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CERTIFICATION
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EMBASSY OF DENMARK
Pretoria, South Africa

FINAL BENCHMARKING REPORT

ANALYSIS OF WATER LOSSES AND NON-REVENUE WATER IN SOUTH AFRICAN MUNICIPALITIES

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EXECUTIVE SUMMARY

Over the years, South Africa has built a considerable foundation for sound performance regulation in the potable water quality, wastewater quality and in the past ten years, Non-Revenue Water and water loss management. The enhanced focus on NRW and water loss management specifically, has moved to the forefront at a particularly crucial and opportune time, given the central role of water in the fulfilment of the *National Development Plan* (NDP). The NDP sets out the vision for South Africa touching on the balance between the economy, socio-economic development and environmental sustainability.

The *National Water Master Plan*, in tandem with the macro national vision, issues an ambitious and timely call to action to the water sector, which includes (i) the provision of equitable access to reliable water supply (ii) protection, management and development of the nations' water resources in a manner that supports justifiable and ecologically sustainable economic and social development and (iii) transformative access to water to redress the racial imbalances created by apartheid. The journey towards achieving these objectives begins with understanding the extent and nature of the Non-Revenue Water (NRW) challenges faced by those tasked with its management.

Objectives

The key objectives of this study were as follows:

- Assess the current status of water losses in the country in order to strengthen the efforts of the WSA in managing NRW, and to amplify the need for an effective regulatory and enforcement environment.
- Report on System Input Volume (SIV), NRW, water loss and efficiency trends based on 2010/11 to 2020/21 municipal financial year data (11 years).
- Calculate a 2020/21 water balance for each municipality where no better information exists.
- Assess municipal water loss and water use efficiency against regulatory compliance and best management practices.

The primary intent of this report is to provide a status update of the levels of NRW, water losses and efficiencies in the country, after a five-year gap since the last benchmarking study undertaken in 2017. While it builds on the regulatory compliance programme which commenced in 2015, this report only focusses on Criteria 1.2: Water Balance of the No Drop programme.

It is anticipated that the status update on the NRW in South African municipalities will serve as a catalyst for the next round of the No Drop assessment with expanded Key Performance Indicators (KPIs) for all municipalities. It is also envisaged that this report will create a higher level of awareness and fast track prioritisation and execution of Water Conservation and Water Demand Management (WCWDM) initiatives to address the prevalent issues in a coherent manner.

Policy and Legislation

The original mandate for efficient and effective distribution of water resources comes from the ***Constitution Act 108 of 1996,*** which states that every citizen has a right to, amongst other things, sufficient food and water, placing water at the forefront of human development and therefore emphasizing the importance of its management and beneficial use. The ***National Water and Sanitation Master Plan*** clearly articulates that building a water secure future will require proactive infrastructure management, effective water infrastructure operations and maintenance and overall reduction in future water demand, while looking at further infrastructure development and augmentation if necessary. The ***National Water Resources Strategy II*** outlines the importance of WCWDM and NRW management, and that they will be priority programmes to reach the 15 % demand reduction target. The ***DWS Strategic Plan for the 2020/21 to 2024/25*** clearly sets out a performance target approach to WCWDM, highlighting its importance as one of the key priority implementation areas for the DWS. The Strategic Plan also clarifies that set targets could be met through the use of existing grant mechanisms considering the impact of WCWDM on bulk infrastructure requirements. **The National**

Water Act (36 of 1998) recognises that water is a scarce and precious resource that belongs to all the people of South Africa and that the ultimate goal of water resource management is to achieve the sustainable use of water for the benefit of all South Africans. **Water Services Act (108 of 1997)** provides a framework for the provision of water supply and sanitation services to end users such as households, business and industries within municipalities. It sets the standards for the local and provincial spheres of government and establishes the norms and standards for tariffs. **The Regulations relating to compulsory national standards and measures to conserve water (GNR.509 of 8 June 2001)** under the Water Services Act, 1997 (Act No. 108 of 1997) provides for the protection of consumers and WSAs and to ensure the application of sound management principles.

History of Benchmarking Studies

South Africa has a 20 years benchmarking history with the foundation of the current methodology for calculating and understanding NRW and water losses established in 2002, through the "Development of a pragmatic approach to benchmark water losses in potable water distribution systems in South Africa". The first comprehensive national benchmark study was published in 2012 with "The State of Non-Revenue Water in South Africa (2012)". Since 2012, several detailed assessments and updates were undertaken including the No Drop assessment in 2015. The last national water loss benchmarking study was based on the 2015/2016 data and published in 2017.

Stakeholder Engagement and Collection of Water Balance Data

The stakeholder engagement component of the study was considered one of the most critical aspects to achieving the objectives. The initiation phase of the stakeholder engagement process was crucial in obtaining the buy in of the sector leaders and municipalities, both of which were vital in obtaining the requisite information for executing the national benchmarking exercise. The Regional Office were supportive and displayed a distinct willingness to work with the study team in obtaining the information required. The KwaZulu Natal, Western Cape and Gauteng Regions were particularly adept at gathering and submitting good quality information with medium to high confidence levels. The Northern Cape utilise a similar strategy and were able to provide some credible water balance information. The Eastern Cape provided some information particularly from the District Municipalities, which varied significantly in quality and useability

Data Submission Statistics

There has been a noticeable improvement in the quality of data for Regions that have active data collection and collation programmes going or their municipalities are requested to report on a regular basis at reconciliation strategy progress meetings.

For the purpose of differentiating useability of the data, the data was categorised into one of three groups as follows:

- **High confidence level**: Data sets are submitted on a regular basis, show trends and are credible.
- **Medium confidence level**: One or more data sets were submitted in the past three years and seem credible.
- **Low confidence level**: None or one data set was submitted in the past three years, and the data sets submitted are questionable, with considerable gaps and/or inaccuracies.

A total of 88 datasets (61%) were received from WSAs which is the highest to date. Less than 50% of WSAs were able to submit water balance data in previous surveys. The confidence level of the data submitted varies between high (40%), medium (18%) and low (42%).

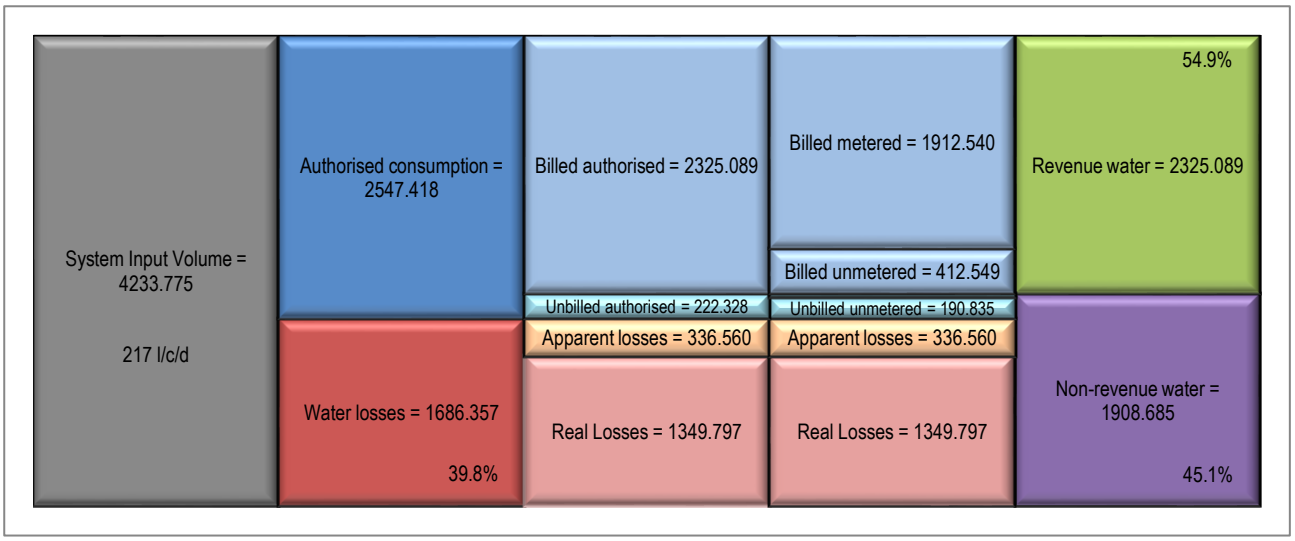
The confidence levels take into account the WSAs that did not submit data and for, which water balances had to be calculated.

Estimated Water Balance

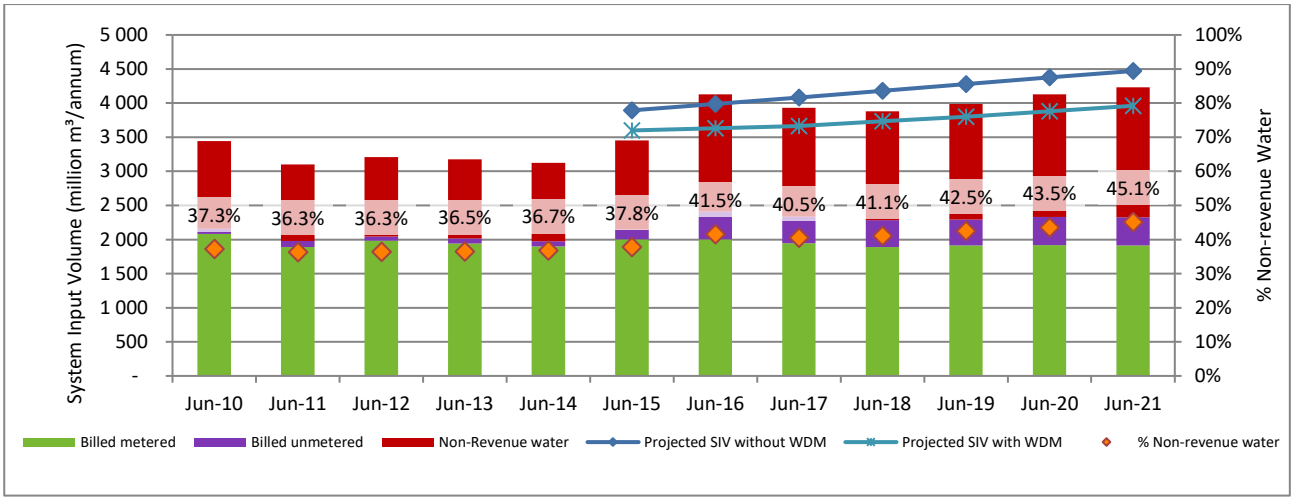
Prior to the 2017 benchmark report, all reports calculated the national water balance based on an extrapolated sample size. The national water balance is highly influenced by the metro and secondary city data, which has high confidence level while data for the category C2, B3 and B4 municipalities have a low confidence and are poorly represented in the sample size. The extrapolated results provided NRW figures between 35 to 40% depending on the methodology followed. It was substituted with bottom-up approach by estimating a water balance for each municipality that could not provide information.

National Water Balance

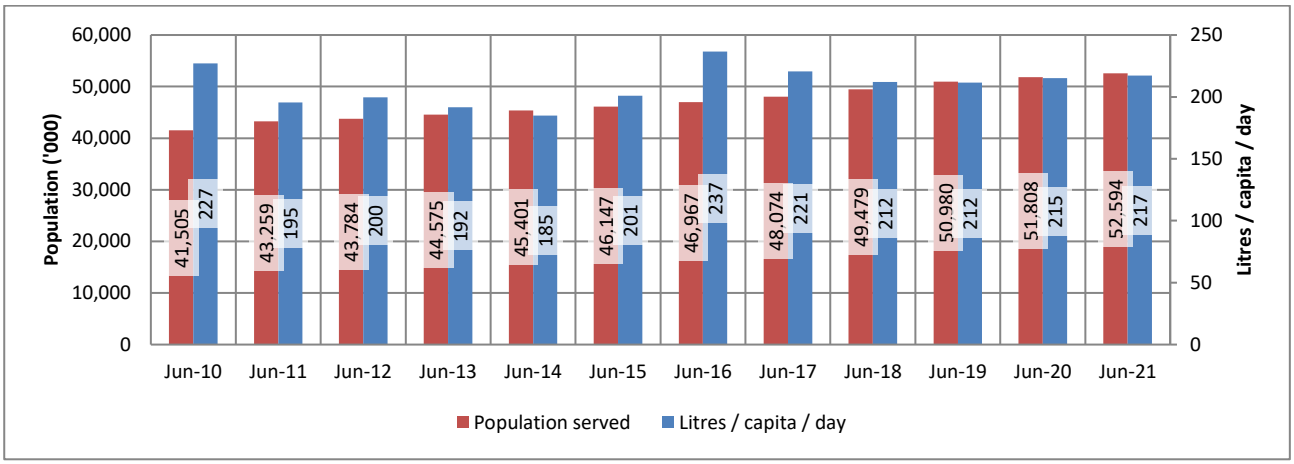
The 2020/21 national water balance indicates a SIV of 4233.8 million m³/annum, NRW of 1908.7 million m³/annum (45.1%) and water losses of 1686.4 million m³/annum (39.9%). There has been a noticeable increase in billed unmetered consumption as a result of incorporating free basic water supply in the estimated water balances for especially rural municipalities. Unbilled unmetered consumption remains lower than expected, considering the high number of unbilled properties in the country. Municipalities need to correct their water balance calculations and show any water use after an accepted connection as authorised consumption and not water loss.



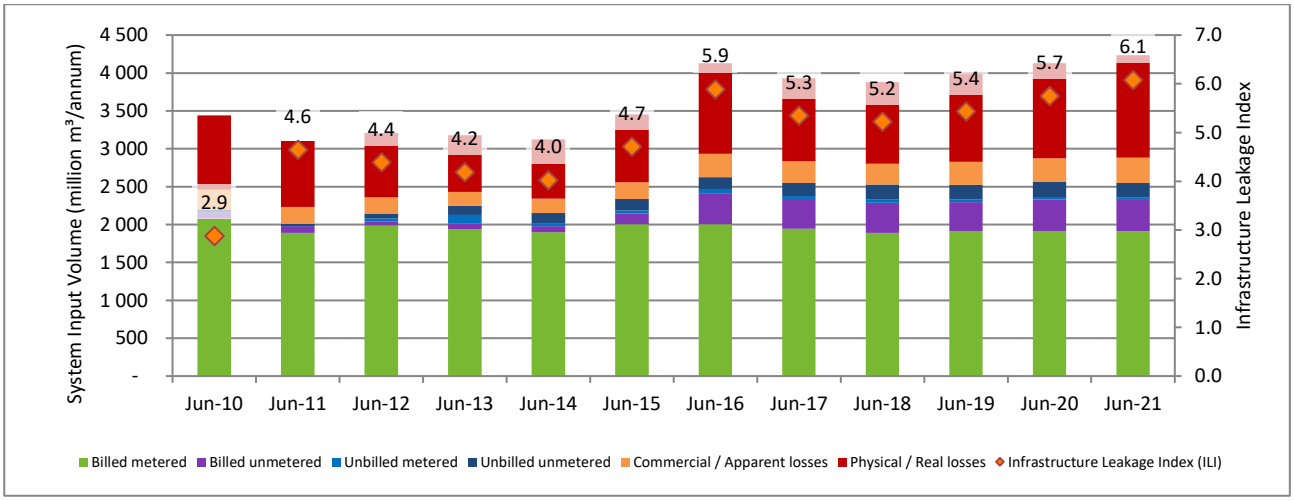
The NRW and water losses have increased by a notable 3.5% and 3.4% respectively from June 2016, however, the greatest increase was in the past two years and attributed to the COVID-19 pandemic. The fluctuation between 2016 and 2019 was generally less than 1%. The national NRW and water loss trends show a steady increase in NRW over the past 10 years and gradual exceedance of the SIV projections with WCWDM scenario. The figures are highly influenced by the category A, B1 and B2 municipalities, most of which have made significant strides in improving NRW management, reducing water losses and managing the demand in line with reconciliation strategy targets. There is significant scope for improvement of NRW and all municipalities would benefit from targeted demand management programmes including community education and awareness, leak repair, infrastructure refurbishment, pressure management, installation of bulk meters amongst other measures.



National trends suggest that the per capita consumption has remained almost constant over the past 10 years, which is commendable, however, WCWDM efforts must be elevated considering the level of service, inefficiencies and the country is one of the 30 driest in the world. The per capita consumption is however significantly lower than the previous national average of 237 ℓ/c/d presented in June 2016.



The ILI deteriorated slightly from 2016 to 2021 and showed signs of improvement in 2017 and 2018. The COVID-19 pandemic has played havoc with municipal water losses and this trend is expected to improve once municipalities have return to normal and have eliminated the leak repair back-logs and improved revenue collection.



The results indicate increased NRW, water losses and ILI but a significant decrease in the national per capita consumption. Given the increases on three key NRW metrics, WCWDM must be implemented as a matter of urgency in all regions, especially considering that a number of regions have NRW and water losses above 50%. There is significant scope for improvement in reporting levels, data accuracy and a reduction of SIV, NRW, water losses and improved efficiency across the country. Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM can be measured.

Conclusions

The following conclusions are drawn from the assessment:

- **Category A** - Metropolitan municipalities continue to report consistently and most can provide a water balance on a monthly basis. This is encouraging considering that metropolitan municipalities represent 52.2% of the total water use and 46.7% of the population.
- **Category B1 and B2** - Most secondary city and large municipalities can provide a water balance on a regular basis although there is considerable room for improvement in some regions. The secondary city and large municipalities represent 21.3% of the total water use and 20.6% of the population. These municipalities are of economic significance and should have the necessary budgets and resources to implement WCWDM.
- **Category C2, B3 and B4 –** Less than 50% of the small and rural municipalities can provide an accurate water balance on a regular basis. Reasons for this include lack of budget, difficultly measuring the supply due to the large number of boreholes and large indigent consumer base. These municipalities represent approximately 26.5% of the total water use and 32.7% of the population.
- Water balance information is continuously updated and improved which means that the data shown in this report differs from the data presented in the Benchmarking of water losses, NRW and efficiency report (2004 to 2015/16).
- Water losses and NRW have increased in most municipalities since the onset of the Covid-19 pandemic in early 2020. The increase in NRW and water losses are attributed to reduced payment levels, operations and maintenance budget cuts and lack of capacity in municipalities to undertake repairs due to ill health and deaths.
- The results indicate increased NRW, water losses and ILI but a significant decrease in the national per capita consumption. Given the increases on three key NRW metrics, WCWDM must be implemented as a matter of urgency in all regions, especially considering that a number of regions have NRW and water losses above 50%. There is significant scope for improvement in reporting levels, data accuracy and a reduction of SIV, NRW, water losses and improved efficiency across the country. Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM can be measured.
- All municipalities would benefit from targeted demand management programmes including community education and awareness, leak repair, infrastructure refurbishment, pressure management, installation of bulk meters amongst other measures.
- Based on the functional expenditure and SIV of 49 WSAs, the average cost of supplying water is R 12.41/kl. This ranges from R 14.38/kl for metropolitan municipalities to R 10.30 for category B3 municipalities. The cost of supplying rural municipalities (category B4 and C2) is the highest, ranging from R 13.21/kl to R 16.33/kl. This is a meaningful change from previous assessments that suggested that cost of supplying water in the rural schemes are cheaper than large municipalities. The higher cost can be justified considering that these schemes often consist of many small systems with boreholes which are expensive to operate.
- Using the national average and category average tariffs, the estimated cost to supply water in the country is between R 52 and R 57 billion per annum and revenue of between R 45 and R 51 billion is generated from water sales. The value of NRW is between R 23 and R 26 billion at R 12.41/kl which is

considerably higher than previous estimates. The increase is due above inflation water tariff increases from water boards and the under estimation of water supply costs to rural municipalities.

- The results show that approximately R 1 billion per annum could be saved if the SIV is reduced by 2% and municipalities will generate nearly R 1 billion per annum for every 2% increase in revenue. The nett benefit could be R 10 billion per annum if revenue is increased by 10% the SIV is reduced by 10%. Reducing the SIV by 10% and increasing the revenue by 10% would bring reduce the national NRW figure to 32.9% and the per capita consumption to 194 l/c/d.

Recommendations

The following recommendations are made to address the progress made with the reporting and implementation of WCWDM in the municipal environment:

- Maintenance of the reconciliation strategies must continue and used to monitor the progress made with the implementation of WCWDM. Municipalities must actively participate and report at these meetings and use the outcomes to prioritise resources and budgets.
- Municipalities should increase their efforts to achieve the targets set under the various water reconciliation strategies to ensure water security and targets need to be reviewed on a regular basis.
- Too many local municipalities are not aware of the reconciliation strategies or expect DWS to provide the necessary funding to implement these strategies. Municipalities must be reminded of their responsibilities in terms of the Water Services Act and actively participate, budget through the IDP process and implement the results from the reconciliation strategies.
- Budgets are allocated towards new infrastructure projects through ACIP, MWIG, RBIG, MIG, etc. funding programmes but the management of these funds are fragmented with emphasis on new infrastructure and insufficient focus on WCWDM.
- Ongoing monitoring and reporting of municipal NRW and water loss performance by DWS against determined targets and baselines are critical.
- Monitoring and reporting on water balances by municipalities could become more self-regulatory if a policy is implemented that no new infrastructure projects will be funded unless the municipality can provide actual consumption figures and proof that their water losses are under control. The IWA water balance should become the backbone of all water related management and decision support systems, especially grant application and awarding processes.
- Municipalities should increase their efforts to reduce NRW and the negative impact it has on their ability to generate own income and operate a viable water business.
- Metropolitan municipalities and secondary cities account for ??? of the water supply to ???% of the population.
- Municipalities should, through on-going awareness programmes, encourage the consumer to appreciate the value of water and enforce the user pays principal.
- Municipalities should resolve metering and billing issues to increase payment levels, encourage consumer fixing of leaks, and prosecution of illegal water connections and reduce theft of water.
- Municipalities should continue their effort to capitalise on the awareness created and sustain the savings achieved during the drought.
- Municipal asset management needs to be improved to ensure greater sustainability of water supply services.
- Closer involvement and collaboration with National Treasury is critical to ensure issues related to funding of WCWDM programmes, metering and billing issues are resolved with municipal finance departments.
- On-going provision of mentorship to municipalities through the DWS Regional Offices, CoGTA, SALGA and other institutions is critical.
- DWS Regional Offices / CMAs must upscale their skills and capacity to provide WCWDM support to municipalities, monitoring and reporting.

