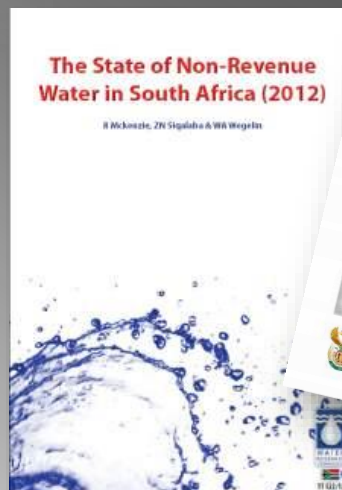




2015

BENCHMARKING OF WATER LOSS, WATER USE EFFICIENCY AND NON-REVENUE WATER IN SOUTH AFRICAN MUNICIPALITIES (2004/05 to 2012/13)



water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA



EXECUTIVE SUMMARY

The “National Development Plan – 2030” (NDP) states that reducing growth in water demand is just as important as increasing its supply. The NDP assumes it is possible to achieve an average reduction in water demand of **15% below baseline levels** (“business as usual levels”) **in urban areas by 2030**. Detailed targets have been set for different areas through the Reconciliation Strategies and the All-Town Studies. The NDP also calls for a dedicated national water conservation and water demand management (WCWDM) programme by 2012, with clear national and local targets for 2017 and 2022.

The Second Edition of the National Water Resource Strategy (NWRS2) builds on the first National Water Resource Strategy (NWRS1) published in 2004. The purpose of the NWRS2 is to ensure that national water resources are protected, used, developed, conserved, managed and controlled in an efficient and sustainable manner. In light of the urgency to protect our water resources and the adverse effects of climate change, **the NWRS2 submits that WCWDM should be one of the top priorities, and measures to reconcile demand and supply** in order provide for all our goals of a better life for all through job creation and economic growth.

Progress made with the implementation of WCWDM can only be measured against an accurate baseline. The first comprehensive baseline assessment, of non-revenue water (NRW) and water losses in South Africa, was made in 2012 with the publication of the *The State of Non-revenue water in South Africa (2012)* (WRC, Report TT522/12). Key results from this report included:

- 36 of 237 (15%) municipalities have never submitted any water loss information in 6 years;
- 107 of 237 (45%) municipalities have submitted poor or erratic water loss information which tend to be of little value;
- 94 of 237 (40%) municipalities maintain a reasonable to very good water balance;
- The national non-revenue water for 132 (54%) municipalities is 36.8%, which is in line with an international average of 36.2%;
- The national average water consumption is 238 litres / capita /day, which is high compared to the international average of 178 litres / capita /day;
- The volume non-revenue water for the country represents 1 580 million m³ and has been increasing over the past 6 years; and

Reporting by all municipalities is therefore very important as it facilitates transparency, awareness, provides management information for decision support systems and provides warning mechanisms for councils, officials, business, industry, residents and DWS to monitor water security, improve municipal performance and improve efficiency among consumers.

The 2012/13 data included in this report is mainly based on the first order No Drop assessment that was undertaken in 2014 as part of the 2014 Blue Drop Assessment, at all municipalities in South Africa. The No Drop component focussed on three (3) key performance areas, namely water balance, strategy and planning, and performance and compliance. The first order No Drop assessment **is not a certification process**, but serves to measure a municipality’s knowledge of its status and is considered the **first audited NRW / water loss data set**.

Conclusions and Recommendations

The **Eastern Cape** has managed to maintain leakage levels and per capita consumption in the past 5 years but, especially with the looming drought situation, there is significant scope for improvement in reporting levels, data accuracy and a reduction of NRW and water losses.

The **Free State** has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 270 l/c/d. Leakage levels fluctuate considerably and it is difficult to assess if any progress is made with the reduction of NRW and water losses. WCWDM must be implemented as a matter of priority, considering that water restrictions have already been imposed in Mangaung metro. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

Gauteng has been unable to reduce their demand in the past 9 years, although water use efficiency seems to have been improving in the past 5 years. NRW and water loss levels have come down, which is commendable, but WCWDM implementation levels must be elevated to ensure the targets of the Greater Vaal reconciliation strategy are achieved. There is significant scope for improvement in the reduction of system input volume, NRW, water losses and efficiency. Data accuracy and reporting are excellent at metro-level but can improve for some of the smaller municipalities.

KwaZulu Natal has managed to maintain their system input, leakage levels and per capita consumption in the past 5 to 6 years. There is however, significant scope for improvement in the reduction of system input, NRW and water losses in the province and WCWDM implementation levels must be elevated to ensure the targets of the KZN Metropolitan areas reconciliation strategy are achieved, especially with the looming / imposed water restrictions in the province. Data accuracy and reporting are excellent at metro and secondary city level but there is significant scope for improvement in reporting levels and data accuracy for the smaller municipalities.

The **Limpopo** province has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 205 l/c/d. Leakage levels and NRW are also consistently increasing and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

The **Mpumalanga** province has been unable to reduce their demand in the past 8 years with some signs of improvement in 2013, although this requires further investigation. NRW and water losses have reduced slightly over the past 8 years despite a significant increase in the system input volume and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

The **North West** province has been unable to reduce their demand in the past 9 years and have shown significant growth in the past 2 years. NRW have reduced slightly in the past year but water losses are consistently increasing. WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

Northern Cape has managed to maintain their system input, NRW and per capita consumption in the past 5 to 6 years. Increased efforts are required by municipalities to implement WCWDM to ensure targets are achieved and water restrictions are mitigated in the driest province. There is

significant scope for improvement in reporting levels, data accuracy and a reduction of system input, NRW and water losses in the province.

Municipalities in the **Western Cape** have been doing well to maintain their system input volume for the past 3 to 4 years, while reducing their water losses and per capita consumption. Municipalities must continue their current trends and increase their efforts to implement WCWDM.

Nationally, the system input volume has been consistently increasing since 2006 but the NRW has been improving since 2011 and water losses since 2009. Per capita consumption has remained almost constant over the past 9 years, which is commendable, but WCWDM efforts must be elevated considering these figures are significantly above international benchmarks of approximately 180 l/c/d and the country is one of the 30 driest in the world.

The reduction in non-revenue water is encouraging but the figures are highly influenced by the metros that have made considerable progress to reduce their non-revenue water while there is significant scope for improvement in most of the other municipalities. The reduction in water losses is mainly due to the shift of water losses to unbilled consumption in the water balance. This shift emphasises the extent of leakage on private properties and the need for metering and billing systems, mechanisms to control consumer demand, the War-on-Leaks programme and consumer education and awareness.

Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM may be measured. WCWDM must be implemented as a matter of urgency in all provinces, especially with the looming and reported droughts in the country. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input, NRW, water losses and improved efficiency across the country.

ACKNOWLEDGEMENTS

Research funded by: Strategic Partners Network (SWPN-SA)

Researchers: Marlene van der Merwe-Botha, Willem Wegelin, Tony Ceronio

TABLE OF CONTENTS

	Page
1 INTRODUCTION.....	1
1.1 BACKGROUND	1
1.2 OBJECTIVES.....	2
1.3 IWA WATER BALANCE.....	2
1.4 WATER BALANCE SHEET	4
1.5 MUNICIPAL CATEGORISATION	8
2 LITERATURE REVIEW	10
2.1 INTRODUCTION.....	10
2.2 WRC 2002 ASSESSMENT	10
2.3 WRC 2005 ASSESSMENT	11
2.4 WRC 2007 ASSESSMENT	12
2.5 WRC / DWS 2012 ASSESSMENT	12
2.6 DWS 2013 METRO ASSESSMENT	13
2.7 DWS 2013 SECONDARY CITIES ASSESSMENT	14
2.8 DWS 2014 NATIONAL ASSESSMENT	15
2.9 DWS 2014 NATIONAL ASSESSMENT (UPDATE)	15
2.10 NO DROP 2015 NATIONAL FIRST ORDER ASSESSMENT	16
2.11 NO DROP 2015 FULL METRO ASSESSMENT	17
2.12 OTHER SOURCES OF INFORMATION	18
3 WATER BALANCE TRENDS.....	19
3.1 EASTERN CAPE PROVINCE	19
3.2 FREE STATE PROVINCE.....	21
3.3 GAUTENG PROVINCE.....	22
3.4 KWAZULU NATAL PROVINCE.....	24
3.5 LIMPOPO PROVINCE	26
3.6 MPUMALANGA PROVINCE	28
3.7 NORTH WEST PROVINCE.....	30
3.8 NORTHERN CAPE PROVINCE.....	32
3.9 WESTERN CAPE PROVINCE	34
3.10 NATIONAL WATER BALANCE TRENDS	35
6 CONCLUSIONS AND RECOMMENDATIONS.....	38
Appendix A : Municipal water balance scorecards	

ACRONYMS

BD	Blue Drop
DWS	Department of Water and Sanitation
CARL	Current Annual Real Losses
GD	Green Drop
ILI	Infrastructure Leakage Index
IWA	International Water Association
KPA	Key Performance Area
KPI	Key Performance Indicator
MNF	Minimum Night Flow
ND	No Drop
NDP	National Development Plan (2011)
NWRS2	National Water Resource Strategy 2 (2013)
NRW	Non-Revenue Water
RPMS	Regulatory Performance Management System
SIV	System Input Volume
SLA	Service Level Agreement
SWPN	Strategic Water Partners Network
UARL	Unavoidable Annual Real Losses
WCWDM	Water Conservation Water Demand Management
WSA	Water Services Authority
WSP	Water Services Provider
WTW	Water Treatment Works
WUE	Water Use Efficiency
WUL	Water Use License

1 INTRODUCTION

1.1 BACKGROUND

The “National Development Plan – 2030” (NDP) states that reducing growth in water demand is just as important as increasing its supply. The NDP assumes it is possible to achieve an average reduction in water demand of **15% below baseline levels** (“business as usual levels”) **in urban areas by 2030**. Detailed targets have been set for different areas through the Reconciliation Strategies and the All-Town Studies. The NDP also calls for a dedicated national water conservation and water demand management (WCWDM) programme by 2012, with clear national and local targets for 2017 and 2022.

The Second Edition of the National Water Resource Strategy (NWRS2) builds on the first National Water Resource Strategy (NWRS1) published in 2004. The purpose of the NWRS2 is to ensure that national water resources are protected, used, developed, conserved, managed and controlled in an efficient and sustainable manner. The NWRS2 acknowledges that South Africa is a water-stressed country and is facing a number of water challenges and concerns, which include security of supply, environmental degradation and resource pollution, **and the inefficient use of water**. In light of the urgency to protect our water resources and the adverse effects of climate change, **the NWRS2 submits that WCWDM should be one of the top priorities, and measures to reconcile demand and supply** in order provide for all our goals of a better life for all through job creation and economic growth.

Progress made with the implementation of WCWDM can only be measured against an accurate baseline. The first comprehensive baseline assessment, of non-revenue water (NRW) and water losses in South Africa, was made in 2012 with the publication of the *The State of Non-revenue water in South Africa (2012)* (WRC, Report TT522/12). Key results from this report included:

- 36 of 237 (15%) municipalities have never submitted any water loss information in 6 years;
- 107 of 237 (45%) municipalities have submitted poor or erratic water loss information which tend to be of little value;
- 94 of 237 (40%) municipalities maintain a reasonable to very good water balance;
- The national non-revenue water for 132 (54%) municipalities is 36.8%, which is in line with an international average of 36.2%;
- Non-revenue water for the country ranges from 30.5%, for municipalities with a small town as core, to 72.5% for rural municipalities;
- The national average water consumption is 238 litres / capita /day, which is high compared to the international average of 178 litres / capita /day;
- Metropolitan and secondary city municipalities represent 59% of the urban consumption and approximately 50% of the population;
- The volume non-revenue water for the country represents 1 580 million m³ and has been increasing over the past 6 years; and
- The results from the WRC scorecard indicate that water conservation and water demand management are not sufficiently addressed.

Reporting by all municipalities is therefore very important as it facilitates transparency, awareness, provides management information for decision support systems and provides warning mechanisms

for councils, officials, business, industry, residents and DWS to monitor water security, improve municipal performance and improve efficiency among consumers.

To improve NRW, water losses and efficiency in the municipal environment, the Minister of Water and Sanitation introduced the No Drop Certification Programme for water use efficiency and water loss management on 21 May 2013 during her Budget Vote Speech. The No Drop Certification Programme is an incentive-based regulation programme, inspired by the Blue Drop Certification Programme for drinking water quality management regulation and the Green Drop Certification Programme for wastewater services regulation.

The 2012/13 data included in this report is mainly based on the first order No Drop assessment that was undertaken in 2014 as part of the 2014 Blue Drop Assessment, at all municipalities in South Africa. The No Drop component focussed on three (3) key performance areas, namely water balance, strategy and planning, and performance and compliance. The first order No Drop assessment **is not a certification process**, but serves to measure a municipality's knowledge of its status and is considered the **first audited NRW / water loss data set**.

1.2 OBJECTIVES

The key objectives of this study were as follows:

- Update the report on *The State of Non-Revenue Water in South Africa (2012)* (WRC, Report TT522/12) with the latest available information from previous studies and the No Drop programme into a single national NRW / water loss data base. The WRC study captured water balance information from 2004/05 to 2009/10 municipal financial years.
- Report on NRW / water loss trends, based on 2004/05 to 2012/13 municipal financial year data;
- disseminate NRW / water loss benchmarking information in municipalities, government organisations and consumers throughout South Africa to create awareness.

This report does not attempt to repeat the results from the 3% Municipal No Drop audit for 2012/13 which is captured in detail in the report "No Drop Report - First Order Assessment on the Status of Water Loss, Water Use Efficiency And Non-Revenue Water in Municipalities". The values in this report, for 2012/13, differ slightly from the figures presented in the No Drop report due to the larger number of data sets.

1.3 IWA WATER BALANCE

The modified International Water Association (IWA) water balance was accepted as the standard reporting format for NRW and water losses in South Africa in the late 1990s. The IWA water balance is now generally accepted throughout most countries in the world as the most standard, robust and comprehensive approach to report on NRW / water losses. The IWA water balance was slightly modified for South Africa to include free basic water.

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Free basic
			Billed Unmetered Consumption	Revenue Water
	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	

Modified IWA water balance

- *System input volume (SIV)* represents the potable volume input to the water supply system from the water utility's own sources, as measured at the water treatment works (WTW) outlet, allowing for all known errors (i.e. errors on bulk water meters) as well as any water imported from other sources, also corrected for known bulk metering errors;
- *authorised consumption* is the volume of metered and / or unmetered water used by registered customers, the water utility and others who are implicitly or explicitly authorised to do so by the water utility, for residential, commercial and industrial purposes;
- *water losses* is the sum of the physical and commercial losses and is calculated as the difference between the SIV and the authorised consumption. In most countries, water losses are also considered to be unaccounted for water (UFW) although the exact definition of UFW can vary from country to country;
- *billed authorised consumption* is effectively the revenue water, and is the volume of authorised metered and unmetered consumption which is billed by the water utility and paid for by the customer;
- *unbilled authorised consumption* is the volume of authorised metered and unmetered consumption that is not billed or paid for;
- *commercial losses or apparent losses* are made up from the unauthorised consumption (theft or illegal use), plus all technical and administrative inaccuracies associated with customer metering. If commercial losses are reduced, generally more revenue will be generated by and for the water utility;
- *real losses* are the physical water losses from the pressurised system, up to the point of measurement of customer use. In most cases, real losses represent the unknown component in the overall water balance. The purpose of most water balance models is therefore to estimate the magnitude of real losses so that the water utility can gauge whether or not it has a serious leakage problem. Real losses are generally calculated as the difference between total losses and estimated commercial losses; and

- NRW is the volume of water supplied by the water utility but for which it receives no income. NRW incorporates unbilled (metered or unmetered) authorised consumption, apparent / commercial losses and real / physical losses.

Once the water balance has been calculated, various KPIs can be calculated to measure the performance of the water supply system. With the water balance and KPIs available, the water utility can determine which components must be targeted first to improve efficiency, reduce commercial losses, physical losses or NRW. Once the main water loss contributing components have been identified and quantified, it is important to identify the most effective WCWDM intervention to address these losses. It is therefore important to obtain a clear understanding of what impact various WCWDM interventions would have to ensure that targets are achieved.

1.4 WATER BALANCE SHEET

A two-page water balance sheet is included in **Appendix A** for each municipality. Cognisance should be taken of the following:

- All information was provided by the respective municipalities or Water Services Authority unless otherwise indicated.
- The water balance sheet is divided into four sections to ease the capturing and display of information. The four sections include input data, water balance calculations, key performance indicators and graphics.
- White cells require an input value, while yellow cells are calculated. The municipality is required to provide only 15 values per annum to complete the sheet. The 15 values are split between basic information, such as the population served, and the water balance information. The basic information is used to calculate key performance indicators. The water balance component follows the format of the IWA water balance.
- All volumes are in kℓ/annum ($k\ell = m^3 = 1000$ litres) and based on the municipal financial year (July to June). Data for “Year ending - Jun-05” therefore means water supply and demand figures from July 2004 to June 2005.
- All underlined values were calculated using trends and / or averages based on previous years.
- The last two columns indicate the 2017 and 2022 targets in line with the NDP requirements. The targets were obtained from the relevant reconciliation and all town strategies, unless otherwise indicated.
- Targets could not be obtained for all municipalities and were therefore excluded from the analysis. Further discussions, evaluation, interpretation, monitoring and analysis would be required to comment on the progress made with the implementation of WCWDM.
- The provincial and district water balances are based on the sum of the municipalities located within the province or district.

