



water affairs

Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA



water affairs

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WRC 40th Year

Municipal Water Losses in South Africa

1 September 2011

**Presented by:
Ronnie Mckenzie**



Identification of the Problems



THE MAGIC ROUNDABOUT

Town
centre

Cirencester

(A 419)

A 4289



Wroughton
Devizes
B 4289 (A 4361)



End of
bus lane



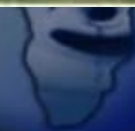




Photo: Courtesy Cloudbusters Paragliding Club



*"It's life Jim,
but not as we know it"*
- Dr Spock speaking to
Captain Kirk on board the
Starship Enterprise





Photo courtesy Enoch Sekate

Leaking Taps

(7 March 2006)



Illegal connections onto air valves in South Africa



Photo courtesy Guy Price

Extra connection
available for future
expansion



Photo courtesy Guy Price

No Gasket



Home Made Gasket



Lack of concern ?



Driver

Photo: Courtesy Willem Wegelin

Are we really ready ?



Garden Watering



Garden Watering ??



Photo: Courtesy Zama Siqualeba



Result of excessive Garden Watering

Photo: Courtesy Zama Siqalaba



**Dual Water
meter**

09/05/2008



09/05/2008

42 m³ over 3 months
= 14 m³ /month @ R5/m³
= ± R70/month (\$10/month)



619 m³ over 3 months
= ± 200 m³ /month @ R5/m³
= ± R1000/month (\$150/month)





09.04.09 12:15



What we need is some powerful software ?





**Water
Meter
register**



Valve Spotter



Valve Chamber
(cleaned)



Valve
maintenance



Need to expose valve



Check if Valve is open or closed



Importance of Community Support and Awareness









Software available from the WRC



Key Concepts

- **Terminology & Water Balance**

Standardise terminology: agree on IWA Water Balance

- **BABE**

Burst and Background Leakage Estimate

- **FAVAD**

Fixed Area Variable Area Discharges

- **UARL**

Unavoidable Annual Real Losses

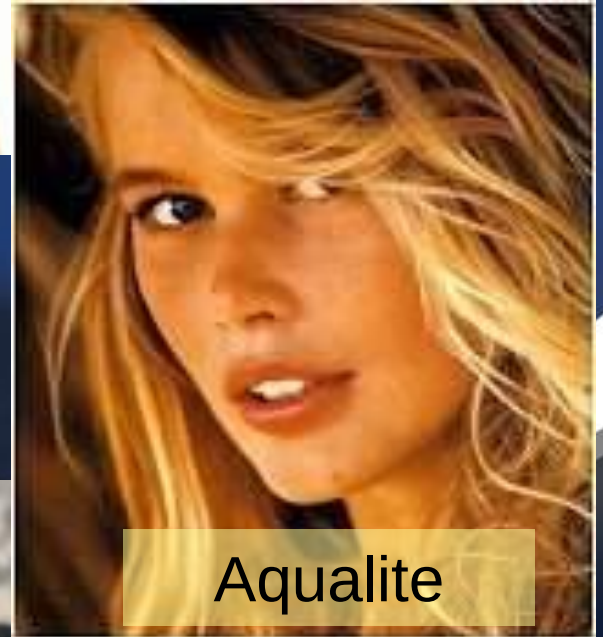
- **ILI**

Infrastructure Leakage Index





Presmac



Aqualite

4 WRC MODELS



Econoleak



Sanflow



4 WRC MODELS





Sanflow

Press any key to continue.....

Version 2.0.3: March 2009



Developed by:



WATER RESEARCH COMMISSION
www.wrc.org.za

Designed by:
Ronnie McKenzie

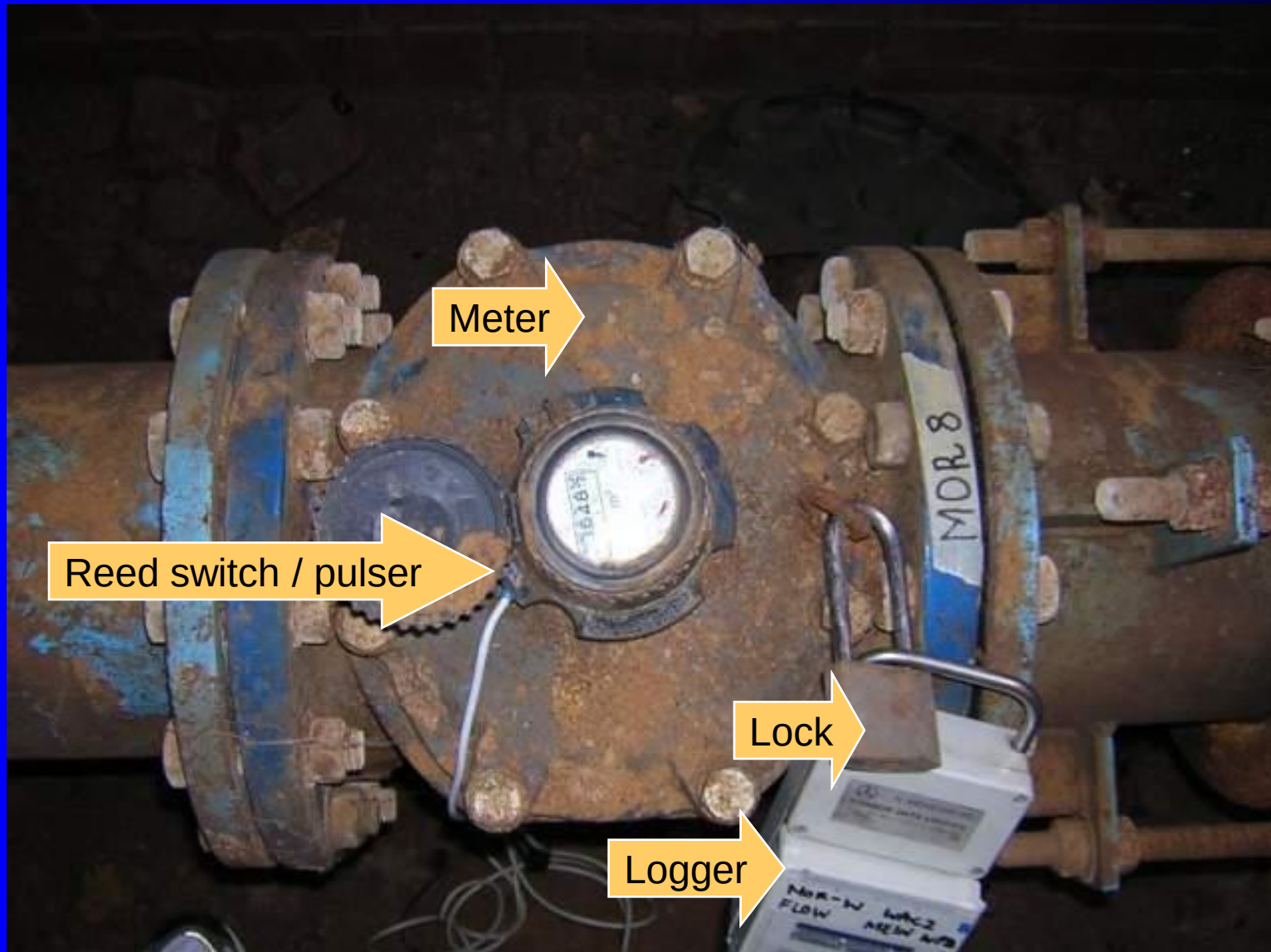
Logging of Minimum Night Flows

“One of Most Valuable WDM Tools”

(Tim Waldron Chair IWA Water Losses Specialist Group)



Logging flow







Presmac

Press any key to continue.....

Version 2.0.3 March 2009

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Fixed Area Variable Area Discharges (FAVAD)

- A concept to explain why different reticulation systems react differently to pressure changes.
- Systems with steel and iron pipes tend to have fixed area leaks while systems with plastic and asbestos cement pipes tend to have variable area leaks.



Fixed Area Variable Area Discharges

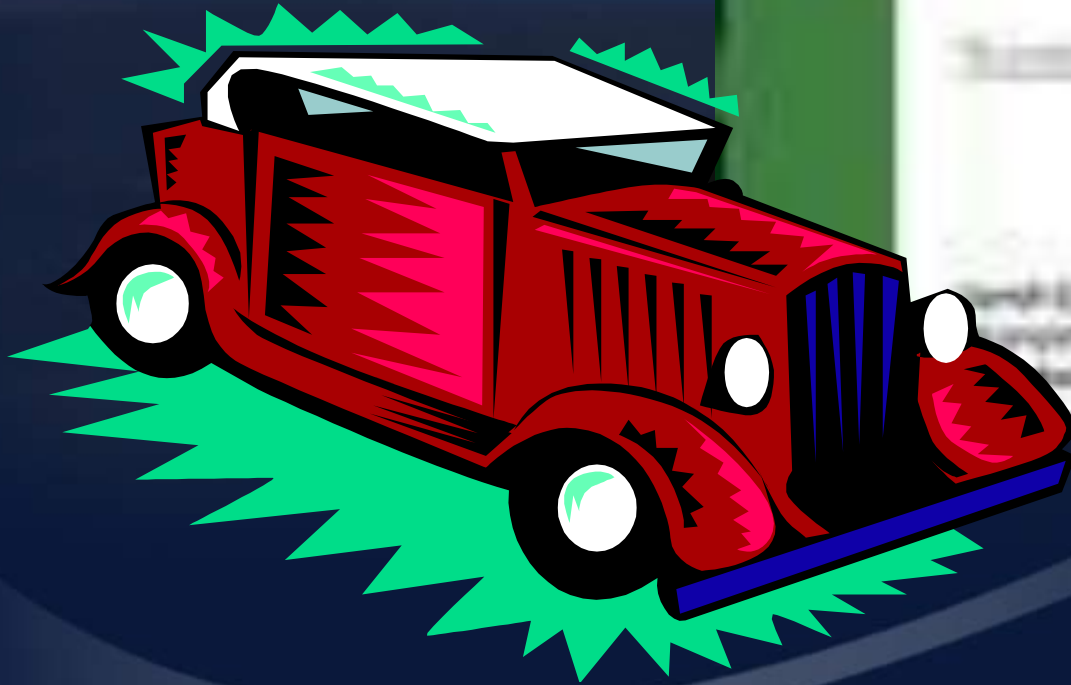
- FAVAD acronym - John May & Allan Lambert 1993
- FAVAD concept W Ledochowski – SAICE 1956
- Rigid Orifice Flexible Orifice Discharge Theory (ROFOD)
- Rigiede Plaatmondstuk Beweegbare Plaatmondstuk
Deurstroming (RPBPD)