- All regional offices should establish reporting templates, schedule meetings with municipalities to confirm targets, analyse the water balance information and provide feedback. The reporting structures in well performing regions are now well established, managed by the regions and most municipalities are reporting on a quarterly basis. The initiative was supported by Regulations sending directives to municipalities who did not respond. A similar approach could be followed for all the other Regions to improve communications and water balance reporting.
- The Regulations Relating to Compulsory National Standards and Measures to Conserve Water (R509, 2001) states that a water services institution must fit a suitable water volume measuring device or volume controlling device to every user connection to control demand. Many municipalities do not comply with this regulation which results in excessive leakages on private properties through leaking taps and toilets as there is no incentive for consumers to fix their leaks. DWS should consider a policy whereby water services institutions are forced to either measure and control or fix leaks on private properties but government cannot continue to fund new infrastructure projects to supplement leakage. DWS is already encouraging the fixing of leaks through various programme.
- The national non-revenue water assessment completed between 2011 and 2017 suggests that 45% of municipalities cannot provide basic information such as monthly consumption figures. One of the key challenges with gathering the information is the poor communication channels with municipalities which includes resigned staff and a considerable number of private e-mails. Discussions also indicate that in some cases municipalities are unwilling to provide the information as it reflects badly on them or they feel that the information has already been submitted through the WSDP and various questionnaires. Government needs to re-look at communication channels with municipalities. Communications should be more formal, avoid duplication and targeted at senior management in the organization. In this regard, the circulars provided by National Treasury provides clear guidelines to municipalities and communications are only with the mayor, municipal manager and CFO.
- The No Drop incentive-based regulation programme should be rolled-out as planned with the other Drop programmes to elevate WCWDM regulation in the municipal environment. DWS should also enforce its regulatory mandate to penalise municipalities that do not comply.
- Elevate the profile of NRW management by fully integrating the No Drop Programme into the regulatory agenda. The No drop programme should be fully funded by the Department of Water and Sanitation to support the implementation of the No Drop System, and to signal the establishment of the tool as a priority long term strategy to improve the management of water losses and NRW in the country.
- Strengthen the relationship between DWS and the municipalities to improve the frequency of reporting and quality of the data through the regional champions. The regional champions play a critical role in this approach, demonstrating considerable success in Regions such as KwaZulu Natal and the Western Cape, where the champions have taken ownership of this relationship building exercise. The result has been consistent and accurate reporting and effective monitoring of WCWDM programmes in the municipalities.
- Promote the culture and practice of water measurement, monitoring and data verification. To attain an environment of readily available credible data for effective and informed decision making, ongoing measurement or water losses, monitoring and verification is required. Bulk and district metering as well as live telemetry monitoring systems can be used effectively to improve the data environment nationally.
- Closer involvement and collaboration with CoGTA and SALGA is critical to ensure issues related to human resources skills and capacity in municipalities, payment for services and unauthorised water use are resolved.
- Closer collaboration is required with other national, provincial and local departments that are big water users. These include Departments of Education, Correctional Services, Health, Public Works and Housing to ensure leakages and wastage are brought under control.
- The recommendations of the Second Edition of the National Water Resource Strategy (DWA, June 2013) must be implemented which calls for greater emphasis on meeting specific targets to reduce water loss. WCWDM measures will have multiple benefits in terms of the postponement of infrastructure

augmentation, mitigation against climate change, support to economic growth and ensuring that adequate water is available for equitable allocation.

- The recommendations of South Africa's National Development Plan (Vision for 2030)(NPC, 2013) must be implemented which calls for clear national and local targets to be achieved by 2022.
- The National Water and Sanitation Master Plan (DWS, 2018) goes further and states that South Africa is facing a water crisis caused by insufficient water infrastructure maintenance and investment, recurrent droughts driven by climatic variation, inequities in access to water and sanitation, environmental degradation and resource pollution, and a lack of skilled water engineers. This crisis is already having significant impacts on economic growth and on the well-being of everyone in South Africa. The recommendations of the National Water and Sanitation Master Plan should be implemented as a matter of urgency.

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ACRONYMS

BD	**Blue Drop**
CARL	**Current Annual Real Losses**
DWS	**Department of Water and Sanitation**
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)**
NRW	**Non-Revenue Water**
NWRS2	**National Water Resource Strategy 2 (2013)**
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

Over the years, South Africa has built a considerable foundation for sound performance regulation in the potable water quality, wastewater quality and in the past ten years, Non-Revenue Water (NRW) and water loss management. The enhanced focus on NRW and water loss management specifically, has moved to the forefront at a particularly crucial and opportune time, given the central role of water in the fulfilment of the *National Development Plan* (NDP). The NDP sets out the vision for South Africa touching on the balance between the economy, socio-economic development and environmental sustainability.

The *National Water Master Plan*, in tandem with the macro national vision, issues an ambitious and timely call to action the water sector, which includes (i) the provision of equitable access to reliable water supply (ii) protection, management and development of the nations' water resources in a manner that supports justifiable and ecologically sustainable economic and social development and (iii) transformative access to water to redress the racial imbalances created by apartheid. The journey towards achieving these objectives begins with understanding the extent and nature of the NRW challenges faced by those tasked with its management.

The No Drop programme, like the Blue and Green Drop programmes, was designed to elevate the profile of NRW management, and the urgency with which the considerable water loss challenges must be addressed. Furthermore, the haemorrhaging of revenue from both the water being lost and the overall revenue collection/ recovery process, in part stemming from an unwillingness of consumers to pay for their water use, need a coordinated and coherent plan of action. This plan should assist in changing the dire circumstances which have led to a progressively declining state of the infrastructure and unsustainable municipalities.

The regulatory programme was established to institutionalise NRW in municipalities across the country, with the view that such a measure would help Water Services Authorities (WSA) to face the nature and extent of the NRW challenges head on. It would also assist the municipalities with developing a business approach to water services, to improve the overall sustainability of water services.

This study seeks to report the progress made on the state of NRW, water losses and efficiency in the South African municipal sector. This can only be accurately determined through a concerted effort by all WSAs to report their water balances as stipulated by GNR.509 of 8 June 2001: Regulations relating to compulsory national standards and measures to conserve water under the Water Services Act, 1997 (Act No. 108 of 1997). The work presented builds on the previous No Drop and benchmarking assessments spanning from 2002 to 2017, which marks the last benchmarking update undertaken. In undertaking this and future benchmarking studies, the following is critical:

- Consistent and regular reporting on the NRW water balance to facilitate coherent and accurate water balance calculations.
- Regular and consistent communication between the municipalities and the Department of Water and Sanitation (DWS) regional offices in order to timeously identify municipalities that require urgent assistance.
- Concerted budget allocation and a programmatic approach to implementing NRW interventions, that is the installation of bulk meters in order to measure and monitor progress, and develop a credible water balance that allows for well informed decision making when it comes to actions to reduce NRW in the municipalities.

1.2 OBJECTIVES

The key objectives of this study were as follows:

- Assess the current status of water losses in the country in order to strengthen the efforts of the WSA in managing NRW, and to amplify the need for an effective regulatory and enforcement environment.
- Report on System Input Volume (SIV), NRW, water loss and efficiency trends based on 2010/11 to 2020/21 municipal financial year data (11 years).
- Calculate a 2020/21 water balance for each municipality where no better information exists.
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It is anticipated that the status update on the NRW in South African municipalities will serve as a catalyst for the next round of the No Drop assessment with expanded Key Performance Indicators (KPIs) for all municipalities. It is also envisaged that this report will create a higher level of awareness and fast track prioritisation and execution of Water Conservation and Water Demand Management (WCWDM) initiatives to address the prevalent issues in a coherent manner.

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 standard and most robust and comprehensive approach to report on NRW and water losses. The IWA water balance was slightly modified for South Africa to include free basic water as shown in **Figure 1**.

<table>
<tr><td rowspan="8">System input volume

(Water security and efficiency)</td><td rowspan="4">Authorised Consumption
(All water use and wastage after connection on user side)</td><td rowspan="2">Billed authorised</td><td>Billed metered</td><td rowspan="2">Revenue water (Includes free basic water)</td></tr>
<tr><td>Billed unmetered</td></tr>
<tr><td rowspan="2">Unbilled authorised</td><td>Unbilled metered</td><td rowspan="2"></td></tr>
<tr><td>Unbilled unmetered</td></tr>
<tr><td rowspan="4">Water Losses

(All losses before the connection on municipal side)

(Environmentally and financially unattractive)</td><td rowspan="2">Commercial / Apparent losses</td><td>Unauthorised consumption</td><td rowspan="4">Non-Revenue water

(Financial sustainability of the WSA and promotion of water use efficiency)</td></tr>
<tr><td>Meter inaccuracies</td></tr>
<tr><td rowspan="2">Physical / Real losses</td><td>Transfer errors</td></tr>
<tr><td>Leakage on distribution pipes</td></tr>
<tr><td>Leakage & overflows on storage tanks</td><td></td></tr>
<tr><td colspan="2">Leakage on connection pipes up to point of connection</td><td></td></tr>
</table>

Figure 1: Modified IWA water balance in South Africa

Each component of the water balance is significant as it highlights various important issues. The SIV provides an indication of the water security, if compared to the licensed abstraction, and the water use efficiency in terms of litres per capita per day. The water losses are financially and environmentally unattractive and cannot be allowed while the NRW provides an indication of the financial sustainability of the WSA. Payment for water services promotes water use efficiency as it has been shown all over the world that people who pay for water tend to use it more sparingly.

The following definitions are adopted from the *State of Non-revenue Water in South Africa* (Seago & McKenzie 2007):

- *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. If real losses are reduced, more water will be available for distribution to customers or the total system input volume will reduce. 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.

Key points

- A connection is defined as any point of water supply by the WSA and can be formal, informal or unauthorised. A formal connection has been installed by the WSA and is controlled with a service level agreement. An informal connection has been installed by the user but is accepted by the WSA. All users, supplied with potable water by the utility, should therefore be included in the water balance and

should either have a metered or unmetered connection. All informal connections that are accepted, and therefore authorised, by the WSA should be considered unmetered connections, unless the WSA intends to remove these connections. Connections that are not accepted by the WSA should be considered unauthorised (illegal) and removed or formalised, which usually involves a legal process of informing the user, imposing a fine and possible prosecution.

- Any losses on the reticulation network, before the metered or unmetered connection, should be considered commercial or physical losses whereas any leakage and water use after the connection should be considered authorised consumption. The objective with this approach is to highlight unbilled or unmetered consumption and should not be confused with commercial or physical losses which occur on the reticulation network.
- The water balance is based on the potable water supplied to the system and does not make allowance for water treatment losses. Water treatment losses are typically between 5% and 10% of system input volume and must not be included in the IWA water balance.
- Free basic water is considered billed metered or unmetered consumption, billed at a zero rate, and forms part of the billed consumption and revenue water. Care must be taken not to duplicate free basic water where it has already been included in the billed consumption.
- There is a clear distinction between NRW and water losses. Water losses are a function of the real and commercial losses and are resolved through fixing of visible leaks and improving metering and billing efficiencies. NRW is a function of real losses, commercial losses and unbilled consumption and resolved by addressing water losses and unbilled consumption.

1.4 NO DROP OBJECTIVES

The No Drop Certification scorecard seeks to select the key areas (institutional, social, technical, economical and legal proficiency) required for the sector, that, if strengthened, will help improve the current level of water losses and NRW in the municipal sector in South Africa. In addition, No Drop endeavours to:

- Develop an incentive based, regulatory environment to improve service delivery and water security and reduce water losses and non-revenue water.
- Provide a guideline to water services institutions to reduce water losses, NRW and improve efficiency.
- Incorporate the full water services cycle of the WSA by targeting political and management levels, finance and technical departments and users.
- Align and complement the Blue Drop and Green Drop programmes.

1.5 MUNICIPAL CATEGORISATION

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

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

2 LITERATURE REVIEW

The South African water sector has faced a varied spectrum of challenges, amongst the highest ranking being NRW, which has resulted in a rapid decline in the delivery of basic services across municipalities in the country. The pressure on basic resources is further compounded by increasing demands on the economy, which has resulted in a confounding interspersion of push and pull factors, where water resources are increasingly limited by growth in population, socio-economic demands and deteriorating quality, while the resource in turn starts to become a limit to growth. This dictates the parameters and avenues that growth can traverse for the country. The World Economic Forum Report 2017 identifies water as the third highest global risk in terms of impact and it has been featured on the top five global risk list for the past five years. The World Economic Forum Report 2020 in contrast lists infectious diseases and livelihood crises as the top two prevailing threats which too are inextricably linked to water. Infectious diseases cannot be managed or controlled without water and livelihoods cannot be regenerated without water. In this respect, water remains uppermost as one of the key challenges across the world.

WCWDM features prominently in many planning, strategy and policy documents, including acts, and it is paramount that the objectives of these documents are achieved to provide for the national goals of a better life for all through job creation and inclusive economic growth. South Africa has a 20 year benchmarking track record to measure the progress made with the implementation of these gaols. This chapter summarises the key policy and legislation documents related to NRW and water loss control and provides a brief history of the benchmarking reports prepared to date.

2.1 POLICY AND LEGISLATION

From a legislative perspective, the original mandate for efficient and effective distribution of water resources comes from the ***Constitution Act 108 of 1996,*** which states that every citizen has a right to, amongst other things, sufficient food and water, placing water at the forefront of human development and therefore emphasizing the importance of its management and beneficial use. The Constitution is the foundation for sound water management and the view that the resource cannot be carelessly used in order to meet the condition of sufficiency for all.

The ***National Water and Sanitation Master Plan*** clearly articulates that building a water secure future will require proactive infrastructure management, effective water infrastructure operations and maintenance and overall reduction in future water demand, while looking at further infrastructure development and augmentation if necessary. Management of NRW is central to the achievement of these objectives based on the principle that measurement and monitoring of water resources is the foundation of sound decision making, allocation of resources and effective implementation.

The ***National Water Resources Strategy II*** (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 to provide for the national goals of a better life for all through job creation and economic growth.

The ***DWS Strategic Plan for the 2020/21 to 2024/25*** clearly sets out a performance target approach to WCWDM, highlighting its importance as one of the key priority implementation areas for the DWS. The Strategic Plan also clarifies that set targets could be met through the use of existing grant mechanisms considering the impact of WCWDM on bulk infrastructure requirements. The strategy includes a requirement

for the development of individual sector WCWDM strategies for industrial, agricultural, mining, power generation and municipal water and domestic water use with targets set for each water use sector.

The National Water Act (36 of 1998) recognises that water is a scarce and precious resource that belongs to all the people of South Africa and that the ultimate goal of water resource management is to achieve the sustainable use of water for the benefit of all South Africans. The Act aims to develop, protect, use, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. The NWA, amongst others, deals with the development of strategies to facilitate the proper management of water resources.

Water Services Act (108 of 1997) provides a framework for the provision of water supply and sanitation services to end users such as households, business and industries within municipalities. It sets the standards for the local and provincial spheres of government and establishes the norms and standards for tariffs. The main objectives of the WSA are to provide for:

- The right of access to basic water supply and the right to basic sanitation necessary to secure sufficient water and an environment not harmful to human health or well-being.
- The setting of national standards and norms and standards for tariffs in respect of water services.
- The preparation and adoption of water services development plans (WSDPs) by water services authorities.
- A regulatory framework for water services institutions and water services intermediaries.
- The establishment and disestablishment of water boards and water services committees and their duties and powers.
- The monitoring of water services and intervention by the Minister or by the relevant Provincial government departments.
- Financial assistance to water services institutions.
- The gathering of information in a national information system and the distribution of that information.
- The accountability of water services providers.
- The promotion of effective water resource management and conservation.

The Regulations relating to compulsory national standards and measures to conserve water (GNR.509 of 8 June 2001) under the Water Services Act, 1997 (Act No. 108 of 1997) provides for the protection of consumers and WSAs and to ensure the application of sound management principles. Key clauses relating to the preparation of the IWA water balance are the following:

Regulation 10 – Water services audit as a component in the WSDP

10 (1) A water services authority must include a water services audit in its annual report on the implementation of its Water Services Development Plan (WSDP) required in terms of section 18(1) of the Act.

10(2) a water services audit must contain details for the previous financial year and, if available, comparative figures for the preceding two financial years of:

(a) the quantity of water services provided.

(b) the levels of services rendered.

(d) cost recovery.

(e) meter installation and meter testing.

(g) water conservation and demand management including at least:

(i) the results of the water balance as set out in regulation 11.

(ii) the total quantity of water unaccounted for (water losses).

(iii) the demand management activities undertaken.

(iv) the progress made in the installation of water efficient devices.

Regulation 11: Water and effluent balance analysis and determination of water losses

11 (1) Within two years of the promulgation of these Regulations, a water services institution must every month:

(a) measure the quantity of water provided to each supply zone within its supply area.

(b) determine the quantity of unaccounted for water by comparing the measured quantity of water provided to all user connections within that supply zone.

11 (2) A water services institution must -

(a) take steps to reduce the quantity of water unaccounted for (water losses).

(b) keep record of the quantities of water measured and of the calculations made.

The legislative framework presented above provides a clear pathway for municipalities to ensure effective management of NRW. With respect to data collection, the following issues must be noted:

- WSAs are required to produce a water balance on a monthly basis.
- WSAs have had 21 years during which to become accustomed to the practice of NRW data collection given that the Regulations were promulgated in 2001.
- Irrespective of the regularity or consistency of the National Benchmarking or No Drop exercise, the development of a water balance for all water supply systems should be an ongoing and consistent practice, which should be used to inform areas of immediate action and appropriate resource allocation for municipalities.
- The Regulations make reference to monitoring cost recovery. This implies that the data collection process requires coordinated effort from both the technical and financial departments of the municipality to achieve a common goal – that of improved NRW management and long term, sustainable water service provision.

2.2 BENCHMARKING STUDIES

The history of water loss benchmarking is South Africa over the past 20 years is shown in **Figure 2**Error! Reference source not found.**.** The foundations of the current methodology for calculating and understanding NRW and water losses were established in 2002, through the "Development of a pragmatic approach to benchmark water losses in potable water distribution systems in South Africa". The first comprehensive national benchmark study was published in 2012 with "The State of Non-Revenue Water in South Africa (2012)". Since 2012, several detailed assessments and updates were undertaken including the No Drop assessment in 2015. The last national water loss benchmarking study was based on the 2015/2016 data and published in 2017. These studies have enabled the DWS and other stakeholders to obtain a better understanding of water losses, NRW and water use efficiency in South Africa.

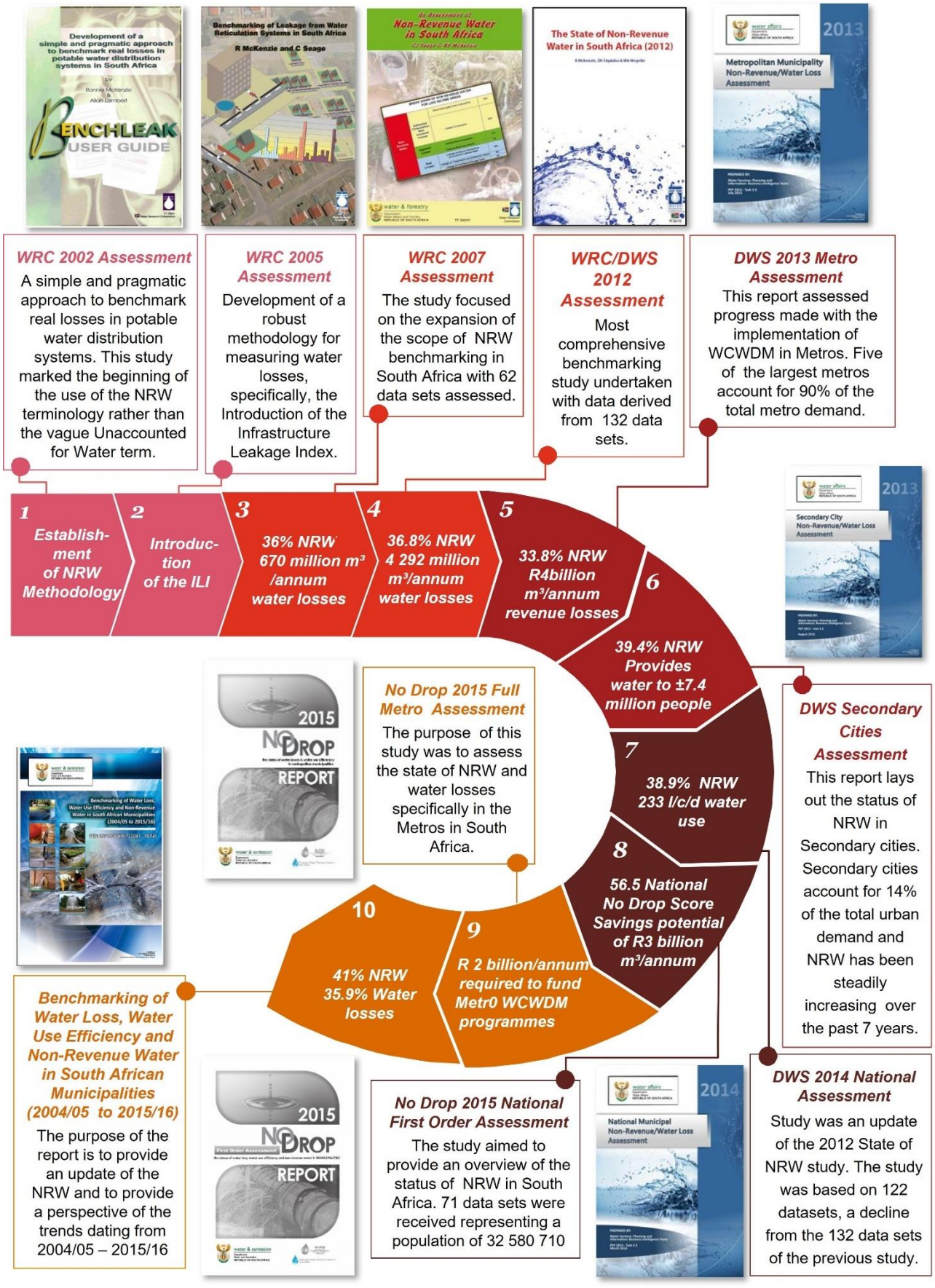


Figure 2: History of NRW Benchmarking studies undertaken in South Africa

3 METHODOLOGY

3.1 STAKEHOLDER ENGAGEMENT AND COLLECTION OF WATER BALANCE DATA

The stakeholder engagement component of the study was considered one of the most critical aspects to achieving the objectives. The stakeholder engagement was rolled out as summarised in **Figure 3**Error! Reference source not found..