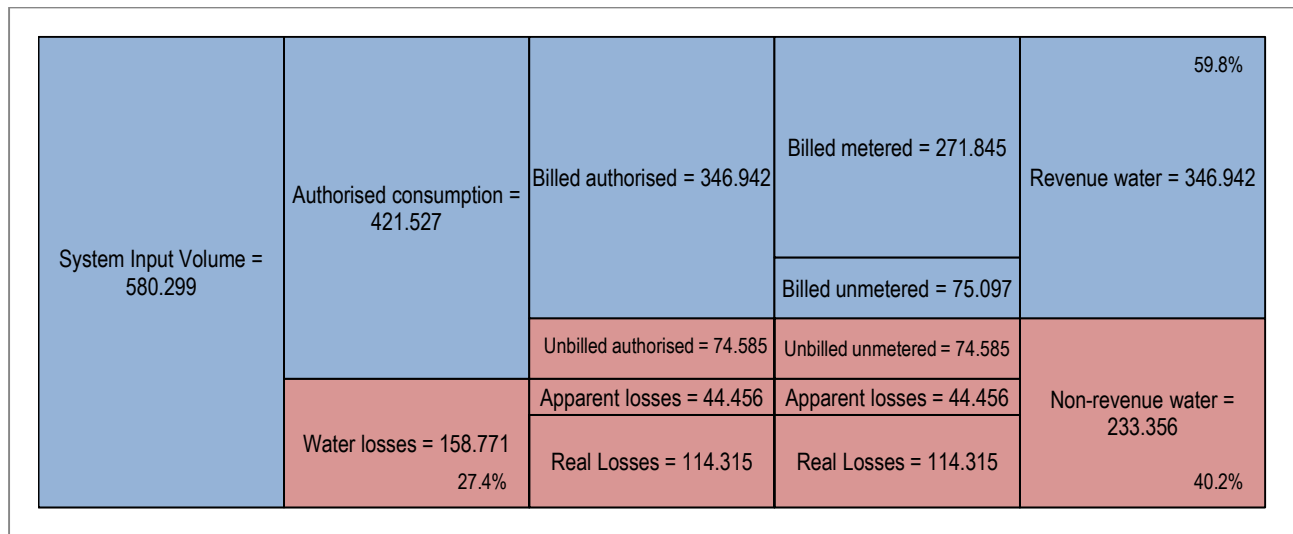
Province	Gauteng	WSA
Municipal Code	ABC	Yes
District Municipality		Category

Municipality		EXAMPLE					B
Settlements						Target	Target
		Year ending	Jun-05	-----	Jun-13	Jun-17	Jun-22
Input Data	Population served	No	2 615 798	2 705 495	3 296 125	<u>3 465 058</u>	<u>3 590 783</u>
	Households served	No	824 826	853 114	1 122 991	<u>1 182 582</u>	<u>1 296 760</u>
	Connections - total	No	377 263	378 727	596 487	535 993	555 440
	Connections - metered	No	377 263	378 727	516 038	463 511	480 329
	Domestic	No	377 263	378 727	516 038	<u>463 511</u>	<u>480 329</u>
	Non-domestic	No					
	Connections - unmetered	No			80 449	<u>72 482</u>	<u>75 111</u>
	Households / connection	No	2.2	2.3	1.9	2.2	2.3
	Length of mains	km	<u>8 384</u>	<u>8 416</u>	<u>13 255</u>	<u>11 911</u>	<u>12 343</u>
	Connections / km	No / km	45	45	45	45	45
	Average system pressure	m	50	50	50	50	50
	Time system pressurised	%	100%	100%	100%	100%	100%
	Apparent losses	%	20%	20%	49%	48%	48%
	Consumer meter age	%	6%	6%	20%	20%	20%
	Illegal connections	%	6%	6%	12%	12%	12%
	Data transfer	%	8%	8%	<u>17%</u>	16%	16%
Water Balance Calculations	System input volume	kl/annum	282 970 013	288 375 444	346 582 721	348 393 260	382 366 221
	Own sources	kl/annum					
	Other sources	kl/annum	282 970 013	288 375 444	346 582 721	<u>348 393 260</u>	<u>382 366 221</u>
	Authorised Consumption	kl/annum	215 700 847	235 004 771	236 369 415	255 000 000	299 000 000
	Billed authorised	kl/annum	215 700 847	235 004 771	206 909 884	240 000 000	284 000 000
	Billed metered	kl/annum	215 700 847	235 004 771	206 909 884	240 000 000	284 000 000
	Domestic	kl/annum	215 700 847	235 004 771	206 909 884	240 000 000	284 000 000
	Non-domestic	kl/annum					
	Export volume	kl/annum					
	Billed unmetered	kl/annum					
	Unbilled authorised	kl/annum	0	0	29 459 531	15 000 000	15 000 000
	Unbilled metered	kl/annum					
	Unbilled unmetered	kl/annum			29 459 531	15 000 000	15 000 000
	Water Losses	kl/annum	67 269 166	53 370 673	110 213 306	93 393 260	83 366 221
	Commercial / Apparent loss	kl/annum	13 453 833	10 674 135	54 004 520	44 828 765	40 015 786
	Physical / Real losses	kl/annum	53 815 333	42 696 538	56 208 786	48 564 495	43 350 435
	UARL	kl/annum	8 262 060	8 294 121	13 063 065	11 738 237	12 164 143
	Potential real loss saving	kl/annum	45 553 273	34 402 417	43 145 721	36 826 258	31 186 292
	Revenue water	kl/annum	215 700 847	235 004 771	206 909 884	240 000 000	284 000 000

	Non-Revenue water	kl/annum	67 269 166	53 370 673	139 672 837	108 393 260	98 366 221
	Projected SIV without WDM	kl/annum			345 311 163	372 815 299	410 073 755
	Projected SIV with WDM	kl/annum			335 951 252	348 393 260	382 366 221
Source of information			DWA NIS Municipality	DWA NIS Municipality	DWA NIS Vaal Recon	DWA NIS Vaal Recon	IVRS Recon Study
Comments							
Note : All underlined values have been calculated using trends and / or averages based on previous years.							
Year ending			Jun-05		Jun-13	Jun-17	Jun-22
Key performance indicators	Indicator as % of system input volume						
	% Revenue water		76.2%	81.5%	59.7%	68.9%	74.3%
	% Non-revenue water		23.8%	18.5%	40.3%	31.1%	25.7%
	% Water Losses		23.8%	18.5%	31.8%	26.8%	21.8%
	System input volume unit consumption						
	Litres / capita / day		296	292	288	275	292
	m³ / household / month		29	28	26	25	25
	m³ / connection / month		63	63	48	54	57
	Authorised Unit Consumption						
	Litres / capita / day		226	238	196	202	228
	m³ / household / month		22	23	18	18	19
	m³ / connection / month		48	52	33	40	45
	Domestic m³ / connection / month		48	52	33	43	49
	Non-domestic m³ / connection / month						
	Water loss indicators						
	Litres / capita / day		70	54	92	74	64
	m³ / household / month		7	5	8	7	5
	m³ / connection / month		15	12	15	15	13
	UARL : Losses (litres / connection / day)		60	60	60	60	60
	CARL : Losses (litres / connection / day)		391	309	258	248	214
	Infrastructure Leakage Index (ILI)		6.5	5.1	4.3	4.1	3.6
	CARL : Losses (m³ / km mains / day)		18	14	12	11	10
	% Population growth			3.43%	-1.42%	0.40%	0.72%
	% Water demand growth			1.91%	2.31%	-2.29%	1.88%
	% Water demand growth without WDM				1.94%	1.93%	1.92%
	% Water demand growth with WDM				-0.82%	0.97%	1.88%
	5 Year Annualised Population Growth				2.92%	0.72%	0.72%
	5 Year Annualised Water Growth				1.74%	0.56%	1.88%

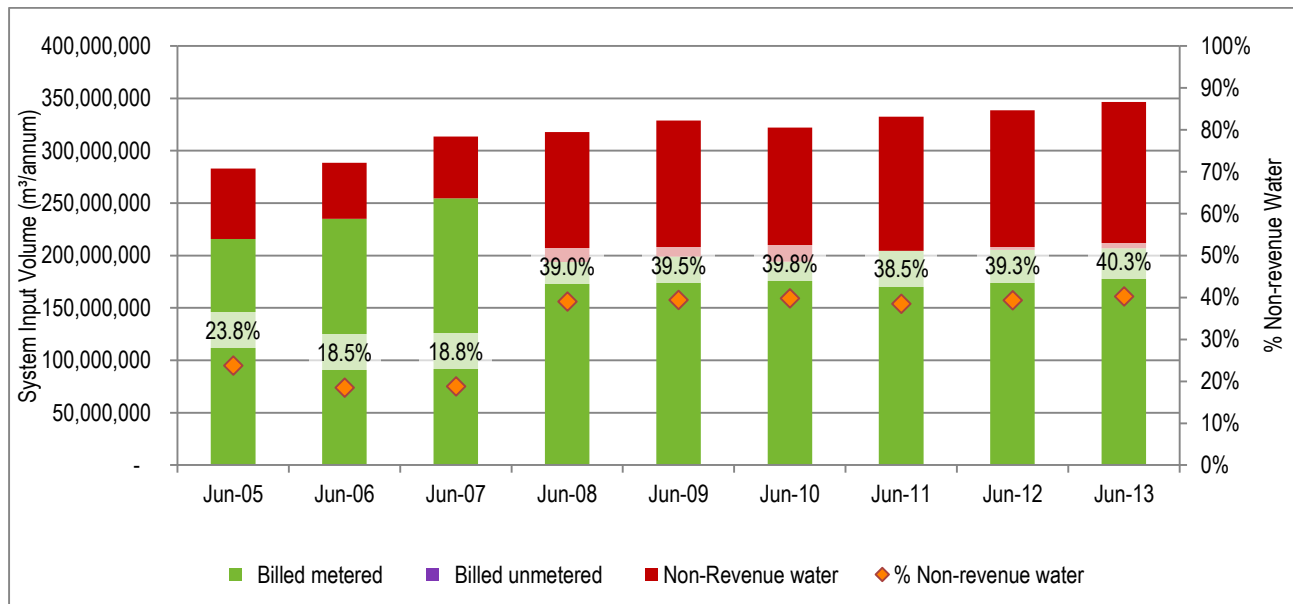
IWA Water Balance Diagram (million m³/annum)

The 2012/13 or latest realistic IWA water, with percentages for water losses, revenue and non-revenue water, is shown for each municipality.



Non-revenue water trend

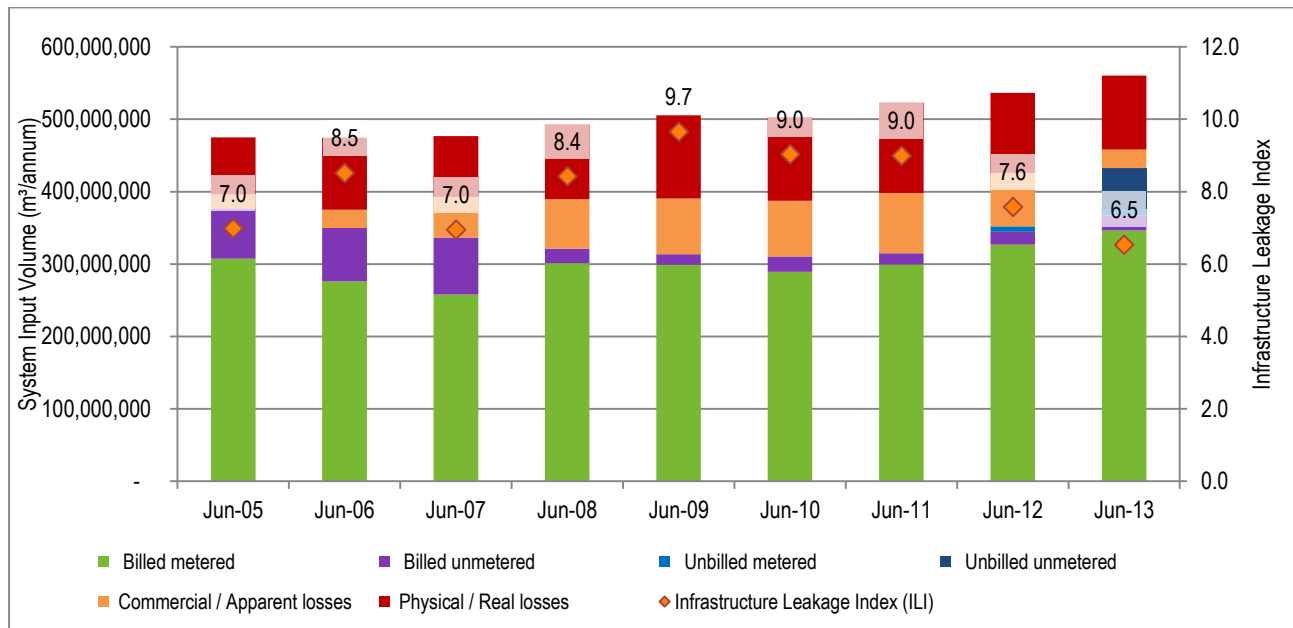
NRW consists of all unbilled authorised consumption and water losses. The NRW trend graph shows the increase or decrease in volume and percentage NRW. It also shows the projected demand with and without WCWDM as included in the recon or all town strategies, unless otherwise indicated.



Water losses trend

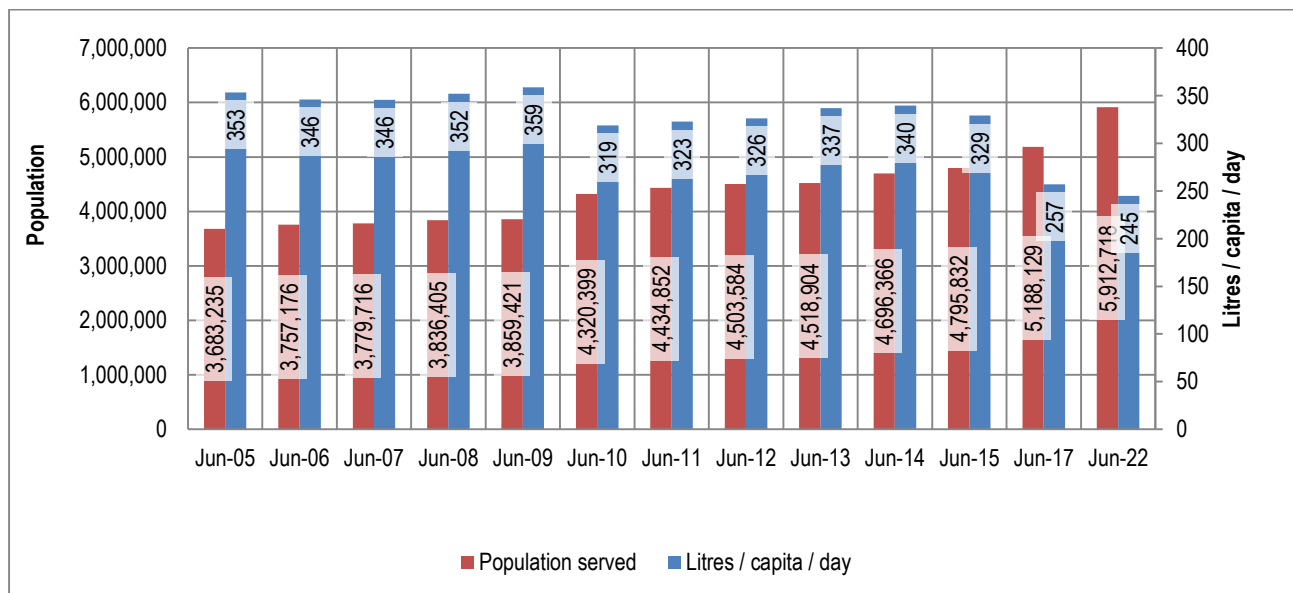
Water losses consist of apparent or commercial losses and real or physical losses and typically includes all losses on the municipal side (up to the consumer meter) of the reticulation system. Some municipalities do however, include internal plumbing losses as part of their water losses, although this should be indicated as unbilled authorised consumption. The water losses trend graph therefore

indicates the increase or decrease in volume, apparent or commercial losses and real or physical losses. The Infrastructure Leakage Index (ILI) which is an indication of the physical leakage is shown on the right-hand axis.



Population versus System Input Volume trend (litres / capita / day)

The per capita consumption (litres / capita / day) is based on the system input volume divided by the population served. The system input volume includes commercial and industrial demand.



1.5 MUNICIPAL CATEGORISATION

The data was categorised according to the Municipal Infrastructure Investment Framework (MIIF) and per province. The MIIF categorisation is as follows:

Category	Number	Short description	Long Description
A	8	Metros	Metropolitan municipalities
B1	19	Major cities	Secondary cities, local municipalities with the largest budgets
B2	27	Minor cities	Municipalities with a large town as core
B3	110	Rural dense	Municipalities with relatively small population and significant proportion of urban population but with no large town as core
B4	70	Rural scattered	Municipalities which are mainly rural with, at most, one or two small towns in their area

2 LITERATURE REVIEW

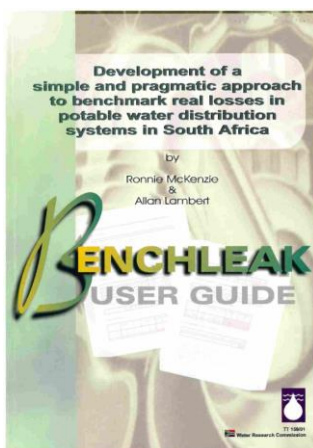
2.1 INTRODUCTION

Various previous assessments of Non-Revenue Water (NRW) have been undertaken in South Africa since the standard International Water Association (IWA) methodology was introduced in the late 1990s. The following details provide the background to the latest assessment, which is documented in this report.

- 2002 – Development of a simple and pragmatic approach to benchmark real losses in potable water distribution systems in South Africa. WRC Report TT 159/01 by Mckenzie and Lambert.
- 2005 – Benchmarking of Leakage from Water Reticulation Systems in South Africa. WRC Report TT 244/05 by Mckenzie and Seago.
- 2007 – Non-Revenue Water in South Africa. WRC Report TT 300/07 by Seago and Mckenzie.
- 2012 – The State of Non-revenue Water in South Africa (2012). WRC Report TT by Mckenzie, Sigalaba and Wegelin.
- 2013 - Metropolitan Municipality Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team.
- 2013 – Secondary City Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team.
- 2014 – National Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team.
- 2014 - A 2011/12 Assessment of Non-Revenue and Water Losses in South Africa by DWA Water Services Directorate: Planning and Information - Business Intelligence Team.
- 2015 - No Drop Report - First order assessment of water loss, water use efficiency and non-revenue water in municipalities, DWS and SWPN, Oct 2015.
- 2015 No Drop Report - The status of water loss, water use efficiency and non-revenue water in metropolitan municipalities, DWS and SWPN, Oct 2015.

These assessments each provided updated and more reliable information on municipal water use than the previous estimates, and in each case, the available database was expanded to include additional municipalities which had not previously provided any useful information.

2.2 WRC 2002 ASSESSMENT



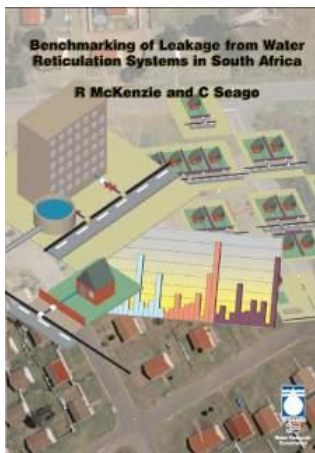
The 2002 assessment was fully described in the BENCHLEAK User Guide “**Development of a simple and pragmatic approach to benchmark real losses in potable water distribution systems in South Africa. WRC Report TT 159/01 by Mckenzie and Lambert**”, which was the first time that the IWA Water Balance Methodology had been presented officially to South African Municipalities through official WRC software.

One of the key recommendations made in the report was the adoption of certain standard terminology, which had been agreed by WCWDM specialists from around the globe. For example, it was recommended that the terms ‘Non-Revenue Water’ and ‘Water Losses’ should be used

in preference to the familiar (but often vague) term ‘Unaccounted-for-Water’ – since, with modern techniques, it is now possible to account for virtually all water entering a water distribution system. The use of percentages to express real losses was identified as a potential problem issue. It is widely recognised that percentages can be misleading when used as a measure of the efficiency of managing real losses (leakage and overflows) from distribution systems with different levels of consumption. It was recommended that, where possible, the alternative performance indicator namely the Infrastructure Leakage Index (ILI) should be used when quantifying Physical Leakage.

As part of this assessment, water balance calculations were completed for 34 water supply systems throughout South Africa, which covered a wide range of municipalities, from the largest in the country to many of the smaller towns. For each, a full water balance calculation was completed and various key indicators were calculated, full details of which are provided in the report. All data sets were presented anonymously in order to avoid the assessment being perceived in a negative light by those willing to provide information.

2.3 WRC 2005 ASSESSMENT



In 2005, the initial assessment undertaken for the WRC was repeated in order to verify or correct the information used in the previous assessment and to derive a more robust estimate of water losses in South African Municipalities. The assessment is fully documented in the 2005 report entitled “**Benchmarking of Leakage from Water Reticulation Systems in South Africa. WRC Report TT 244/05 by Mckenzie and Seago**”

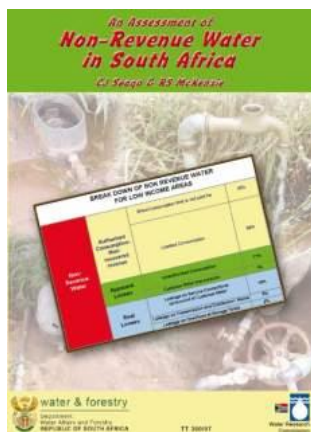
The study included assessment data from approximately 60 water supply systems and after careful screening the sample data set was reduced to 30 systems. For each system, various performance indicators were evaluated, which are presented in the report. For the purpose of leakage evaluation, it was agreed that the most reliable and meaningful indicator is the Infrastructure Leakage Index (ILI) and provides an indication of how effectively a utility is managing real losses under the current operating pressure regime.

From the 2005 assessment, it was concluded that:

- The information required to calculate the various performance indicators was often not available from the water suppliers, despite the fact that the information was very basic. It was noted that it was also often very difficult to get the water utilities to fill out the data request forms as they were either too busy or were unwilling to assist.
- It was noted that water supply systems in South Africa were often poorly metered with regard to both bulk and consumer metering.
- With regard to the ILI, it was noted that for South African conditions, it would be unusual to achieve an ILI value of below 2.0 and values in the order of 5.0 were common and represented systems in a reasonable condition.
- Based on the results from the final data set documented in the report, it was concluded that an average ILI value of 5.5 was appropriate for South African systems with more than 50 000 connections, 7.8 for systems with between 10 000 and 50 000 service connections and 5.0 for

systems with less than 10 000 connections. It was, however, noted that there was no clear correlation between the size of the system and the ILI value.

2.4 WRC 2007 ASSESSMENT



The 2007 assessment is fully described in the report titled **“Non-Revenue Water in South Africa. WRC Report TT 300/07 by Seago and Mckenzie”**. In this instance, one of the key objectives was to try to expand the useful data sets to cover as much of the country as possible and thereafter extrapolate the results to provide an indication of the overall water losses from municipal reticulation systems for the whole of South Africa.

