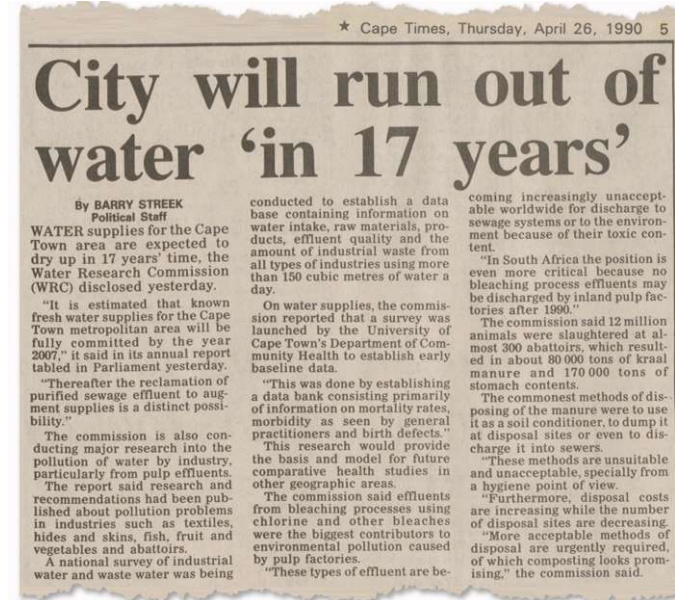
Water Affairs regional director Rashid Kahn said they had agreed to institute heightened water usage awareness and to draw up action plans.

Ollants and Doorn rivers was below average for this time of year and dams supplying metropolitan Cape Town and adjacent irrigation areas were under pressure.

"With the late start of the rainy season, the Voëlvele is unlikely to be filled. This is the second-largest source of water supply to greater Cape Town."

A feasibility study would examine raising the Clanwilliam dam wall. This, with the Berg River dam, would increase water supply.

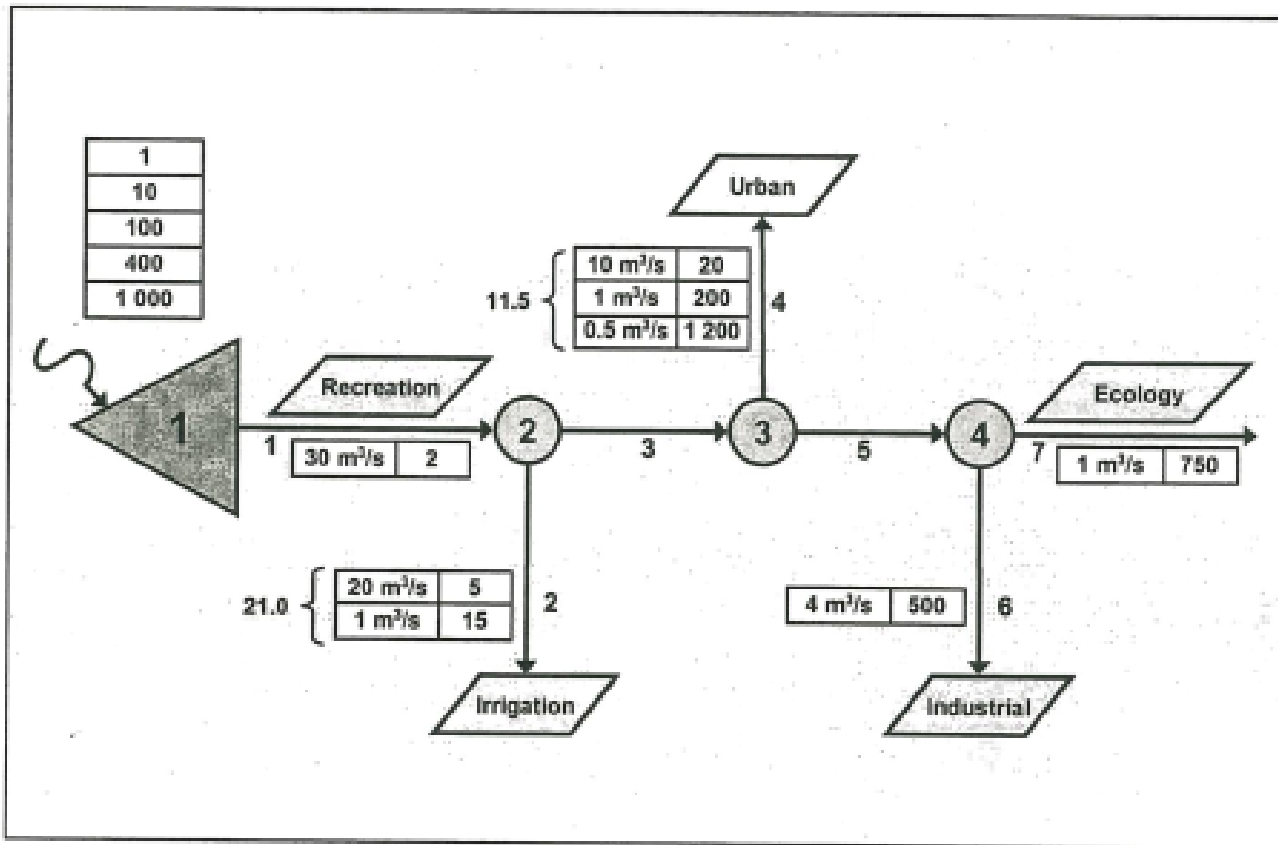
Arne Singels, head of bulk water in the city, said the ban on watering gardens between 10am and 4pm had not been scrapped after other water restrictions introduced in November 2000 were dropped: "This ban will now have to be enforced."
- Environment Writer