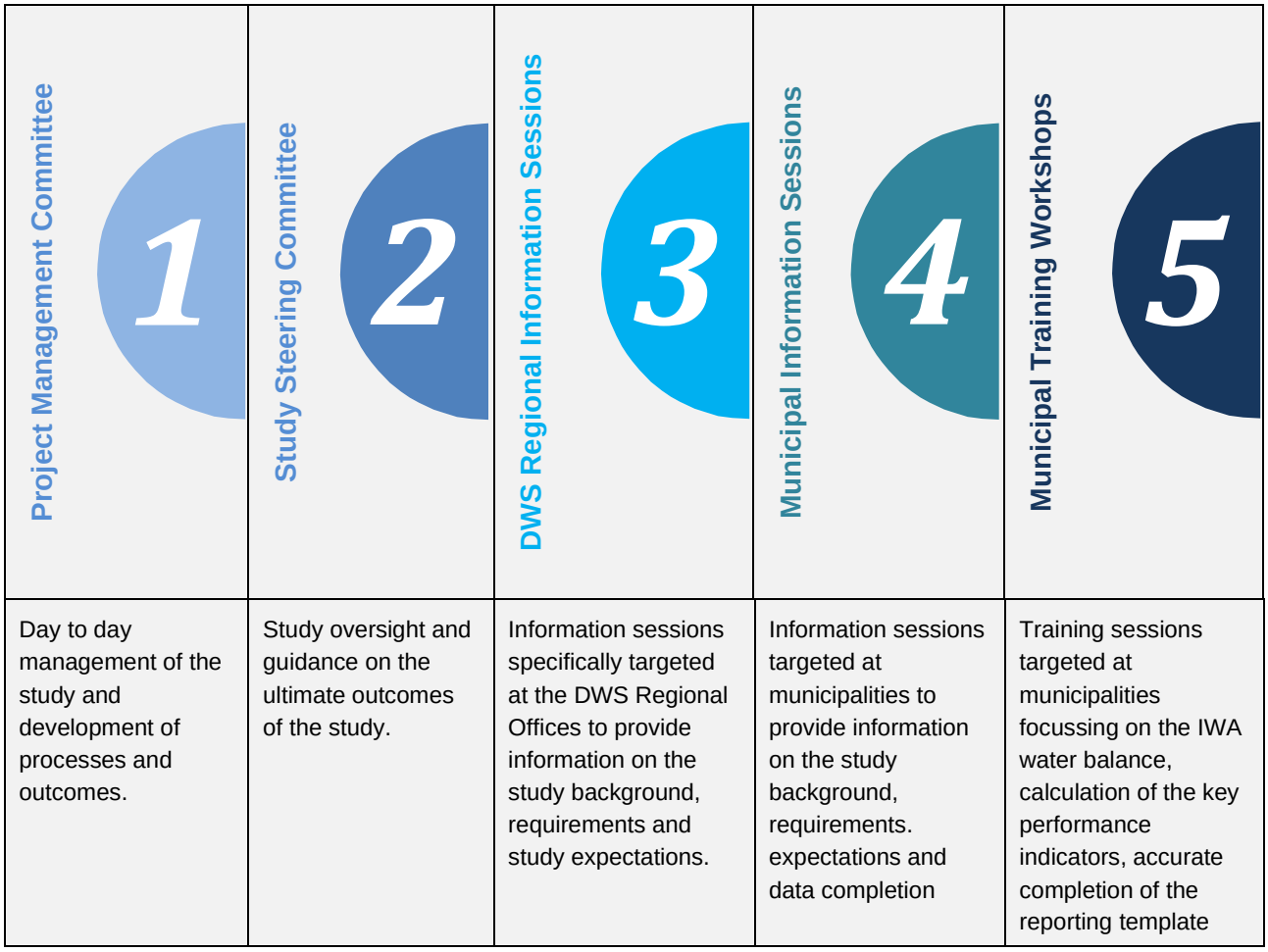


Figure 3: Summary of Stakeholder Engagement Processes

The initiation phase of the stakeholder engagement process was crucial in obtaining the buy in of the sector leaders and municipalities, both of which were vital in obtaining the requisite information for executing the national benchmarking exercise. The regional offices were supportive and displayed a distinct willingness to work with the study team in obtaining the information required. The KwaZulu Natal, Western Cape and Gauteng Regions were particularly adept at gathering and submitting good quality information with medium to high confidence levels. The Northern Cape utilise a similar strategy and were able to provide some credible water balance information. The Eastern Cape provided some information particularly from the District Municipalities, which varied significantly in quality and useability.

In contrast, there were very low levels of response from the Limpopo, Mpumalanga, North-West and Free State Regions. In general, a large portion of the data submitted was poor with low confidence levels. In such cases, the study team had to extrapolate existing data and calculate the water balances for municipalities that have not submitted any information.

It is important to note that the lack of response from the above-mentioned regions is a response in and of itself. This continues to be an untenable situation in the short to long term as it is indicative of municipalities with little

to no information upon which to make calculated, reasonable and defensible decisions. The DWS has made it clear that no further augmentation or additional water allocations will be considered until municipalities can demonstrate that all possible measures have been taken to conserve and make beneficial use of the existing resources. Such decisions cannot be made even in cases where communities legitimately require further augmentation in water resources if proper measurement and monitoring is not being executed on an ongoing basis.

The information and training sessions were well attended and expected deliverables and due dates were communicated. All communications and follow-ups with municipalities were through the DWS Regional Offices and standard IWA water balance templates were circulated. The completion of the standard templates has been workshopped and discussed through numerous training sessions over the past 10 years, which should assist in entrenching the standardisation of the information gathering process and reporting regime.

3.2 WATER BALANCE REPORTING TEMPLATE

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

- All information was provided by the respective municipalities or WSA 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, KPIs and graphics.
- White cells require an input value, while yellow cells are calculated. The municipality is required to provide only 11 values on an annual basis and 8 values on a monthly basis to complete the sheet. The values are split between basic information, such as the population served, and the water balance information. The basic information is used to calculate KPIs. The water balance component follows the format of the IWA water balance.
- All volumes are in kℓ/annum (kℓ = m^3 = 1000 litres) and based on the municipal financial year (July to June). Data for "Year ending - Jun-21" therefore means water supply and demand figures from July 2020 to June 2021.
- All underlined values were calculated using trends and / or averages based on previous years.
- The projected SIV with and without WCWDM are based on the all town or reconciliation strategies as developed by the DWS Chief Directorate: Integrated Water Resource Planning.
- Further discussions, evaluation, interpretation, monitoring and analysis would be required to comment the on discrepancies and progress made with the implementation of WCWDM.
- The provincial and district water balances are based on the sum of the municipalities located within the region or district.
- Population and households served figures were mostly obtained from the DWS National Water Services Knowledge System (http://ws.dwa.gov.za/wsks/). 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 reliability, is considered served.

Province	Province	WSA
Municipal Code	ABC123	Yes
District Municipality		Category
Municipality	EXAMPLE	B
Settlements		

			Year ending	Jun-18	Jun-19	Jun-20	Jun-21
Input Data	**Population served**		**No**	**24 560**	**25 519**	**26 172**	**26 891**
	Households served		**No**	**6 477**	**6 721**	**6 891**	**7 062**
	Connections - total		**No**	**6 477**	**6 721**	**6 891**	**7 062**
	Connections - metered		**No**	**6 268**	**6 504**	**6 669**	**6 834**
	Domestic (and non-domestic)		No	6 268	6 504	6 669	6 834
	Non-domestic		No				
	Connections - unmetered		**No**	**209**	**217**	**222**	**228**
	Households / connection		**No**	**1.0**	**1.0**	**1.0**	**1.0**
	Length of mains		**km**	**130**	**134**	**138**	**141**
	Connections / km		**No / km**	**50**	**50**	**50**	**50**
	Average system pressure		**m**	**50**	**50**	**50**	**50**
	Time system pressurised		**%**	**100%**	**100%**	**100%**	**100%**
	Apparent losses		**%**	**20%**	**20%**	**20%**	**20%**
	Consumer meter age		%	6%	6%	6%	6%
	Illegal connections		%	6%	6%	6%	6%
	Data transfer		%	8%	8%	8%	8%
Water Balance Calculations	**System input volume**		**kl/annum**	**1 940 694**	**2 112 604**	**2 041 138**	**2 126 823**
	Own sources		kl/annum	1 940 694	2 112 604	2 041 138	2 126 823
	Other sources		kl/annum				
	Authorised Consumption		**kl/annum**	**1 159 359**	**1 231 886**	**1 430 608**	**1 615 657**
	Billed authorised		**kl/annum**	**1 155 478**	**1 227 661**	**1 329 641**	**1 312 222**
	Billed metered		kl/annum	1 155 478	1 227 661	1 329 641	1 312 222
		Domestic (and non-domestic)	kl/annum	1 155 478	1 227 661	1 329 641	1 312 222
		Non-domestic	kl/annum				
		Export volume	kl/annum				
	Billed unmetered		kl/annum				
	Unbilled authorised		**kl/annum**	**3 881**	**4 225**	**100 967**	**303 435**
	Unbilled metered		kl/annum			96 885	299 181
	Unbilled unmetered		kl/annum	3 881	4 225	4 082	4 254
	Water Losses		**kl/annum**	**781 335**	**880 718**	**610 530**	**511 166**
	Commercial / Apparent losses		**kl/annum**	**156 267**	**176 144**	**122 106**	**102 233**
	Physical / Real losses		**kl/annum**	**625 068**	**704 574**	**488 424**	**408 933**
	UARL		**kl/annum**	**137 118**	**142 284**	**145 882**	**149 503**
	Potential real loss saving		**kl/annum**	**487 950**	**562 291**	**342 541**	**259 431**
	Revenue water		**kl/annum**	**1 155 478**	**1 227 661**	**1 329 641**	**1 312 222**
	Non-Revenue water		**kl/annum**	**785 216**	**884 943**	**711 497**	**814 601**
	Projected SIV without WDM		kl/annum	2 236 553	2 304 005	2 371 457	2 438 909
	Projected SIV with WDM		kl/annum	2 092 190	2 147 049	2 201 908	2 256 767
	Source of information			DWS WSKS Municipality	DWS WSKS Municipality	DWS WSKS Municipality	DWS WSKS Municipality
	Comments						

Note : All underlined values have been calculated using trends and / or averages based on previous years.

	Year ending	Jun-18	Jun-19	Jun-20	Jun-21
Key performance indicators	Indicator as % of system input volume				
	% Revenue water	59.5%	58.1%	65.1%	61.7%
	% Non-revenue water	40.5%	41.9%	34.9%	38.3%
	% Water Losses	40.3%	41.7%	29.9%	24.0%
	System input volume unit consumption				
	Litres / capita / day	216	227	214	217
	m³ / household / month	25	26	25	25
	m³ / connection / month	25	26	25	25
	Authorised Unit Consumption				
	Litres / capita / day	129	132	150	165
	m³ / household / month	15	15	17	19
	m³ / connection / month	15	15	17	19
	Domestic (& ND) m³ / connection / month	15	15	17	19
	Non-domestic m³ / connection / month				
	Water loss indicators				
	Litres / capita / day	87	95	64	52
	m³ / household / month	10	11	7	6
	m³ / connection / month	10	11	7	6
	UARL : Losses (litres / connection / day)	58	58	58	58
	CARL : Losses (litres / connection / day)	264	287	194	159
	Infrastructure Leakage Index (ILI)	4.6	5.0	3.3	2.7
	CARL : Losses (m³ / km mains / day)	13	14	10	8
	% Population growth	3.26%	3.90%	2.56%	2.75%
	% Water demand growth	-5.37%	8.86%	-3.38%	4.20%
	% Water demand growth without WDM	3.11%	3.02%	2.93%	2.84%
	% Water demand growth with WDM	2.69%	2.62%	2.56%	2.49%
	5 Year Annualised Population Growth	0.38%	0.78%	0.92%	3.44%
	5 Year Annualised Water Growth	7.90%	2.31%	1.42%	1.11%

Figure 4: Example of the IWA Water Balance Template Completed

IWA Water Balance Diagram (million m³/annum)

An example of the IWA water balance, with the unit consumption based on the SIV divided by the population served and percentages for water losses, revenue water and NRW is shown in **Figure 5.**

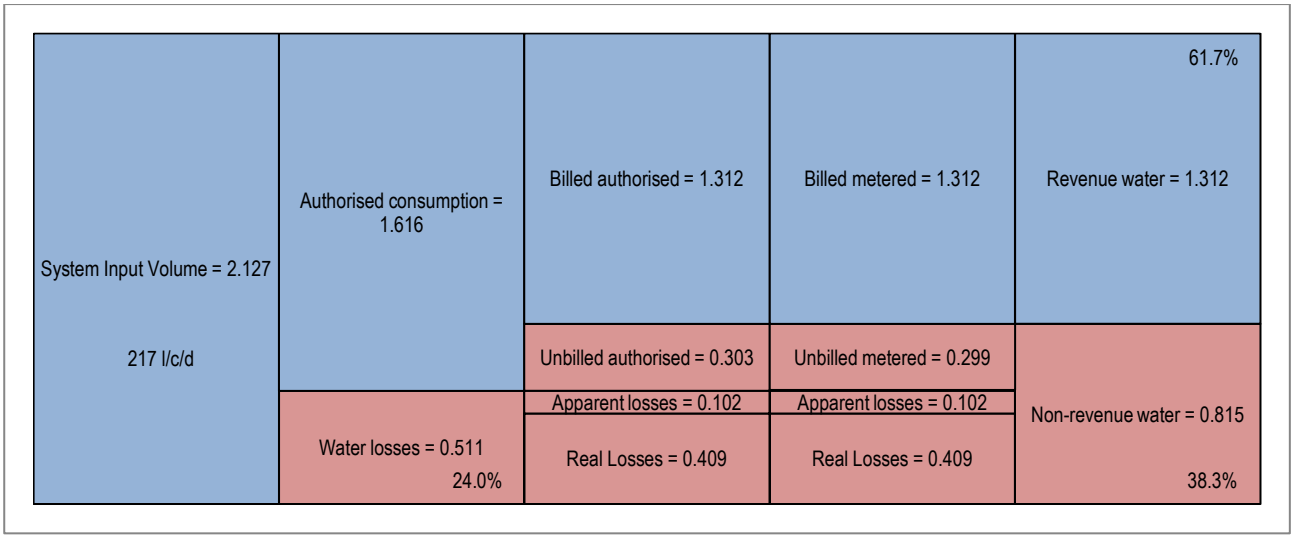


Figure 5: IWA Water Balance

System input volume and NRW 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 reconciliation or all town strategies, unless otherwise indicated.

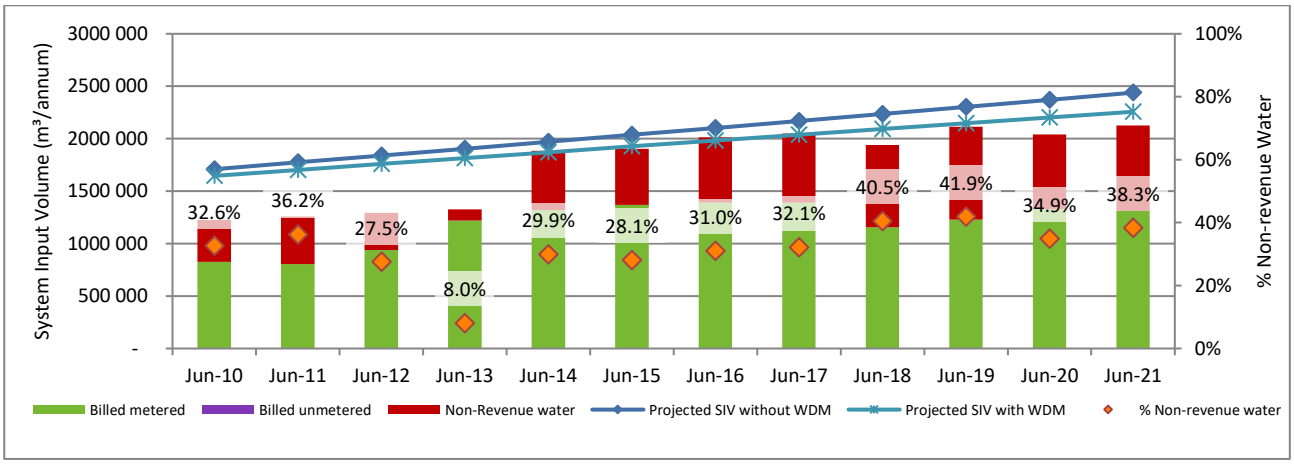


Figure 6: System input volume and NRW trend

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.

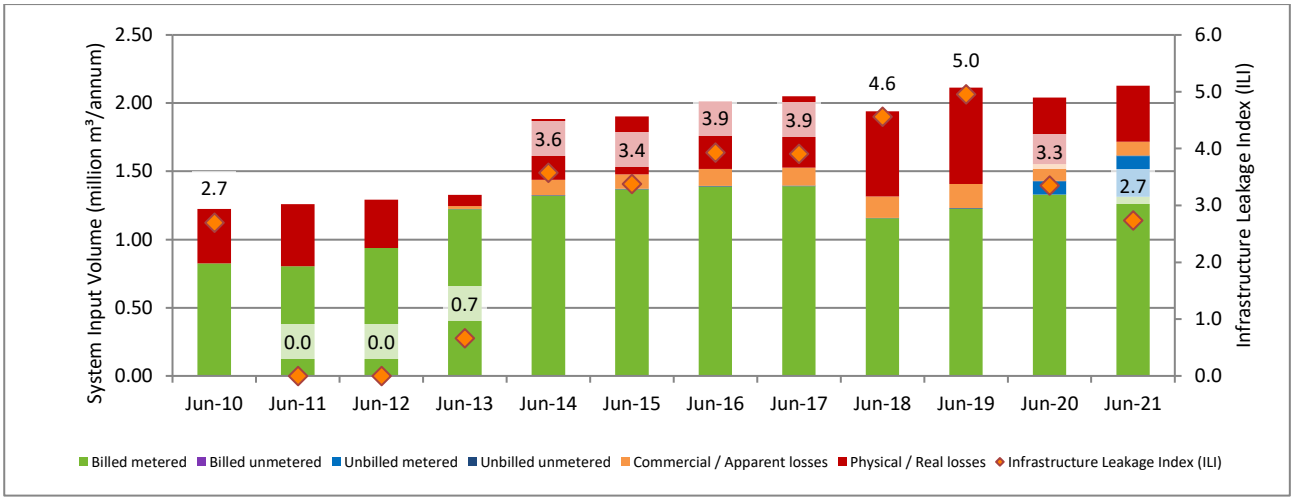


Figure 7: System input volume and water loss trend

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

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

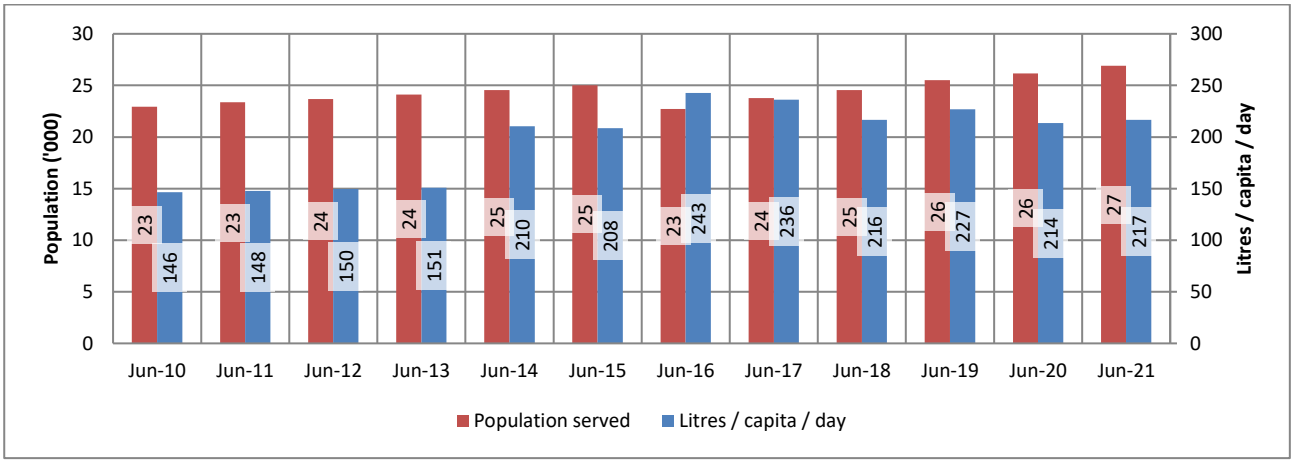


Figure 8: Population versus SIV trend (litres / capita /day)

3.3 DATA SUBMISSION STATISTICS

There has been a noticeable improvement in the quality of data for regions that have active data collection and collation programmes going or their municipalities are requested to report on a regular basis at reconciliation strategy progress meetings.