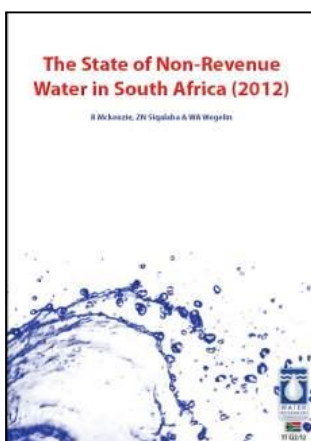
The total water losses (physical and commercial) for the 62 systems analysed was estimated to be 670 million m³/annum or 31% of the total water supplied. Estimating the un-billed consumption was difficult in many areas due to a lack of reliable information, however, it was estimated in

the cases where proper data were available and subsequently extrapolated to cover the whole country. The un-billed consumption was conservatively estimated to be approximately 104 million m³/annum, which in turn provides **an estimate of 774 million m³/annum for the Non-Revenue Water – approximately 36% of the water supplied.**

Based on the above figures, the extrapolated total water losses from water reticulation systems for the whole of South Africa were estimated to be in the order of 1150 million m³/annum (extrapolated from the 54% sample size). The total Non-Revenue Water for the whole country was estimated to be 1 430 million m³/annum (extrapolated from the 54% sample size). The fact that the majority of water utilities in South Africa were unable to provide basic data was highlighted as a reflection on the poor state of management of many utilities. To address this problem, it was recommended in the report that the various government departments took action to enforce an annual water audit for all utilities and that such audits were fully supported by the appropriate politicians.

This report is also the most comprehensive guideline for water balance calculations and recommended for anyone who would like to know more about the subject.

2.5 WRC / DWS 2012 ASSESSMENT



The 2012 study was the most comprehensive and detailed study of its type to date and expanded on the knowledge acquired previously and through collaborative efforts with the DWA Regional Offices in the data gathering process. The assessment is fully documented in the 2012 report entitled **“The State of Non-revenue Water in South Africa (2012) WRC Report TT by Mckenzie, Siqalaba and Wegelin”**.

The 2012 study captured all available data from all municipalities in South Africa from 2004/05 until 2009/10. Data gathered from a 132 useable data sets of the possible 237 municipalities throughout South Africa, representing over 75% of the total volume of municipal water supply, show

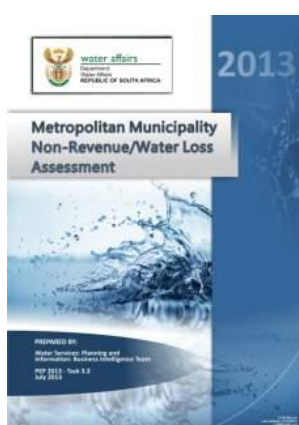
that the current level of Non-Revenue Water estimated for the country as a whole is 36.8%. While it is clear that there is significant room for improvement, it is also important to recognise that the South African figure is in line with the world average value of 36.6%. The world average ranges from over 70% in developing countries, such as Albania and Armenia, to below 10% in highly developed countries, such as Australia and New Zealand. Of this 25.4% is considered to be losses through physical leakage (real losses). Extrapolating the Non-Revenue Water data for the country, provides an estimated urban consumption of 4 292 million m³/annum and a national Non-Revenue Water volume of 1 580 million m³/annum. The national non-revenue water is approximately one-third of the water supplied and almost equal to the total Rand Water supply per annum with estimated value of more than R 7 billion per annum.

The average per capita consumption of 238 l/c/d for South Africa is high compared to the international gross average consumption of 173 l/c/d.

Based on various previous studies undertaken for the Department of Water and Sanitation, it is estimated that a realistic target for Non-Revenue Water of 25% is achievable over a period of 10 years if the required investment of approximately R 2 billion per annum is allocated to WCWDM interventions throughout all municipalities in South Africa. Although these figures are approximate estimates based on previous interventions and the associated results, they do provide a realistic estimate of the magnitude of investment needed as well as the appropriate period.

The percentage level of Non-Revenue Water appears to have risen gradually over the past 10 years from the date of the first assessment. It must be noted, that the number and reliability of the data sets used in the analyses has improved over the years and therefore it is difficult to draw firm conclusions on the percentage level of Non-Revenue Water. The ILI which is also used to quantify the level of physical leakage (real losses) has remained relatively constant over the past 10 years at approximately 6.8. The levels of water losses in South Africa therefore suggest that there is significant scope for improvement although the values remain well in line with global norms.

2.6 DWS 2013 METRO ASSESSMENT

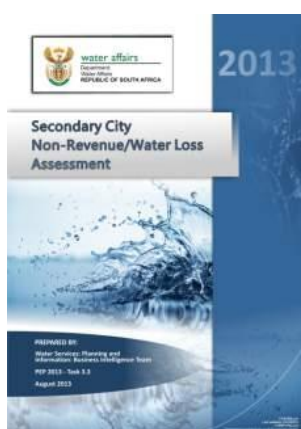


This 2013 report was to assess progress made with the implementation of WCWDM in metros. The assessment is fully documented in the 2013 report entitled **“Metropolitan Municipality Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team (July 2013)”**. Key findings from this study included:

- The study included metropolitan data from June 2007 to December 2012 and June 2014 targets.
- Approximately 40% of South Africa’s population lives within eight metropolitan municipalities and utilises approximately 46% of the total urban water supplied.
- Although good progress has been made, the Presidential target, to halve water losses in South Africa by 2014, is unlikely to be achieved in the metros, due to a lack of awareness and commitment, inadequate levels of funding, lack of technical expertise, or a combination of the above.

- Metro NRW has decreased from 35% (2009 - 2010) to 32.9% (June 2012), but of greater concern is that it has started to move upwards again to 33.8% (Dec 2012). The June 2014 WRS NRW target of 27.4% is thus unlikely to be achieved.
- The December 2012 estimated cost of metro NRW is R 4.0 billion per annum, (based on the purchase price of water).
- The five largest metros (Johannesburg, Cape Town, Tshwane, Ekurhuleni, and eThekweni), account for almost 90% of the total metropolitan water demand.
- Increased water scarcity (and climate change) will have a profound effect on metro water supply systems, whether from an economic growth, human security, environmental, or geopolitical stability perspective and needs urgent attention.

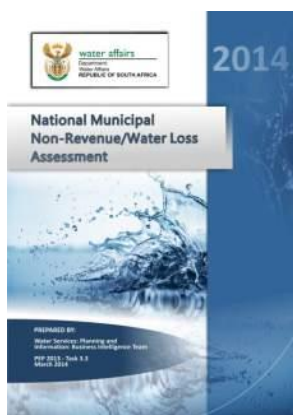
2.7 DWS 2013 SECONDARY CITIES ASSESSMENT



This 2013 report was to assess progress made with the implementation of WCWDM in secondary cities. The assessment is fully documented in the 2013 report entitled **“Secondary City Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team (July 2013)”**. Key findings from this study included:

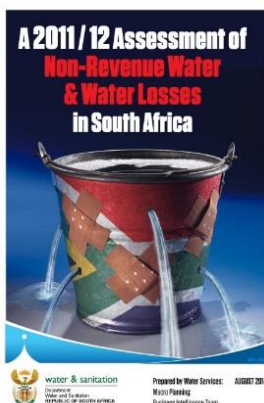
- There are nineteen Secondary Cities in South Africa in accordance with the Municipal Infrastructure Investment Framework categorisation. They are classified as B1 municipalities, or those local municipalities with the largest budgets. They provide water services to approximately 7.4 million people or 14% of the South African population and utilise about 14% of the total urban water use.
- The Secondary Cities are of high economic significance and reducing water losses and non-revenue water in Secondary Cities is of utmost importance.
- This study, based on 7 years of data, is the most detailed assessment of non-revenue water/ water losses in Secondary Cities.
- NRW in Secondary Cities is 39.4% which is higher than the metro NRW of 33.8% (Dec 2012) and the (2009/10) National average of 36.8%.
- NRW for Secondary Cities has consistently been increasing over the past 7 years, which is of concern.
- Most Secondary Cities do not have a 2014 target and do not take cognisance of the targets set under the various DWA Reconciliation Strategies.
- Most Secondary Cities will not half their water losses by 2014 and in most cases water losses have increased over the past 3 years.
- Most municipalities are able to provide water balance information but the completeness, plausibility and understanding thereof are of concern in some instances.
- Urgent intervention is required in Madibeng, Emalahleni and City of Matlosana as these municipalities can provide no credible information.

2.8 DWS 2014 NATIONAL ASSESSMENT



This study provided an update on The State of Non-revenue water in South Africa 2012 (WRC, 2012) and included data until 2011/12. The assessment is fully documented in the 2013 report entitled “**National Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team (July 2013)**”. Key findings from this study included:

- This study was based on 122 datasets, which is less than the WRC study, which was based on 132 datasets. Despite adding 21 new datasets, 31 municipalities failed to submit updated information which is an indication that municipalities fail to continuously monitor and report water loss information.
- NRW for the available dataset has consistently been increasing from 28.4% in 2005 to 37.4% in 2011, with a slight improvement to 36.2% in 2012.
- Extrapolating the NRW figures for the country suggest NRW in South Africa is between 36.2%, using a national extrapolation, and 38.9%, using a municipal category extrapolation. The results are highly influenced by the Category B4 municipalities, of which the credibility is very low. NRW is 38.9%, water losses 36.8% and consumption per capita per day is 233 litres if the municipal category extrapolation is accepted. It should be noted the water balance is a volumetric balance and does not include water losses due to non-payment.
- International studies have shown that an ILI of between 2 and 4 is achievable in developed and developing countries. Targeting an average ILI of 2.7 or halving the current real losses for the country will result in an annual saving of approximately 400 million m³/annum or R 2.22 billion / annum. This saving does not include income due to improved metering and billing, deferred capital costs and electricity savings.
- Many municipalities do not have a 2014 target and do not take cognisance of the targets set under the various DWA Reconciliation Strategies and All Town Studies.
- Most municipalities will not half their water losses by 2014 and in most cases water losses have increased over the past 3 years.
- 52% of municipalities are able to provide water balance information, but the completeness, plausibility and understanding thereof are of concern in some instances.
- It appears that the importance of demand management is slowly being appreciated by some municipalities, but not by others. These municipalities are in crisis and require urgent intervention to ensure water security and sustainability.

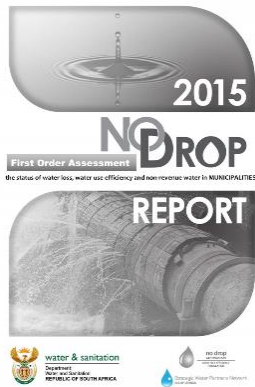


2.9 DWS 2014 NATIONAL ASSESSMENT (UPDATE)

This study is an update on 2013 National Non-Revenue / Water Loss Assessment by DWA Water Services Directorate: Planning and Information - Business Intelligence Team (July 2013) but incorporates an estimated NRW figure for all municipalities. The assessment is fully documented in the 2014 report entitled “**A 2011/12 Assessment of Non-Revenue and Water Losses in South Africa by DWA Water Services Directorate: Planning and Information - Business Intelligence Team (July 2014)**”.

Based on somewhat limited data and the tenuous assumption that the trends continue, then NRW, water losses, consumption and SIV values in 2013/14 should be about 38%, 35%, 233 l/c/d and 4550 million m³/a.

2.10 NO DROP 2015 NATIONAL FIRST ORDER ASSESSMENT



The purpose of this study was to provide an overview of the status of municipalities as pertaining to their water losses, non-revenue water and water use efficiency, based on the 2012/13 financial year. The assessment is fully documented in the 2015 report entitled **“2015 No Drop Report - First order assessment of water loss, water use efficiency and non-revenue water in municipalities, DWS and SWPN, Oct 2015”**.

Based on verified evidence and data sets, the No Drop audit concluded that all 152 water services authorities participated in the No Drop assessment. Data sets were received for 71 water services authorities, representing a total population of 32 580 710 and 9 043 534 households which is approximately 62% of the country's total population. These households are supplied via a total mains network of 121 449 km and 5 382 613 connections, with an average of 44 connections per km pipeline. A total of 4 712 677 (87.6%) of all connections are metered and 669 936 (12.4%) are unmetered. The average system pressure is 45 m, ranging between 52 m and 36 m reported by the various municipalities.

A total of 949 water supply systems have been assessed. In total, 30% of the water supply systems obtained >50% No Drop score, with the balance of 70% attaining <50%. An overall National No Drop Score of 56.5% was achieved, which falls within the No Drop category of 'Average Performance'. This (weighted) national score bodes well for the future of WCWDM in the country, given that it is a first time assessment and steep learning curve for the municipalities. The higher score is positively influenced by the good scores obtained by the metropolitan municipalities and some of the municipalities with larger capacity systems.

Up to 51% of the 152 water services authorities have proper or partial WCWDM Strategies and Plans in place, and are busy with some form of implementation in the field. Coupled with 38% to 40% of WSAs having proper or partial Water Balances in place, and a savings potential of R 3 billion/annum, this makes strong case to focus on improvement in the QUALITY OF PLANNING and the INTENSITY AND ACCELERATION OF IMPLEMENTATION. Of concern is that 62% of WSA do not have WCWDM contained within their IDPs. This is a fundamental requirement to ensure that projects are rolled out in the field. Regulatory letters to Mayors and Municipal Managers, annexed to their No Drop results, will serve to rectify this omission.

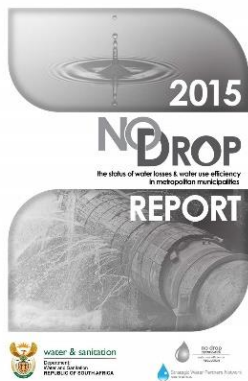
The National Water Balance for the 2012/13 audit year shows a total SIV 2 997.58 million kl/annum of which 2 168.97 million kl/a (72.4%) is Authorised Consumption and 828.61 million kl/a (27.6%) is Water Losses. The Water Losses is made up of 165.32 million kl/a (20%) apparent Losses and 663.29 million kl/a (80%) real losses, which result in a NRW of 1 038.05 million kl/annum (34.6%).

A total volume of 1 038.05 million kl/annum is lost as NRW which, calculated at a unit cost of R 6 / kl, amounts to R 6,228 million per annum for the country as a whole. By implementing WCWDM projects, a potential saving of 331.65 million kl/annum can be achieved, which translate to

R1 989.9 million per year. **Savings in excess of R 3 billion** can be projected if all 152 water services authorities' water balances are considered. The potential savings that can be realised by investing in WCWDM in Category A and B1 municipalities is 84% of the national savings potential.

Water use efficiency is typically one of the key performance indicators and reported at national government level. The average WUE is 237 $\ell/\text{c}/\text{d}$ and 234 $\ell/\text{c}/\text{d}$ for the Provinces and the WSA Categories, respectively. The reported efficiencies are significantly above the international benchmark of 180 $\ell/\text{c}/\text{d}$ and municipalities must continue to plan for improvement towards an average consumption of below 200 $\ell/\text{c}/\text{d}$.

2.11 NO DROP 2015 FULL METRO ASSESSMENT



This report is the first full No Drop audit of metropolitan municipalities. The assessment is fully documented in the 2015 report entitled **“2015 No Drop Report - The status of water loss, water use efficiency and non-revenue water in metropolitan municipalities, DWS and SWPN, Oct 2015”**.

All metros have strategies and business plans to address the NRW, water losses and efficiency. Significant progress has been made with the implementation of these strategies and business plans, but there is still a lack of political support, budgets, alignment to the Department's reconciliation strategies and understanding of the possible consequences of water restriction. The targets set under the various reconciliation

strategies are included in the NDP and NWRS2 and it is critical that these targets are achieved to avoid possible water restriction and the subsequent detrimental economic impact. All metros must revise their strategies and business plans to ensure targets are achieved and the risk of water restrictions is minimised.

Asset management has a direct impact on WCWDM. Without proper operation and maintenance, it will not be possible to monitor the water losses in a distribution system and perform basic functions such as metering, billing and cost recovery. All metros could improve the operations and maintenance of their assets, which have a direct impact on water loss control.

No water services authority would be able to implement WCWDM without the necessary staff capacity and skills. Most WCWDM activities and preventative maintenance could be performed as part of the daily operation and maintenance of the system. Staff capacity and skills obtained the second lowest score of all the criteria and should be addressed as a matter of priority. A standard must be developed to specify the skills and capacity required to operate and maintain a water distribution system.

The information used to prepare a monthly water balance is, in general, credible, plausible and readily available. Proper management, reading and billing of consumer meters cannot happen if there is not a good relationship between the finance and technical departments. The finance and technical departments in all metros should interact on a daily basis to ensure consumer meters are properly installed, repaired, inspected, read and billed. All metros should strive to meter and bill, based on actual meter readings, to ensure the financial sustainability of the metro and customer satisfaction.

Key performance indicators and compliance with the water demand management regulations contributed most to the overall score. Metros should endeavour to fix all leaks within 48 hours of becoming aware thereof, improve water losses, NRW and efficiency and implement pressure management. Improved compliance and performance will significantly improve the overall score of all metros. The large number of unmetered connections and deemed (flat rate) consumers must be addressed as a matter of priority to promote water use efficiency and generate income for the metros. The results indicate that average system pressures are high and there is scope for aggressive pressure reduction in all metros. Pressure reduction is a cost effective WCWDM measure and should be implemented as a priority.

All metros have the necessary policies and bylaws, but enforcement could be improved through political support and additional human resources. Metros will receive the benefit through reduced water theft, consumer awareness and equality.

There is significant scope for increased community awareness in all metros. Consumers need to be made aware that South Africa is a water scarce country and the value of water should be appreciated. Community awareness programmes will improve the relationship between the metro and its customers, create more informed consumers and reduce the risk of service delivery unrest.

Metros could benefit from WCWDM programmes through improved service delivery, sustainable resources, financial viability, social and economic improvement. The key WCWDM interventions identified by the metros, include pressure management, top consumer audits, household leak repair programmes, metering of unmetered properties and water reuse, have been proven to provide a very good return on investment, with payback periods of less than 3 years.

Metros require approximately R 2 billion per annum to fund their WCWDM programmes and currently have a shortfall of R 500 million. A 10% reduction in SIV and reducing NRW to 25% can generate approximately R 2 billion additional income for metros, through reduced water purchases and increased water sales. There is a business case for obtaining funding from financial institutions, as the estimated savings are equivalent to the average annual budget required for WCWDM.

2.12 OTHER SOURCES OF INFORMATION



- **Population and households served** figures were obtained from the DWS National Water Services Knowledge System (<https://www.dwa.gov.za/wsksl/>). These figures are compiled by DWS, in close collaboration with StatsSA, and are used for all planning purposes, including the development of Water Services Development Plans. Any household with access to potable water, regardless of the level of service, is considered served. Municipalities should contact the

Directorate Water Services Planning and Information if they disagree with any of the figures.

- **Number of metered and unmetered connections** was obtained from Census 2011, where all house and yard connections were considered metered. The balance between households served and metered connections were considered unmetered connections. Municipalities should update this information from their billing system. Close correlation between households served and number of connections is expected, except in some municipalities with a high number of townhouse developments, with single connection, or backyard dwellers.

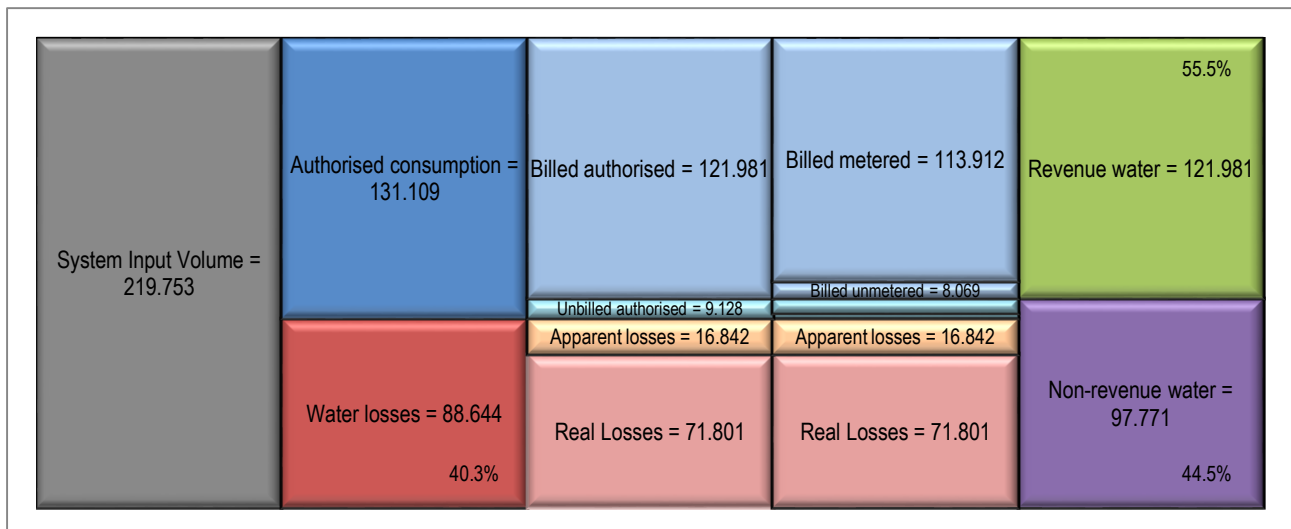
3 WATER BALANCE TRENDS

The water balance trends for the nine provinces and a national perspective are provided in the following sections. The information is based in the literature review as described in section 2.