So before the crap hit the fan

There was a tool

Network model with penalties



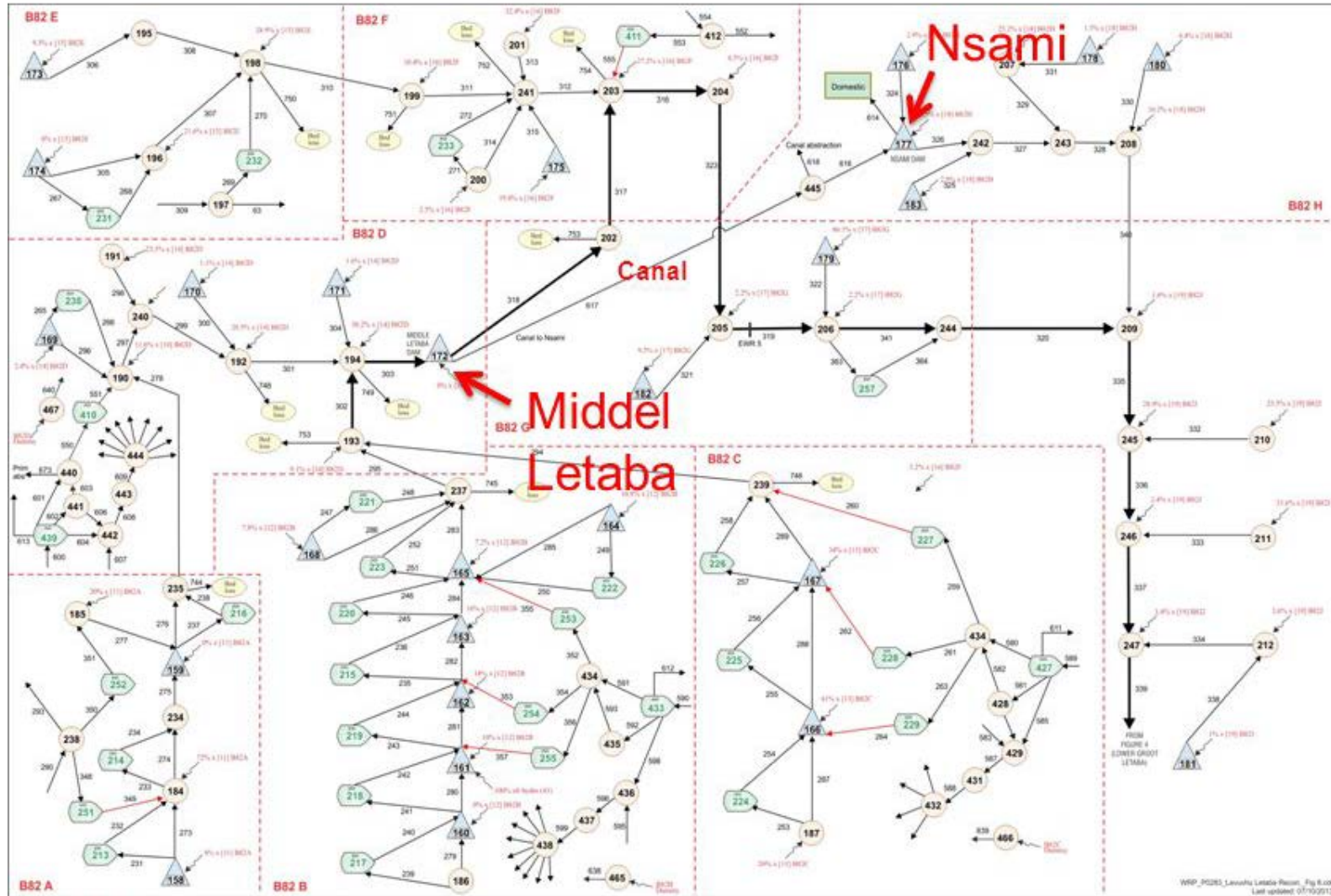
DWAF (August 2004)