For the purpose of differentiating useability of the data, the data was categorised into one of three groups as follows:

- **High confidence level**: Data sets are submitted on a regular basis, show trends and are credible.
- **Medium confidence level**: One or more data sets were submitted in the past three years and seem credible.
- **Low confidence level**: None or one data set was submitted in the past three years, and the data sets submitted are questionable, with considerable gaps and/or inaccuracies.

A total of 88 datasets (61%) were received from WSAs which is the highest to date. Less than 50% of WSAs were able to submit water balance data in previous surveys. The confidence level of the data submitted varies between high (40%), medium (18%) and low (42%) as summarised in **Table 1**.

Table 1: Summary of data submissions and confidence levels

Region/ Category	WSA	Submissions	%	High	Medium	Low	% SIV	% Population
EC	14	7	50%	2	6	6	8.1%	8.5%
FS	19	4	21%	1	1	17	5.7%	5.6%
GT	9	9	100%	8	1	0	35.8%	29.7%
KZN	14	13	93%	13	0	1	18.5%	18.3%
LP	10	6	60%	0	5	5	8.0%	8.6%
MP	17	5	29%	2	2	13	6.7%	7.7%
NC	26	14	54%	8	6	12	2.6%	2.2%
NW	10	6	60%	0	5	5	5.4%	6.7%
WC	25	24	96%	24	0	1	9.4%	12.7%
Total	**144**	**88**	**61%**	**58**	**26**	**60**	**100.0%**	**100.0%**
A	8	8	100%	8	0	0	52.2%	46.7%
B1	19	18	95%	11	6	2	17.0%	15.8%
B2	17	12	71%	9	4	4	4.3%	4.7%
B3	71	37	52%	21	13	37	6.6%	8.5%
B4	8	3	38%	0	2	6	2.6%	3.8%
C2	21	10	48%	9	1	11	17.3%	20.5%
Total	**144**	**88**	**61%**	**58**	**26**	**60**	**100.0%**	**100.0%**
%				**40%**	**18%**	**42%**		

The confidence levels take into account the WSAs that did not submit data and for, which water balances had to be calculated. The following is observed from the data submission statistics:

Eastern Cape – The Eastern Cape is showing improvements in data quality and frequency of submissions. Although few data sets fell in the high confidence category, a significant portion fell in the medium category which is a notable shift from the very poor records indicated in the benchmarking study released in 2017. The region still has substantial room for improvement in its journey to consistent and credible reporting, given that the region has medium and low confidence level reporting in equal measure. This prevents proper trend analysis.

Free State – The state of record-keeping and reporting is severely deficient with approximately 90% of the WSAs falling in the low confidence level category for the data submitted. This closely resembles the pattern of data submission in previous benchmarking studies which unfortunately perpetuates and supports an upward trend in NRW and water losses in the region. Water balance information was estimated for most WSAs.

Gauteng – The Gauteng Region has maintained its record of good reporting practices and sound data management. All WSAs submitted data for the study, and provide reports to the Region on a regular basis, which enables proper trend analysis. The regional office has a coherent and coordinated reporting system in

place and has continued its commendable efforts to maintain a sound relationship with the municipalities and monitoring activities. The efforts of the regional office are strongly supported by Rand Water that also provide and require regular feedback through its Project 1600 programme.

KwaZulu Natal – The KwaZulu Natal Region had made excellent progress in the past few years thought consistent efforts and regular forums to improve reporting. The region continues to adhere to a strong and proactive reporting regime, with a 93% submission rate and all but one WSA submitting records with a high confidence rating. The regional office, with the support of Umgeni Water, has demonstrated strong leadership in supporting municipal WCWDM programmes and a consistent and effective monitoring programme.

Limpopo – Limpopo Region has historically had significant challenges with data collection and reporting on NRW. Improvement, however, is noted given that the water balance for the Region is based on a 60% submission rate, which is an improvement from the 48% data sample which was used in the previous assessment. While this is an encouraging turn, the data quality remains a concern, with 50% of the WSA's falling in the low confidence data category. In addition to the improvement in data submission, the next step for the Region will be improving the data quality to ensure that the results are based on credible data, that reflects the true state of NRW particularly with the proportionately larger number of rural municipalities. This would go a long way in aiding the understanding of the true nature and extent of NRW in rural environments, which are a critical part of the NRW management picture in South Africa and the water management and distribution discourse overall.

Mpumalanga – Mpumalanga Region presents a picture of a severely deficient reporting regime. The NRW water balance for the region is based on a 29% submission rate, with the majority of data sets falling in the low confidence category. The region requires a robust and consistent reporting programme supported by an ongoing monitoring programme for NRW initiatives. NRW reporting needs to be institutionalised in this Regional Office and Region to improve the status quo.

Northern Cape - The Northern Cape Region shows significant variance in the data quality across the WSAs. More than half of the municipalities (54%) submitted data, which is 2% increase in data submissions from the previous study, however, 46% of the WSAs fall into the low confidence data category. The region could benefit from improved data reporting efforts and a coherent system of monitoring and verification. The efforts of the region to work closely with the PSPs working in the area are commended, however it appears that a closer working relationship between the regional office and the municipalities is required to improve the data generation and reporting practices.

North West - The North West Region has seen significant growth in reporting from 11% in the previous benchmarking study, to the current 60% reporting rate from a few WSAs that have taken ownership of their WCWDM programmes. The data quality for the Region falls in the medium (50%) and low confidence (50%) categories in equal measure. The improvement is commendable, and this upward trend should be continued along with more robust and consistent data monitoring and verification programme. NRW reporting needs to be institutionalised in this Regional Office and Region to improve the status quo.

Western Cape – The Western Cape Region has historically had an excellent NRW data reporting programme in place and this continues to be the case. All but one of the WSA submitted NRW data in the high confidence category. This trend should be continued, as this level of credible data coming from the Region helps to create a realistic understanding of the nature and extent of NRW In South Africa.

It is positive to note that the three regions with the highest water use, namely Western Cape, Gauteng and KwaZulu-Natal, can also provide the most credible information. These three regions represent 63.6% of the water use and 60.7% of the population served.

Category A - Metropolitan municipalities continue to report consistently and most can provide a water balance on a monthly basis. This is encouraging considering that metropolitan municipalities represent 52.2% of the total water use and 46.7% of the population.

Category B1 and B2 - Most secondary city and large municipalities can provide a water balance on a regular basis although there is considerable room for improvement in some regions. The secondary city and large municipalities represent 21.3% of the total water use and 20.6% of the population. These municipalities are of economic significance and should have the necessary budgets and resources to implement WCWDM.

Category C2, B3 and B4 – Less than 50% of the small and rural municipalities can provide an accurate water balance on a regular basis. Reasons for this include lack of budget, difficultly measuring the supply due to the large number of boreholes and large indigent consumer base. These municipalities represent approximately 26.5% of the total water use and 32.7% of the population.

3.4 ESTIMATED WATER BALANCES

Prior to the 2017 benchmark report, all reports calculated the national water balance based on an extrapolated sample size. The national water balance is highly influenced by the metro and secondary city data, which has high confidence level while data for the category C2, B3 and B4 municipalities have a low confidence and are poorly represented in the sample size. The extrapolated results provided NRW figures between 35 to 40% depending on the methodology followed. It was substituted with bottom-up approach by estimating a water balance for each municipality in accordance with **Table 2** that could not provide information. The water balance was calculated as follows and calibrated if necessary based on available information.

Table 2: Water balance estimation guideline

Municipal category	Average ℓ/c/d consumption above RDP	Average ℓ/c/d consumption below RDP	Design guideline*	Billing efficiency
A	300	55	Very high development level = 260 to 480 ℓ/c/d Yard connections = 55 ℓ/c/d (typical)	90%
B1	250	55	High development level = 130 to 280 ℓ/c/d Yard connections = 55 ℓ/c/d (typical)	70%
B2	200	55	High development level = 130 to 280 ℓ/c/d Yard connections = 55 ℓ/c/d (typical)	50%
B3	150	55	Moderate to high development level = 80 to 145 ℓ/c/d Yard connections = 55 ℓ/c/d (typical)	30%
B4	100	25	Yard connections = 50 to 100 ℓ/c/d Standpipe = 10 to 50	10%

* Note: The Neighbourhood Planning and Design Guide (Part II) - Section J: Water supply (Department of Human Settlements, 2019)

The water balance components were calculated as follows:

- System input volume = Average consumption x population served
    - The population served were obtained from the DWS National Water Services Knowledge System
- Free Basic Water (FBW) = 6 kl x number of indigent households
    - The number of indigent households were obtained from the Division of Revenue Bill (2016/17 to 2018/19)
- Billed consumption = (Total households - indigent households - unserved households) x average consumption x billing efficiency
    - The number of households was obtained from the DWS National Water Services Knowledge System
    - The average consumption and billing efficiency were obtained from the table above

- NRW = SIV - FBW - billed consumption

In most cases, close correlation was obtained between historical data, the calculated value and the all town or reconciliation strategy results. For larger municipalities and municipalities supplied from bulk service providers the average consumption tended to be higher than expected. These communities are often supplied from large water supply schemes at a higher level of development.

The tables below show the distribution of National Treasury's 2016 equitable share per municipal category and province. An indigent household is defined as a household with an income of less than R 2300 per month.

Category	Number of households	Number of indigent households	% Indigent	Free basic water allocation (m^3/annum)	System Input volume (m^3/annum)	% billed consumption
A	6 560 289	3 287 219	50%	236 679 789	2 204 322 416	11%
B1	2 301 265	1 263 093	55%	90 942 678	714 128 992	13%
B2	1 235 172	726 120	59%	52 280 637	278 917 501	19%
B3	1 988 542	1 268 049	64%	91 299 461	428 026 024	21%
B4	3 132 593	2 342 651	75%	168 670 823	421 068 293	40%
Total	**15 217 861**	**8 887 132**	**58%**	**639 873 388**	**4 046 463 225**	**16%**

The results indicate that almost 9 million households or 58% are considered indigent and the municipality receive equitable share on a monthly basis from National Treasury for the provision of free basic water of 6 kl/month. Free basic water is billed at a zero rate and forms part of the authorised billed metered or unmetered consumption in the IWA water balance. The free basic water allocation in the category B4 municipalities is significant and means that on average the NRW cannot be more than 60%. Limpopo has the highest percentage indigent households in the country.

Province	Number of households	Number of indigent households (<R 2300 pm)	% Indigent	Free basic water allocation (m^3/annum)	System Input volume (m^3/annum)	% billed consumption
EC	1 733 805	1 187 761	69%	85 518 788	332 151 376	26%
FS	845 236	523 800	62%	37 713 618	207 835 805	18%
GT	4 183 543	2 091 387	50%	150 579 894	1 473 100 700	10%
KZN	2 638 912	1 659 922	63%	119 514 360	697 751 184	17%
LP	1 488 967	1 052 087	71%	75 750 240	281 235 907	27%
MP	1 147 059	705 259	61%	50 778 622	270 990 713	19%
NC	315 069	177 888	56%	12 807 951	94 205 305	14%
NW	1 138 712	704 370	62%	50 714 638	206 496 825	25%
WC	1 746 785	798 324	46%	57 479 307	482 695 411	12%
Total	**15 238 087**	**8 900 799**	**58%**	**640 857 418**	**4 046 463 225**	**16%**

The estimated water balance calculations still require further refinement and improvement. There are also discrepancies between the estimated water balance and the all town and reconciliation strategies. Reasons for these discrepancies include reference to different supply areas, the inclusion of mining, irrigation and other large water users in the water resource balance. The mining, irrigation and other large water users are excluded from the IWA water balance unless supplied by the municipality.

3.5 BENCHMARKS AND TARGETS

Interpreting the results from the water balance calculation and key performance indicators are critical to assess the performance of the water supply system. The results vary significantly across WSAs and usually depend on the level of service and development. **Table 3** and **Commercial or** apparent losses are made up of unauthorised connections (theft), plus all technical and administrative inaccuracies associated with user metering and billing. If commercial losses were to be reduced, generally more revenue would be generated by and for the WSA. Traditionally, commercial losses were accepted as 20% of water losses but this assumption was revised in the WRC Report TT300/07 (WRC, Jan 2007) as shown in Error! Not a valid bookmark self-reference., which provides a more pragmatic approach to calculating commercial losses.

Table 4 provide typical ranges for basic information and commercial losses.

Table 3: Basic information typical range

KPI	Metros	Local municipalities
Population	750 000 to 5 000 000	7000 to 750 000
Length of mains (km)	5 000 to 15 000	50 to 5 000
Pressure (m)	30 to 60	30 to 60
Households / connection	1.0 to 3.0	1.0 to 1.5
Density of connections	40 to 80	30 to 70

Commercial or apparent losses are made up of unauthorised connections (theft), plus all technical and administrative inaccuracies associated with user metering and billing. If commercial losses were to be reduced, generally more revenue would be generated by and for the WSA. Traditionally, commercial losses were accepted as 20% of water losses but this assumption was revised in the WRC Report TT300/07 (WRC, Jan 2007) as shown in Error! Not a valid bookmark self-reference., which provides a more pragmatic approach to calculating commercial losses.

Table 4: Percentage commercial loss guideline

Unauthorised connections	%	Meter age and accuracy	Good water	Poor water	Data transfer	%
Very high	10%	> 10 years	8%	10%	Poor	8%
High	8%					
Average	6%	5- 10 years	4%	8%	Average	5%
Low	4%					
Very low	2%	< 5 years	2%	4%	Good	2%

*Source: WRC Report TT300/07, 2007

The percentage commercial water losses is calculated as follows:

$$\% \text{ Commercial water loss} = \sum (\text{Unauthorised connections, meter age \& accuracy; data transfer})$$

The No Drop performance based regulatory programme has adopted the KPI performance criteria shown in **Table 5,** which are in line with international best practice. The benchmark should be used to establish targets that are realistic based on the existing water balance. Depending on the performance of the WSA, an improvement of one or two levels over a 5 year period is considered realistic.

Table 5: No Drop Key Performance Areas

ILI (Physical water loss) performance categories

	>8	Extremely high physical water loss
	6-8	Poor performance in physical water loss
	4-6	Average physical water loss performance
	2-4	Good physical water loss performance but some improvement may be possible subject to economic benefit
	<2	Excellent physical water loss management

Non-Revenue Water (%) performance categories

	>40%	Extremely poor non-revenue water management
	30-40%	Poor non-revenue water performance
	20-30%	Average performance with potential for marked improvement
	10-20%	Good performance but some improvement may be possible subject to economic benefit
	<10%	Excellent non-revenue water management

Water Use Efficiency (l/cap/day) performance categories

	>300	Extremely high per capita water use
	250-300	Poor per capita water use
	200-250	Average per capita water use with potential for marked improvement
	150-200	Good per capita water use but some improvement may be possible subject to economic benefit
	<150	Excellent per capita water use management

The results for most utilities fall within these performance criteria and should be used to assess the performance of the WSA. If the results are not within range, the water balance calculations should be checked or there should be very good reasons for the anomaly.

4 WATER BALANCE TRENDS

4.1 GENERAL

The water balance trends for all the regions are presented in the following sections. The following general comments apply to all the regions:

- The sudden increase in water balance data between 2015 and 2016 is because until 2015 only water balance information received from municipalities were included. From 2016, a water balance was estimated for each municipality if no or poor data were received.
- The jump in 2016 population figures is as a result of corrections made by the DWS following the results from the 2016 Community Survey.
- Water balance information is continuously updated and improved which means that the data shown in this report differs from the data presented in the Benchmarking of water losses, NRW and efficiency report (2004 to 2015/16).
- Water losses and NRW have increased in most municipalities since the onset of the Covid-19 pandemic in early 2020. The increase in NRW and water losses are attributed to reduced payment levels, operations and maintenance budgets cuts and lack of capacity in municipalities to undertake repairs due to ill health and deaths.

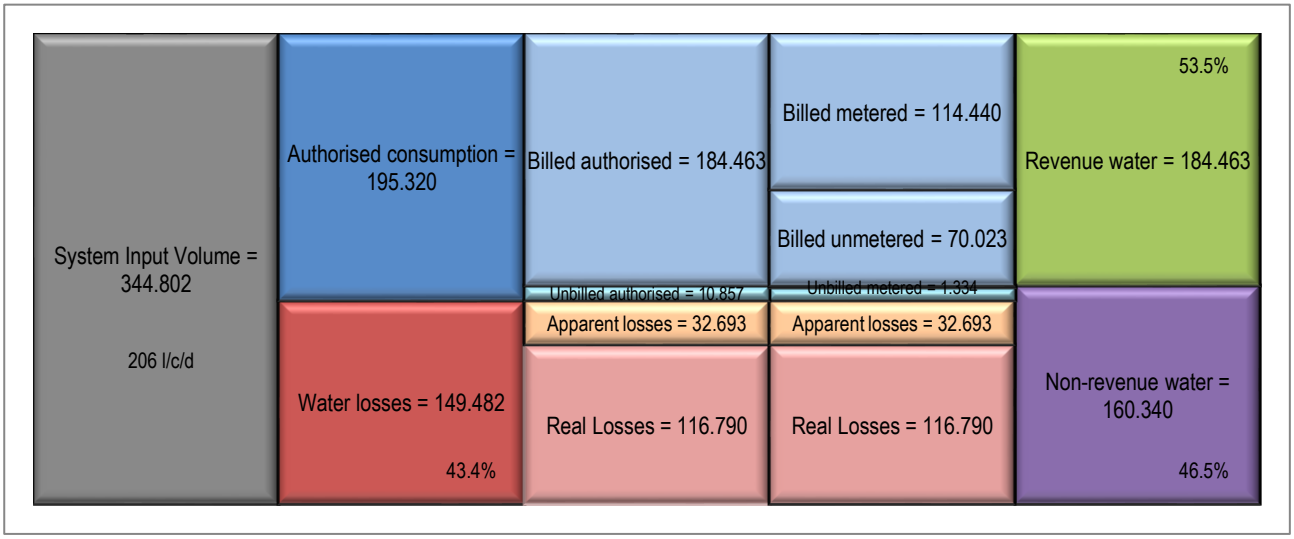
- The population served is a combination of the NWSKS system and figures provided by the municipalities. For the purposes of this study, population served at and above RDP standards, which is approximately 89% of the population, was used to calculate the per capita consumption. According to the NWSKS, only 68% of households have access to reliable water supply as summarised in **Table 6**. Very few municipalities include intermittent supply / reliability in their calculations and can have a significant impact on the water balance and KPIs.