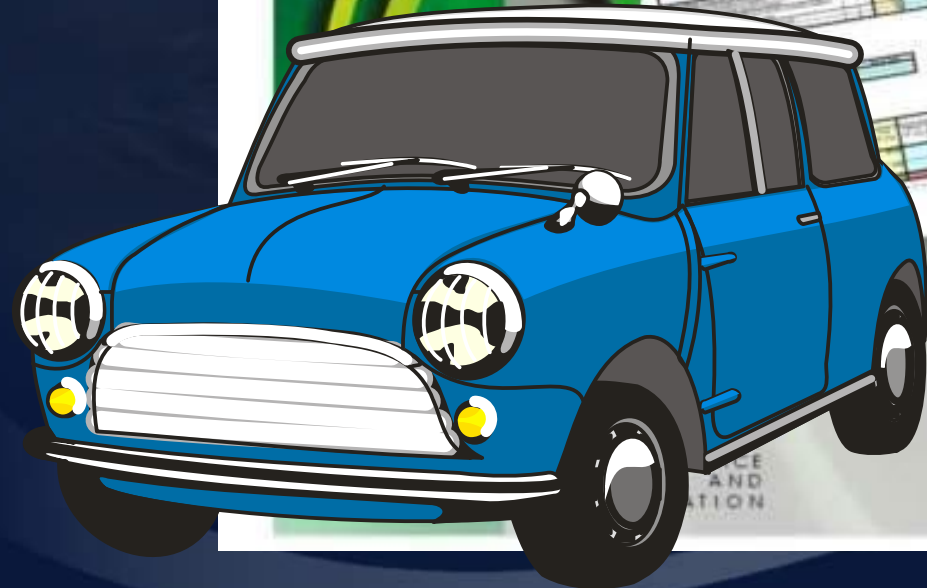
WATER AUDIT SOFTWARE



WATER AUDIT SOFTWARE



WATER AUDIT SOFTWARE: South Africa



WATER AUDIT SOFTWARE: USA

Awwa Research Foundation Project #2811 - Water Balance Software

New Open Save Save As Print Help

All Annual Volumes: **million U.S. gallons** Period: **one year**

System Data Water Balance Performance Indicators
Water Utility System Pressure Mains Connections

Name of water utility

Supply area reference

Reference Year



**Awwa
Research
Foundation**

Advancing the Science of Water®

Awwa Research Foundation project #2811

Standardized Annual Water Balance Software
Version 4.04 - February 2004

Software Designed by Bristol Water Services Ltd. and Ronnie McKenzie (GWR Ltd.)

WATER AUDIT SOFTWARE: Australia

BENCHMARKING OF WATER LOSSES IN AUSTRALIA

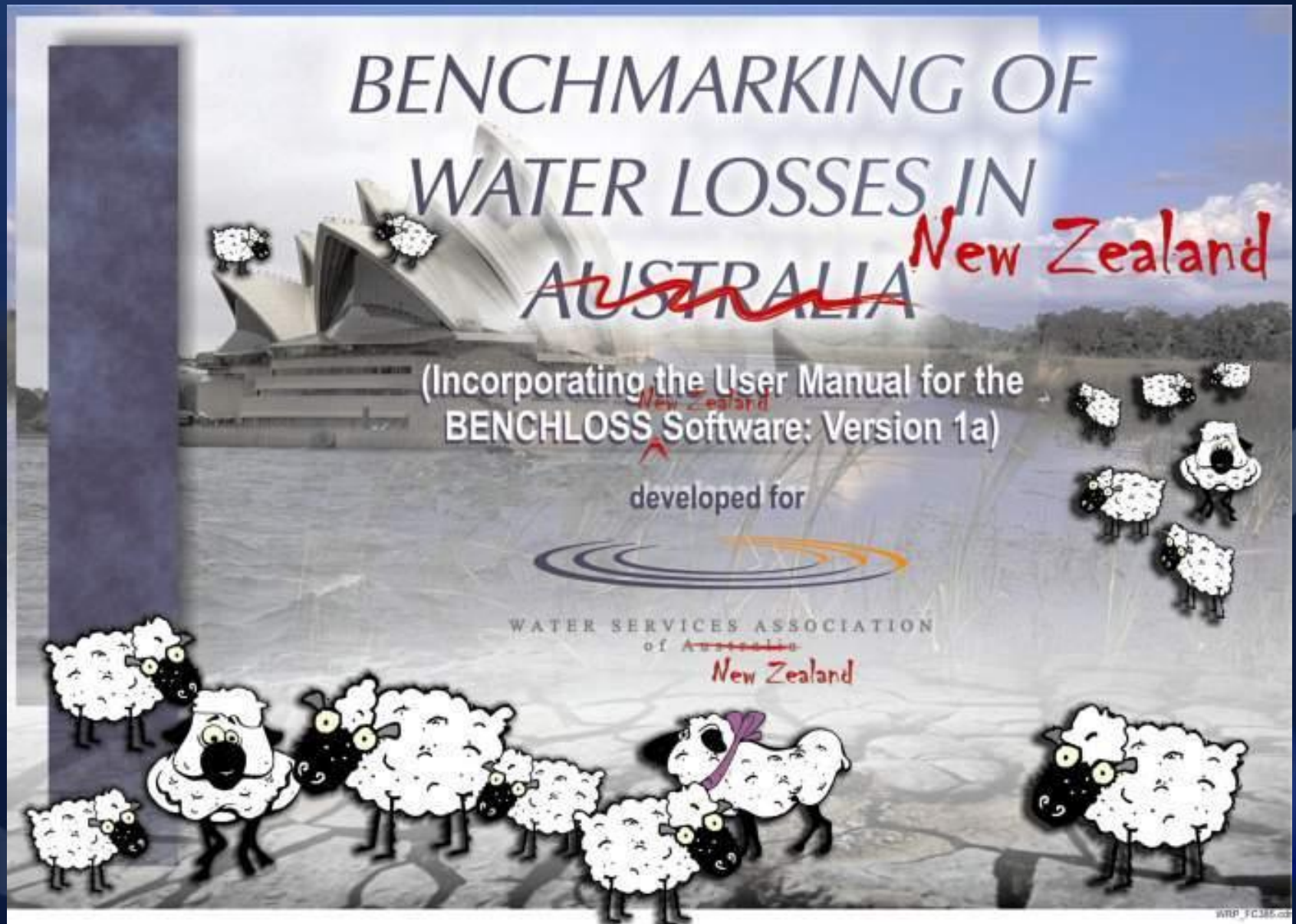
(Incorporating the User Manual for the
BENCHLOSS Software: Version 1a)

developed for

WATER SERVICES ASSOCIATION
of Australia



WATER AUDIT SOFTWARE: New Zealand



WATER AUDIT SOFTWARE: Latest Developments



AquaLite

Press any key to continue.....

Version 2.0.4 January 2009

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www.wrp.co.za

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Version 2.1 May 2010

Municipal WDM Score Card



Developed by:



Designed by:
Ronnie McKenzie

DWA & WRC Water Audits Preliminary Results

Courtesy Wensley and Herbst
2011 African Water Loss Summit

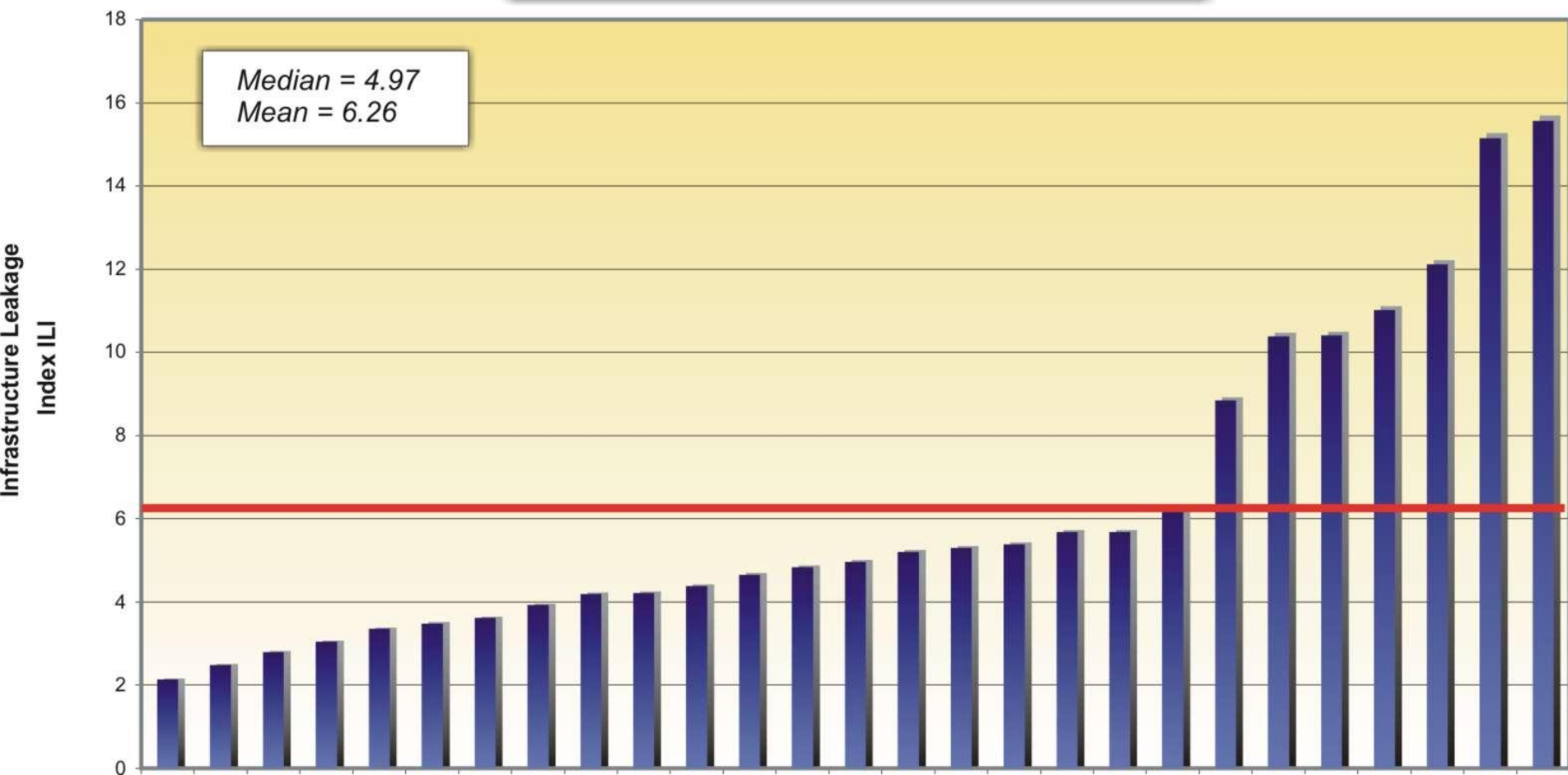


National Non-Revenue Water Assessment based on slightly modified IWA Water Balance