Water Resources Yield Modelling Tool

- Naturalised hydrology
- Rivers
- Reservoirs
- Weirs
- Diversions
- Losses
- Canals
- Pipelines
- Pipe outlets
- Pumps
- Water requirements

So before the crap hit the fan

There was a tool

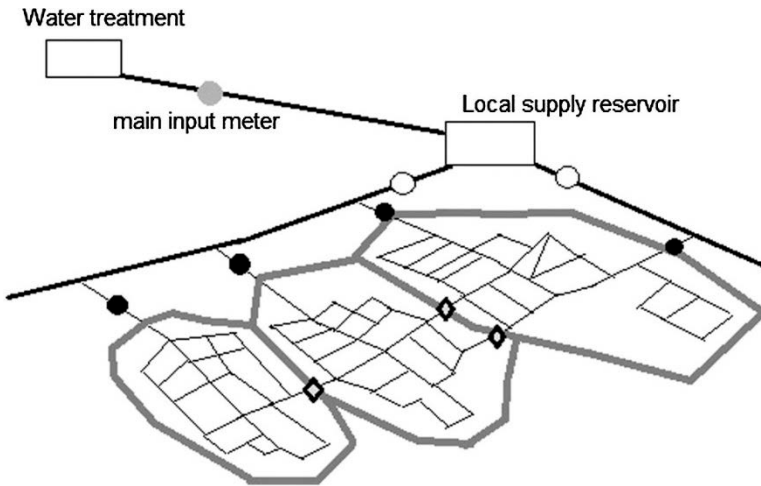


- Complex water systems
- Configure operating rules
- Long-term system yield
- Reliability of yield
- Stochastic flow generation

So before the crap hit the fan

there was Water Demand Management

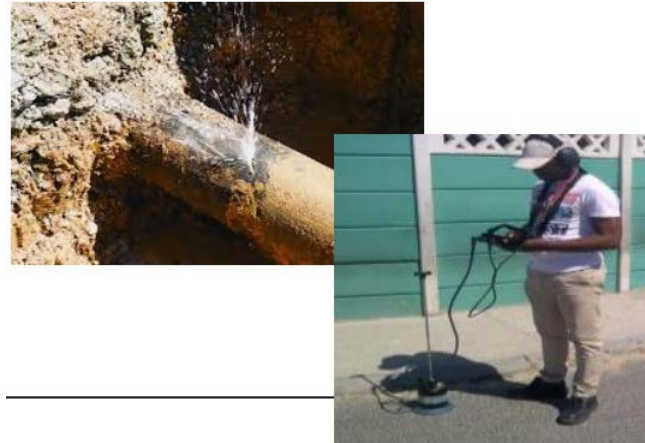
District Metering Areas (DMAs)



Leakage → 7.5 Mm³ in 2016 (WC)



Active leak detection



Khayelitsha pressure management project (2001)

Estimated savings:
9 Mm³/a



Mitchells Plain pressure management project (2008)

Estimated savings:
2.4 Mm³/a



So before the crap hit the fan

there were studies being done on alternatives

Voëlvlei augmentation scheme (phase 1)