Table 6: Summary of households served (NWSKS April 2021)

Region	Total Households	Access to Water Infrastructure Households	Access to Water Infrastructure Households %	Total At and Above RDP Water Infrastructure Households	Total At and Above RDP Water Infrastructure Households %	Reliable Water Households	Reliable Water Households %
Eastern Cape	1 748 487	1 312 702	75.08	1 214 441	69.46	784 442	44.86
Free State	1 049 686	1 035 143	98.61	1 028 244	97.96	737 615	70.27
Gauteng	5 985 580	5 951 793	99.44	5 919 358	98.89	4 926 896	82.31
KwaZulu-Natal	3 315 092	2 908 910	87.75	2 673 662	80.65	1 935 233	58.38
Limpopo	1 625 371	1 484 278	91.32	1 219 543	75.03	801 096	49.29
Mpumalanga	1 468 761	1 372 475	93.44	1 270 327	86.49	904 125	61.56
North West	1 469 867	1 384 000	94.16	1 238 953	84.29	872 843	59.38
Northern Cape	374 485	369 835	98.76	354 467	94.65	256 278	68.43
Western Cape	2 112 156	2 108 413	99.82	2 105 157	99.67	1 767 613	83.69
National	**19 149 485**	**17 927 549**	**93.62**	**17 024 152**	**88.9**	**12 986 141**	**67.81**

4.2 EASTERN CAPE REGION

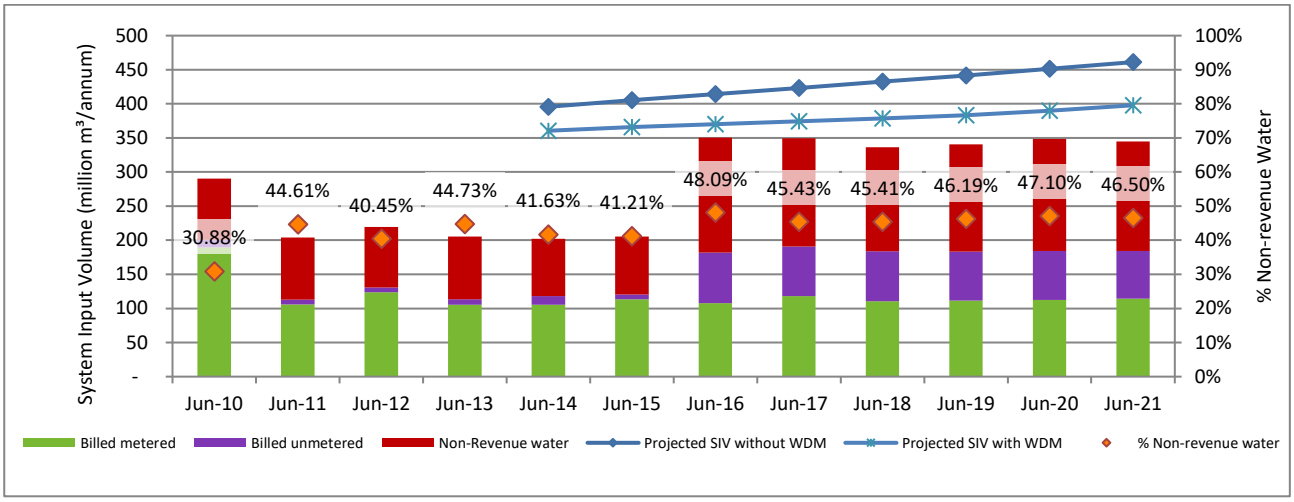
The water balance and trends for the Eastern Cape are based on 7 (50%) plausible data sets of a possible 14 WSAs . The water balance information is highly influenced by the Nelson Mandela Bay, Buffalo City, King Sabata Dalindyebo (Mthatha) and Enoch Mgijima (Komani (former Queenstown)) municipalities, which account for approximately 60% of the demand.



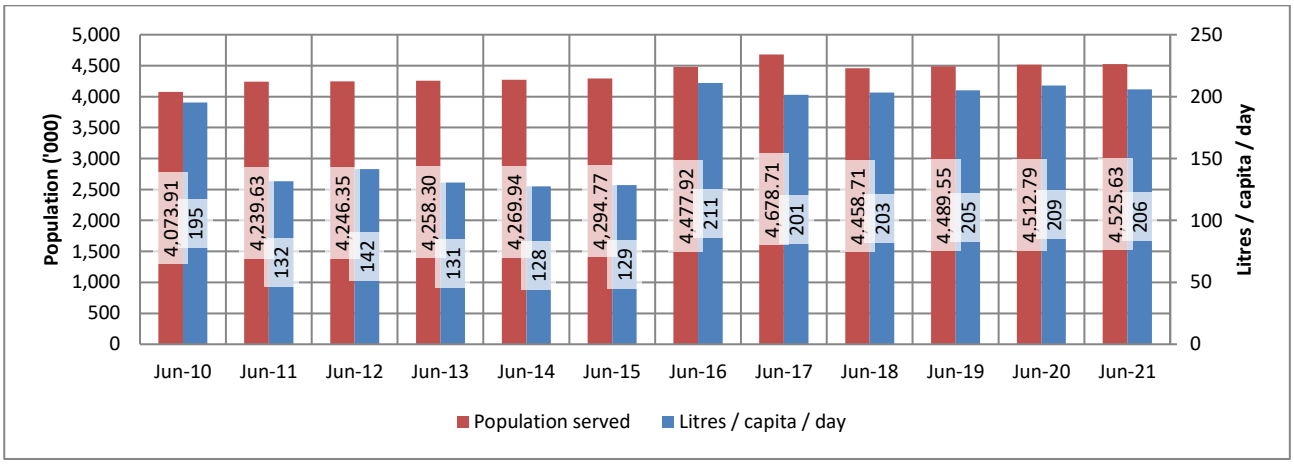
Current results indicate NRW of 160.3 million m³/annum (46.5%) and corresponding water losses of 149.5 m³/annum (43.4%). The results are generally consistent with the outcomes of the 2017 assessment, except

for a marginal reduction in NRW and water losses.

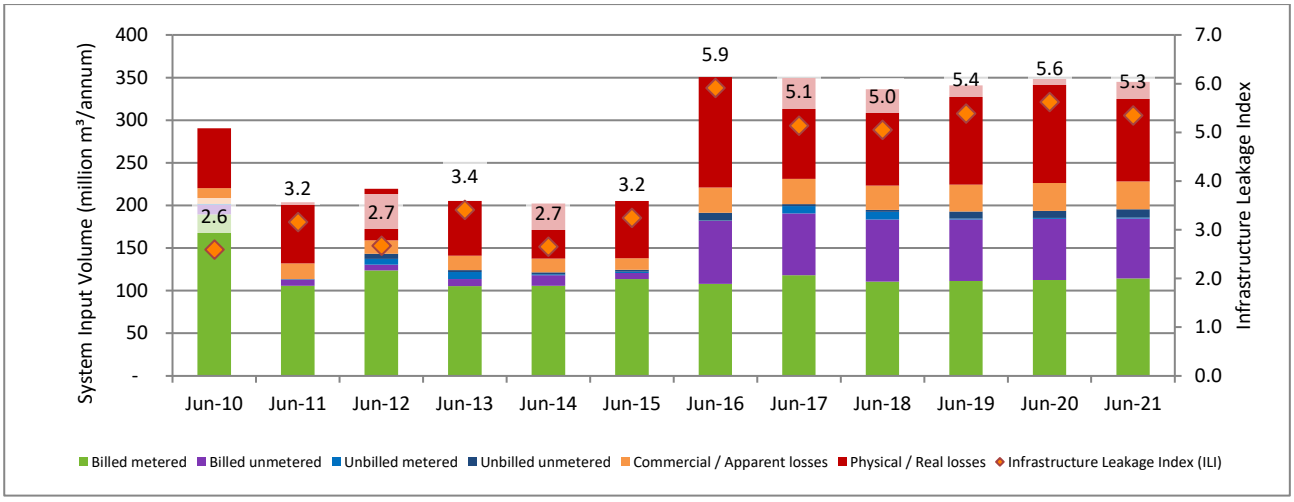
The NRW has improved slightly over the past six years, however, almost half of the potable water supplied is not generating revenue. The billed metered consumption has grown substantially in the past six years due to estimated water balances for rural municipalities in the region. The SIV has remained fairly constant as a results of the ongoing drought in the parts of the region and the estimated SIV is below the projected demand with WCWDM. The lack of growth in the demand is attributed a combination of intermittent supply, imposed water restrictions and limited WCWDM activities.



The improved water use efficiency between 2017 to 2019 is mainly as a result of the drought in Nelson Mandela Bay and a marginal variance in per capita consumption was observed in most other municipalities over the past six years as shown below. The per capita consumption in Nelson Mandela Bay has returned to 2016 levels in 2021.

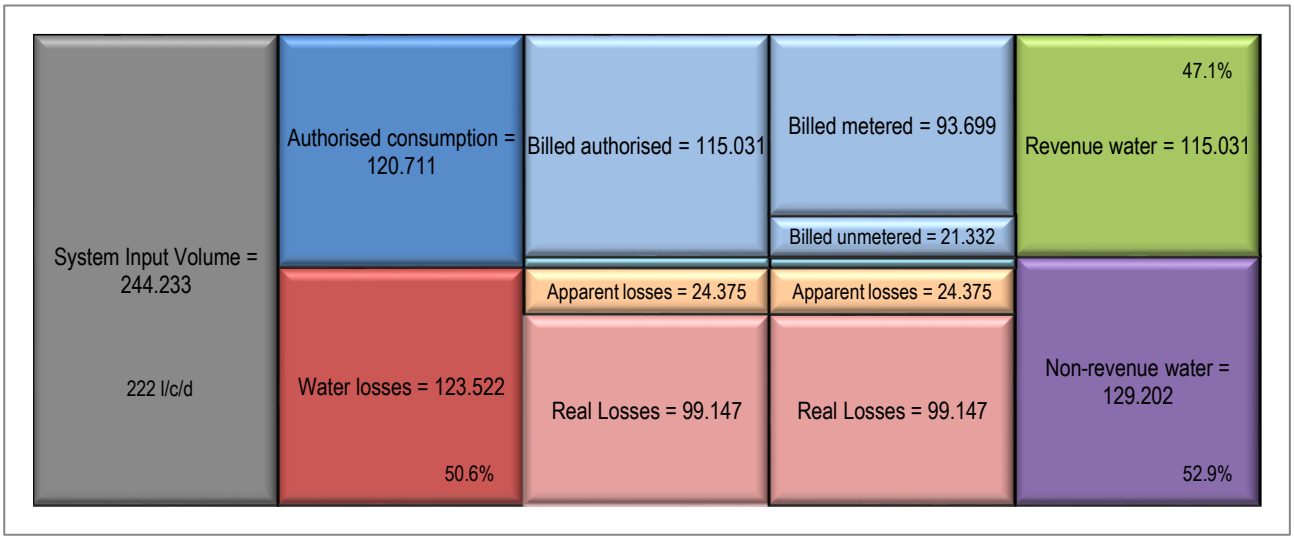


Leakage levels remain an enduring challenge for the Eastern Cape Region with physical losses hovering around 120 million m³/annum over the past few years. With water losses at approximately 149 million m³/annum and the ILI at 5.3, it is clear there should be an urgency to review the state of the water infrastructure and use across the Eastern Cape to address the unabated water losses that tamper with the sustainability of the municipalities in the region.

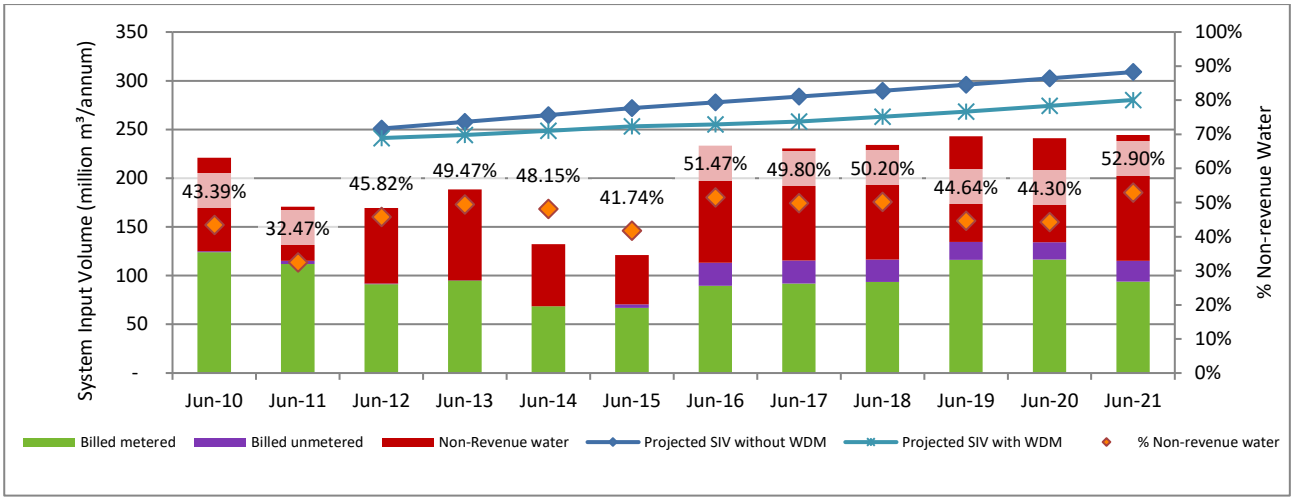


4.3 FREE STATE REGION

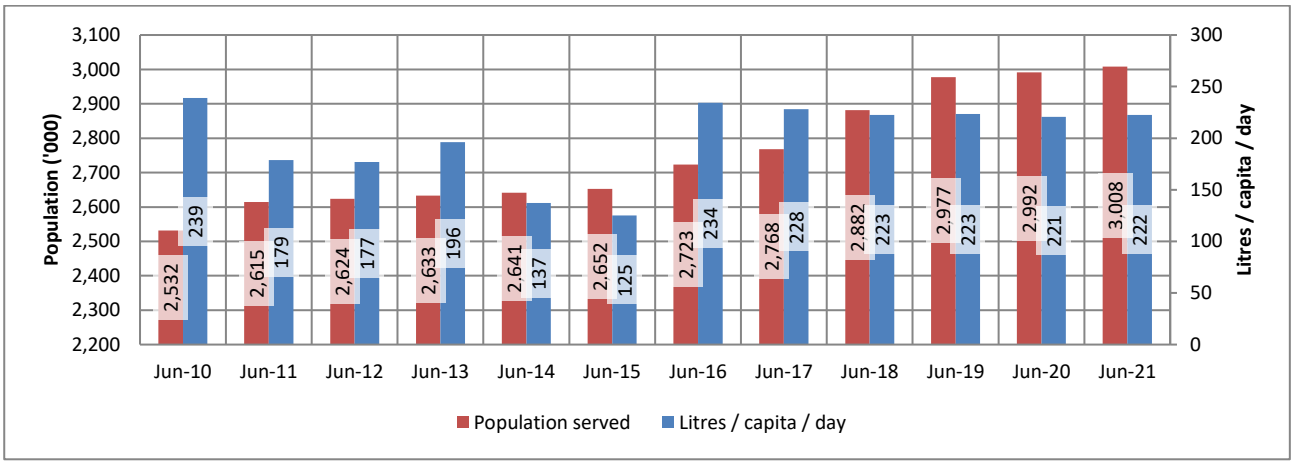
The Free State region is based on a sample of 4 (21%) submission of a possible 19 by the WSAs. The region has exceptionally poor levels of reporting which was also observed in previous assessments. The water balance information is highly influenced by the Mangaung, Matjhabeng, Maluti-a-Phofung, Moqhaka and Metsimaholo municipalities, which accounts for approximately 72% of the demand. The water balances for Matjhabeng, Maluti-a-Phofung and Moqhaka municipalities were estimated.



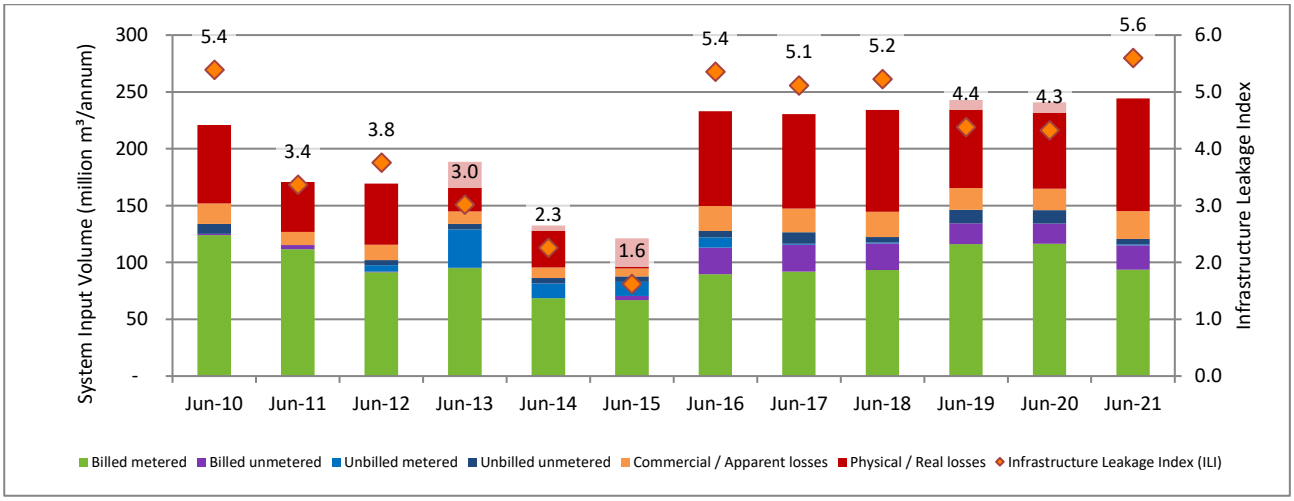
The water balance indicates NRW of approximately 129.2 million m³/ annum (52.9%) and water losses of 123.5 million m³/annum (50.6%). These percentages do not vary substantially from the 2017 assessment although the total SIV has increased by approximately 35 million m³/annum due to improved estimates. The SIV has remained almost constant over the past five years and is below the projected demand with WCWDM. The steady SIV is indicative of the severe droughts and water restrictions imposed in the area, especially Mangaung municipality.



In general, NRW has fluctuated between 44% and 53% in the past six years. The variability before 2015 can be attributed to the poor state of reporting in the region which has resulted in unexpected changes in NRW and water losses from year to year. The data credibility must be improved and the reporting managed more effectively to evaluate the accuracy and extent of NRW in the region.



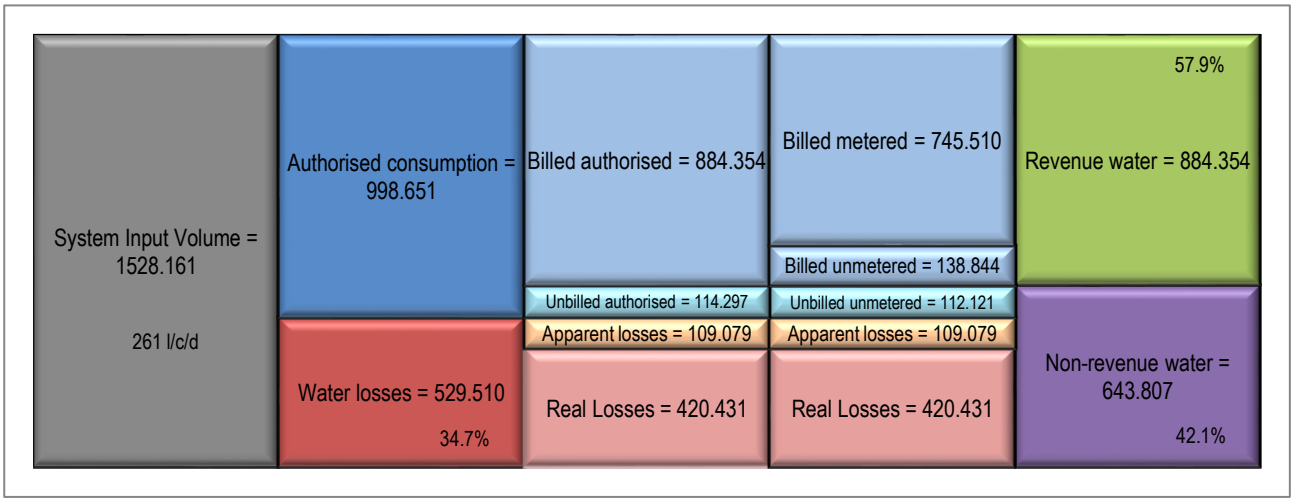
The per capita consumption in the Free State has shown a slight downward trend over the past six years. Current per capita consumption for the region is 222 ℓ/c/d which is mainly as a result of the drought, imposed water restrictions and to a limited extent water loss reduction intervention programmes. Given the level of service in the region, there is significant scope for improvement in water use efficiency.



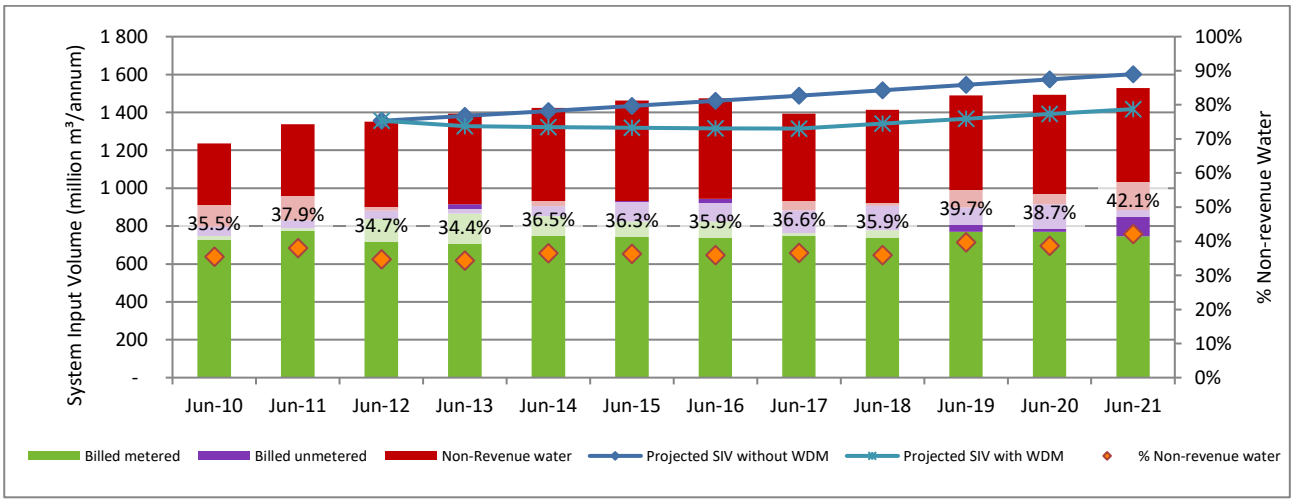
The ILI in the Free State has reached an all-time high at 5.6 which is a similar trend seen in other regions and attributed to the impact of the COVID-19 pandemic. The region could benefit from a focused effort to repair and rehabilitate aging and deteriorating water distribution infrastructure.