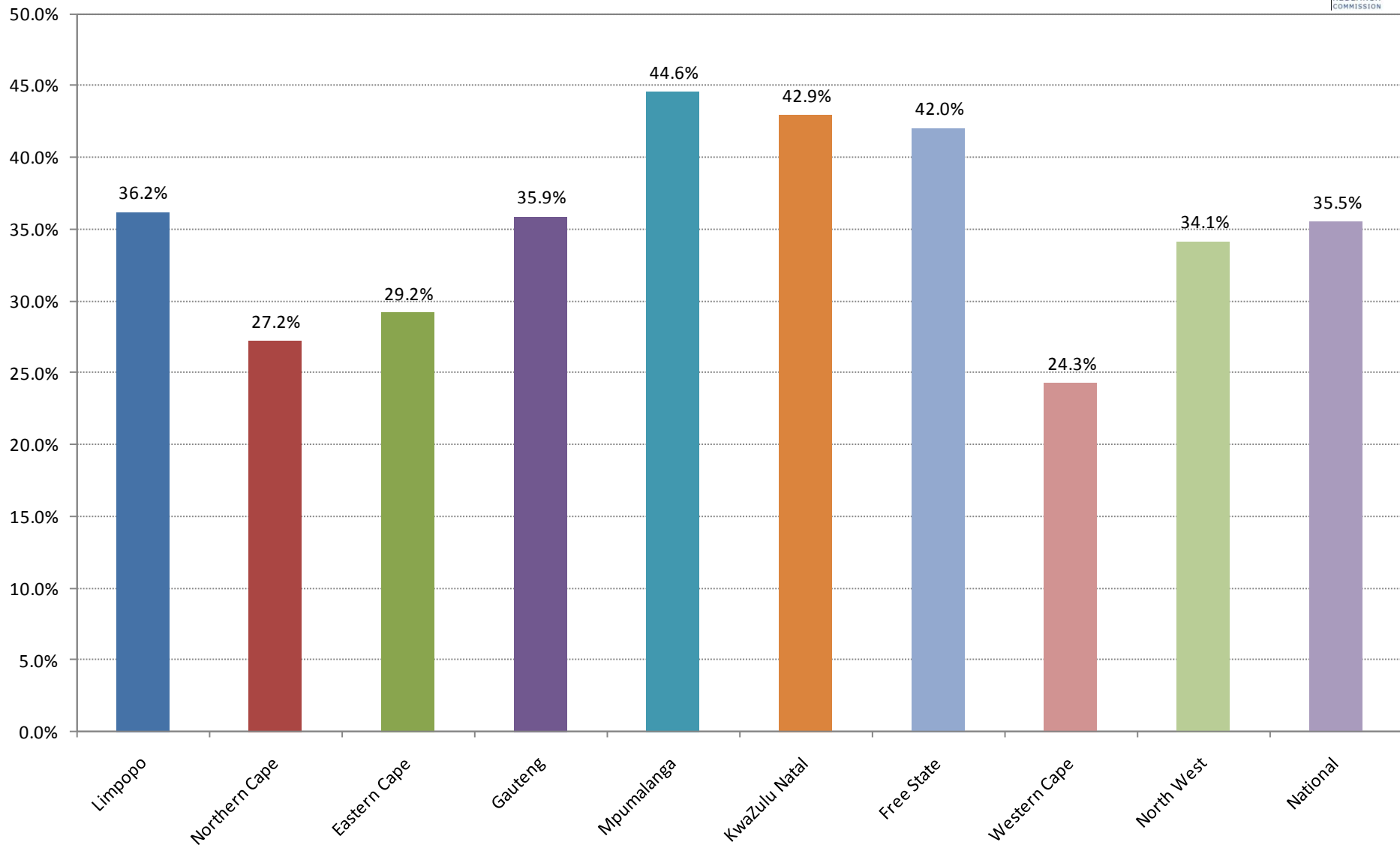
System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	Free basic
	Water Losses	Unbilled Authorised Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
		Apparent Losses	Unauthorised Consumption	
		Real Losses	Customer Meter Inaccuracies	
			Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