Phase 1
35 Mm³/a



Water reclamation for potable use

Possible
110Ml/d
~40 Mm³/a



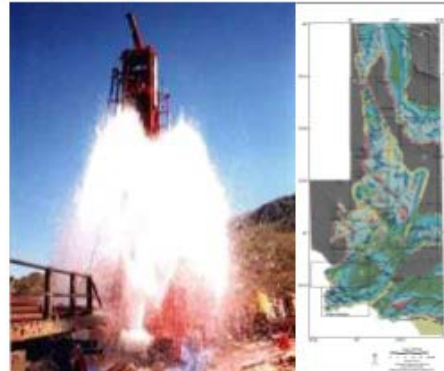
Sea water desalination

Up to
450Ml/d
~160 Mm³/a



Table Mountain Group Aquifer

Possible
40 Mm³/a



INTERVENTION SELECTION		YEAR	YIELD (million m ³ /a)
1	Berg River-Voëlvlei Phase 1	2020	23
2	TMG ¹⁾ Scheme 1	2022	20
3	Re-use Generic 1	2023	40
4	TMG Scheme 2	2026	30
5	Re-use Generic 2	2028	40
6	Desalination	2030	150

¹⁾ Table Mountain Group Aquifer ²⁾ Feasibility

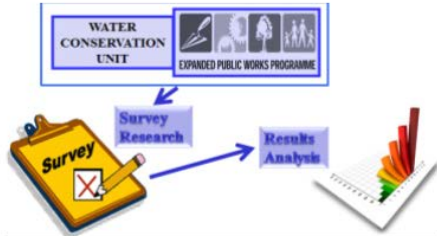


So before the crap hit the fan there were educational programmes

EPWP Pledge



Backyard dwellers



Website

- New website launched in December
 - includes Frequently Asked Question's (FAQ)

Water and sanitation

Water restrictions

The City of Cape Town has implemented Level 2 water restrictions, effective from 1 January 2016 until further notice.

As we are situated in a water-scarce region, the City imposes Level 1 restrictions (10% water savings) at all times. Because the City's dam levels are lower than the norm, Level 2 restrictions (20% savings) have been implemented to preserve the long-term sustainability of the resource.

20% reduction water tariffs

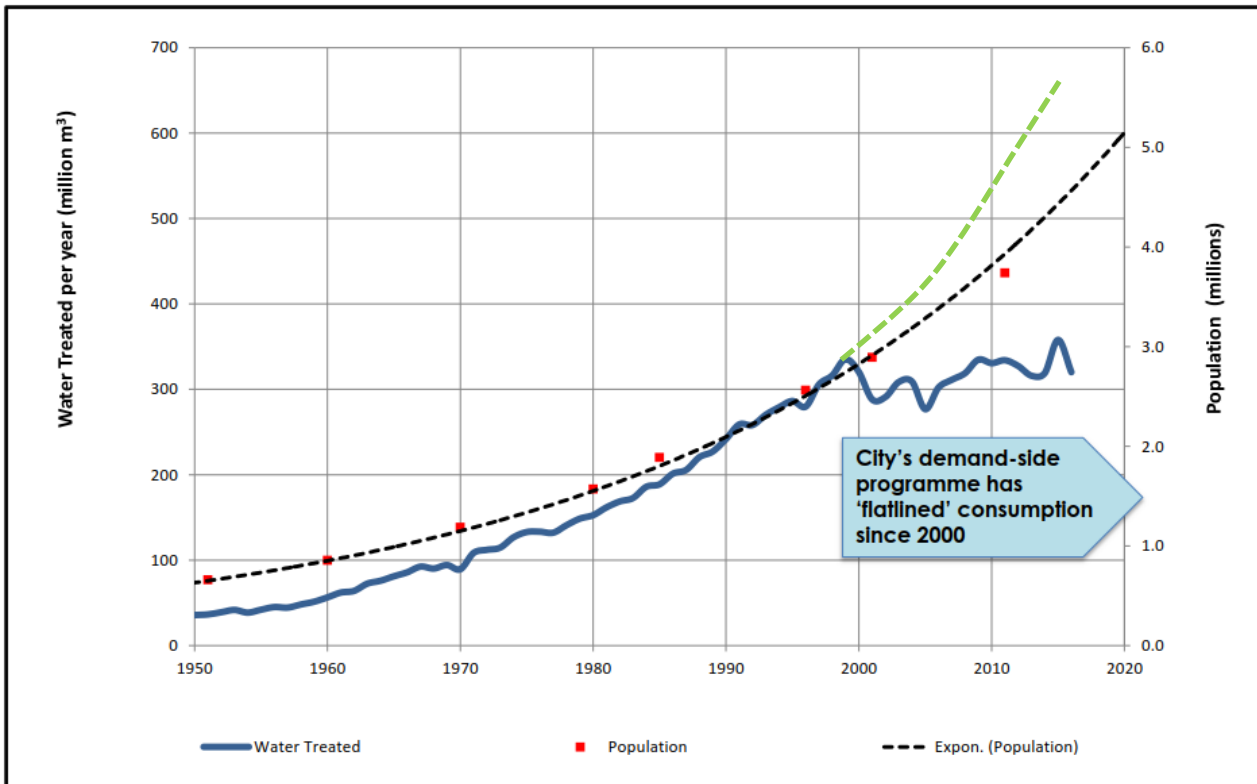
With Level 2 restrictions approved, customers will be charged from 1 January 2016 according to 2 reduction tariffs (water | sanitation) to encourage greater water-use efficiency. The tariff is design to be revenue-neutral when applied to the 10% reduced consumption levels. In other words, if an average customer reduces their consumption by 10%, their bill should remain at a similar rand value. Indigent customers' free allocation will not be affected. The free first 6 kl of water and 4.2 of sanitation a month for all residents will also not be affected.