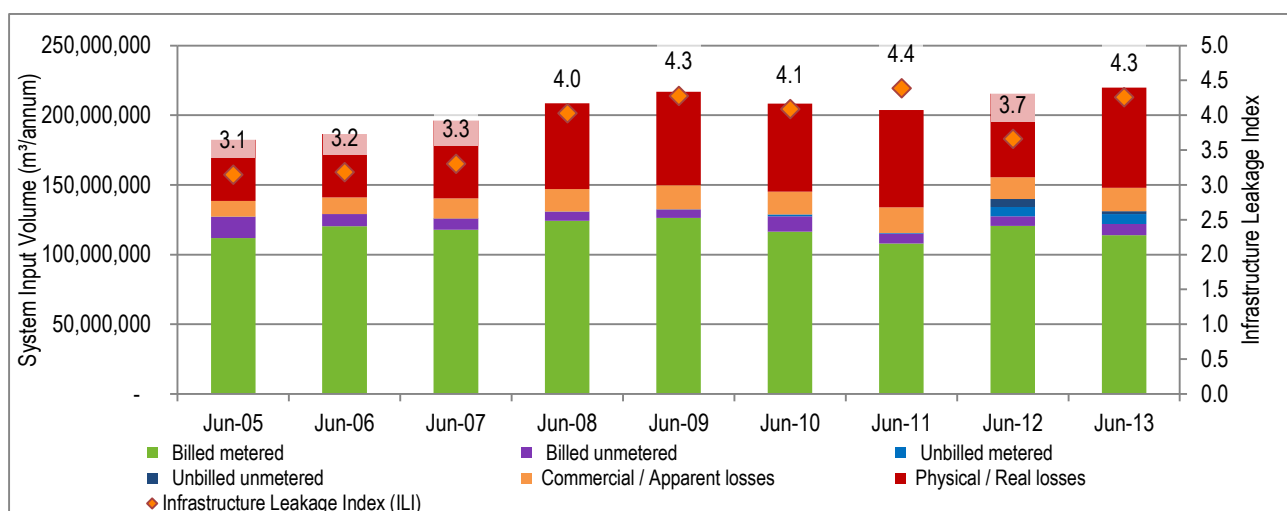
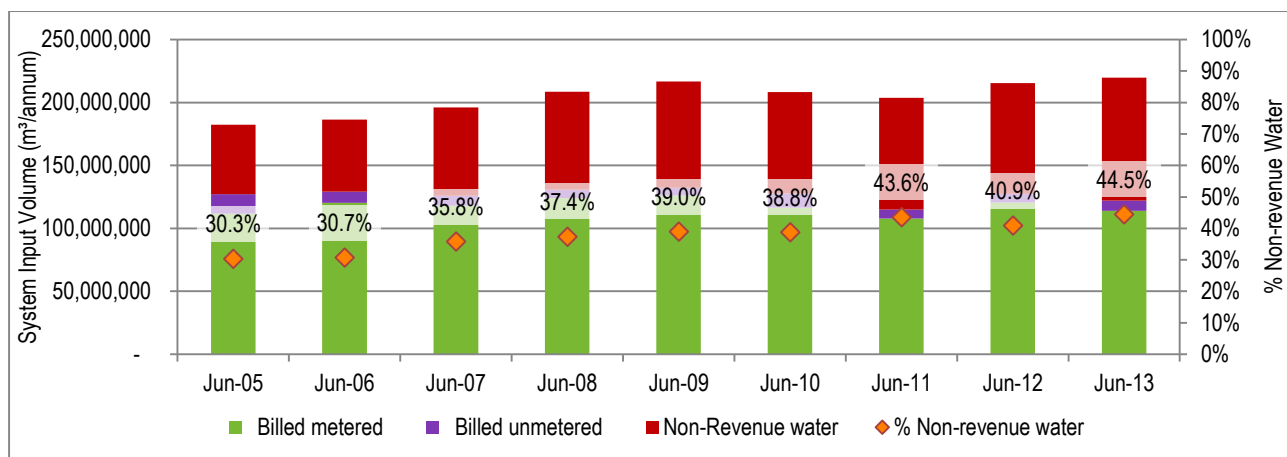
3.1 EASTERN CAPE PROVINCE

The water balance and trends for the Eastern Cape are based on 19 (49%) plausible data sets of a possible 39 municipalities. The water balance information is highly influenced by the Nelson Mandela Bay and Buffalo City metros, which account for approximately 75% of the demand.

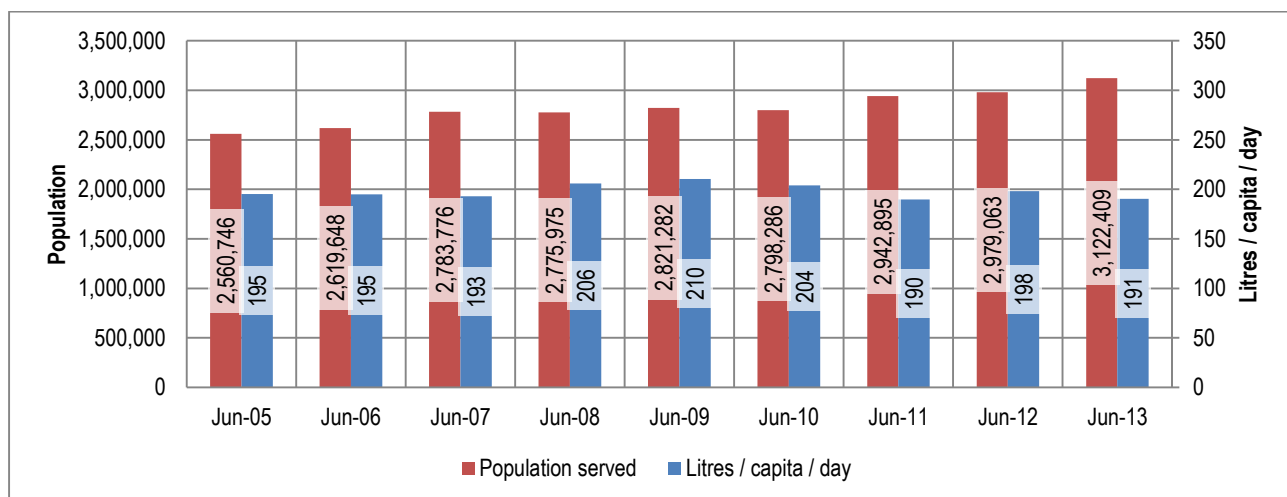
The 2012/13 water balance, for the 19 data sets, indicates water losses of 88.6 million m³/a (40.3%) and NRW of 97.8 million m³/a (44.5%). These figures are approximately 5% higher than the 2012/13 No Drop assessment of 36.4% water losses and 40.8% NRW. The No Drop assessment is based on 10 data sets with a SIV of 204.6 million m³/a. The increase is mainly due to an increased number of category B3 and B4 municipalities included, which tend to have less budget and resources with subsequent higher losses and NRW.



NRW and water loss trends for the Eastern Cape show a gradual increase from 2005 until 2009 and are currently still at 2009 levels. The drop in demand from 2009 to 2011 is mainly due to the water restrictions imposed in the Nelson Mandela Bay metro. Indications are that the system input volume is quickly returning to previously levels since the lifting of the drought restrictions. Leakage levels have remained the same for the past 5 years, with an ILI of 4.1.



Per capita consumption increased from 2005 and peaked in 2009 at 210 l/c/d but has improved again to 2005 levels. The per capita consumption is slightly below the 2012/13 No Drop figure of 220 l/c/d due to inclusion of mainly rural municipalities.

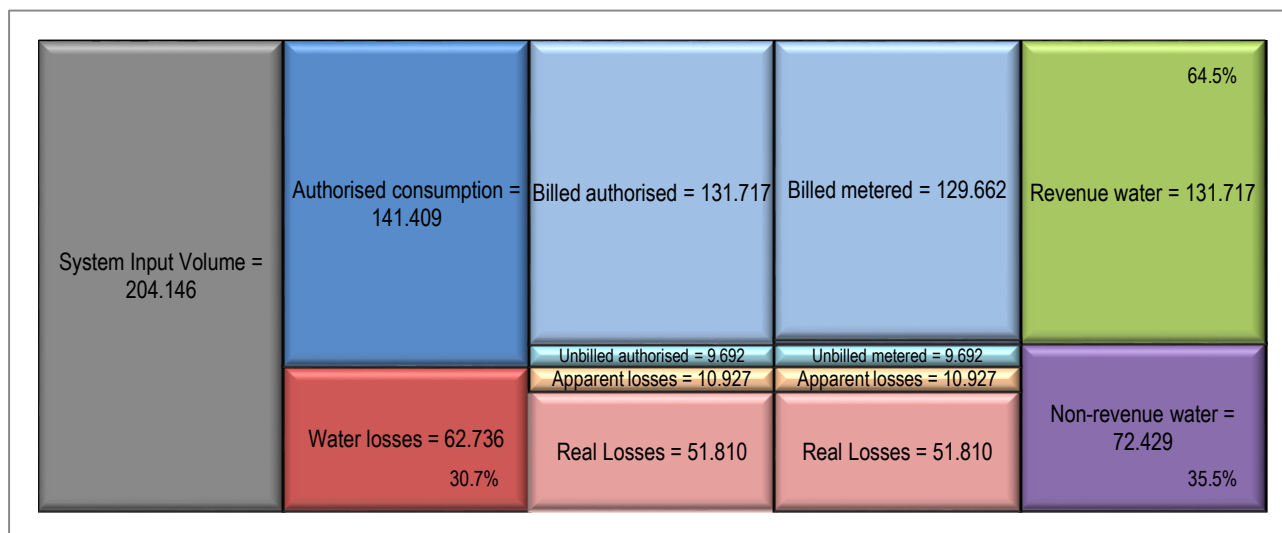


The Eastern Cape has managed to maintain leakage levels and per capita consumption in the past 5 years but, especially with the looming drought situation, there is significant scope for improvement in reporting levels, data accuracy and a reduction of NRW and water losses.

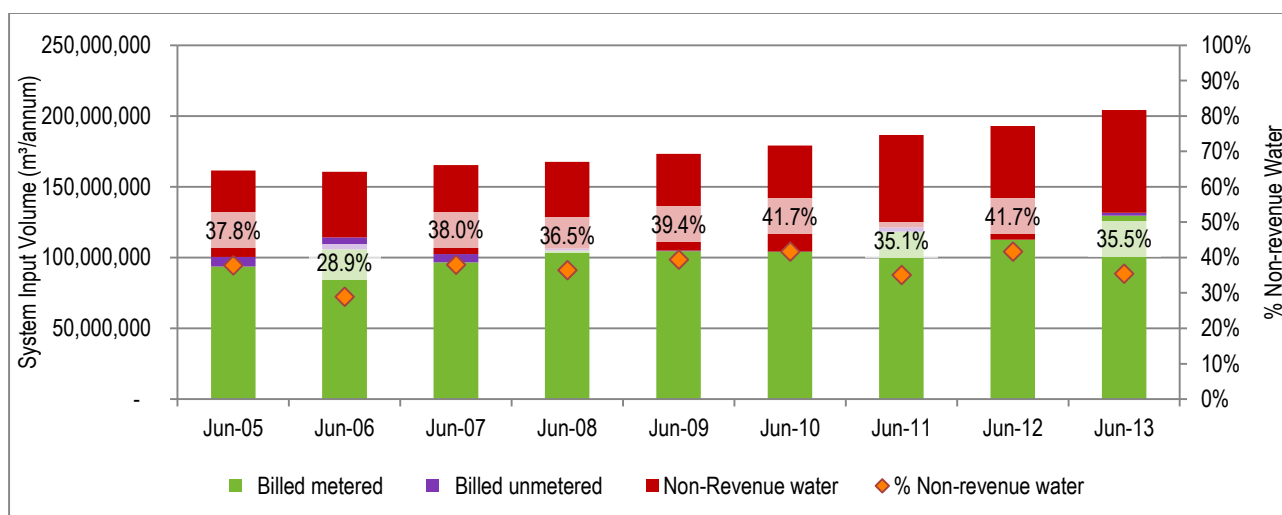
3.2 FREE STATE PROVINCE

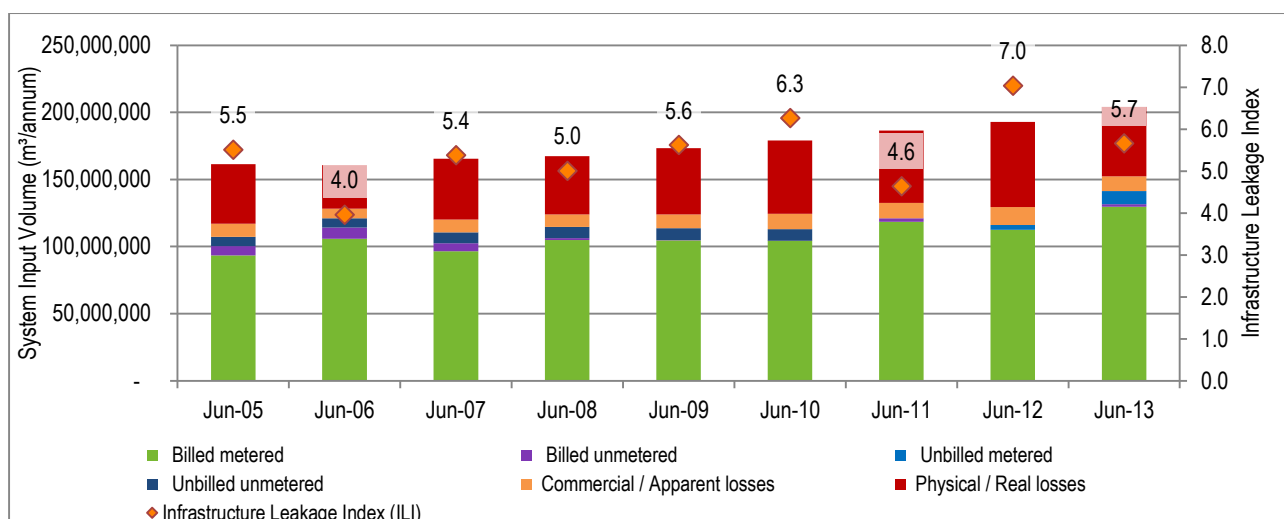
The water balance trends for the Free State are based on 11 (55%) plausible data sets of a possible 20 municipalities. The water balance information is highly influenced by the Mangaung metro and Matjhabeng municipality, which accounts for approximately 62% of the demand.

The 2012/13 water balance, for the 11 data sets, indicates water losses of 62.7 million m³/a (30.7%) and NRW of 72.4 million m³/a (35.5%). These figures compare well with the 2012/13 No Drop assessment of 30.5% water losses and 37.9% NRW. The No Drop assessment is based on 6 data sets with a SIV of 185.9 million m³/a.

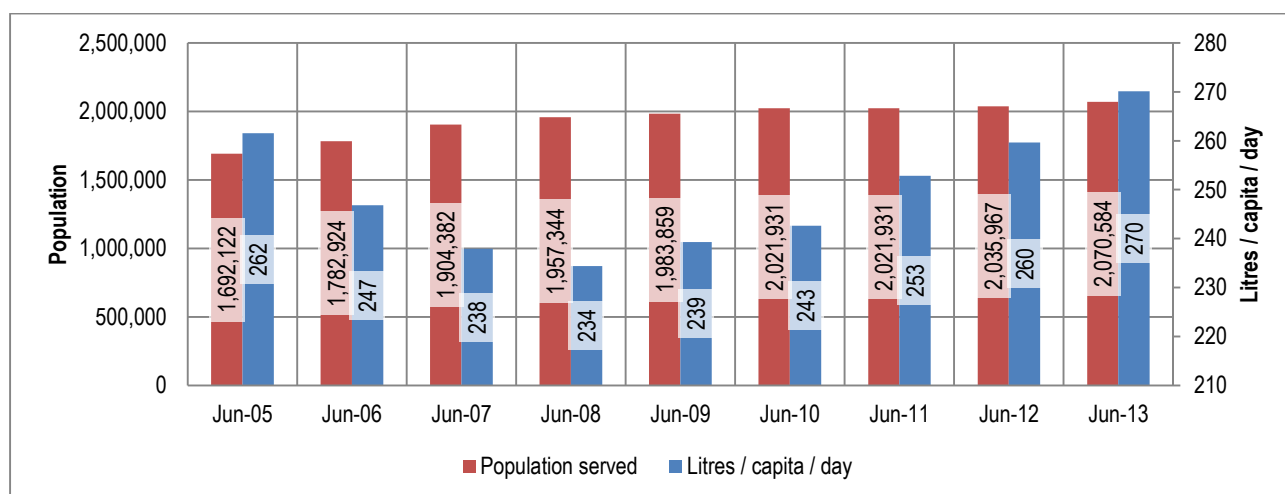


The system input volume in the Free State has been growing consistently from 2005 to 2013. NRW and water losses have improved in 2013, mainly as a result of the intervention undertaken in Mangaung municipality, but the metro No Drop assessment indicate that water losses and NRW returned again to 2012 levels in 2014. Physical losses (ILI) fluctuate considerably and remain high at levels above 4.6.





Per capita consumption in the Free State improved slightly from 2005 to 2009, but since 2009 it is consistently increasing and peaked in 2013 at 270 l/c/d. Per capita consumption is an indication of water use efficiency and could be as result of poor metering and billing systems and lack of awareness among consumers. The per capita consumption is slightly below the 2012/13 No Drop figure of 296 l/c/d.