Infrastructure Leakage Index (ILI) Values for 27 Supply Systems in South Africa

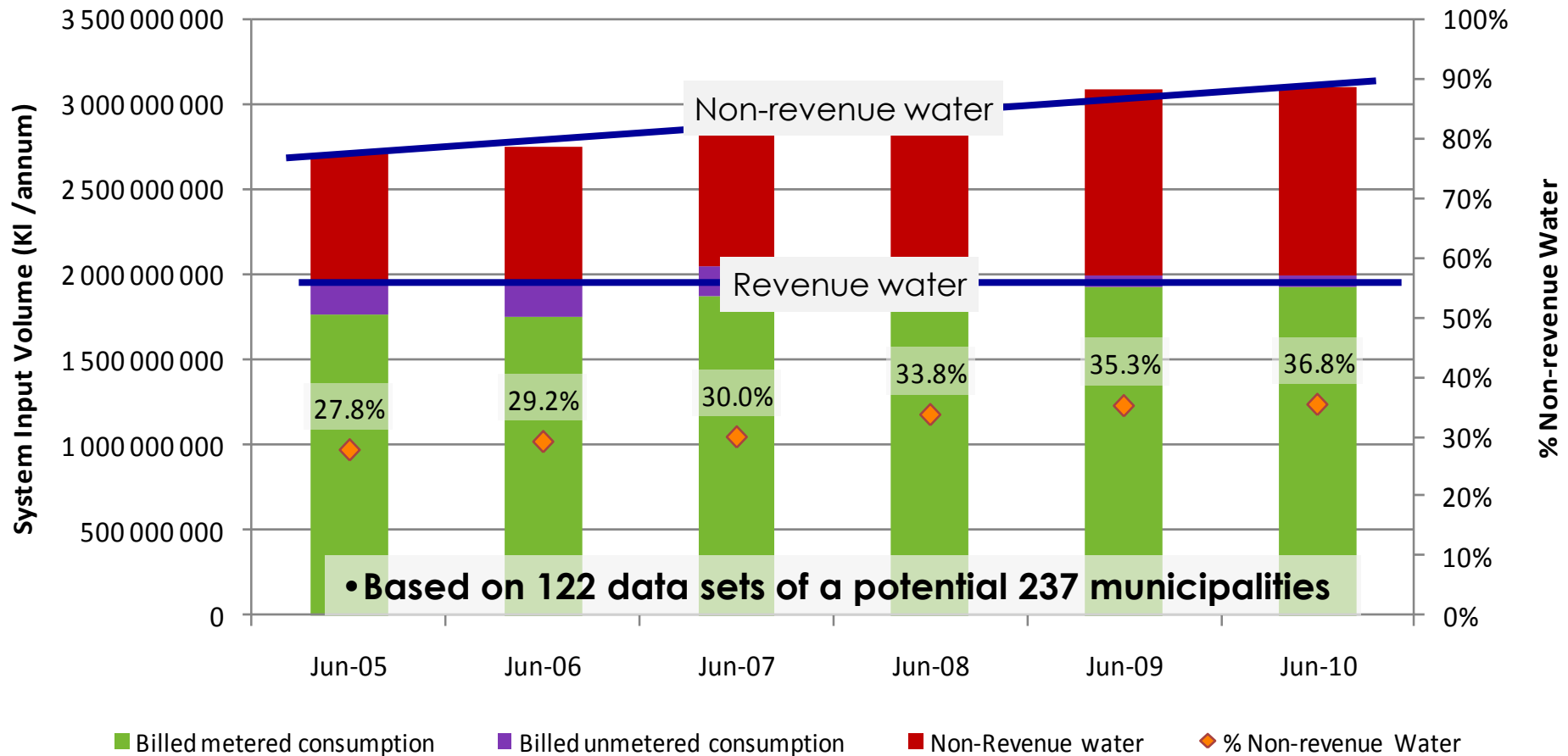


% Non-revenue water per province

Slide Courtesy Wensley: and Herbst IWA Regional Water Losses Summit 2011

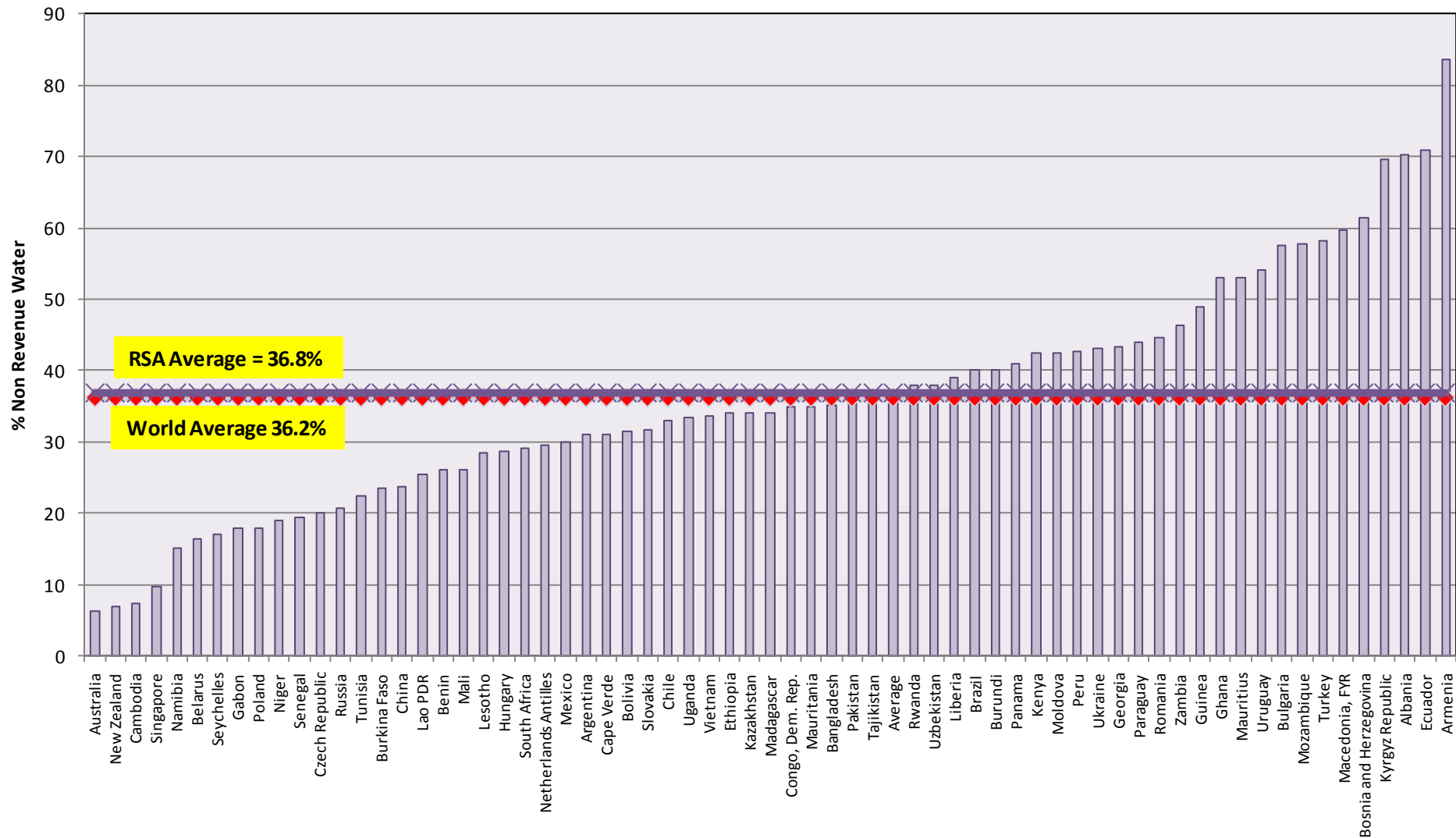


Preliminary National Non-revenue Water Assessment



a presentation by DWA communication services

International NRW benchmark



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Slide Courtesy Wensley: and Herbst IWA Regional Water Losses Summit

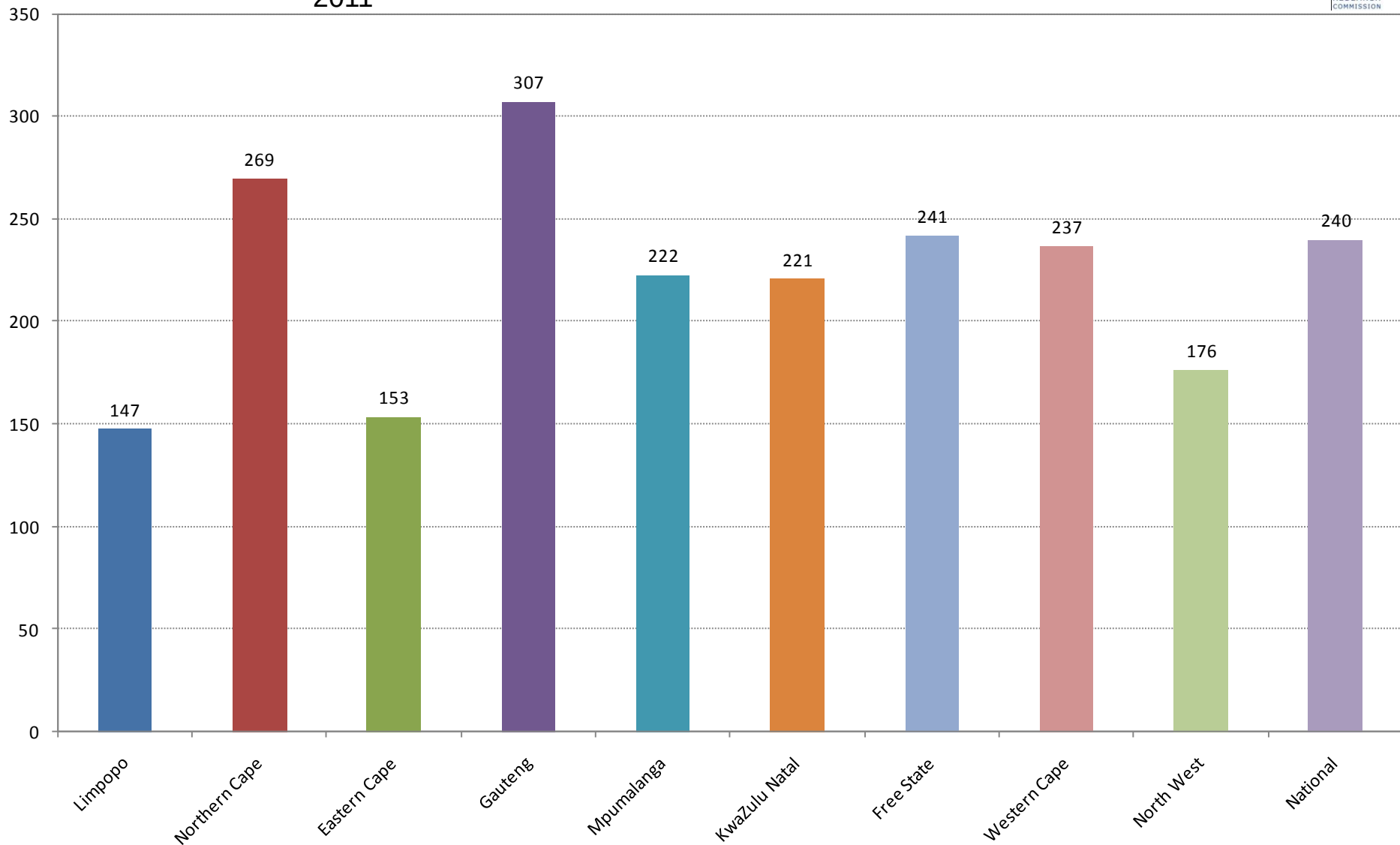
2011

Source: The International Benchmarking Network for Water and Sanitation Utilities (IBNET)