The 2015/16 domestic full tariffs (stand-alone houses) for water are as follows:

Steps	Unit*	Level 1 (10% reduction) Normal tariffs Rands (incl VAT)	Level 2 (20% reduction) During restrictions Rands (incl VAT)
Step 1 (0 - 6 kl)	Per kl	50	50

So before the crap hit the fan

Cape Town got a new Dam



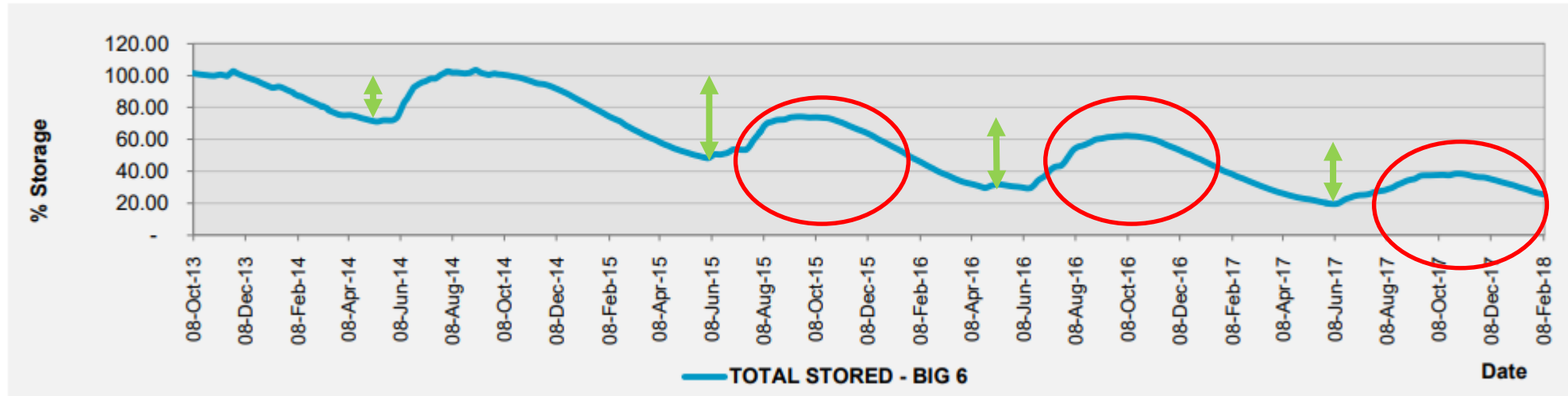
Costs

ZAR 1.5 billion in 2007

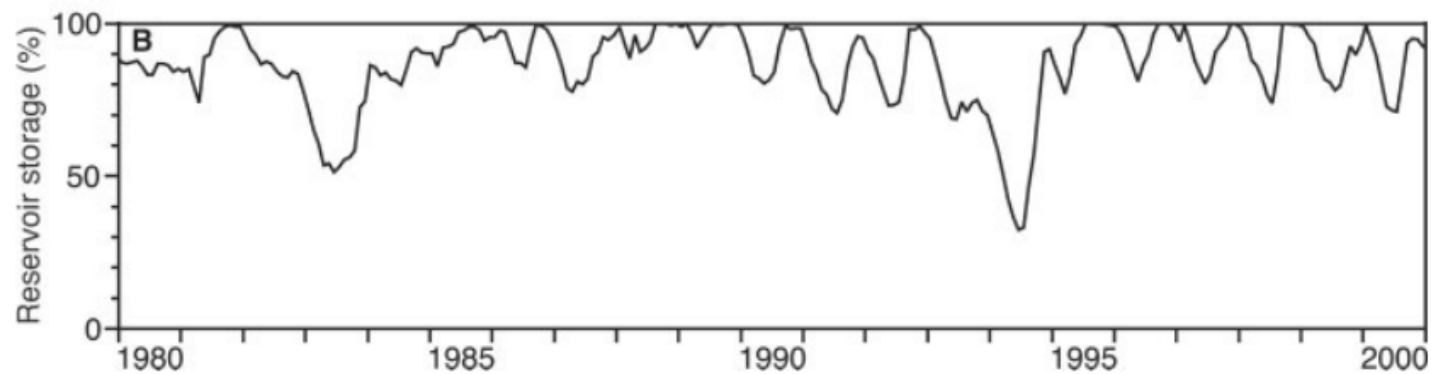
NZ\$ 305.5 million

Then the “unexpected” happened

Percentage Water Stored in Major Dams (WCWSS)



- **United Kingdom** – hydrological drought 1995 - 1998 and again 2003-2006