4.4 GAUTENG REGION

The Gauteng region water balance shows NRW of 643.8 million m³/annum (42.1%) and water losses of 529.5 million m³/annum. This is based on 9 (100%) plausible data sets, which provides an accurate picture of the state of NRW in the region. The trends in the region largely reflect those of the national water balance, which reflects the significant influence Gauteng has on the national NRW and water losses. The water balance information for Gauteng is highly influenced by City of Johannesburg, City of Ekurhuleni, City of Tshwane and Emfuleni municipalities, which account for approximately 94% of the demand.



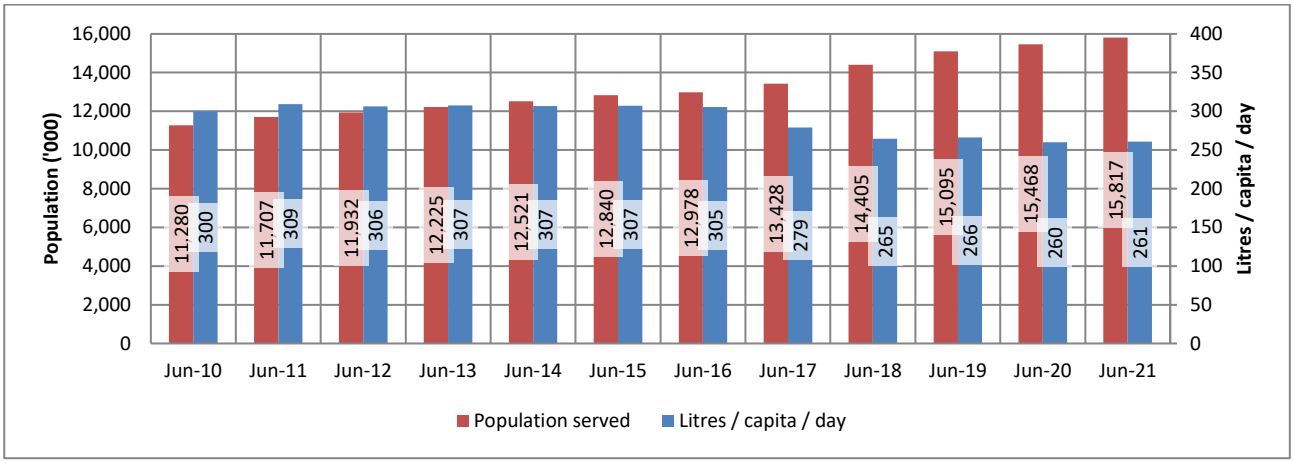
The data derived from the 2017 assessment indicate NRW and water losses of 528.8 million m³/annum (35.9%) and 404.1 million m³/annum (27.4%) respectively. The SIV, water losses and NRW have steadily increased over the past 10 years and municipalities have exceeded the projected demand with WCWDM. Over 40% of the region's water does not generate revenue and 27.5% is lost through physical losses. Given the importance of the region as the economic hub of the country, water supply cannot be allowed to fail.



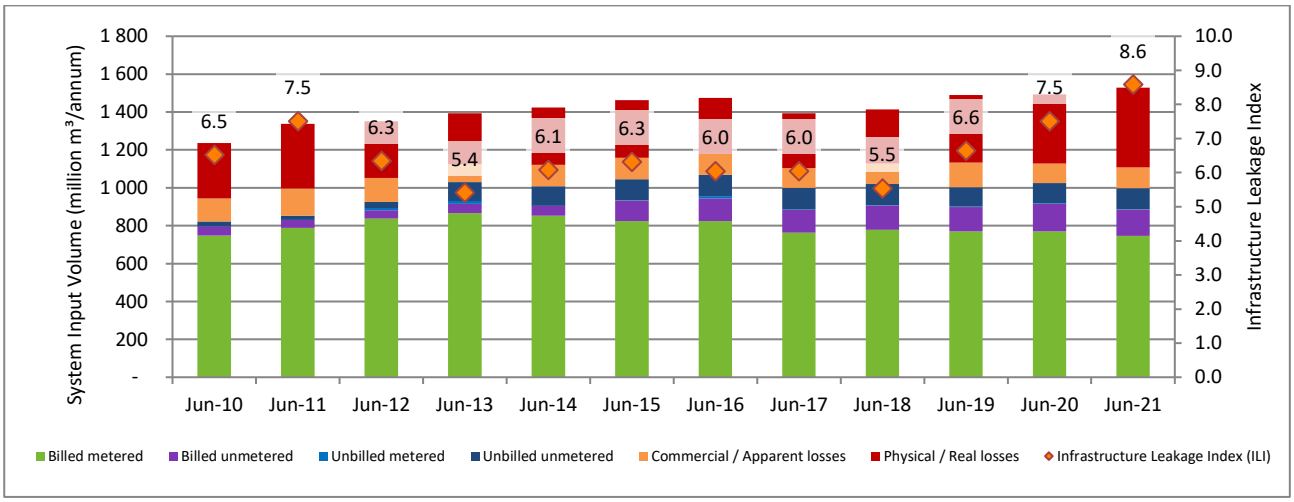
The region has been unable to reduce its water demand and water losses as required by the reconciliation targets. The targets from the Vaal River System reconciliation strategy indicated that municipalities within this system must reduce their demand by a minimum of 15%. This directive was issued close to 15 years ago which was superseded by Project 1600 of Rand Water. The municipalities will therefore need to upscale their

WCWDM efforts rapidly to improve the security of supply.

The per capita consumption for the region shows a consistent trend until 2016 when water restrictions were imposed. WSAs have been able to sustain the per capita consumption as a result of limited water loss reduction programmes, the population growth exceeding the growth in supply and infrastructure reaching its design capacity or infrastructure failure. The per capita consumption is based on the total system input volume and includes industrial and commercial use. City of Ekurhuleni is the metro with the highest number of wet industries in the country with a current per capita consumption of 238 ℓ/c/d. This is an encouraging shift as previous assessments had shown City of Ekurhuleni with per capita consumption over the 300 ℓ/c/d mark.



As indicated previously, Gauteng has been unable to reduce their demand in the past 10 years, although water use efficiency seems to have improved over the past six years. The NRW and water loss levels are at an all-time high, which places ever increasing pressure on the already strained Integrated Vaal River Supply System. The increased ILI is attributed to the COVID-19 pandemic, gradual reduction in billed consumption and increased real losses. This raises the urgency to fast track the implementation of appropriate WCWDM measures and to push the boundaries of the 15% reduction target in order to safeguard the security of water supply in the region. There is significant scope for improvement in the reduction of system input volume, NRW, water losses and efficiency.

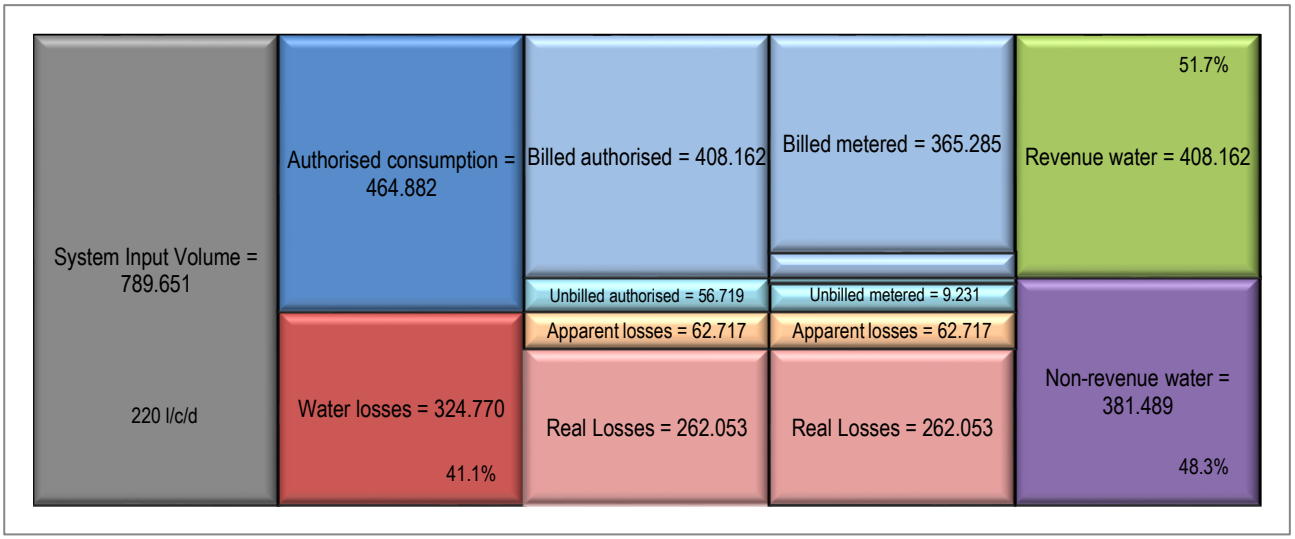


4.5 KWAZULU NATAL REGION

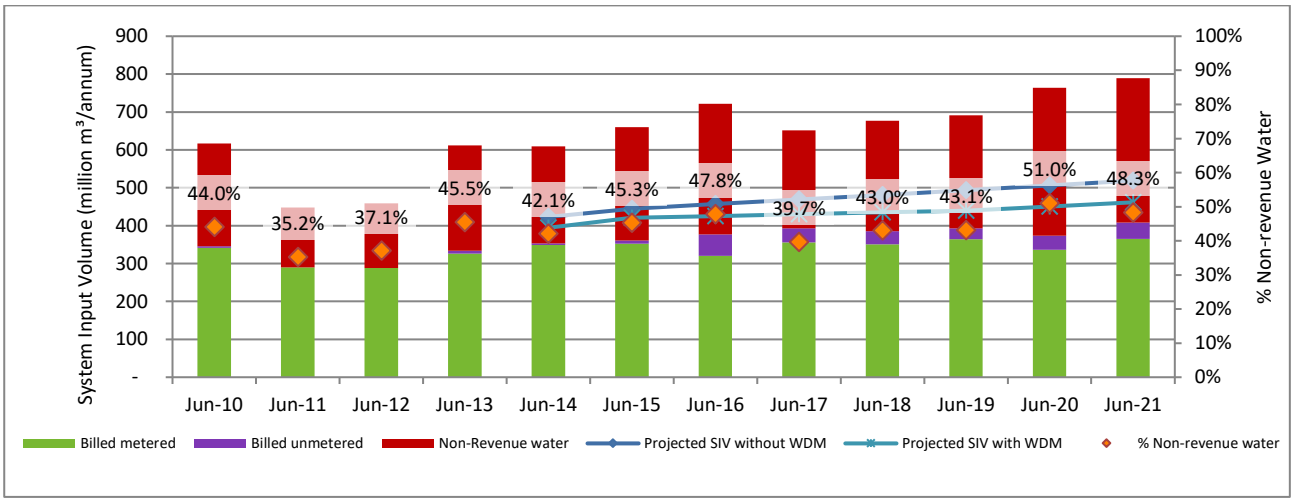
The water balance trends for KwaZulu Natal are based on 13 (93%) plausible data sets from a total of 14 WSAs. The water balance information is highly influenced by eThekwini, Msunduzi, Newcastle and City of

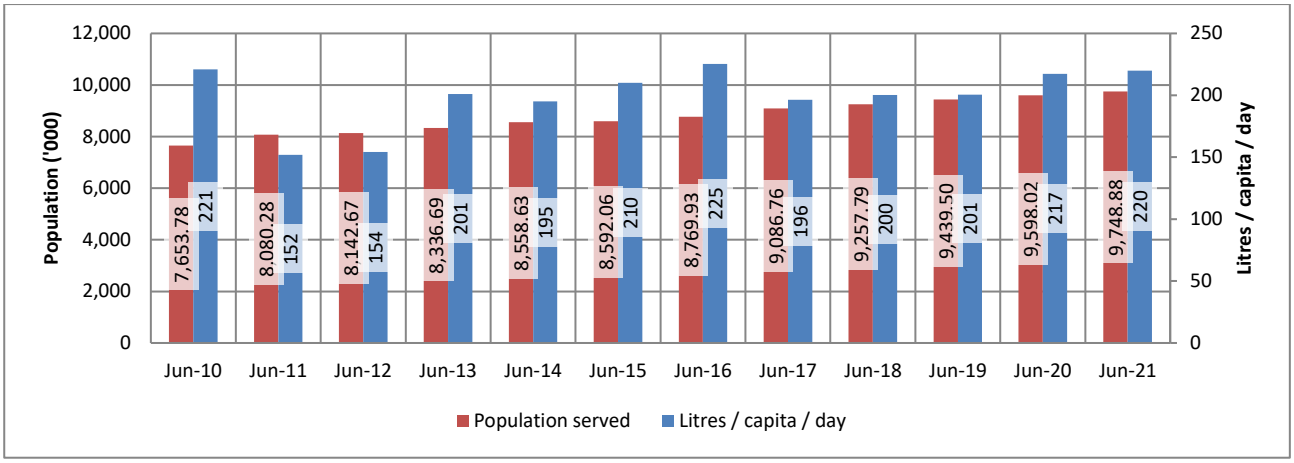
uMhlathuze municipalities, which account for approximately 69% of the demand. As mentioned before, KwaZulu Natal Regional has done excellent work to improve the monitoring of water losses in the region.

The current water balance shows NRW of 381.5 million m³/annum (48.3%) and water losses of 324.8 million m³/annum (41.1%). While the NRW and water losses have gone up slightly from the 2017 figures, the level of data accuracy has increased significantly which should lead to improved decision making and water security.

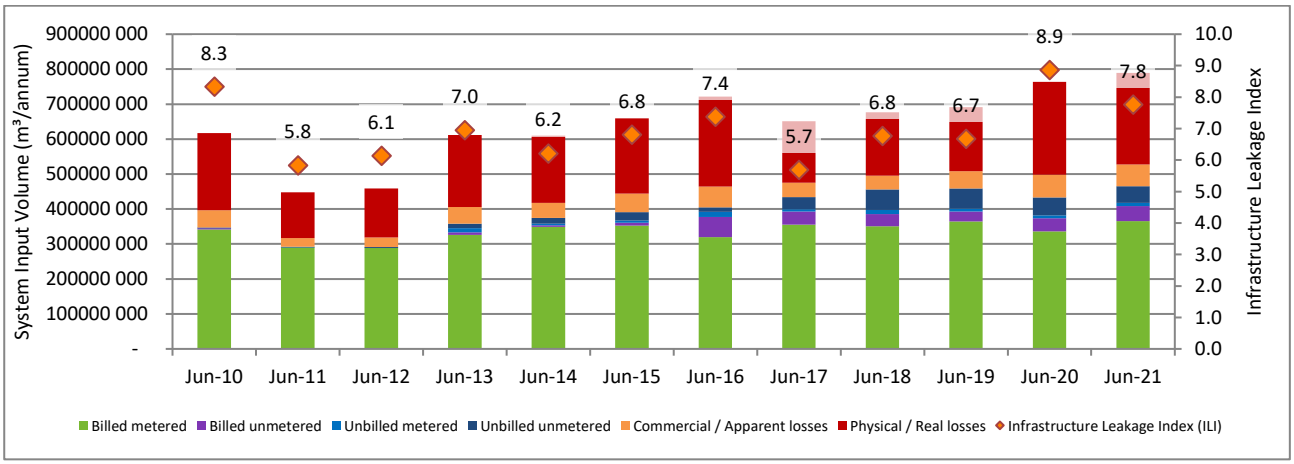


The trend since 2016, provides a reasonable indication of the situation in KwaZulu Natal. The SIV and NRW reduced in 2017 and 2018 with the introduction water restrictions, however, the savings were eliminated in the past two years and NRW reached an all-time high of 51% in 2020. The increase is attributed to COVID-19 pandemic, deteriorating infrastructure and metering and billing challenges faced by most municipalities in the country. The projected demand with and without WCWDM is significantly lower than the actual demand because of the lack of information for some WSAs.





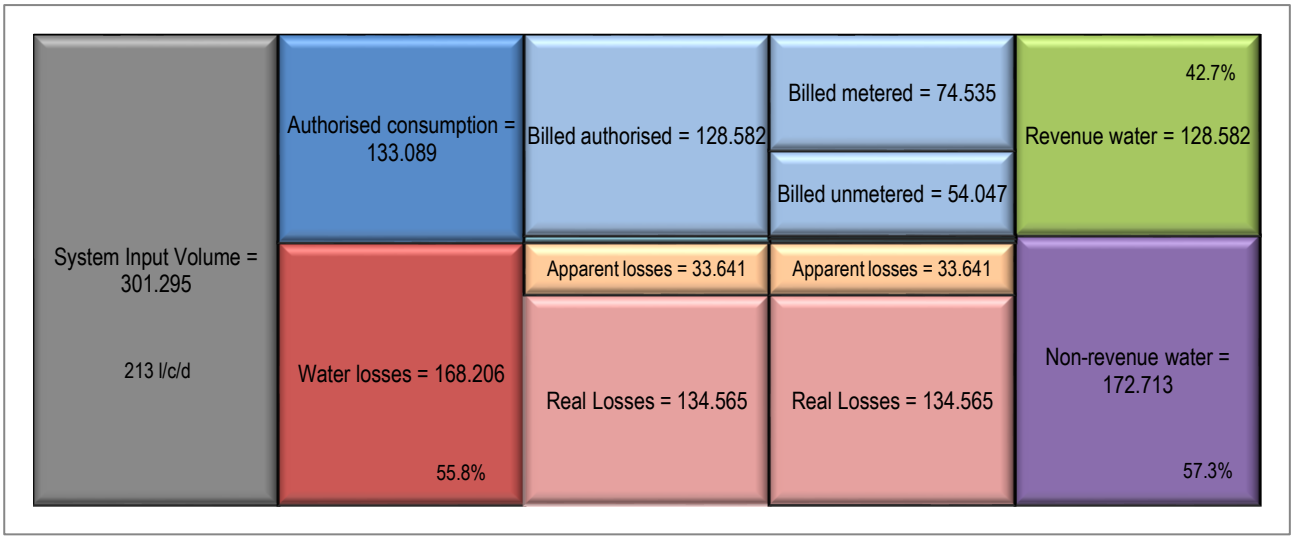
The per capita consumption in KwaZulu Natal has remained almost unchanged between 2020 and 2021. The updated trends for the region differ slightly from those reported in 2017 with the inclusion of new updated data. This is testament to the improvements in data verification and accuracy that is beginning to take root in the region. Furthermore, district municipalities that are the authorised WSAs are increasingly reporting water balance information per water supply system, which is improving the resolution of the NRW data in the region. The current per capita consumption of 220 ℓ/c/d is slightly less than the 255 ℓ/c/d recorded in 2016. The region has not benefitted from improved efficiencies as seen in Gauteng. The marginal change in per capita consumption is, however, commendable and the region should continue its efforts to promote water use efficiency, particularly after water restrictions imposed for drought conditions.



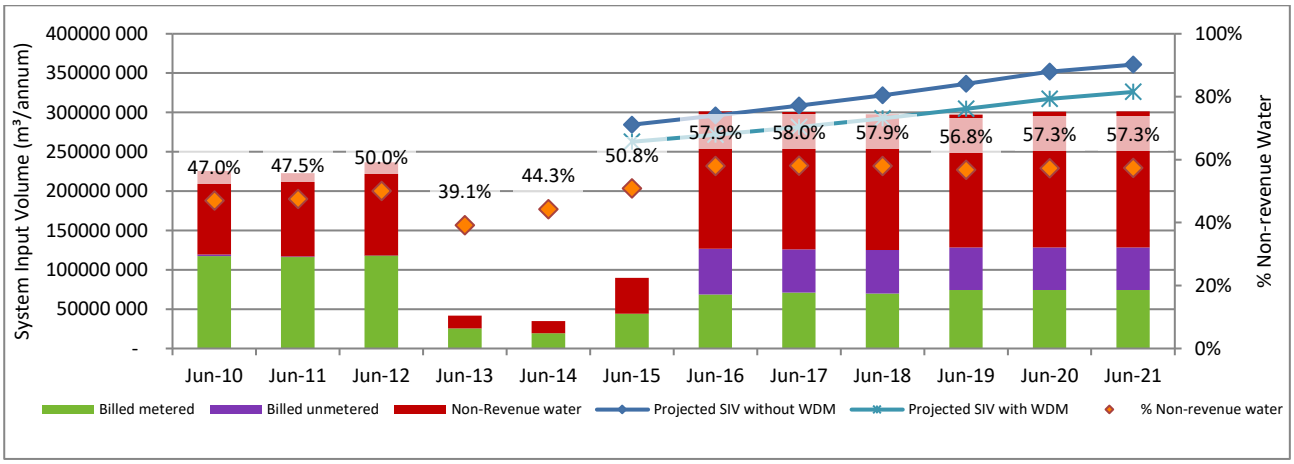
The distribution losses have notably fluctuated over the past five years and the current ILI for KwaZulu Natal is 7.8 with a record high over 10 years reached in 2020 at 8.9. The current ILI for the region is considered poor and signalling the need for significant attention to monitoring and investment in infrastructure repair, maintenance and rehabilitation.