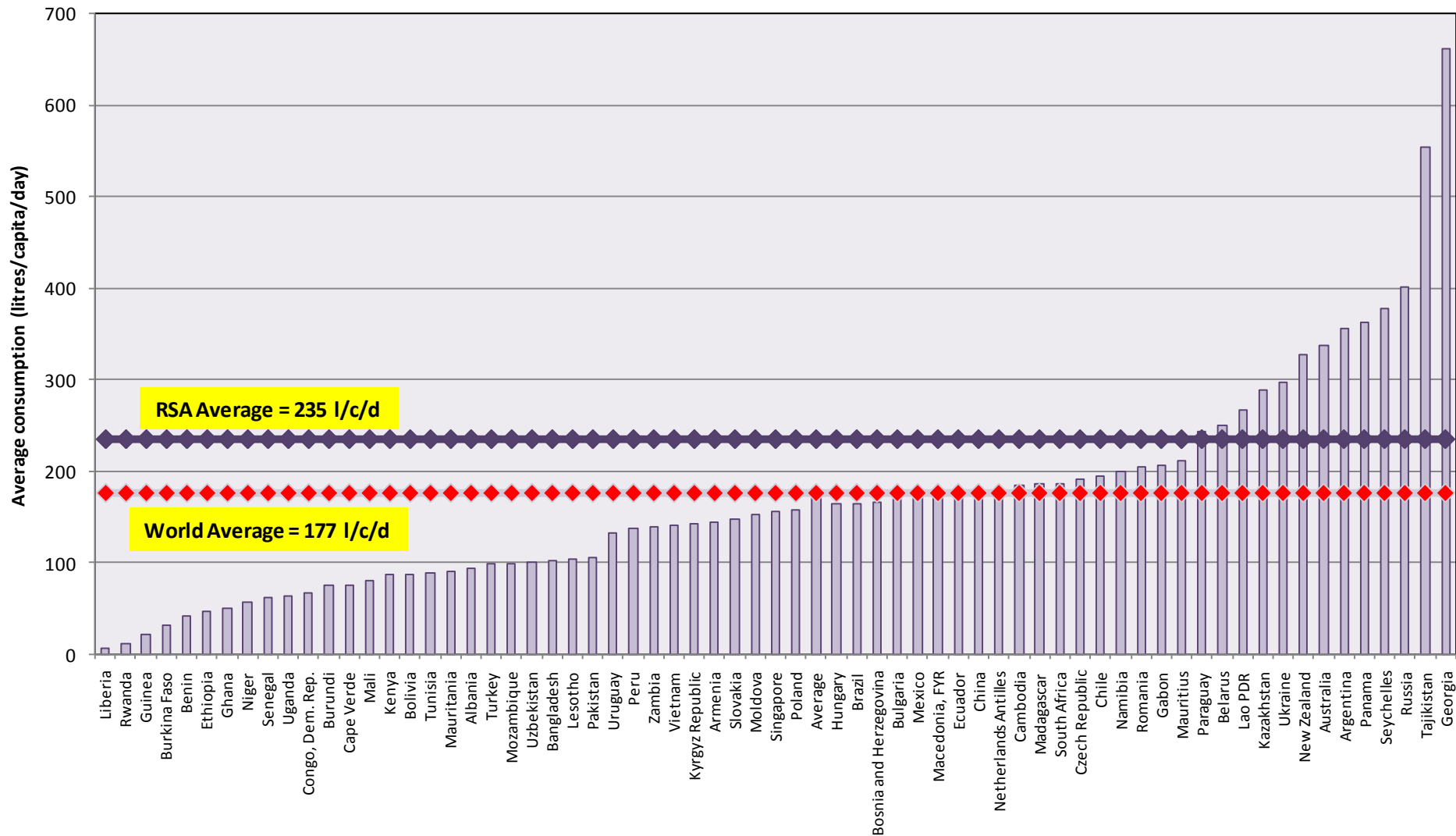


Litres / capita / day

Slide Courtesy Wensley: and Herbst IWA Regional Water Losses Summit 2011



International I/c/d benchmark



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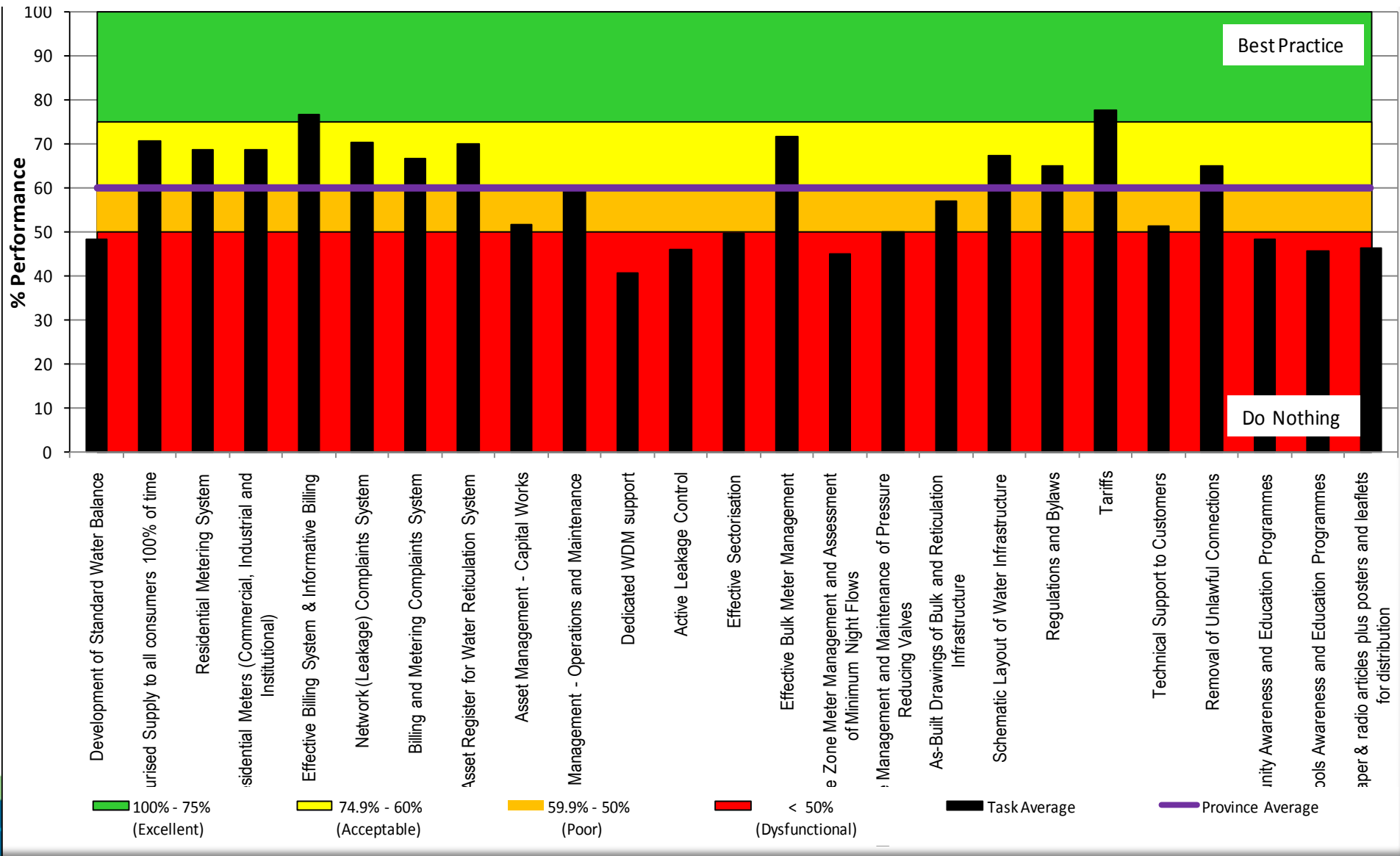
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Slide Courtesy Wensley: and Herbst African Water Losses Summit 2011

• Source : The International Benchmarking Network for Water and Sanitation Utilities (IBNET)



Municipal WC/WDM Performance Scorecard







Low Pressure

Photo: Courtesy Ken Brothers



High Pressure

Photo: Courtesy Ken Brothers



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Khayelitsha Pressure Management Project: 2000