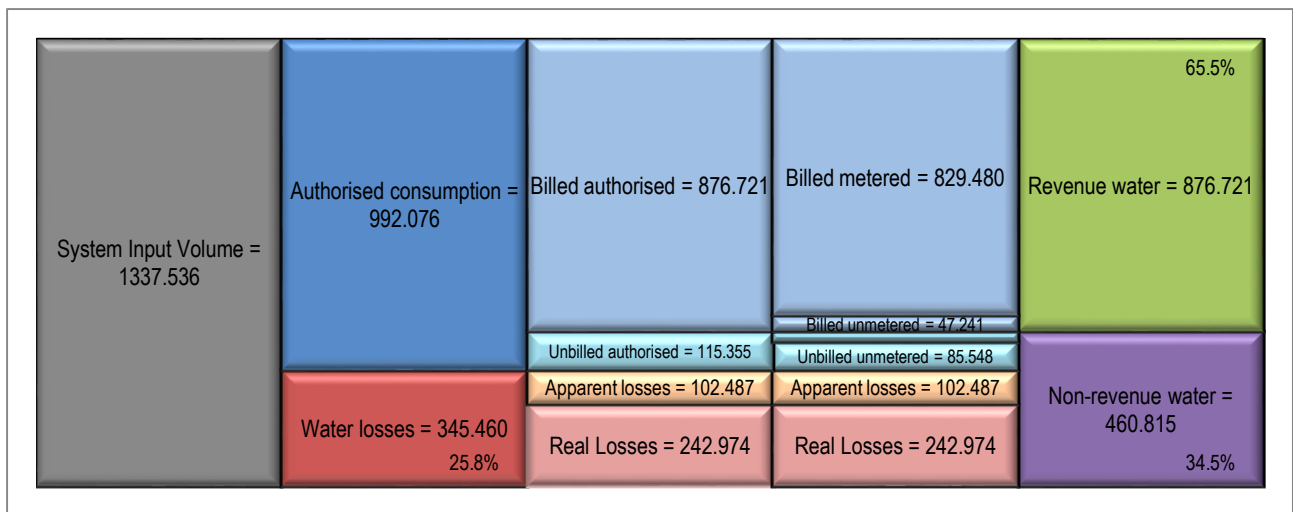


The Free State has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 270 l/c/d. Leakage levels fluctuates considerably and it is difficult to assess if any progress is made with the reduction of NRW and water losses. WCWDM must be implemented as a matter of priority, considering that water restrictions have already been imposed in Mangaung metro. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

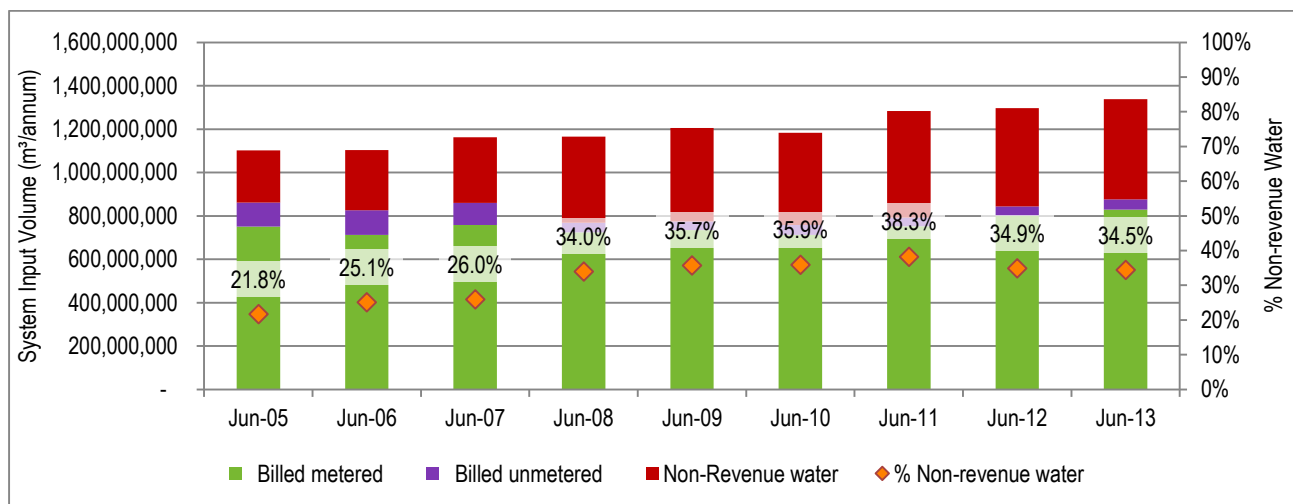
3.3 GAUTENG PROVINCE

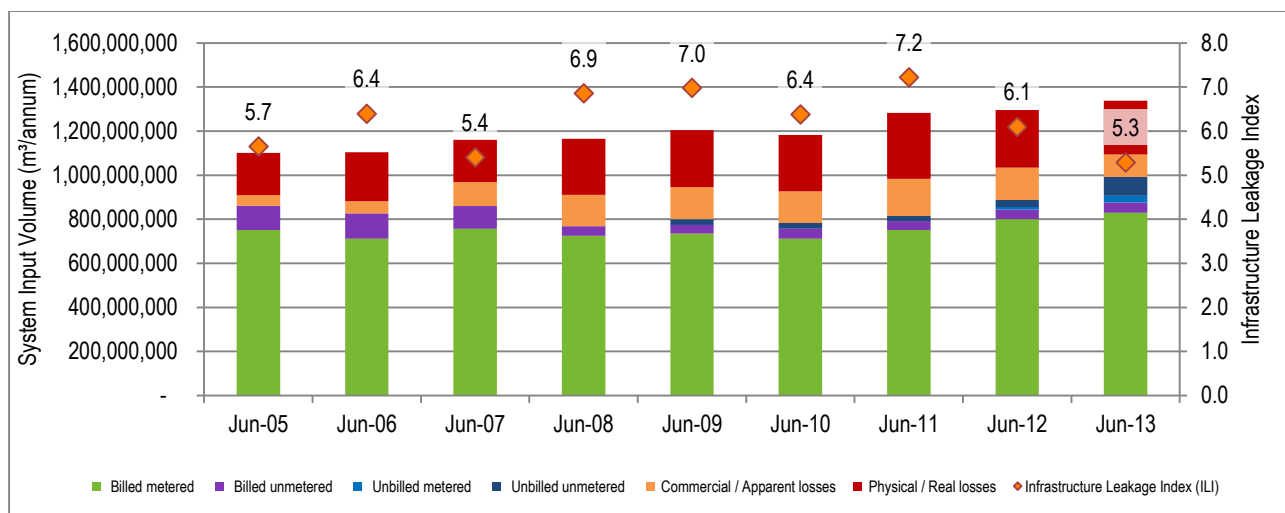
The water balance trends for the Gauteng are based on 6 (60%) plausible data sets of a possible 10 municipalities. The water balance information is highly influenced by City of Johannesburg, Ekurhuleni, City of Tshwane metros and Emfuleni municipality, which accounts for approximately 99% of the demand.

The 2012/13 water balance, for the 6 data sets, indicates water losses of 345.5 million m³/a (25.8%) and NRW of 460.8 million m³/a (34.5%). These figures compare well with the 2012/13 No Drop assessment of 25.9% water losses and 34.6% NRW. The No Drop assessment is also based on 6 data sets with a SIV of 1361.8 million m³/a.

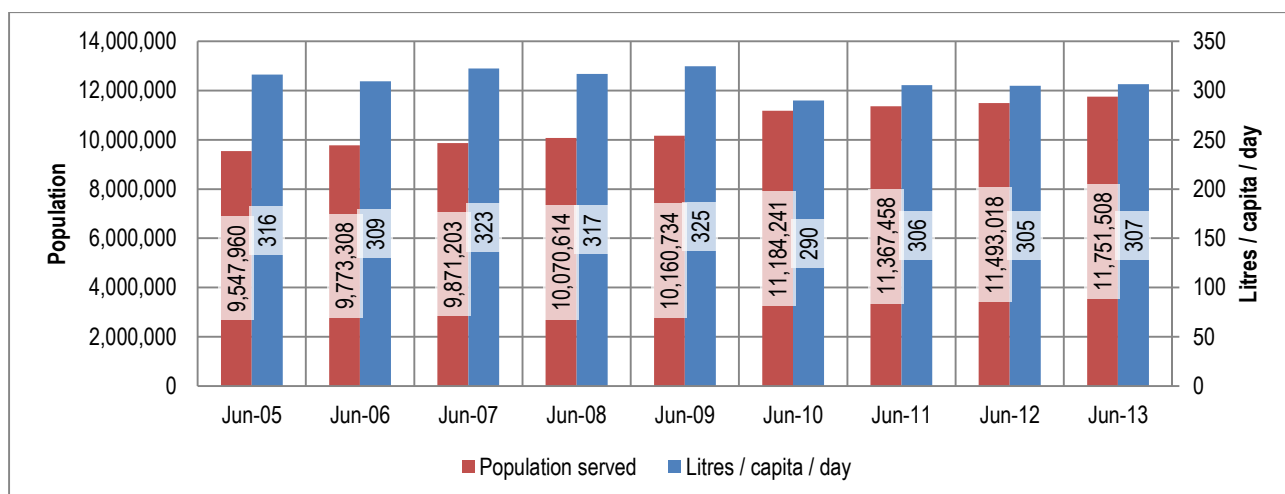


NRW and water losses increased consistently from 2005 to 2011 but have reduced significantly in the past two years. The reduction is mainly due to increased WCWDM awareness and programmes in the large municipalities and changes in the water balance calculations. There is noticeable increase in the unbilled consumption, which was previously included in the water loss component of the water balance. The system input volume is steadily increasing but have shown signs of stabilisation and reduction in 2010.





Per capita consumption peaked in 2009 at 325 ℓ /c/d but has effectively remained constant over the past 8 to 9 years. The per capita consumption is based on the total system input volume and include industrial and commercial use. Ekurhuleni is the metro with the highest number of wet industries. The per capita consumption is slightly below the 2012/13 No Drop figure of 311 ℓ /c/d.

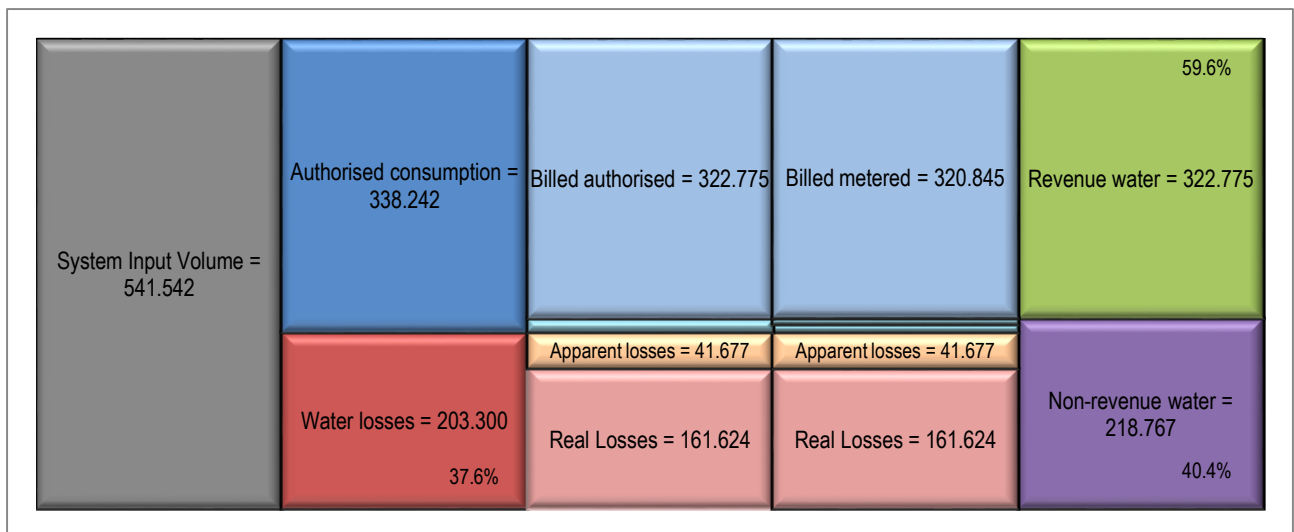


Gauteng has been unable to reduce their demand in the past 9 years, although water use efficiency seems to have been improving in the past 5 years. NRW and water loss levels have decreased, which is commendable, but WCWDM implementation levels must be elevated to ensure the targets of the Vaal reconciliation strategy are achieved. There is significant scope for improvement in the reduction of system input volume, NRW, water losses and efficiency. Data accuracy and reporting are excellent at metro level but can improve for some of the smaller municipalities.

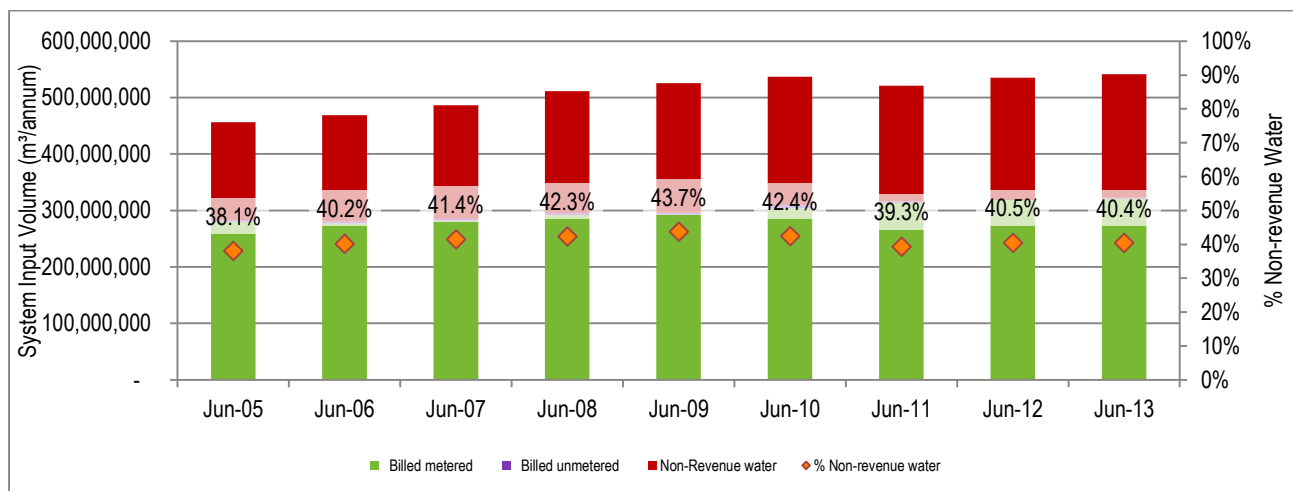
3.4 KWAZULU NATAL PROVINCE

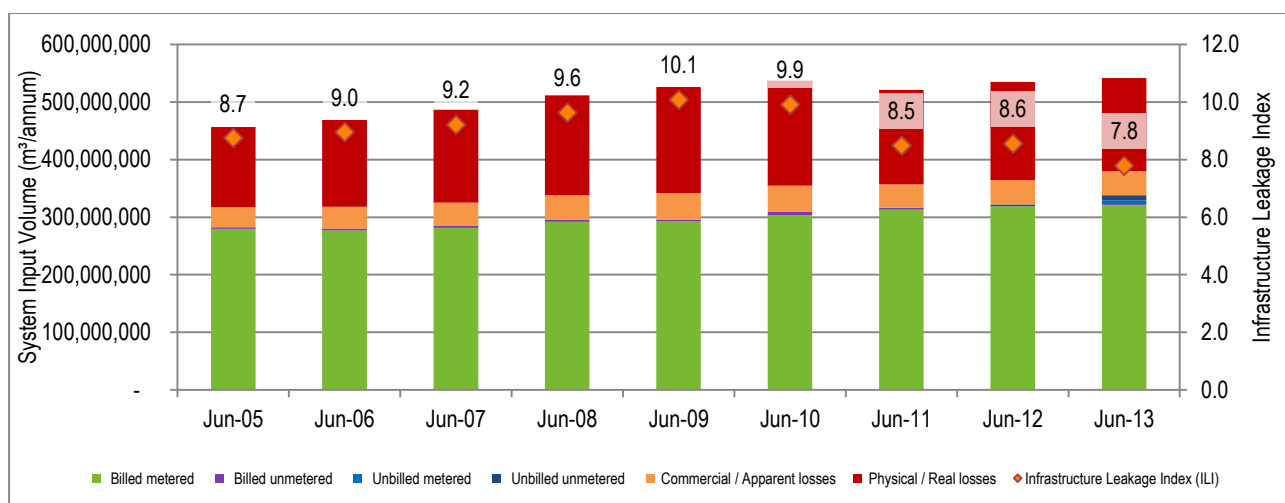
The water balance trends for the KwaZulu Natal are based on 12 (24%) plausible data sets of a possible 51 municipalities. The water balance information is highly influenced by eThekweni metro and Msunduzi, Newcastle and City of uMhlatuze municipalities, which account for approximately 86% of the demand.

The 2012/13 water balance for the 12 data sets, indicates water losses of 204.3 million m³/a (37.6%) and NRW of 219.7 million m³/a (40.5%). These figures compare well with the 2012/13 No Drop assessment of 36.5% water losses and 40.0% NRW. The No Drop assessment is based on 8 data sets with a SIV of 542.3 million m³/a.

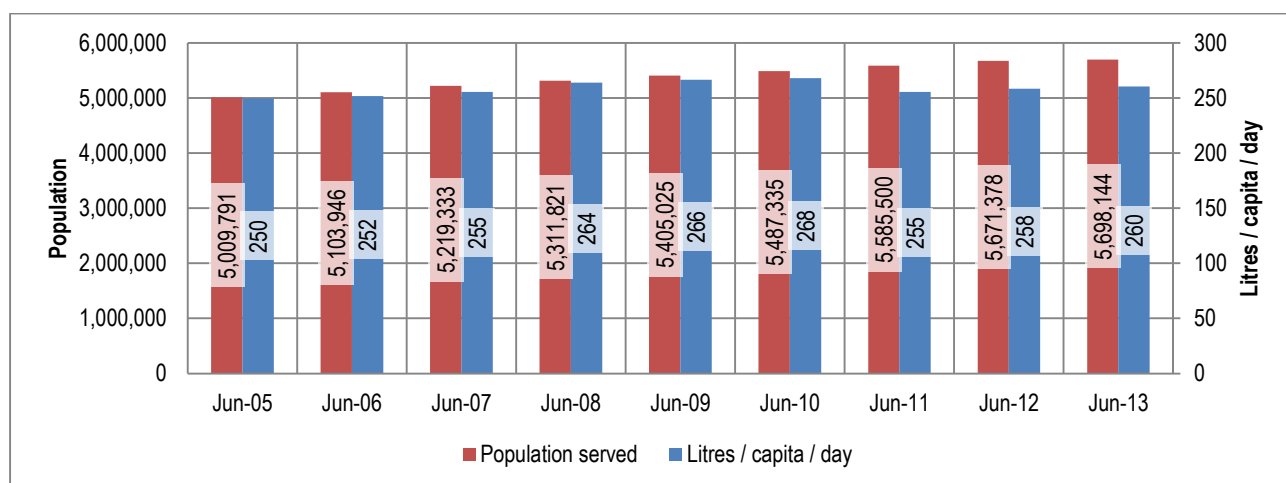


NRW and water loss trends for the KwaZulu Natal show a gradual increase from 2005, which peaked in 2009 at 43.8%, but both NRW and water losses have subsequently decreased. It is encouraging to observe that the system input volume has remained almost constant since 2009 and leakage levels are reducing. There is noticeable increase in the unbilled consumption, which was previously included in the water loss component of the water balance.





Per capita consumption in KwaZulu Natal has remained almost constant in the 6 to 7 years. The per capita consumption is considerably higher than the 2012/13 No Drop figure of 190 l/c/d. This requires further investigation as the District Municipalities have WSA status but water balance information is not provided at municipal or system level and could therefore not be analysed.



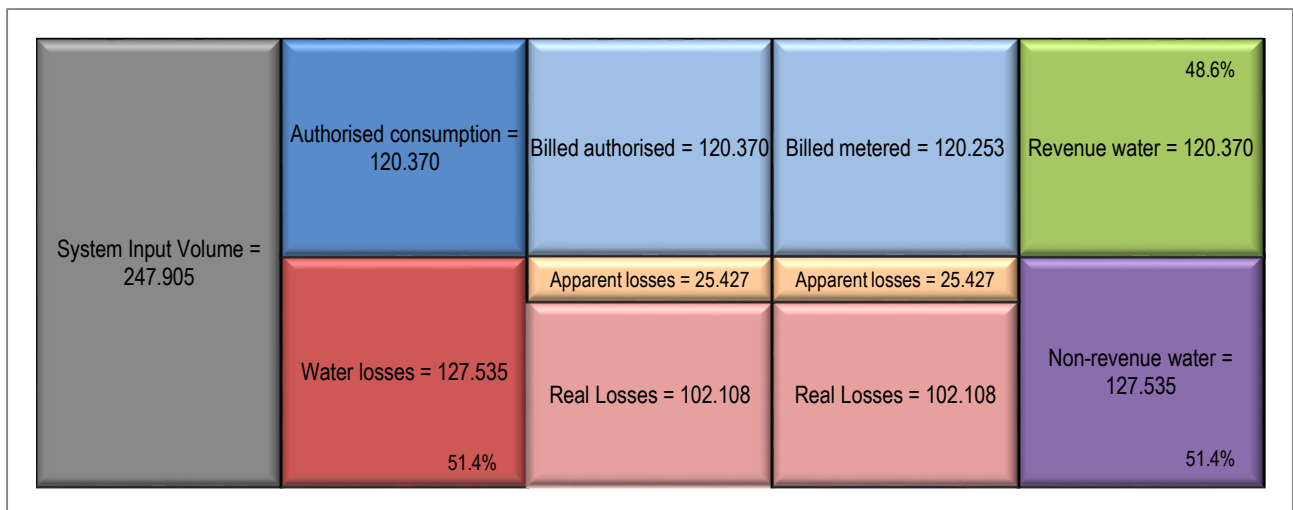
KwaZulu Natal has managed the maintain system input, leakage levels and per capita consumption in the past 5 to 6 years. With the looming / imposed water restrictions in the province, there is significant scope for improvement in reporting levels, data accuracy and a reduction of system input, NRW and water losses in the province.