- **South eastern Australia** – hydrological drought 2001 -2009 (Melbourne Dam water level was 28% in 2007)
- **Auckland** – Dams didn't fill for 2 seasons



Then the “unexpected” happened

So how bad is the drought?? What the climate specialists say

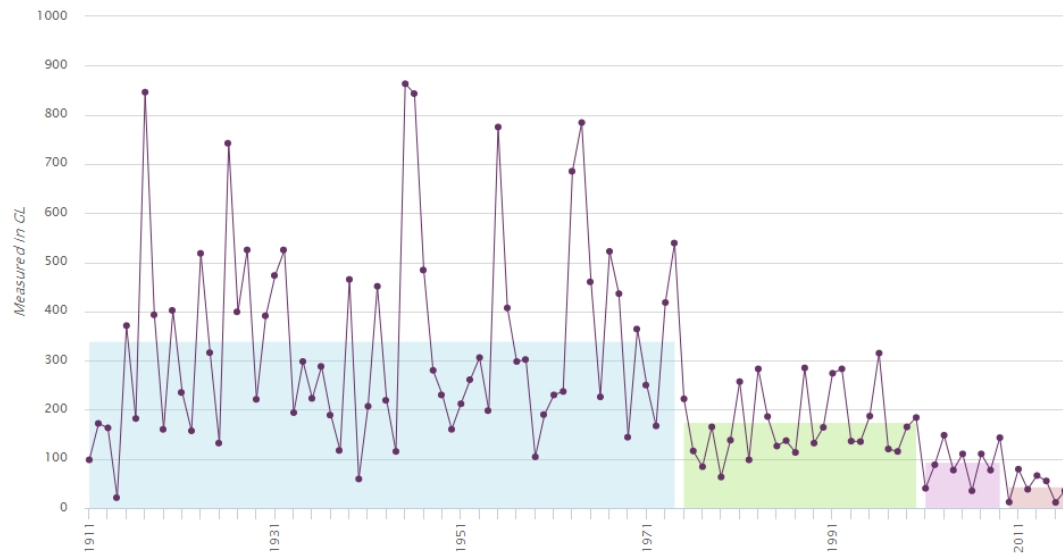
- No question about whether there’s a drought or not – THERE WAS ONE!!
- Worst on record over 1 and 3 years – 2017 was particularly bad
- 311 ARI (2015 -2017)
90% confidence interval: 105 to 1280 ARI
- Cape Town City CBD rainfall was low, but not the lowest on record
- Rainfall over the last 84 years has a decreasing trend (anthropogenic??)