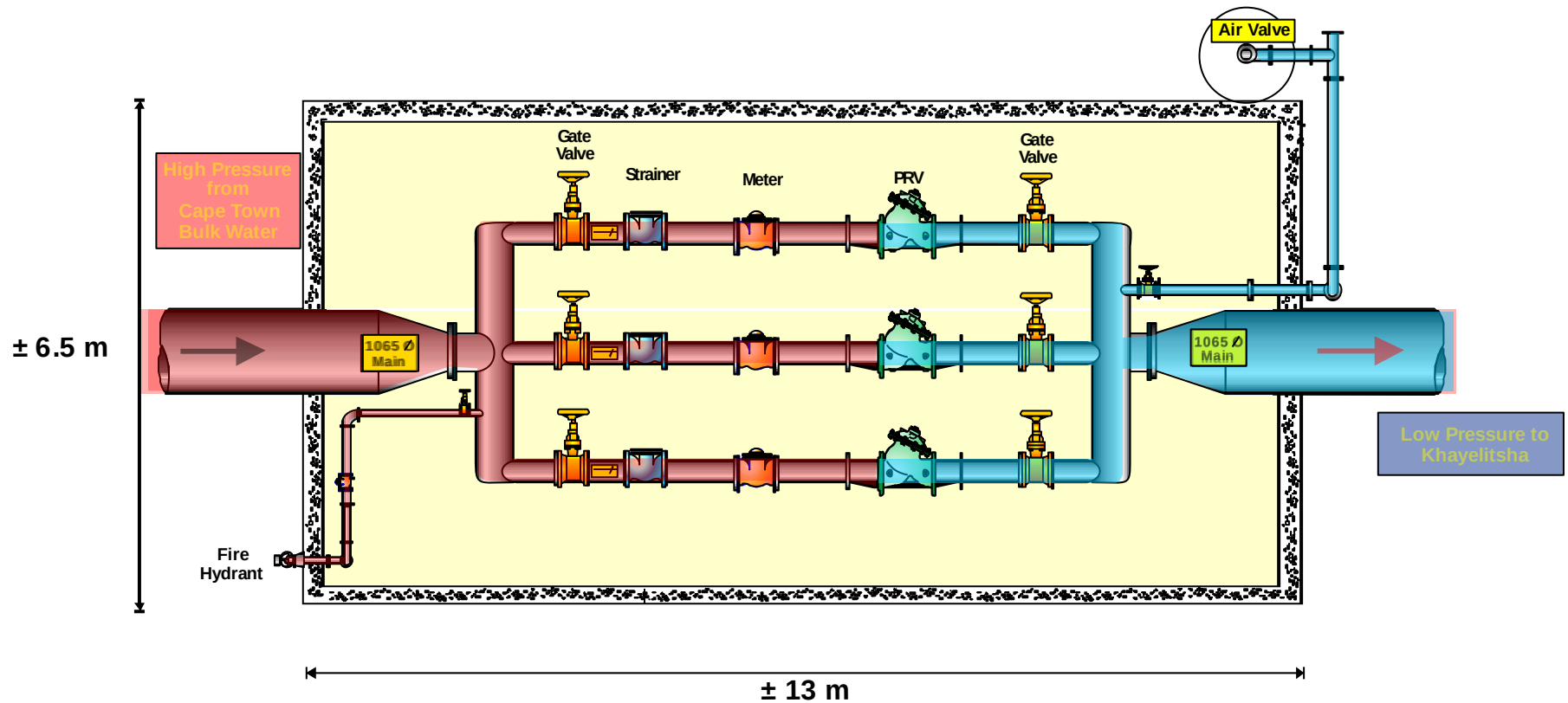




RSW = 3.0



Chamber details of 1065mm diameter installation



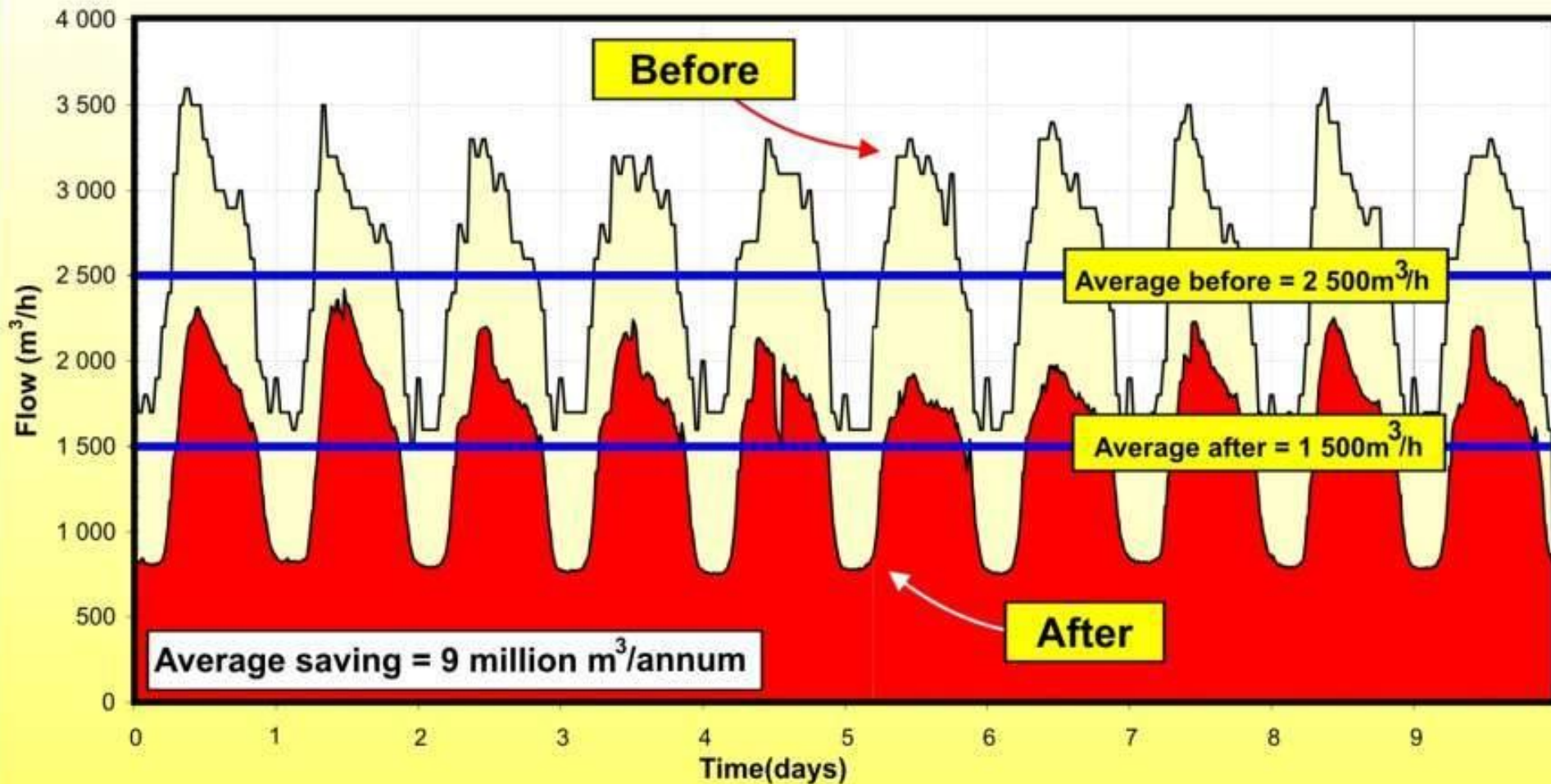
Dimensions

Length = ± 13 m
Width = ± 6.5 m
Depth below ground = ± 3 m
Height above ground = ± 4 m
Total Volume of Excavation = 800 m^3

Equipment

Pressure Reducing Valves: 3 x 350 mm diameter diaphragm actuated, hydraulically operated control valve
Isolating Valves: 6 x 300mm Resilient Seal gate Valves
Meters: 3 x 300 mm diameter Mechanical Turbine Flow Meters
Strainers: 3 x 300 mm Cast Iron "Y" strainers

Advanced Pressure Control





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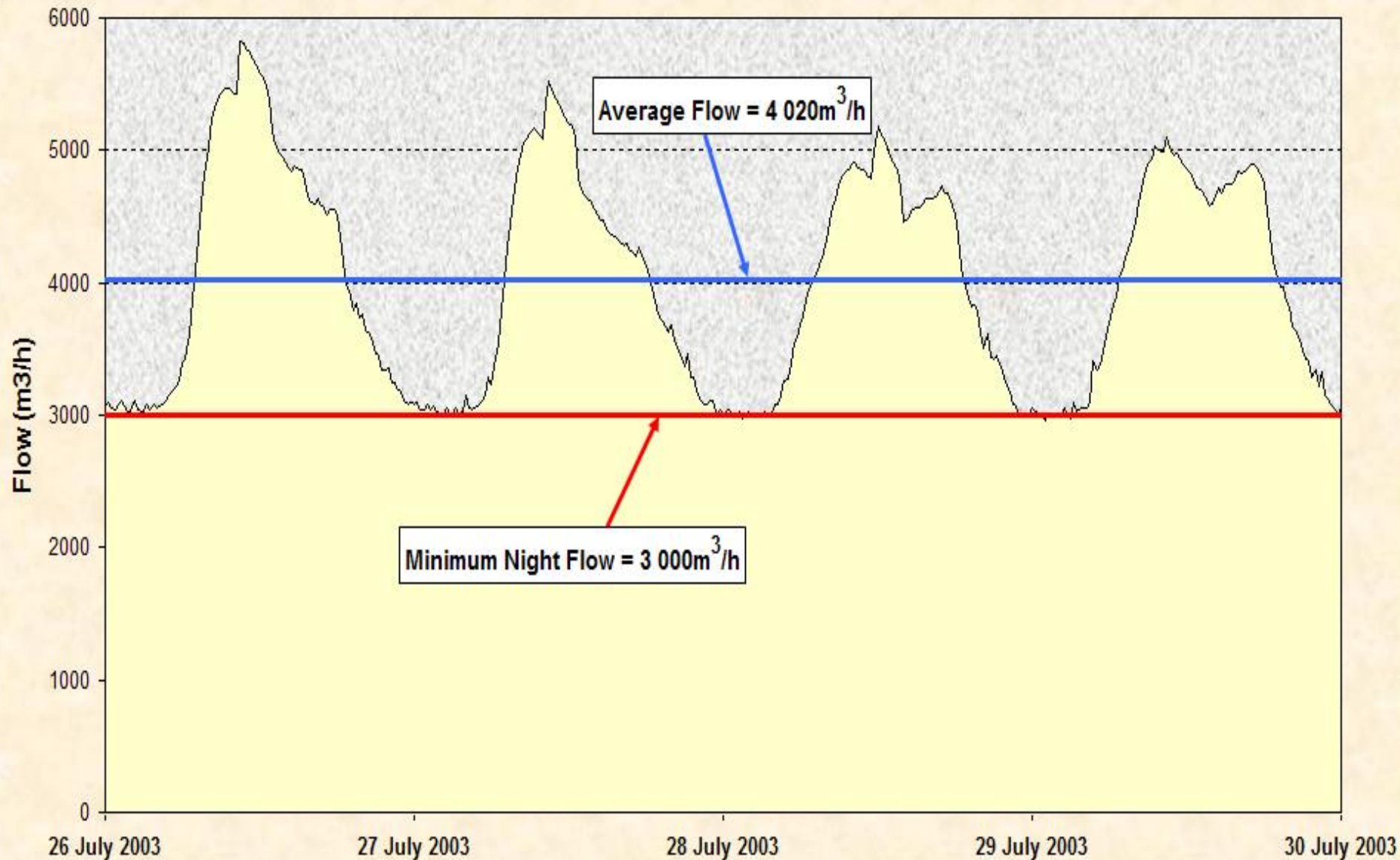
Photo Courtesy Tertius de Jager: City of Cape Town

Sebokeng Evaton Case Study



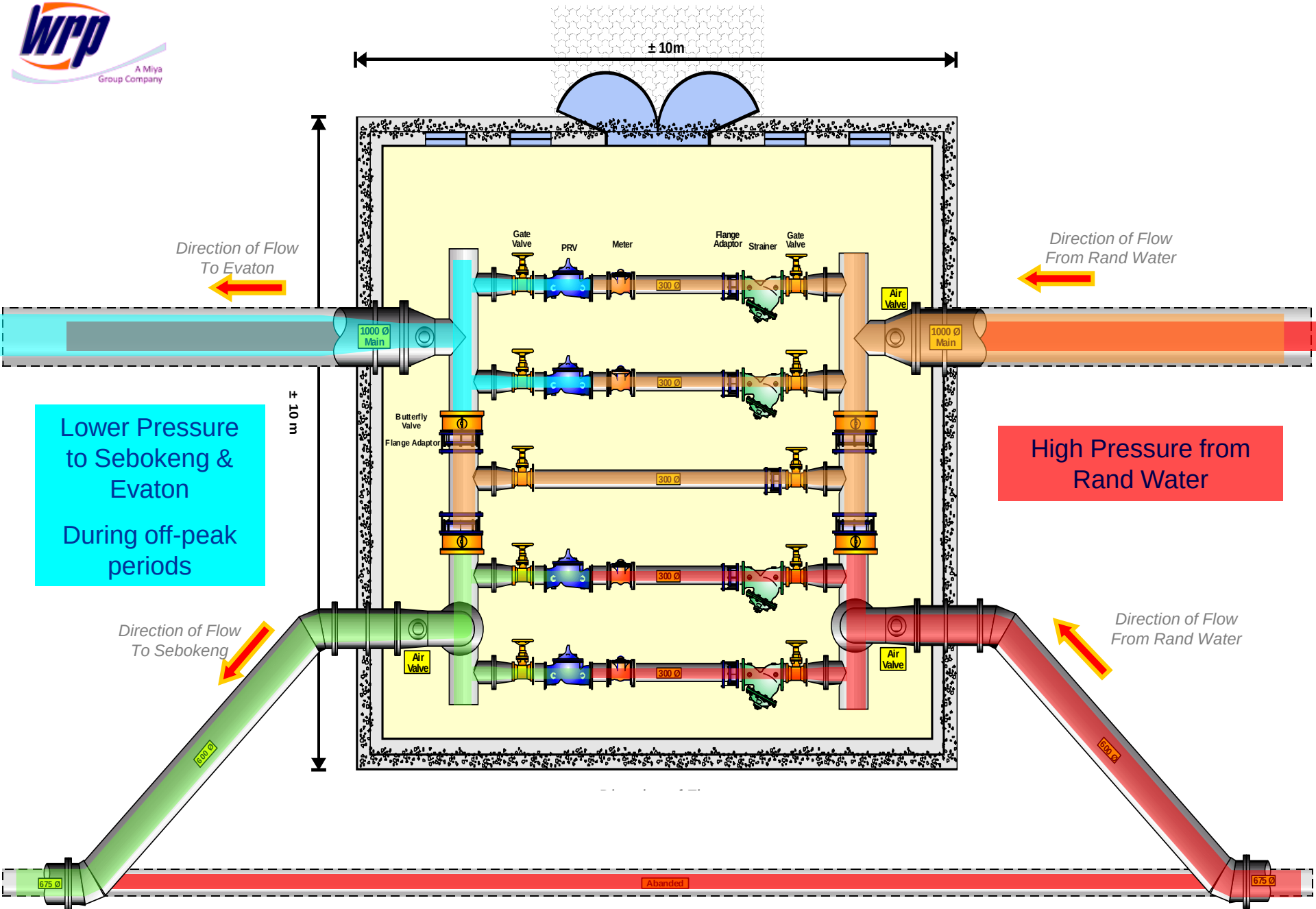
Sebokeng / Evaton Water Loss Reduction Project