3.5 LIMPOPO PROVINCE

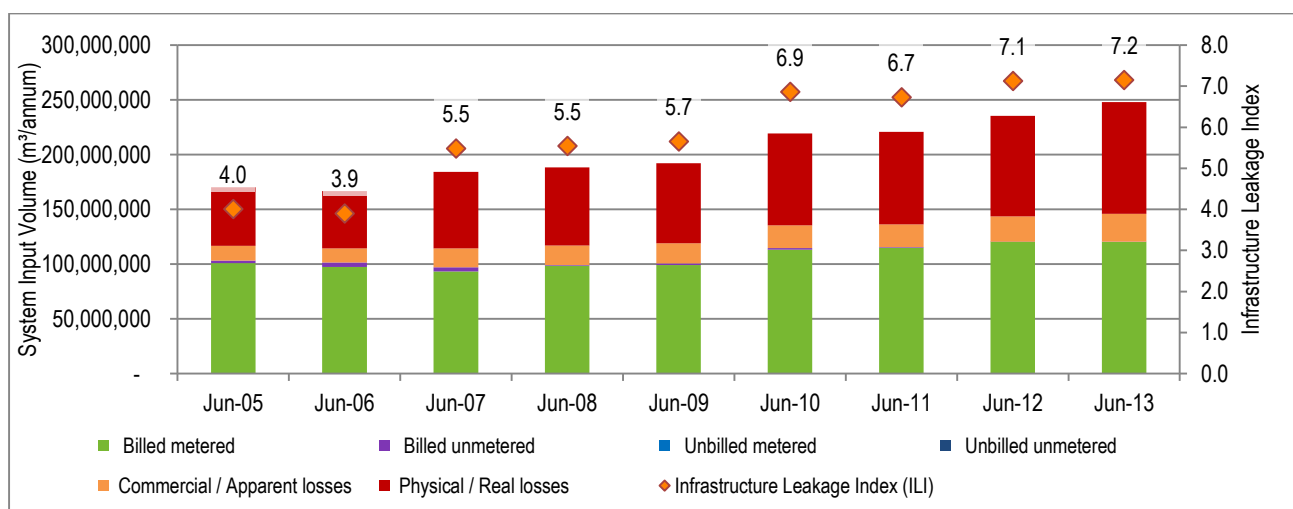
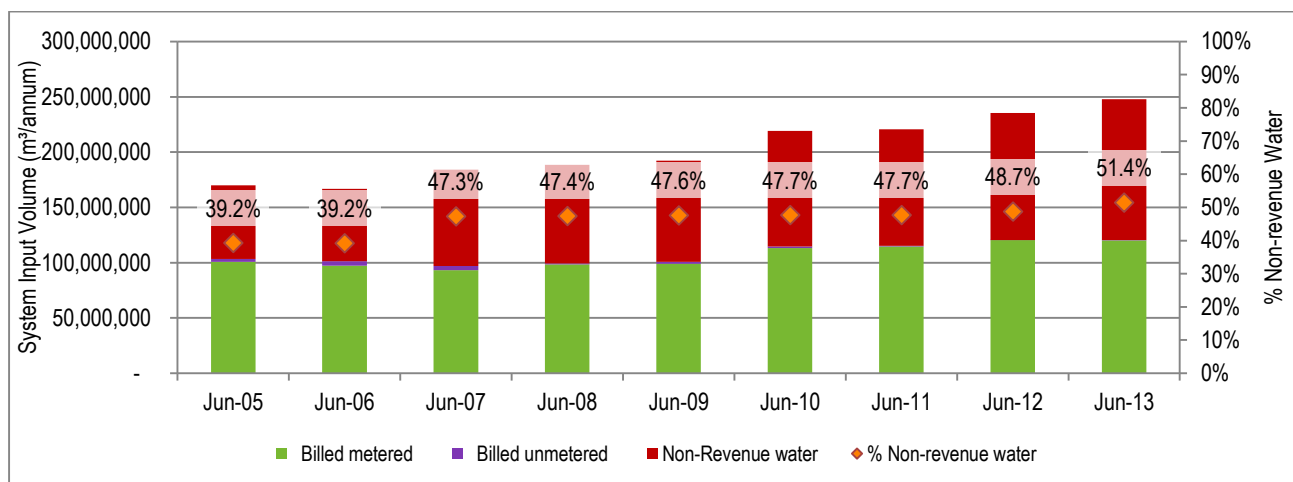
The water balance trends for the Limpopo are based on 12 (48%) plausible data sets of a possible 25 municipalities. Polokwane is the only secondary city included in the data set and accounts for only 16% of the total demand. The other large users are rural municipalities such as Greater Tzaneen and Thulamela (Thohoyandou).

The 2012/13 water balance for the 12 data sets, indicates water losses and NRW of 127.5 million m³/a (51.4%). The NRW figure compares well with the 2012/13 No Drop assessment

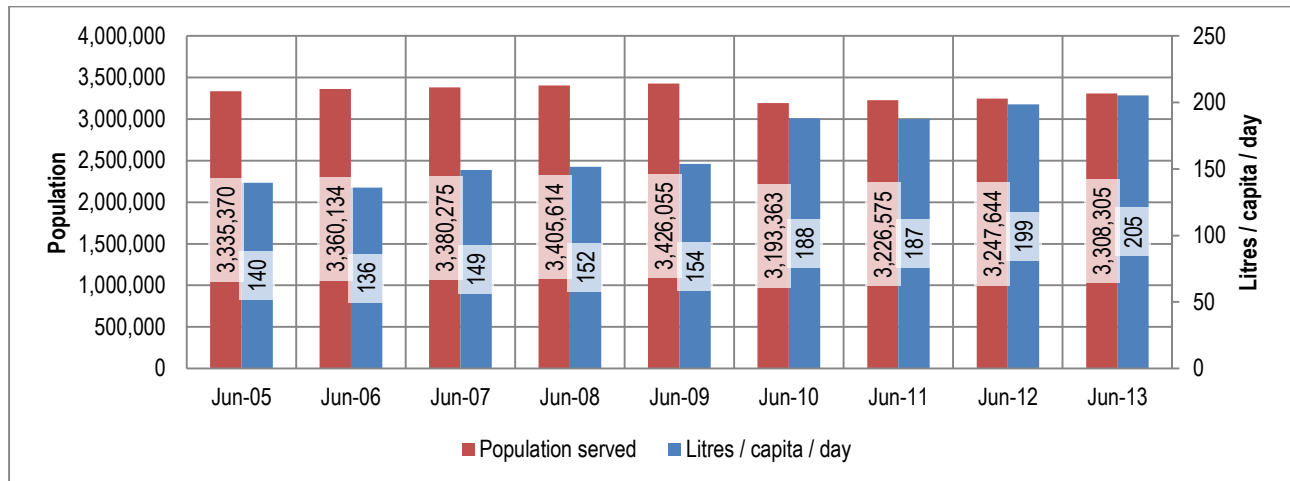
of 47% water, but is significantly higher than the water loss figure of 26.8%. The No Drop assessment is based on 2 data sets, with an SIV of 25.4 million m³/a.



The NRW and water trends indicate consistent growth in system input volume, NRW and water losses over the past 9 years. Urgent attention must be given to the implementation of WCWDM as the water demand already exceeds the supply in large parts of the province.



Per capita consumption for Limpopo indicates consistent growth from 2005 to 2013 and is currently at an all-time high of 205 ℓ/c/d. The growth in per capita consumption aligns with the growth in SIV, NRW and water losses. The growth could be an indication of deteriorating municipal structures and the ability to meter and bill based on actual consumption. The per capita consumption is considerably higher than the 2012/13 No Drop figure of 124 ℓ/c/d.

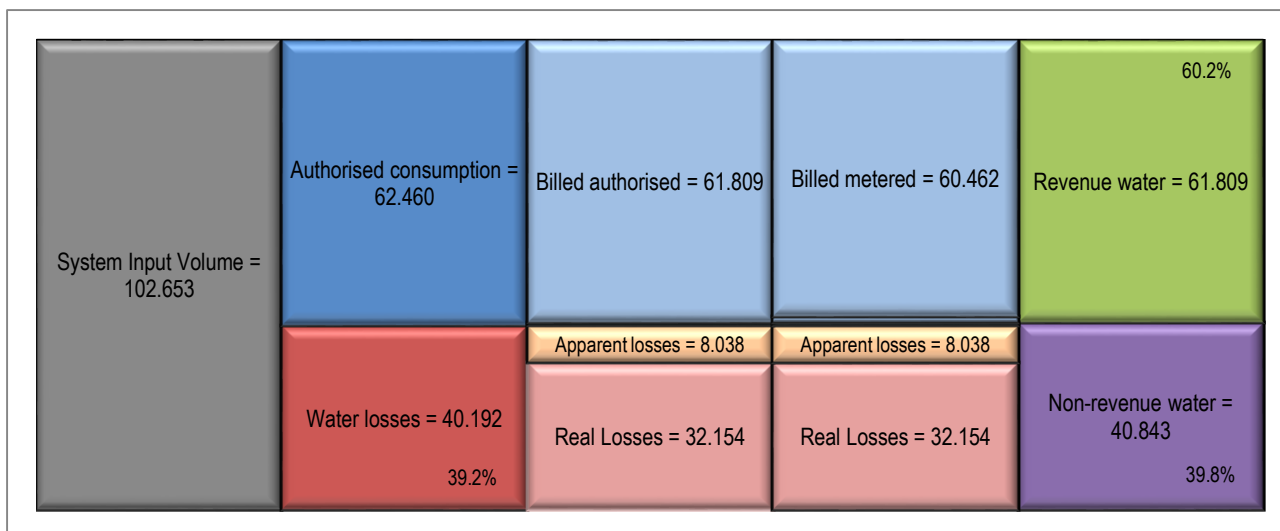


The Limpopo province has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 205 ℓ/c/d. Leakage levels and NRW are also consistently increasing and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

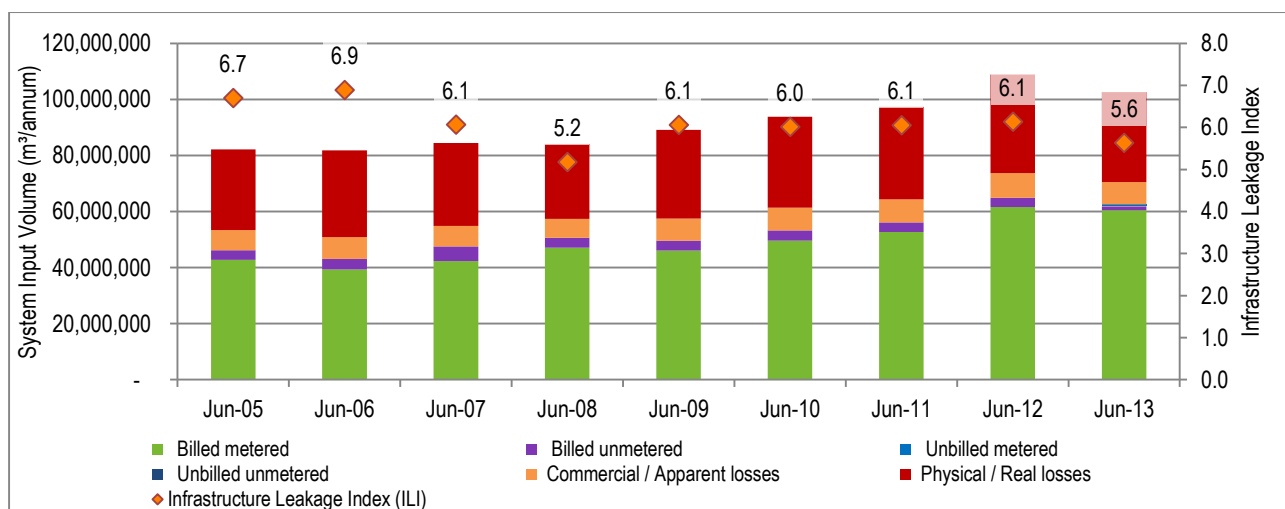
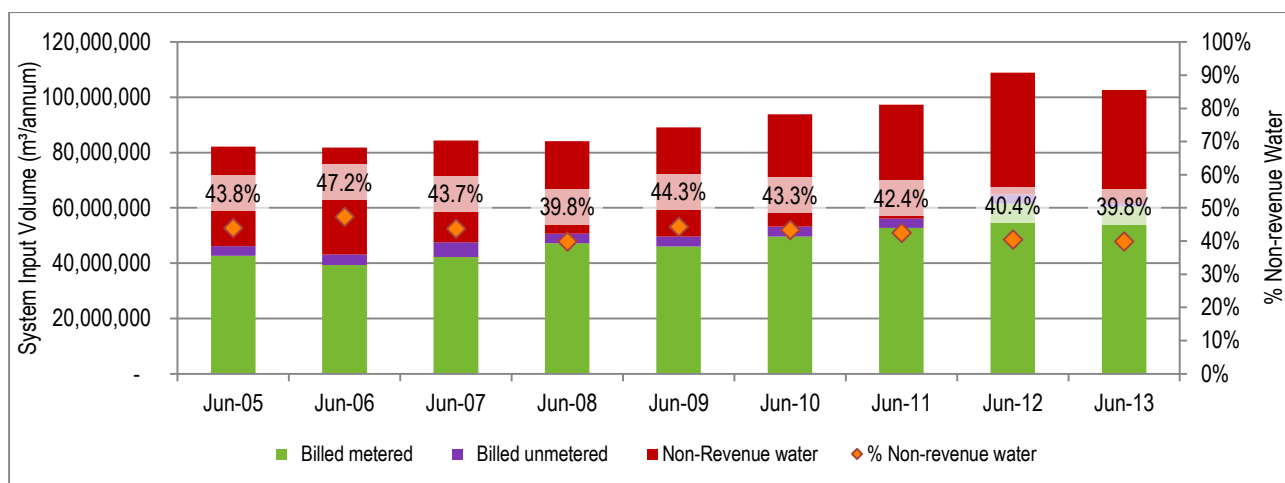
3.6 MPUMALANGA PROVINCE

The water balance trends for the Mpumalanga are based on five (28%) plausible data sets of a possible 18 municipalities. The water balance information is highly influenced by the three secondary cities of Govan Mbeki, Steve Tshwete and Mbombela, which account for 72% of the demand. Dr JS Moroka is also a large user and included in the data set. Data is exceptionally poor in the province and there are no active reporting systems in place.

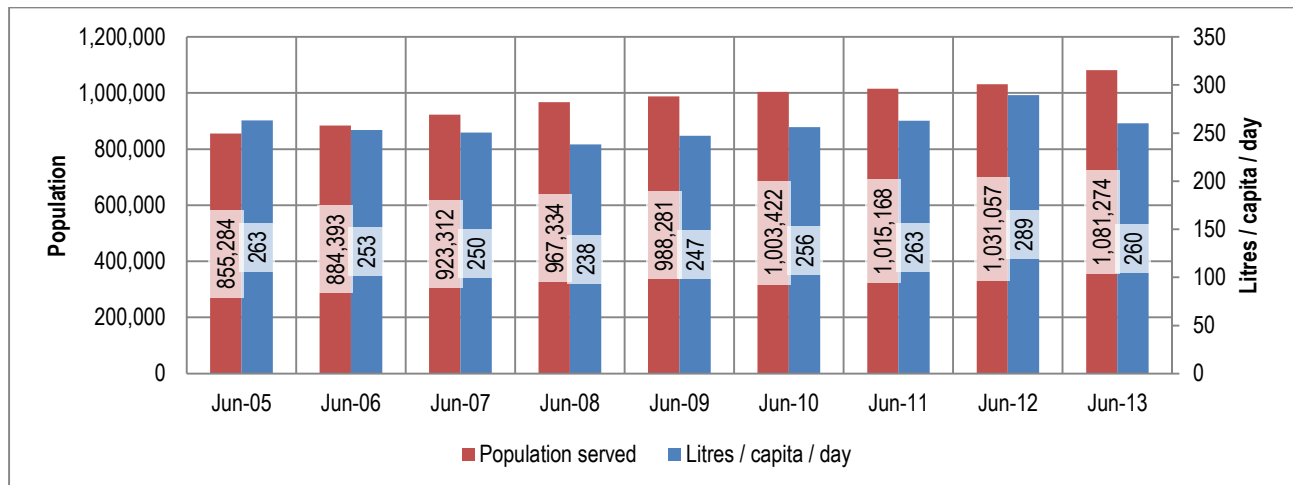
The 2012/13 water balance for the five data sets, indicates water losses of 40.2 million m³/a (39.2%) and NRW of 40.8 million m³/a (39.8%). These figures are significantly higher than the 2012/13 No Drop assessment of 29.2% water losses and 30.9% NRW. The No Drop assessment is based on four data sets with a SIV of 76.6 million m³/a. The inclusion of Dr JS Moroka, with a NRW of 70%, is the main contributor for the increase in NRW and water losses.



NRW and water losses have reduced slightly over the past 8 years, despite a significant increase in the system input volume. The system input volume improved and water losses show significant improvement in 2013 and it is hoped these levels could be maintained but this needs further investigation, as the demand in Mbombela dropped by 18% in 2013. The significant increase in demand in 2012 is mainly due to the inclusion of the supply to Sasol by Govan Mbeki, which was previously excluded from the supply.



Per capita consumption reduced from 2005 to 2008 but has subsequently increased back to slightly below 2005 in 2013. The 2012 spike in the per capita consumption is due to the inclusion of Sasol as part of the Govan Mbeki municipality's system input volume.