4.6 LIMPOPO REGION

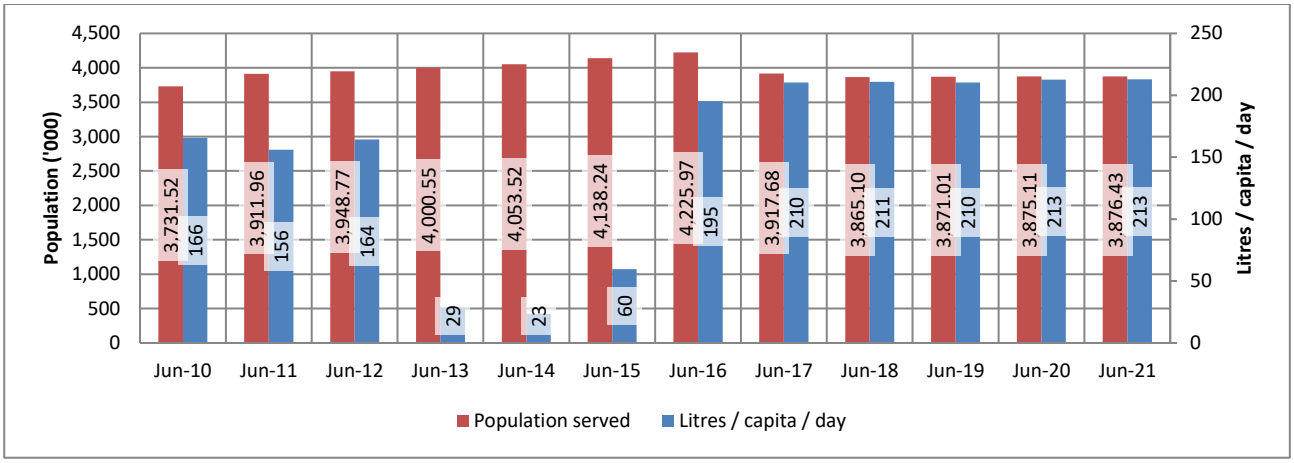
The water balance trends for the Limpopo Region are based on 6 (60%) plausible data sets from a possible 10 WSAs. Polokwane is the only secondary city included in the data set and with Greater Tzaneen, Ba-Phalaborwa, Thulamela (Thohoyandou) and Makhado account for 55% of the total demand.



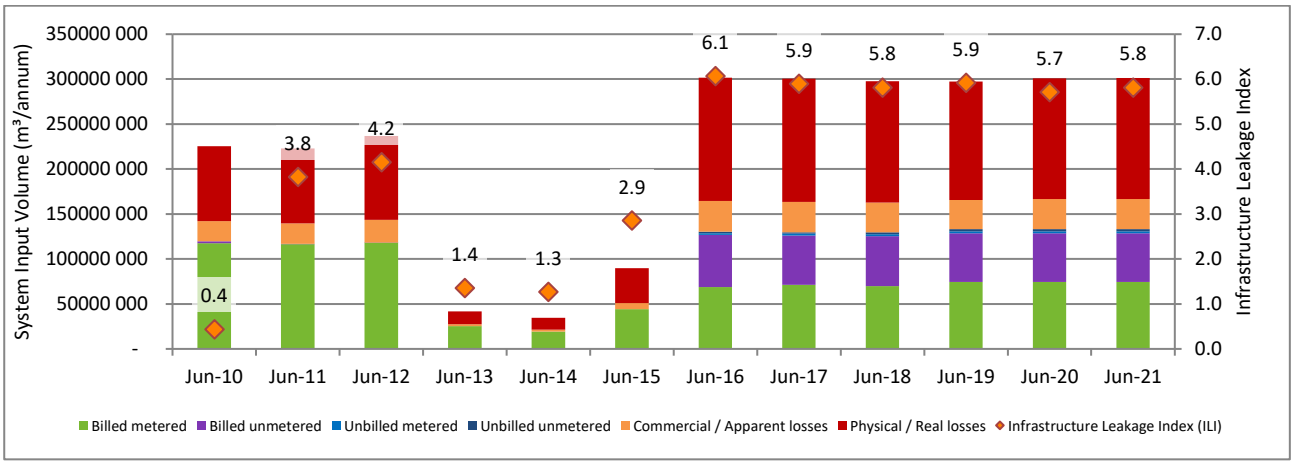
The water balance indicates NRW of 172.7 million m³/annum (57.3%) and water losses of 168.2 million m³/annum (55.8%). This is a marginal decrease from 2017 the water balance assessment trends which indicated NRW of 57.9%, based on updated information submitted by the municipalities. The water balance trends for the region have essentially remained consistent over the past six years, however has low confidence level. The analysis highlights the need for aggressive WCWDM implementation given that NRW is at exceptionally high levels and impacts on the financial sustainability of municipalities and water security.



The water balance trend also indicates water demand is below the projected demand with WCWDM. This trend needs further investigation as the population served has remained almost constant and reliability of supply is below 50% in the region. Going forward, a proactive revenue enhancement programme will be required to address NRW and financial sustainability of WSAs in the region. While it is acknowledged that the region comprises a large rural component, which impacts significantly on the metering and billing ability of municipalities, it is in the best interests of the region to ensure effective billing wherever feasible. Flat rate billing in areas where billed metered consumption is not immediately possible may be a practical first step while municipalities work to formalise connections, or work on an appropriate strategy to effect metering, billing and cost recovery in the long term.



The per capita consumption for Limpopo has remained almost constant over the past six years. This is as a result of the high number of estimated water balances. Given that the region is mostly rural in nature, the per capita consumption is high considering the level of service and development in the region. Water supply in these rural schemes is characterised by some users having an abundance in supply and wasting water while other users have limited access due to infrastructure failures, intermittent supply and rationing. Effective tools to manage the demand and improve efficiency may include community education and awareness which should ideally extend to schools and commercial consumers as well. Measures such as pressure management may also help reduce leakage during off peak periods and prolong the useful life of the distribution infrastructure and household plumbing fixtures.

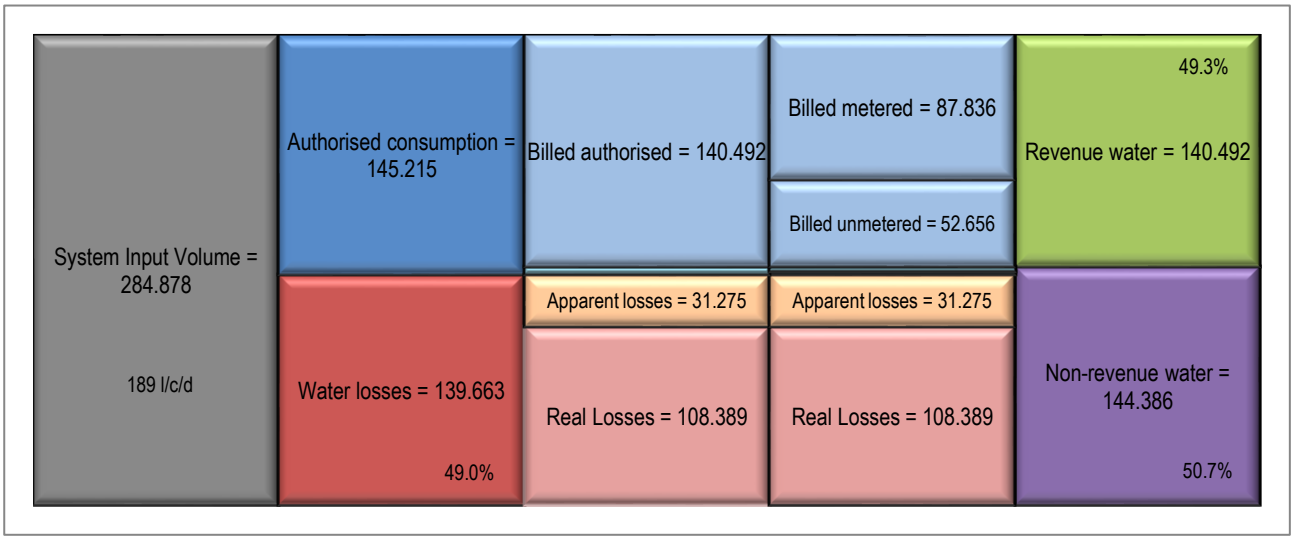


The levels of leakage and water losses have remained largely constant over the past six years. Current trends indicate an ILI of 5.8 which is considered poor performance in terms of the No Drop scorecard. Further data verification and monitoring is required to determine the true extent of the distribution losses which could be improved through increased bulk metering and monitoring to verify the data. This will assist in developing a cogent and effective WCWDM implementation strategy.

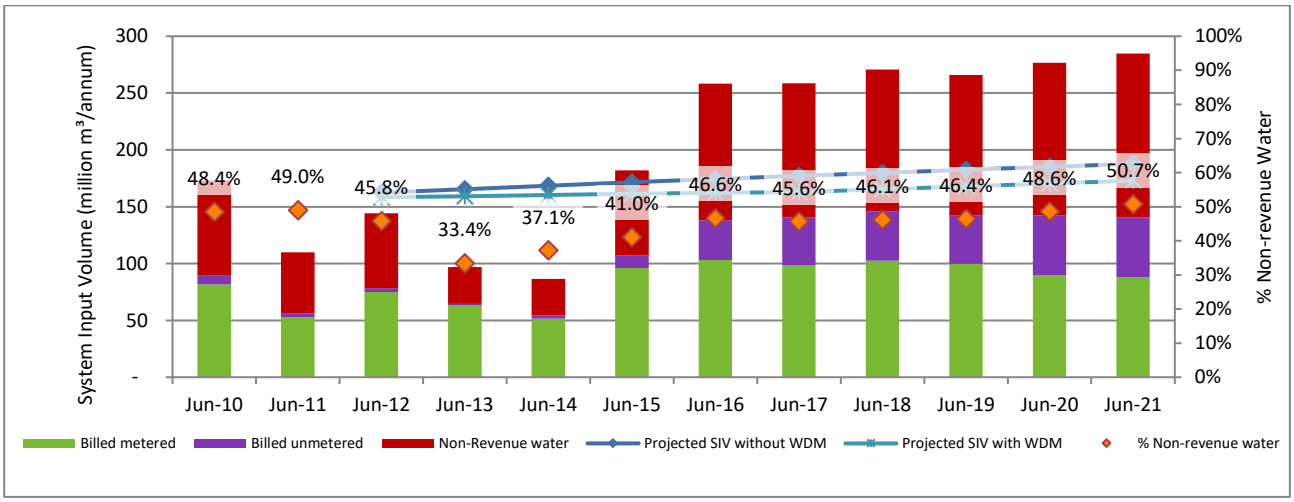
4.7 MPUMALANGA REGION

The water balance trends for the Mpumalanga region are based on five (29%) plausible data sets of a possible 17 WSAs. The water balance information is highly influenced by the four secondary cities of Govan Mbeki, Emalahleni, Steve Tshwete and City of Mbombela, which account for 53% of the demand. The three large rural municipalities of Dr JS Moroka, Thembisile Hani and Bushbuckridge account for 22% of the demand. Together these seven municipalities account for 76% of the demand in the region and should be a focus area to ensure water security and economic growth in the region. The data is exceptionally poor in the region and

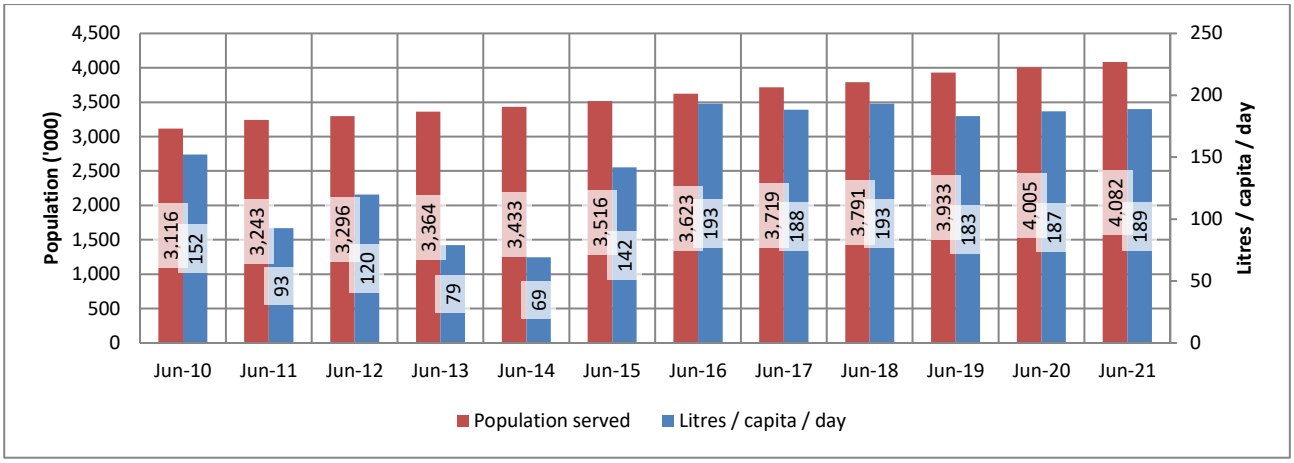
there are no active reporting systems in place, with 71% of data sets falling in the low confidence category. The untenable status quo requires urgent action to improve water security and sustainability through the development a of WCWDM strategy and implementation programme.



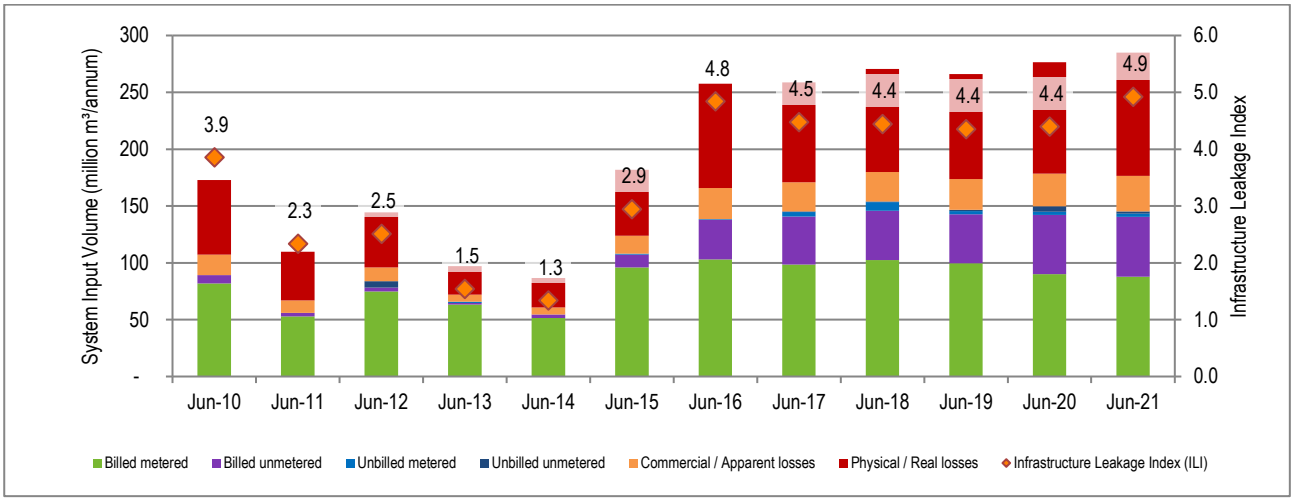
The 2020/21 water balance indicates water losses of 139.7 million m³/annum (49.0%) and NRW of 144.4 million m³/annum (50.7%). These figures are a slight increase from those presented in the 2017 benchmarking assessment which indicated NRW of 46.6% and water losses of 46.3% based on updated estimates and data submissions. The trends in the region show a steady increase in SIV and NRW over the past six years. One of the key priority areas for the Mpumalanga region will be to improve the quality of data and frequency of reporting in order to develop coherent trends that can provide sound intelligence on the nature and extent of NRW and water losses in the region. The SIV is considerably above the projected demand with and without WCWDM because of the lack of information for some municipalities.



The region needs to accelerate and upscale its WCWDM programme implementation to curb the growing water losses and NRW in the region. Key demand centres such as City of Mbombela, Govan Mbeki, Emalahleni and Steve Tshwete municipalities in particular, require ongoing demand management programmes to significantly reduce water losses and pave the way for the other municipalities to do the same.



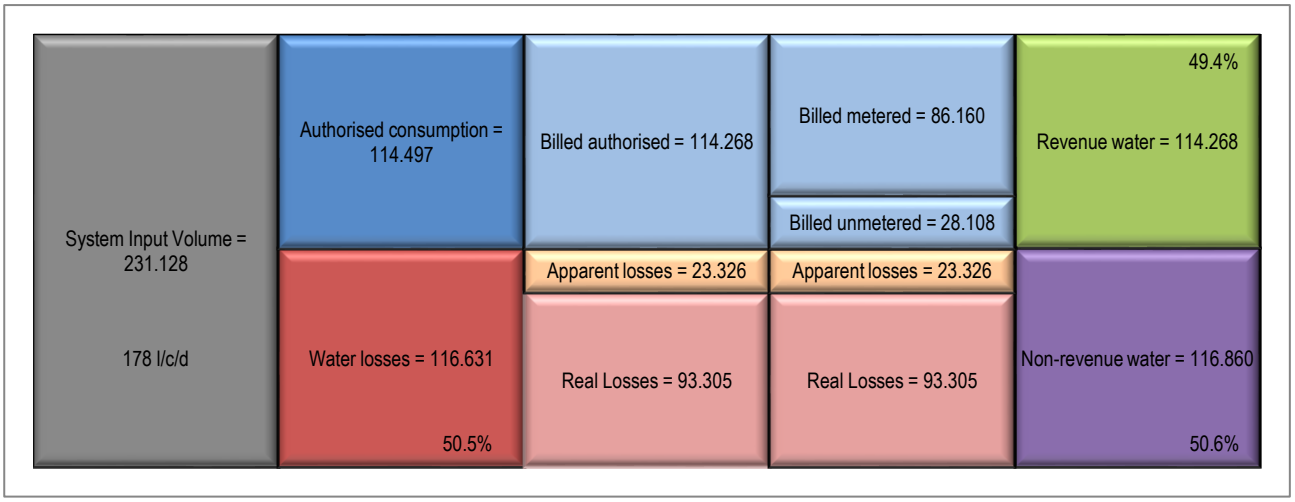
Per capita consumption has remained largely constant over the past six years due to the high number of estimated water balances and lack of reporting by WSAs. The per capita consumption is good in comparison with the No Drop scoring criteria, however, there is room for improvement considering the high number of rural schemes and level of services in the region.

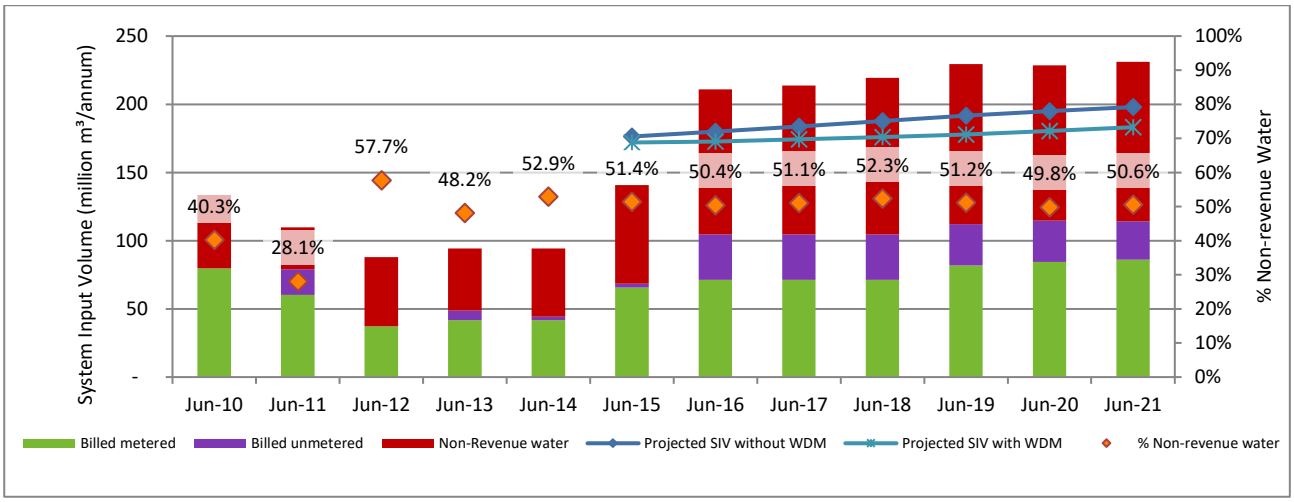


The water loss trend for the Mpumalanga region shows a steady increase in NRW, SIV and water loss between 2016 and 2021. The billed metered consumption has also decreased in the past two years which is cause for concern and the ILI is at an all-time high of 4.9 which is a similar trend noticed in the other regions.