Then the “unexpected” happened

An Aside – Perth’s situation

Historical streamflow

We need steady, regular rain in order to soak our catchments and get the streams flowing into our dams. Slowly declining rainfall means Perth's dams receive much less streamflow than in years past.



Key

1911 – 1974 av 338 GL
1975 – 2000 av 173 GL
2001 – 2009 av 92 GL
2010 – 2016 av 42 GL
Annual Total

Dear Editor

I come from Perth, a city of 1.6 million on the south western tip of Australia - with a climate almost identical to Cape Town. Originally, our city relied 100% on rainfall flowing into our dams.

However, this all changed when we realised in the 1990's that our climate was changing permanently. We now only get 10% of the stream flow that was flowing into the dams for the first 70 years of last century.

The most illuminating graph can be found here:

<https://www.watercorporation.com.au/water-supply/rainfall-and-dams/streamflow/streamflowhistorical>.

If Cape Town is experiencing a similar trend then this would mean a total change to where you get your water. I trust the lessons learnt in Perth can be applied to Cape Town.

James Marshall
Water Engineer

Sincerely
James Marshall
6 Feb 2018

and now...

Water restrictions



PLEASE NOTE

Level 6B water restrictions are in effect from 1 February 2018. Avoid Day Zero and use 50 litres per person per day.



The waterskloof Dam



And now...

Water management devices



The top 100 users, with the highest water usage per month, are located in:

1. Haywood Road, Crawford – 702 000 litres	51. Brockley Road, Muizenberg – 229 000 litres
2. Manenberg Avenue, Manenberg – 655 000 litres	52. Pelican Parade, Melkbosstrand – 226 000 litres
3. Boundary Road, Lansdowne – 557 000 litres	53. Peak Road, Fish Hoek – 225 000 litres
4. Upper Hillwood Road, Bishop's Court – 554 000 litres	54. Lichfield Avenue, Bishop's Court – 224 000 litres
5. Norwich Drive, Bishop's Court – 500 000 litres	55. Pinecroft Close, Parel Vallei – 222 000 litres
6. Pear Lane, Constantia – 461 000 litres	56. Upper Primrose Avenue, Bishop's Court – 220 000 litres
7. Barchan Circle, Big Bay – 457 000 litres	57. Bromley Road, Athlone – 219 000 litres
8. Hoefeld Road, La Concorde – 443 000 litres	58. Khalfe Road, Athlone – 217 000 litres
9. Montana Road, Colorado Park – 441 000 litres	59. Spilhaus Avenue, Constantia – 216 000 litres
10. Charnwood Avenue, Tokai – 431 000 litres	60. Head Road, Fresnaye – 216 000 litres
11. Pallotti Road, Durheim – 424 000 litres	61. Hugon Road, Claremont – 213 000 litres



Take-aways for New Zealand

- Thank goodness CT instituted Water Demand Management
- What signs of drought are we currently observing in New Zealand
- How resilient is the system currently?
- Are we paying enough to make the system resilient?



NEWS24



The poor have survived Day Zero for years

A couple of weeks ago I made two trips to Cape Town in which I became familiar with the looming water crisis in the city. While in the Mother City, I got to chat to a few people who reflected on how the water crisis was affecting them.

[Read the article on news24.com >](https://www.news24.com)



Take-aways for New Zealand

- Some councils in NZ do not charge for water nor do they meter it
 - Risk : no appreciation for the true value of water and can therefore be “wasted”
- Risk-of-failure of water supply system (Benchmarking)
 - Are demands known?
 - What are the operating rules?
 - What is the yield of the system and how close are you to it
 - What return interval of drought can you survive?

Day Zero : Rich vs Poor

- High Gini coefficient
- Poor → What will government provide?
- Poor → Food or water?
- Informal settlements → last to lose water
- Natural springs, but no public transport goes there
- Poor → US \$ 2000/annum



Rich → Fill pool or water garden?



US \$ 700



WORLD

As Cape Town's water runs out, the rich drill wells while the poor worry about eating

THANK YOU!!!!