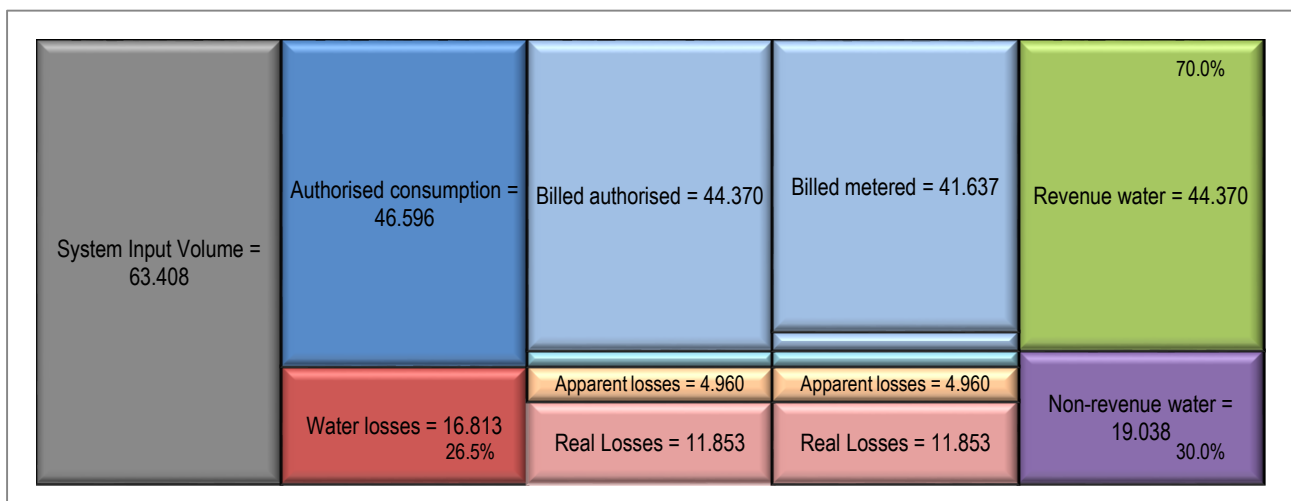


The Mpumalanga province has been unable to reduce their demand in the past 8 years with some signs of improvement in 2013 although this requires further investigation. NRW and water losses have reduced slightly over the past 8 years, despite a significant increase in the system input volume and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

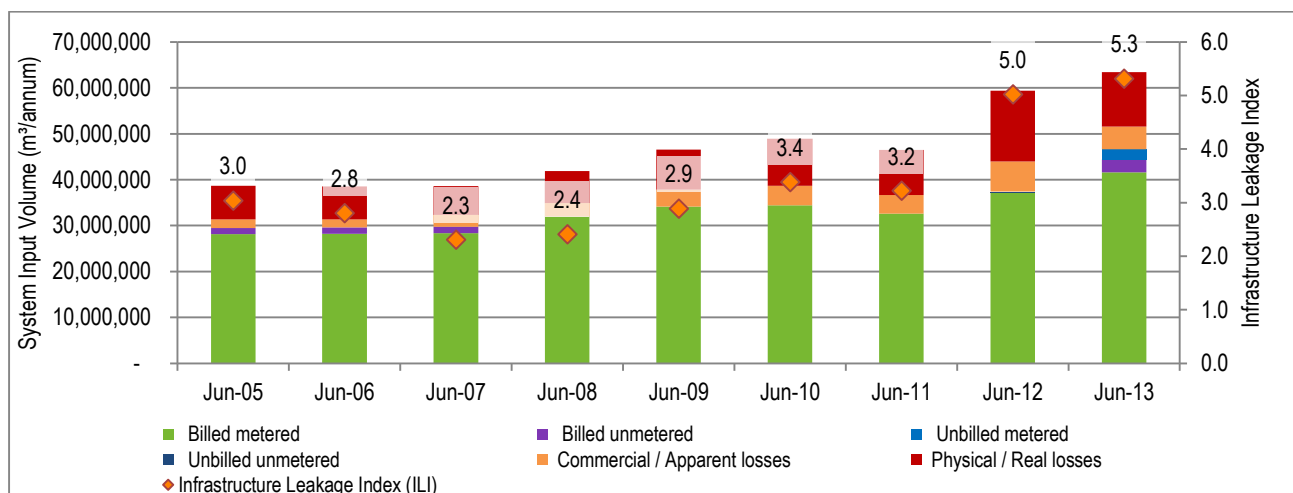
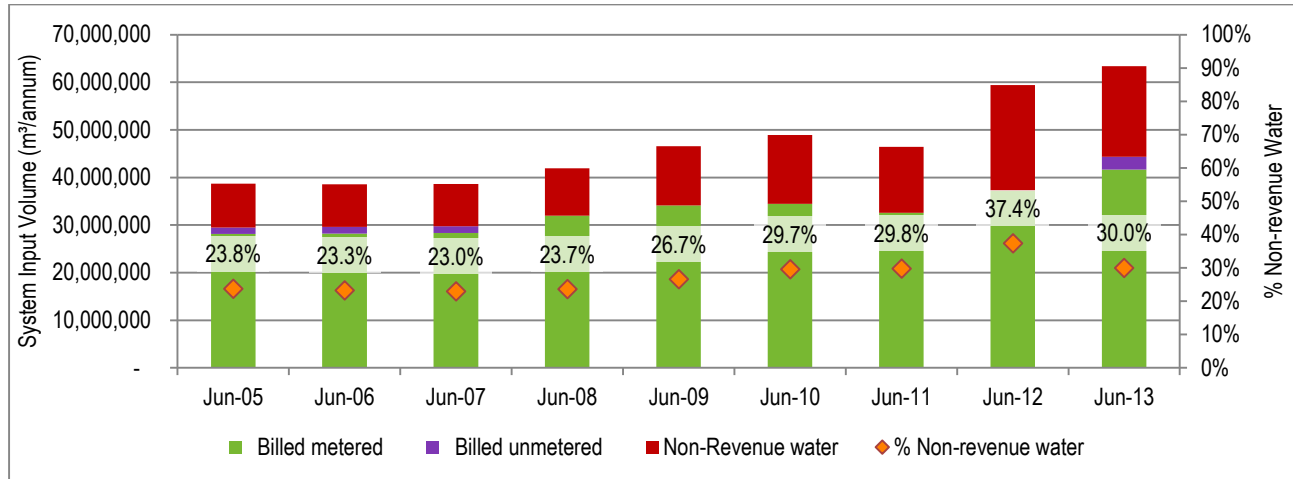
3.7 NORTH WEST PROVINCE

The water balance and trends for North West are based on only 2 (11%) plausible data sets of a possible 19 municipalities. Rustenburg and Tlokwe City Council, both secondary cities, are included in the data set. Water balance information in North West province is exceptionally poor.

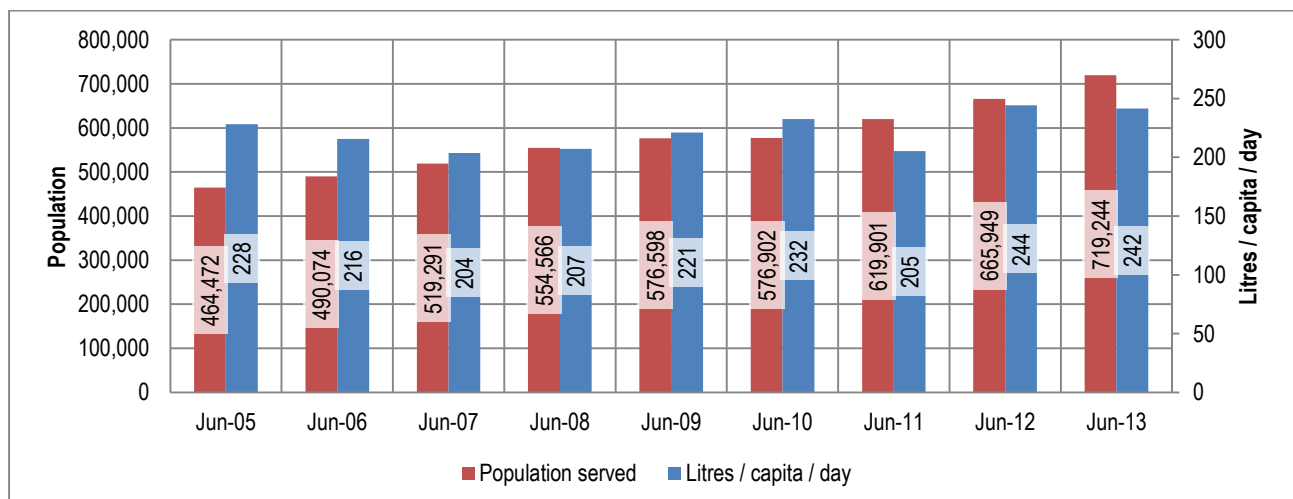
The 2012/13 water balance for the 2 data sets, indicates water losses of 16.8 million m³/a (26.5%) and NRW of 19.0 million m³/a (30.0%). Water losses compare well with the 2012/13 No Drop assessment of 26.1% but the NRW is significantly higher at 48.2% NRW. The No Drop assessment is based on 3 data sets with a SIV of 94.2 million m³/a. The difference is the inclusion of Matlosana, with a water loss 25.1% and NRW of 85.5%.



Water losses and NRW have been increasing consistently from 2005 to 2012, with a considerable reduction in non-revenue water realised in 2013. The drop in NRW and water losses is evident in Rustenburg and requires further investigation. The growth in system input volume has been exceptionally high in the past five years. Rustenburg and City of Tlokwenq experienced a 9.82% and 5.77% five-year annualised growth respectively.



Per capita consumption has been growing consistently in the North West from 2005 to 2013. The per capita consumption is almost equal to the No Drop figure of 240 l/c/d.

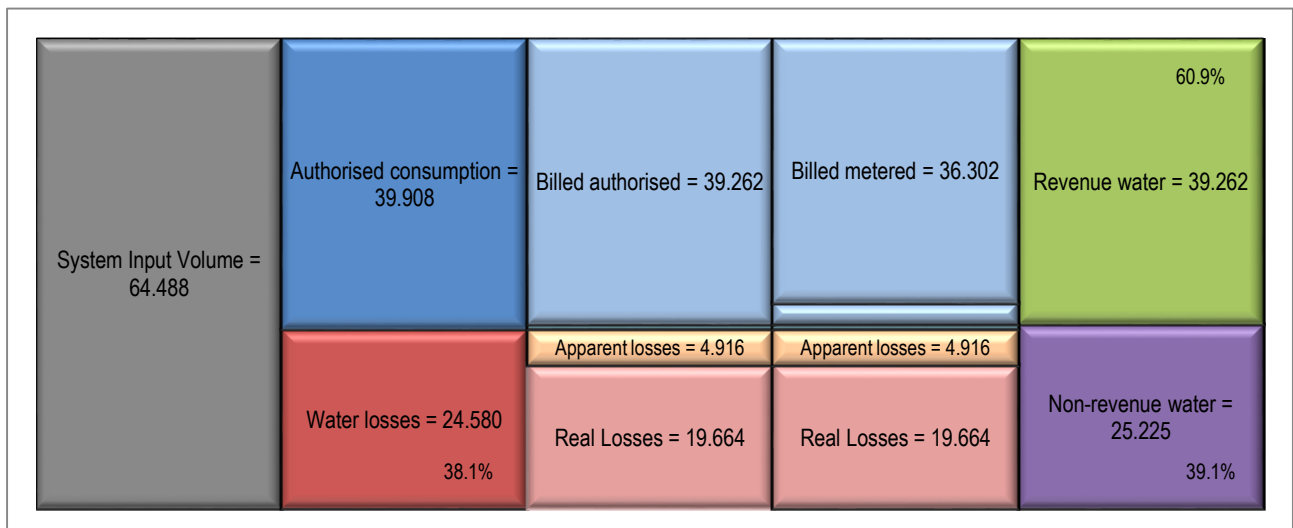


The North West province has been unable to reduce their demand in the past 9 years, except for 2011, and shows significant growth in the past 2 years. NRW have reduced slightly in the past year, but water losses are consistently increasing. WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input volume, NRW, water losses and efficiency.

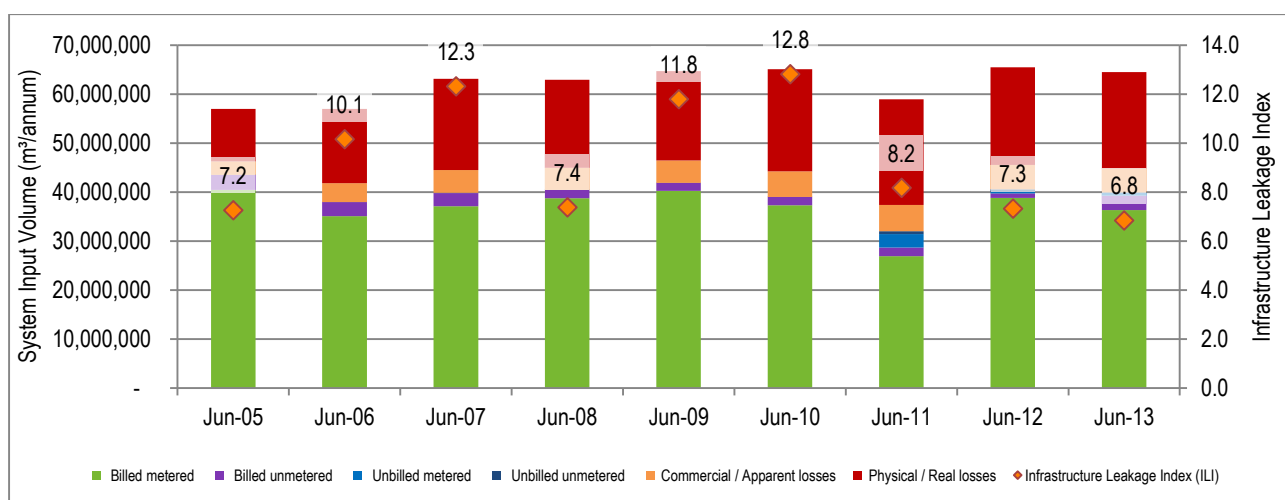
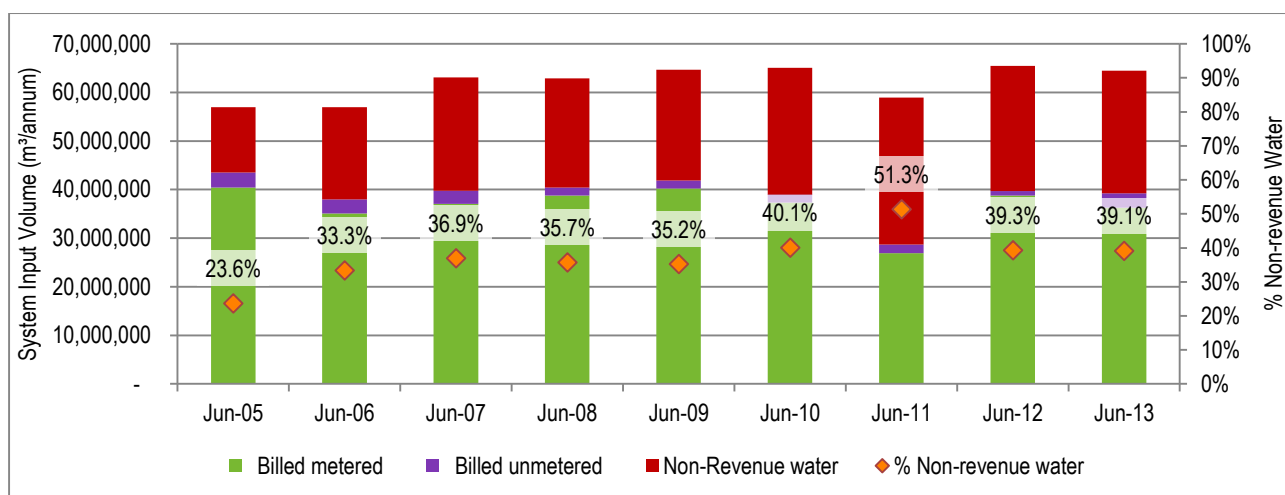
3.8 NORTHERN CAPE PROVINCE

The water balance and trends for the Northern Cape are based on 14 (52%) plausible data sets of a possible 27 municipalities. The water balance information is highly influenced by //Khara Hais (Upington) and Sol Plaatjie (Kimberley) which accounts for approximately 67% of the demand.

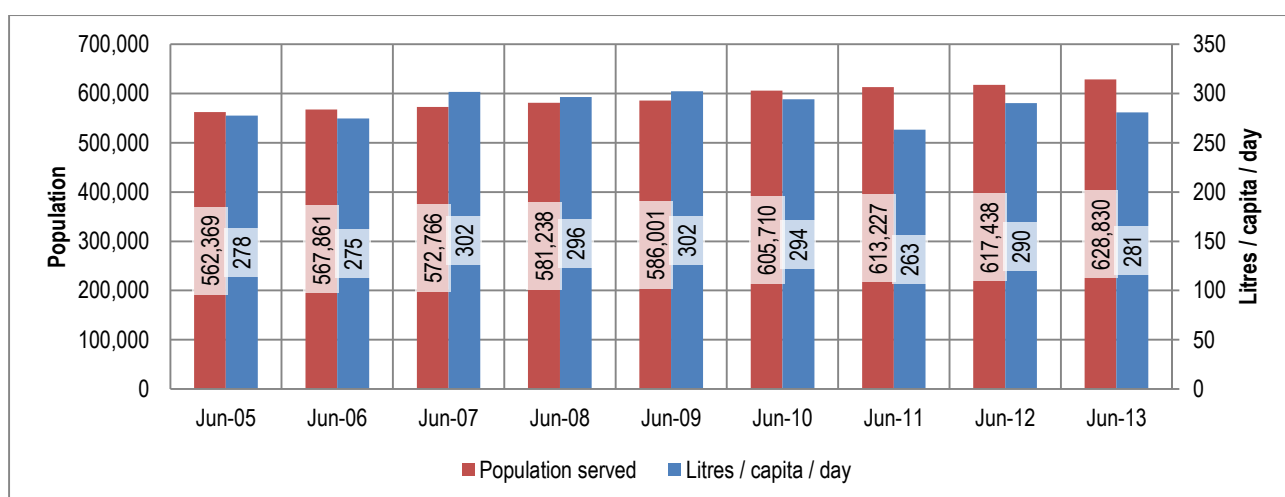
The 2012/13 water balance for the 14 data sets indicates water losses of 24.5 million m³/a (38.1%) and NRW of 25.2 million m³/a (39.1%). These figures compare well with the 2012/13 No Drop assessment of 37.1% water losses and 38.1% NRW. The No Drop assessment is based on 14 data sets, with an SIV of 62.4 million m³/a.



NRW, water losses and system input volume increased consistently from 2005 to 2010, but have improved over the past three years. The drop in demand and spike in NRW and water losses during 2011 is unclear and requires further investigation. Municipalities have managed to control their demands at the same levels for the past 6 to 7 years, which is commendable.



Per capita consumption reduced from 2009 to 2013, which is commendable and could be an indication of the WCWDM interventions taking effect in the province.

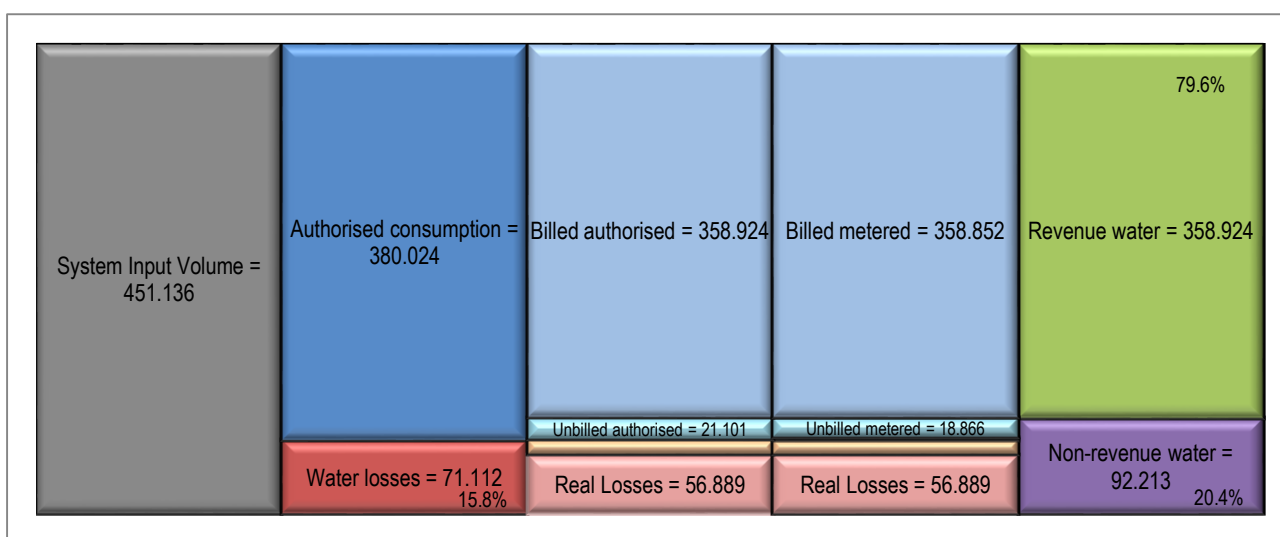


Northern Cape has managed to maintain their system input, NRW and per capita consumption in the past 5 to 6 years. Increased efforts are required by municipalities to implement WCWDM to ensure targets are achieved and water restrictions are mitigated in the driest province. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input, NRW and water losses in the province.