Initial Flow Logging Results (July 2003)



3 000 m³/hr = ± 2 swimming pools/hr



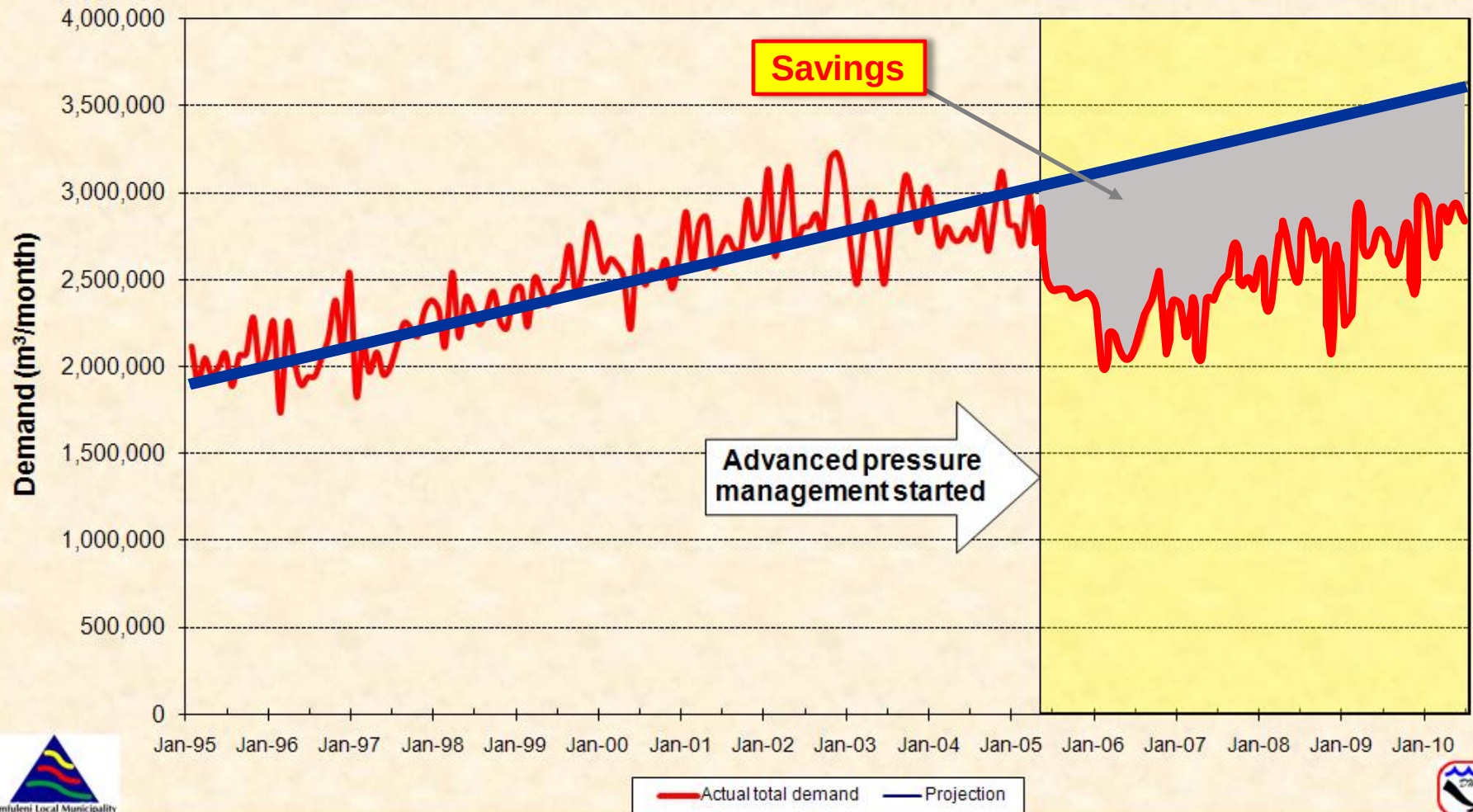


Consumption History for 15 Year Period



SEBOKENG / EVATON CONSUMPTION HISTORY

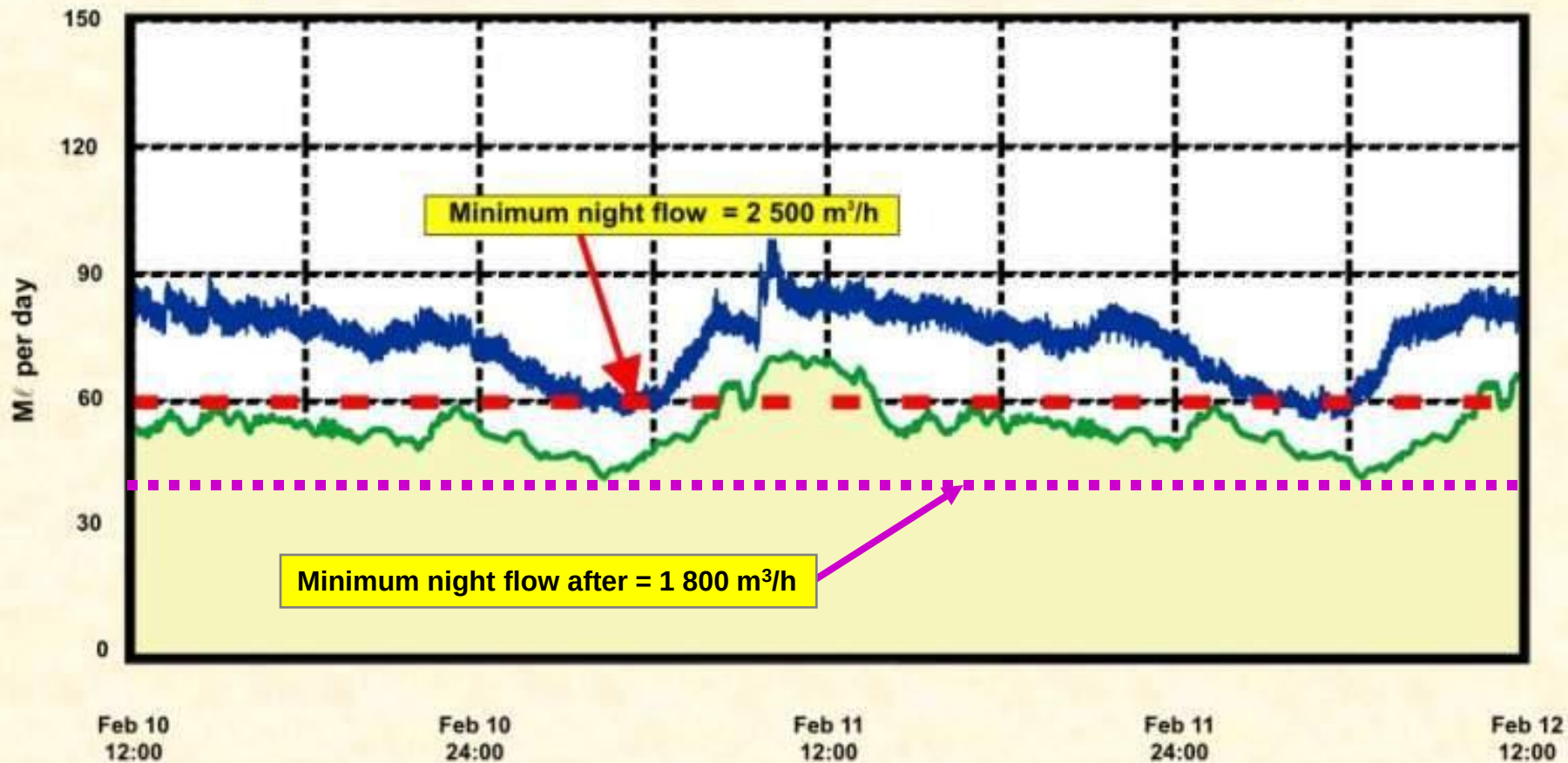
Savings over 5 years = ± 50 million m^3 = $\pm$ R152 million ($\pm$ \$ 20 million)



Savings Achieved for 5 Years

Year	Water Use		Saving		
	Expected	Actual	m3	Rands	US\$
Months 1 to 6	18,721,000	14,614,000	4,107,000	11,499,600	1,691,118
Months 7 to 12	18,751,000	12,785,930	5,965,070	16,702,196	2,456,205
Months 13 to 18	19,403,000	13,886,451	5,516,549	16,218,654	2,316,951
Months 19 to 24	19,423,000	13,877,370	5,545,630	16,304,152	2,329,165
Months 25 to 30	20,086,000	15,269,040	4,816,960	14,788,067	2,112,581
Months 31 to 36	20,206,000	15,633,153	4,572,847	14,038,640	2,005,520
Months 37 to 42	20,769,000	15,870,850	4,898,150	15,918,988	1,768,776
Months 42 to 48	20,766,000	15,692,825	5,073,175	16,487,819	1,831,980
Months 49 to 54	21,452,000	16,479,970	4,972,030	16,159,098	1,901,070
Months 55 to 60	21,438,000	16,874,423	4,563,577	14,831,624	1,744,897
Total Months 1 to 60	201,015,000	150,984,012	50,030,988	152,948,838	20,158,263

Sewerage treatment plant reduced inflow









Mitchells Plain Pressure Management Project



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Information and photographs courtesy Niel Meyer and City of Cape Town