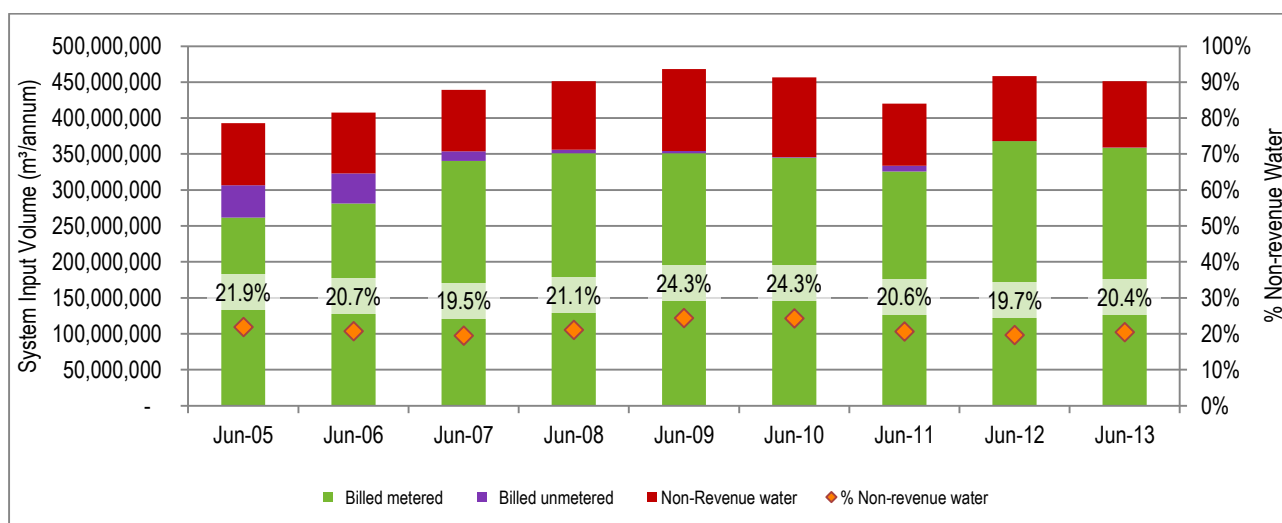
3.9 WESTERN CAPE PROVINCE

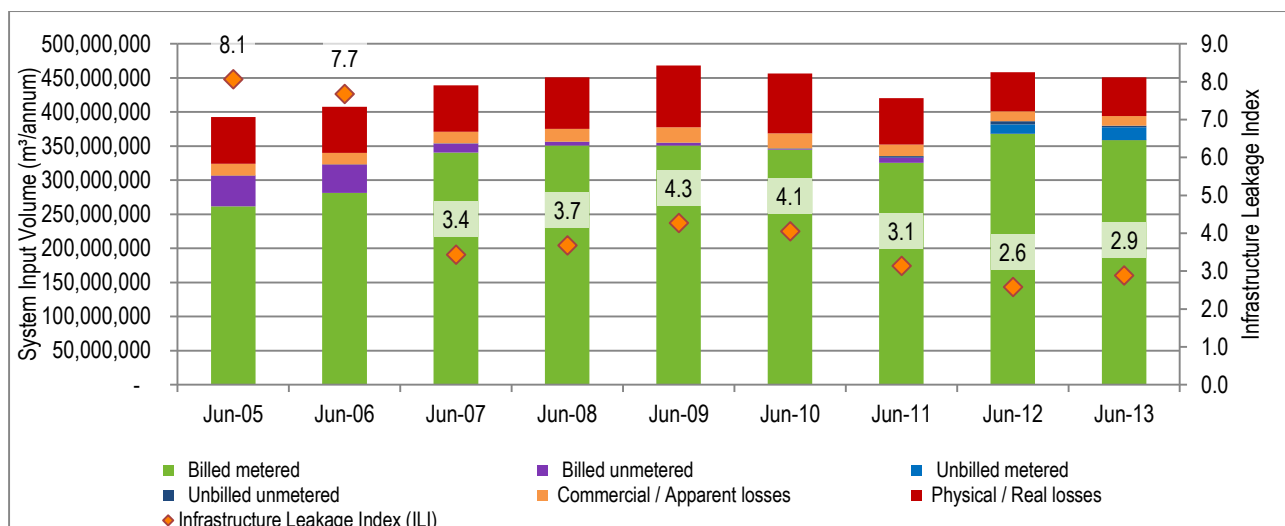
The water balance and trends for the Western Cape are based on 20 (80%) plausible data sets of a possible 25 municipalities. The water balance information is highly influenced by City of Cape Town, Drakenstein, Stellenbosch and George which account for approximately 80% of the demand. The water balance data for the Western Cape is exceptionally good and the DWS Regional office is lauded for their efforts to implement active monitoring and reporting mechanisms.

The 2012/13 water balance for the 20 data sets, indicates water losses of 71.1 million m³/a (15.8%) and NRW of 92.2 million m³/a (20.4%). These figures compare well with the 2012/13 No Drop assessment of 15.8% water losses and 20.5% NRW. The No Drop assessment is based on 18 data sets, with an SIV of 444.3 million m³/a.

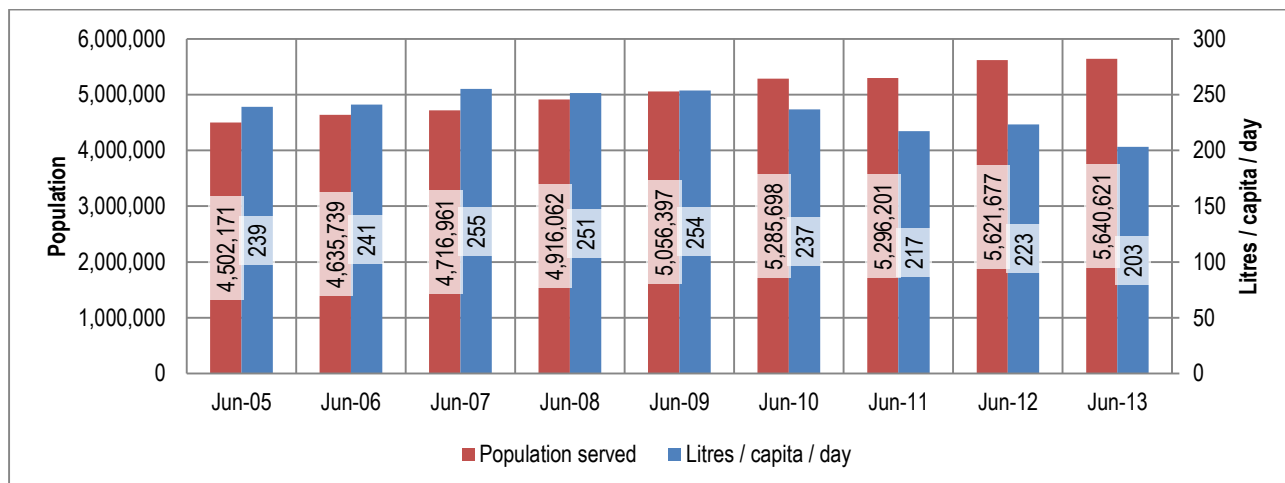


Municipalities in the Western Cape have maintained their system input and NRW in the past 3 to 4 years and water losses have been significantly reduced. The reduction could be attributed to the continuous driving, monitoring and reporting, by both the DWS Regional office and municipalities.





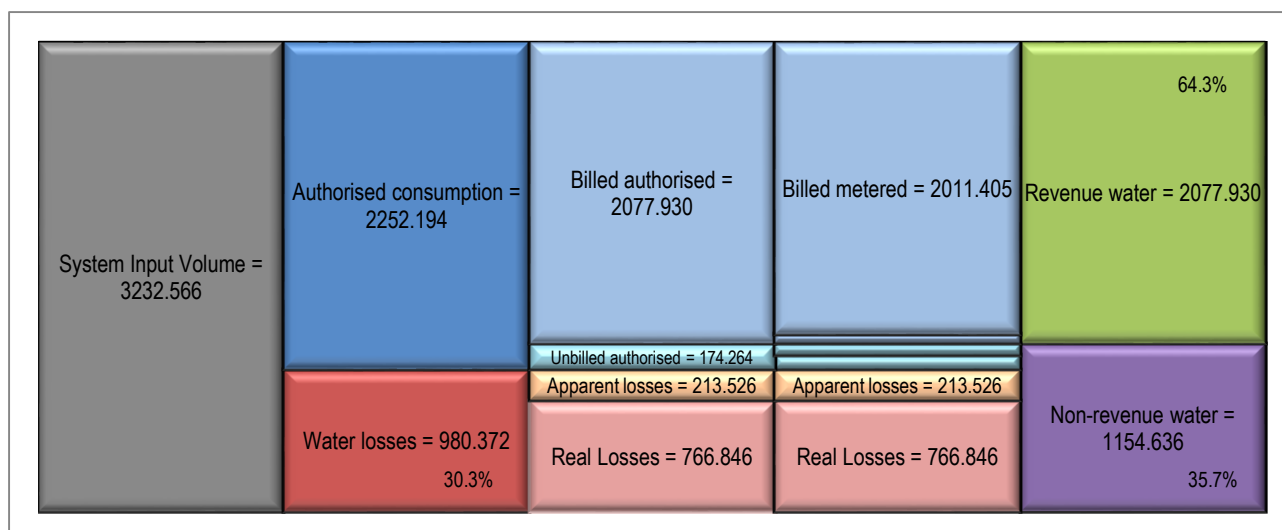
Per capita consumption has consistently been decreasing since 2009, which is commendable.



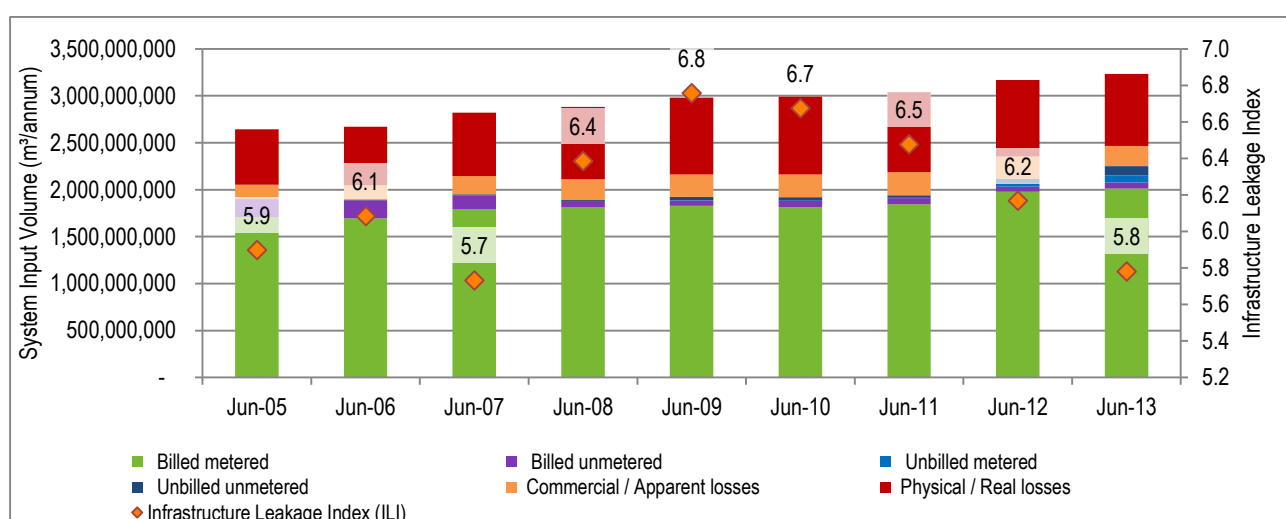
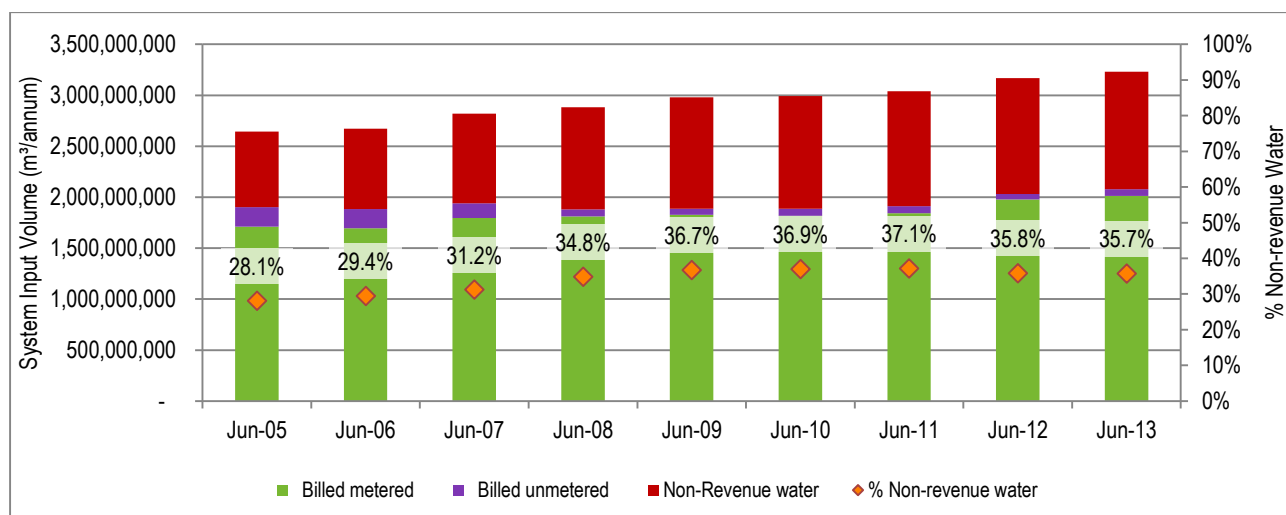
Municipalities in the Western Cape have been doing well to maintain their system input volume for the past 3 to 4 years, while reducing their water losses and per capita consumption. Municipalities must continue their current trends and increase their efforts to implement WCWDM.

3.10 NATIONAL WATER BALANCE TRENDS

The 2012/13 water balance for the 101 data sets, indicate water losses of 980.3 million m³/a (30.3%) and NRW of 1154.6 million m³/a (35.7%). These figures compare well with the 2012/13 No Drop assessment of 27.6% water losses and 34.6% NRW. The No Drop assessment is based on 71 data sets, with an SIV of 2 997.6 million m³/a.



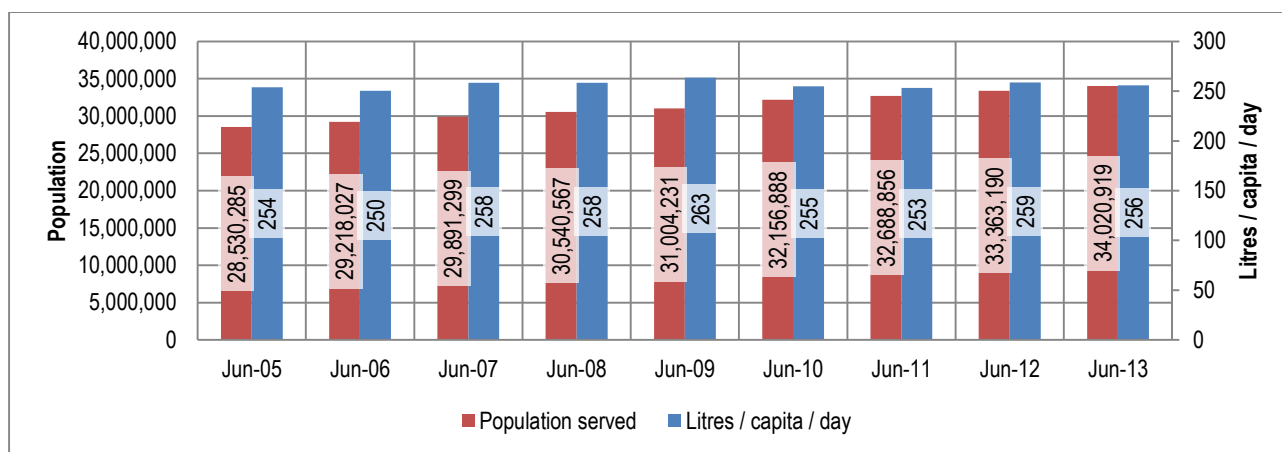
System input volume has been consistently increasing since 2006 but NRW has been improving since 2011 and water losses since 2009.



The reduction in non-revenue water is encouraging but the figures are highly influenced by the metros that have made considerable progress to reduce their non-revenue water while there is

significant scope for improvement in most of the other municipalities. The reduction in water losses is mainly due to the shift of water losses to unbilled consumption in the water balance. This shift emphasises the extent of leakage on private properties and the need for metering and billing systems, mechanisms to control consumer demand, the War-on-Leaks programme and consumer education and awareness.

Per capita consumption has remained almost constant over the past 9 years, which is commendable, but WCWDM efforts must be elevated considering these figures are significantly above international benchmarks of approximately 180 l/c/d and the country is one of the 30 driest in the world. The per capita consumption is also significantly up compared to the previous study, *The State of non-revenue water in South Africa* (WRC, 2012) which was estimated at 235 l/c/d.



The 3% No Drop (DWS, 2015) figures compared to *The State of non-revenue water in South Africa* (WRC, 2012) are shown in the following table.

Category	State of NRW in SA (2009/10)				3% No Drop (2012/13)			
	No of systems	% NRW	ILI	l/c/d	No of systems	% NRW	ILI	l/c/d
A	8	34.3%	8.2	291	8	32.3%	5.4	280
B1	18	41.3%	7.4	241	15	41.5%	6.5	261
B2	26	30.5%	5.7	230	15	26.2%	4.8	321
B3	55	37.0%	4.7	164	49	37.1%	4.2	217
B4 (C2)	25	72.5%	7.8	65	14	49.5%	4.0	90
National Total	132	36.8%	6.8	235	101	34.6%	6.2	252

The results indicate improved NRW and ILI but a significant increase in the national per capita consumption. The increase is mainly in the category B2 and B3 municipalities despite stable or improved water losses and percentage NRW. The increase is attributed to the reduced number of category B2, B3 and B4 data sets and possibly improved data accuracy.

Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM could be measured. WCWDM must be implemented as a matter of urgency in all provinces, especially with the looming and reported droughts in the country. There is significant scope for improvement in reporting levels, data accuracy and a reduction of system input, NRW, water losses and improved efficiency across the country.

6 CONCLUSIONS AND RECOMMENDATIONS

The **Eastern Cape** has managed to maintain leakage levels and per capita consumption in the past 5 years but, especially with the looming drought situation, there is significant scope for improvement in reporting levels, data accuracy and reduction of NRW and water losses.

The **Free State** has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 270 $\ell/c/d$. Leakage levels fluctuate considerably and it is difficult to assess if any progress is made with the reduction of NRW and water losses. WCWDM must be implemented as a matter of priority, considering that water restrictions have already been imposed in Mangaung metro. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input volume, NRW, water losses and efficiency.

Gauteng has been unable to reduce their demand in the past 9 years, although water use efficiency seems to have been improving in the past 5 years. NRW and water loss levels have come down, which is commendable, but WCWDM implementation levels must be elevated to ensure the targets of the Greater Vaal reconciliation strategy are achieved. There is significant scope for improvement in the reduction of system input volume, NRW, water losses and efficiency. Data accuracy and reporting are excellent at metro-level but can improve for some of the smaller municipalities.

KwaZulu Natal has managed to maintain their system input, leakage levels and per capita consumption in the past 5 to 6 years. There is however, significant scope for improvement in the reduction of system input, NRW and water losses in the province and WCWDM implementation levels must be elevated to ensure the targets of the KZN Metropolitan areas reconciliation strategy are achieved, especially with the looming / imposed water restrictions in the province. Data accuracy and reporting are excellent at metro and secondary city level but there is significant scope for improvement in reporting levels and data accuracy for the smaller municipalities.

The **Limpopo** province has been unable to reduce their demand in the past 9 years and water use efficiency is at an all-time low of 205 $\ell/c/d$. Leakage levels and NRW are also consistently increasing and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input volume, NRW, water losses and efficiency.

The **Mpumalanga** province has been unable to reduce their demand in the past 8 years with some signs of improvement in 2013, although this requires further investigation. NRW and water losses have reduced slightly over the past 8 years despite a significant increase in the system input volume and WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input volume, NRW, water losses and efficiency.

The **North West** province has been unable to reduce their demand in the past 9 years, except for 2011, and shows significant growth in the past 2 years. NRW have reduced slightly in the past year but water losses are consistently increasing. WCWDM must be implemented as a matter of priority. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input volume, NRW, water losses and efficiency.

Northern Cape has managed to maintain their system input, NRW and per capita consumption in the past 5 to 6 years. Increased efforts are required by municipalities to implement WCWDM to ensure targets are achieved and water restrictions are mitigated in the driest province. There is

significant scope for improvement in reporting levels, data accuracy, reduction of system input, NRW and water losses in the province.

Municipalities in the **Western Cape** have been doing well to maintain their system input volume for the past 3 to 4 years, while reducing their water losses and per capita consumption. Municipalities must continue their current trends and increase their efforts to implement WCWDM.

Nationally, the system input volume has been consistently increasing since 2006 but the NRW has been improving since 2011 and water losses since 2009. Per capita consumption has remained almost constant over the past 9 years, which is commendable, but WCWDM efforts must be elevated considering these figures are significantly above international benchmarks of approximately 180 l/c/d and the country is one of the 30 driest in the world.

The reduction in non-revenue water is encouraging but the figures are highly influenced by the metros that have made considerable progress to reduce their non-revenue water while there is significant scope for improvement in most of the other municipalities. The reduction in water losses is mainly due to the shift of water losses to unbilled consumption in the water balance. This shift emphasises the extent of leakage on private properties and the need for metering and billing systems, mechanisms to control consumer demand, the War-on-Leaks programme and consumer education and awareness.

Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM may be measured. WCWDM must be implemented as a matter of urgency in all provinces, especially with the looming and reported droughts in the country. There is significant scope for improvement in reporting levels, data accuracy and reduction of system input, NRW, water losses and improved efficiency across the country.