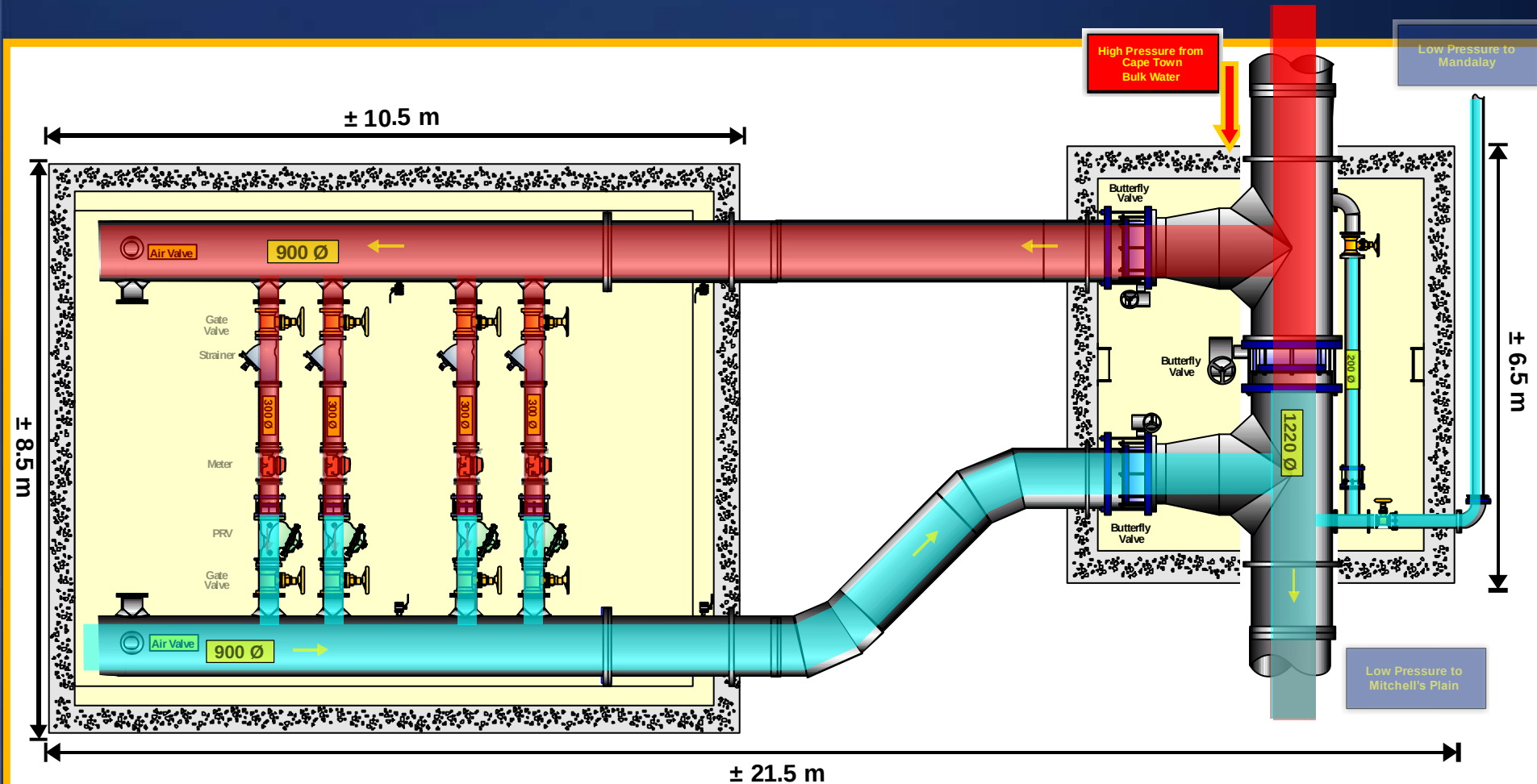
Photo: Courtesy Niel Meyer



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Chamber details for 1220 mm Ø by-pass chamber and PRV Chamber



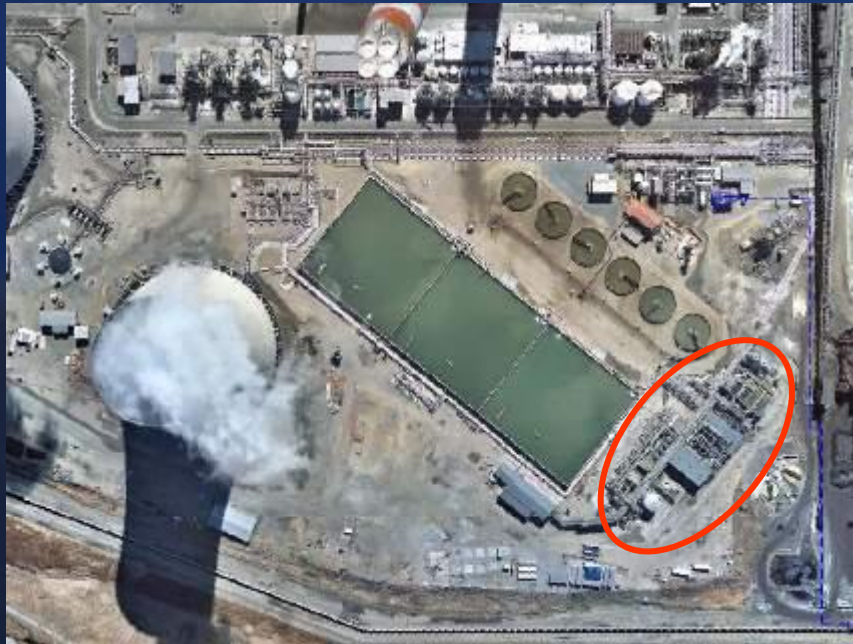
Summary of Savings from 4 Cape Town Installations

Area	Water Savings (million m ³ /yr)	Cost to Construct (Rand)	Value of Savings @R3/ m ³ (R/ year)
Khayelitsha	9 million m ³ /yr	2.7 mill (2001)	R 27 million/yr
Mfuleni	0.4 million m ³ /yr	1.5 mill (2007)	R 1.2 million/yr
Gugulethu	1.6 million m ³ /yr	1.5 mill (2008)	R 4.8 million/yr
Mitchells Plain	2.4 million m ³ /yr	7.7 mill (2009)	R 7.2 million/yr
Total	13.4 mill m³/year	13.4 mill	± R40 million/yr ± \$5 million/yr

Sasol Synfuels, Secunda, South Africa

160 000 barrels/day coal-to-fuels & chemicals facility





Cooling tower blow-down recovery plant:

- Softening, ultra-filtration membranes, reverse-osmosis membranes, ion-exchange
- Capital cost: R 500 mil
- O&M cost: R 20 / m³
- Saving: 18 Mℓ/d

Slide Courtesy Andries Meyer : Presented Turkey World Water Forum March 2009

Sebokeng, Gauteng province, South Africa

Population: > 500 000 people



Water use: $\pm 100 \text{ Ml/d}$

- Minimum night flow > $\pm 60\%$ daily maximum flow*
- Widespread leaks in distribution system & home plumbing systems*

Comparison of Pressure Management with another WDM initiative in same supply area (Equivalent Water ?)

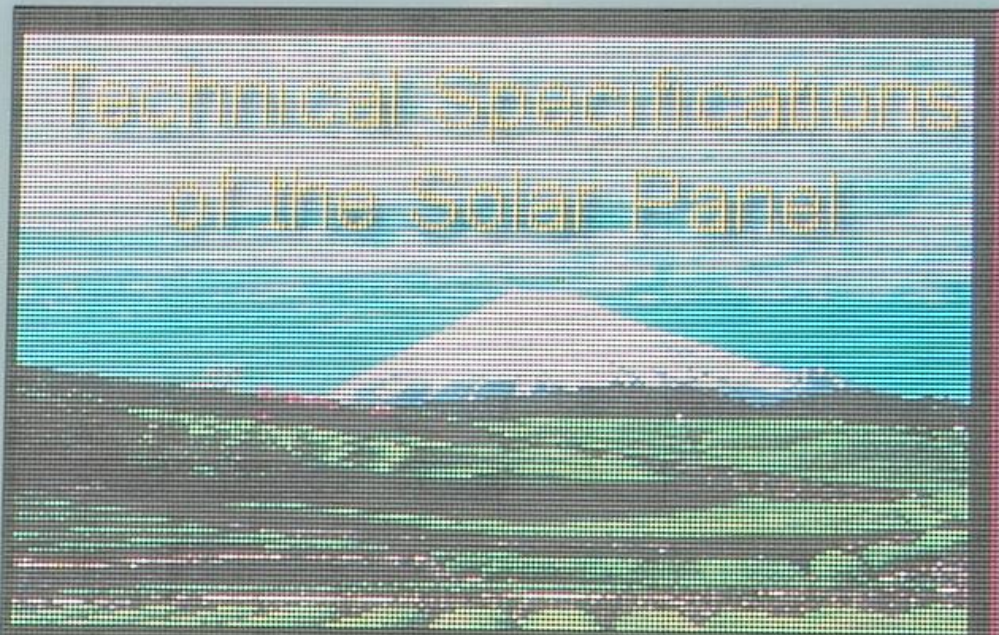
	<i>Direct operations saving (Sasol initiative)</i>	<i>Catchment saving (Private initiative)</i>
<i>Water savings from Vaal River</i>	<i>18 Mℓ/d</i>	<i>28 Mℓ/d</i>
<i>Capital cost</i>	<i>R 500 mil (± \$70 mil)</i>	<i>R 5 mil (± \$700 000)</i>
<i>Unit capital cost</i>	<i>R 28 mil/Mℓ (± \$4 mil) (100%)</i>	<i>R 180 000 /Mℓ (± \$30 000) (0.6%)</i>
<i>Operating & Maintenance cost</i>	<i>R 20 / m3 (± \$3/m3) (100%)</i>	<i>R 0.14 / m3 (\$0.02/m3) (0.7%)</i>

CO2 Savings The Japanese Embassy Case Study





Technical Specifications
of the Solar Panel



Total Installation Cost: R8 Million

Technical Specifications of the Solar Panel

We estimate that

90 Tonnes

of CO₂ emissions will be
saved annually by using
these solar panels.

Comparison of Japanese Embassy Solar Panels with Pressure Management Installation

	<i>Japanese Embassy Solar Panels</i>	<i>Sebokeng Pressure Management Installation</i>
<i>Capital Cost</i>	<i>R 8 Million</i>	<i>R 5 Million</i>
<i>CO2 Saved Annually</i>	<i>90 Tonnes</i>	<i>13 000 Tonnes</i>
<i>Value of CO2 saved at R165/tonne</i>	<i>R 14 850/annum</i>	<i>R 2 145 000/annum</i>





Thank You



There's no life without water !