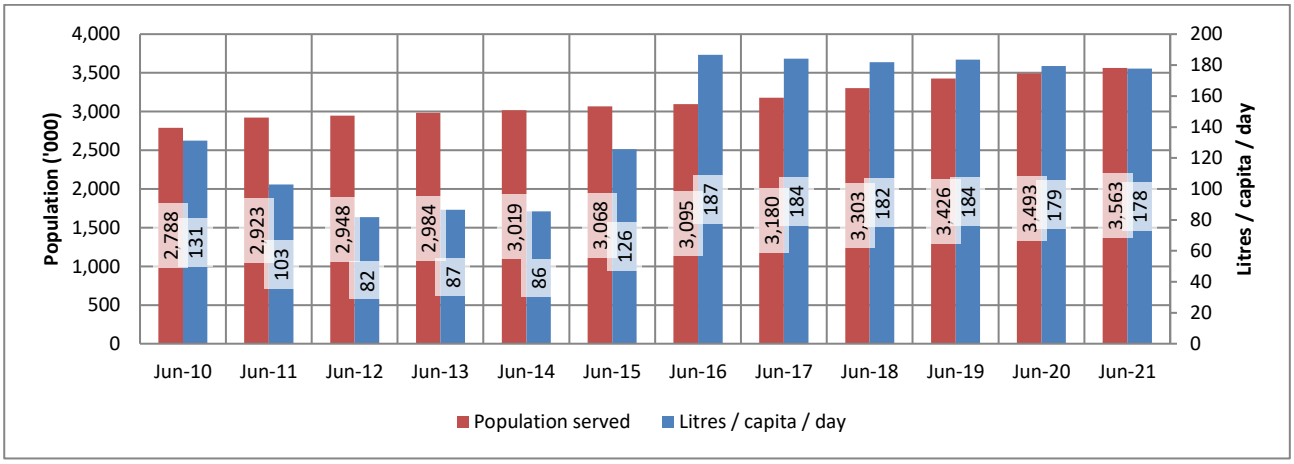
4.8 NORTH WEST REGION

The 2020/2021 water balance for the North West region, indicates NRW of 116.9 million m³/annum (50.6%) and water losses of 116.6 million m³/annum (50.5%). These trends are based on 6 (60%) data out of a possible 10 WSAs. The water balance information is high influenced by Madibeng, Rustenburg, Mahikeng, City of Matlosana and JB Marks municipalities which account for 67% of the water demand. All these municipalities, with the exception of Mahikeng, did submit water balance information, however, the results are questionable and further improvements will be required. Both the NRW and water losses indicate poor performance in terms of the No Drop scoring criteria and WSAs need to enhance revenue to assist in improving sustainability and extending the delivery of services to un-serviced communities given the imperatives of the National Development Plan.

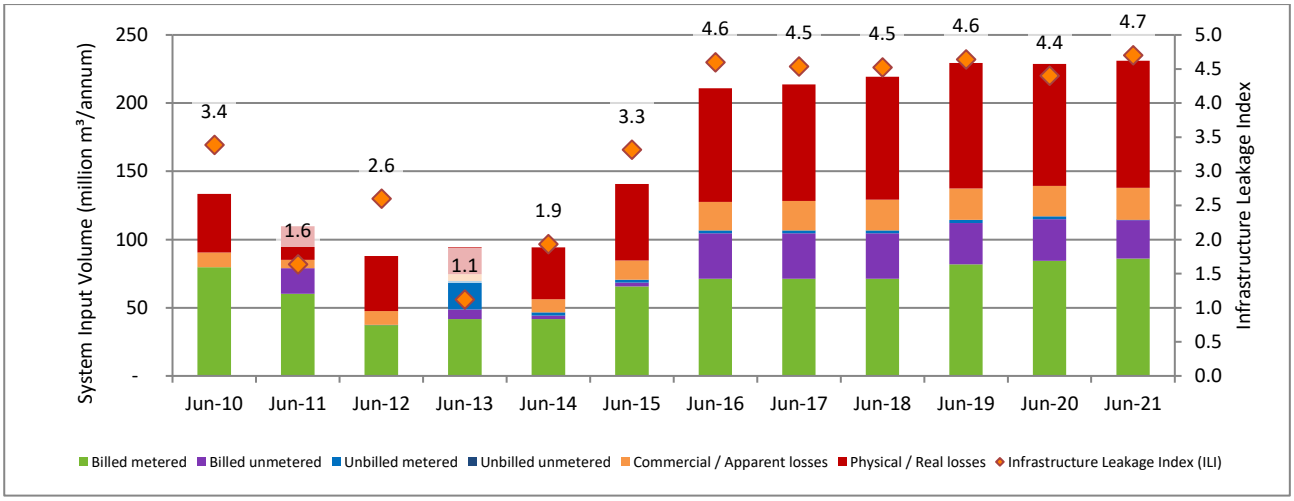




Water losses and NRW has remained consistent between 2016 and 2021 with slight decreases observed between 2019 and 2021. The SIV is above the projected demand with and without WCWDM because there are no strategies available for certain municipalities or data discrepancies. Alignment between the water balance data and all town strategies will be required to address this problem.



The per capita consumption in the North West has shown a slight improvement from its peak of 187 ℓ/c/d in 2016. The improvement needs further investigation due to the high number of estimated water balances in the region and the poor reliability of the supply system.

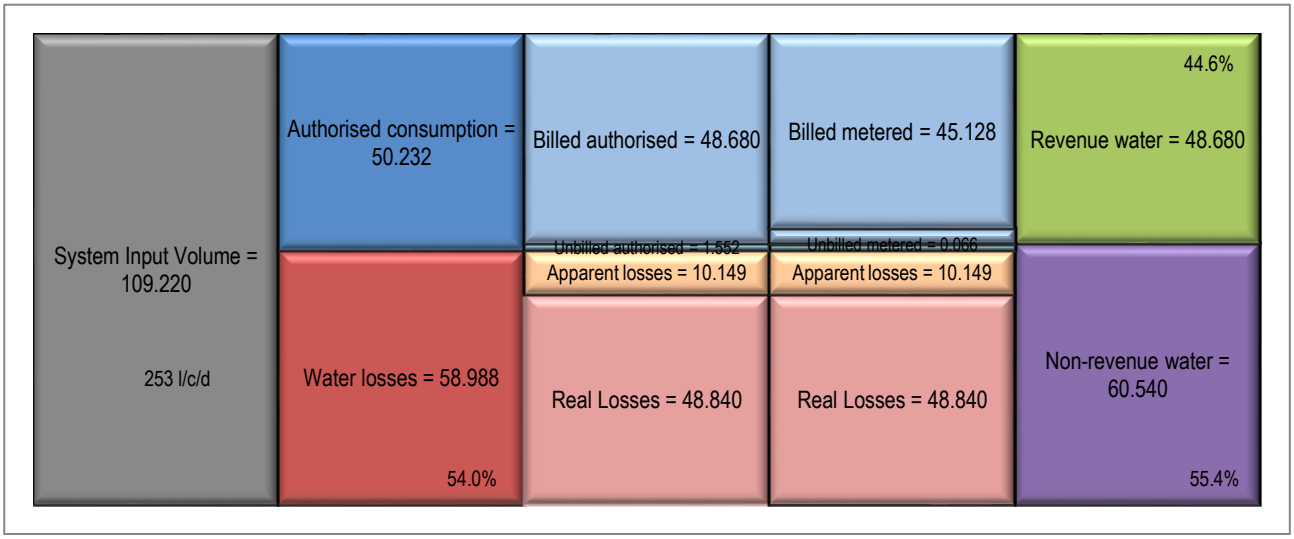


The North West Region has been unable to reduce its demand or water losses for the past six years despite an increase in metered billed consumption. WSAs need to reduce their physical losses to reap the benefits of the revenue enhancement programmes.

4.9 NORTHERN CAPE REGION

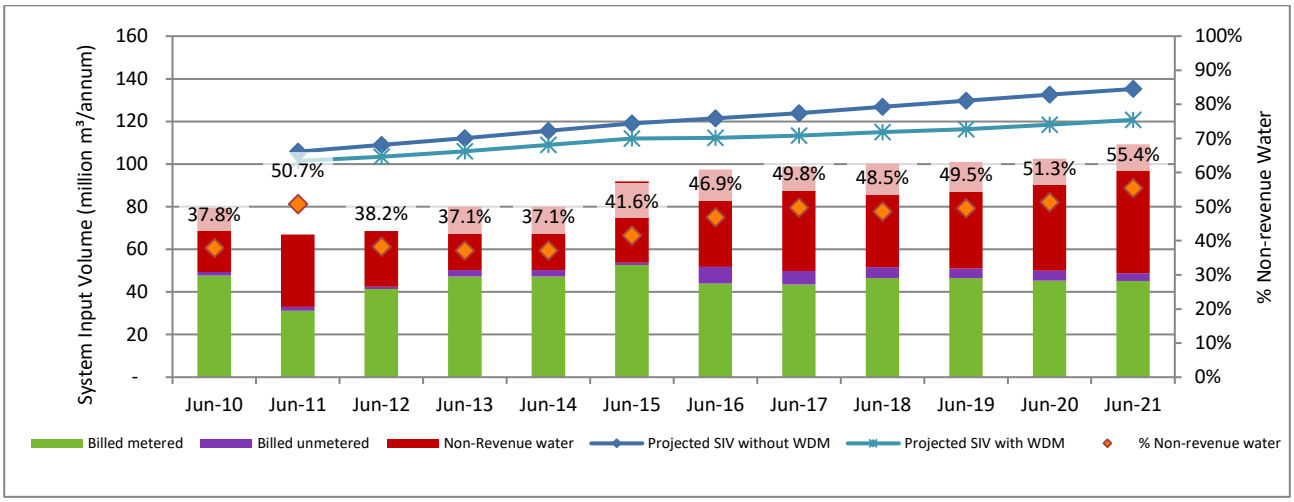
The water balance and trends for the Northern Cape are based on 14 (54%) plausible data sets of a possible 26 WSAs. The water balance information is highly influenced by Dawid Kruiper and Sol Plaatje municipalities which accounts for approximately 37% of the demand. Both municipalities were able to submit water balance information in the past two years.

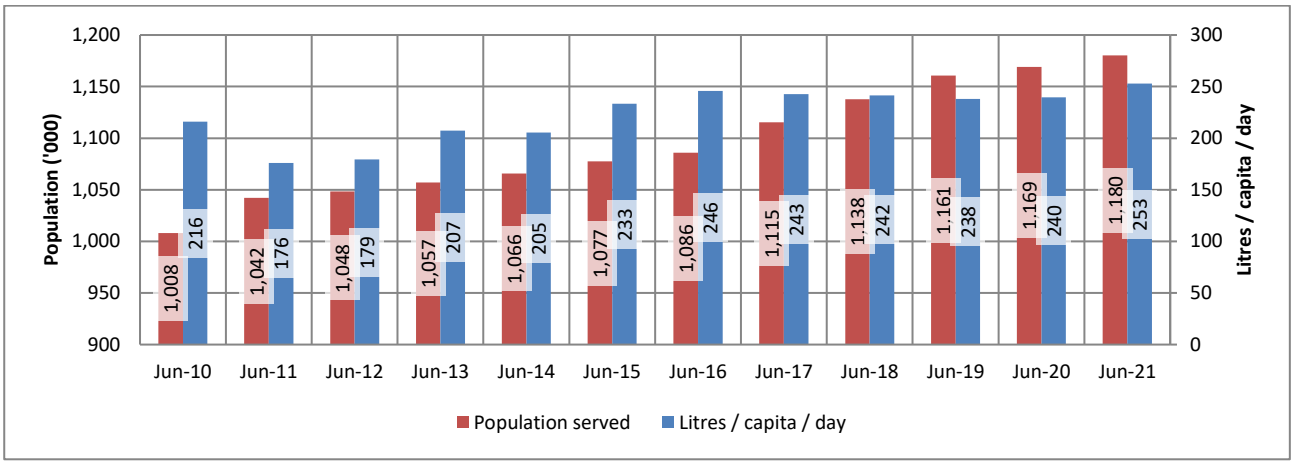
The current water balance indicates NRW of 60.5 million m³/annum (55.4%) and water losses of 59.0 million m³/annum (54.0%). These figures present a significant increase from the 2017 assessment which indicated NRW of 46.9% and water losses of 43.8% based on the updated data submissions and improved estimates.



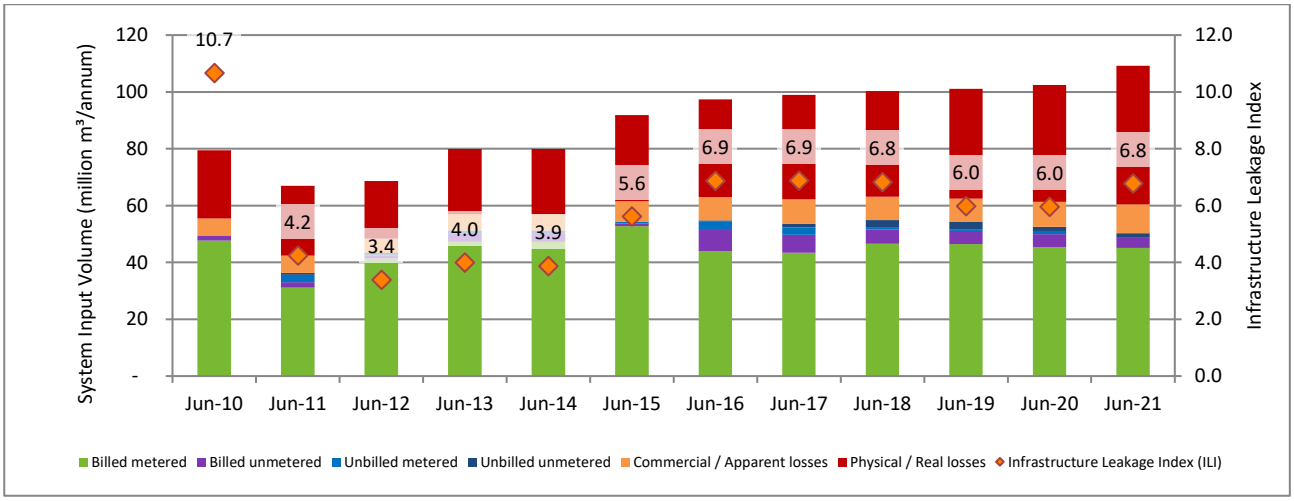
The current water balance trends indicate that the SIV and NRW has been steadily increasing over the past few years. The NRW and water losses in excess of 50% are cause for concern, particularly given the extremely dry climatic conditions in the region. Robust WCWDM programmes will be required in all the municipalities to reduce the water losses and secure the sustainability of water supply. The SIV is below the projected demand with WCWDM due to the very high projections in some municipalities which include mine

water use. Alignment of the all-town strategies and the actual water balance information is required to assess if the targets are realistic and to measure progress made with the implementation of water loss reduction and efficiency programmes. NRW increased drastically in the past two years and peaked at 55.4% in 2021, a trend that has also been noticed in other provinces. This peak is attributed to the COVID-19 pandemic.





The current per capita consumption of 253 ℓ/c/d is high in terms of the No Drop scoring criteria and level of service in the region. Going forward, it will be necessary for the municipalities to collectively assess their reconciliation targets to ensure that the demand and population growth pressures do not outweigh available supply.

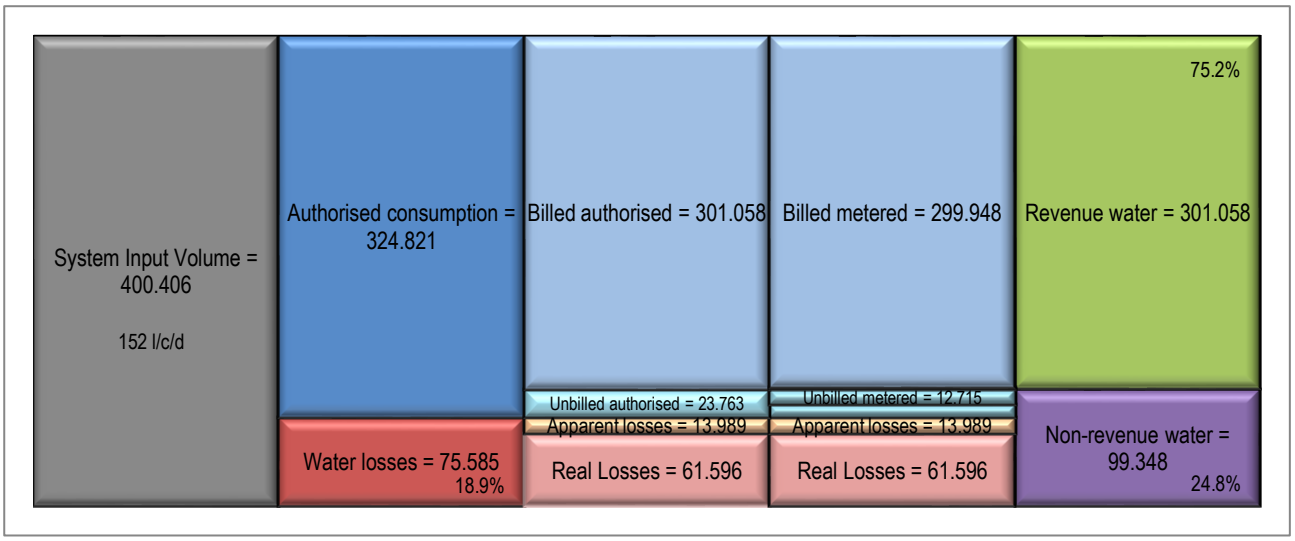


The ILI has remained constant in the past 6 years with signs of improvement in 2019 and 2020. The ILI reflects poor performance by WSAs which need to increase their efforts to reduce visible leakage.

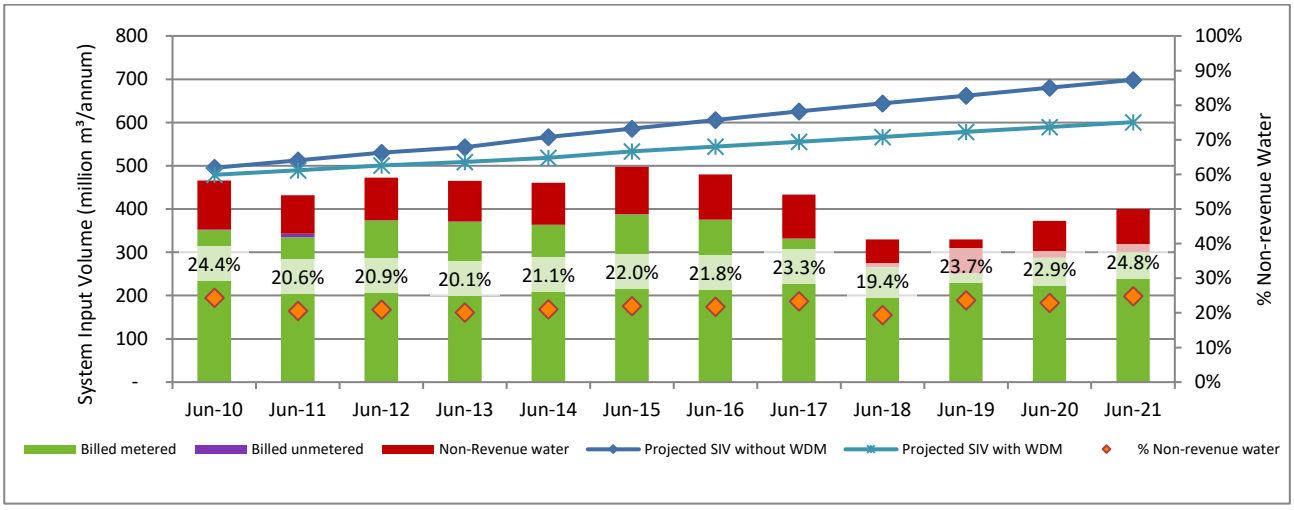
4.10 WESTERN CAPE REGION

The water balance and trends for the Western Cape are based on 24 (96%) plausible data sets of a possible 25 WSAs. The water balance information is highly influenced by City of Cape Town, Drakenstein, Stellenbosch Breede Valley and George which account for approximately 79% of the demand. The water balance data for the Western Cape is exceptionally good and is testament to the consistent effort of the municipalities, in effectively promoting and implementing WCWDM and NRW management measures. The DWS Regional office is also lauded for its efforts to implement active monitoring and reporting mechanisms.

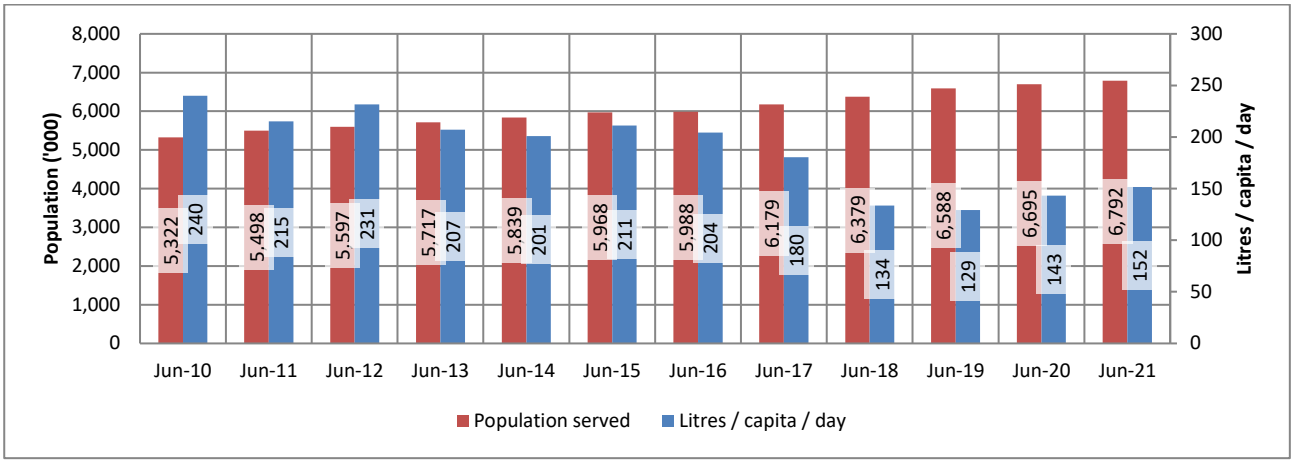
The water balance for the 24 data sets, shows NRW of 99.3 million m³/annum (24.8%) and water losses of 75.6 million m³/annum (18.9%). These figures compare well with the updated June 20216 benchmarking assessment of 21.8% NRW and 16.7% water losses.



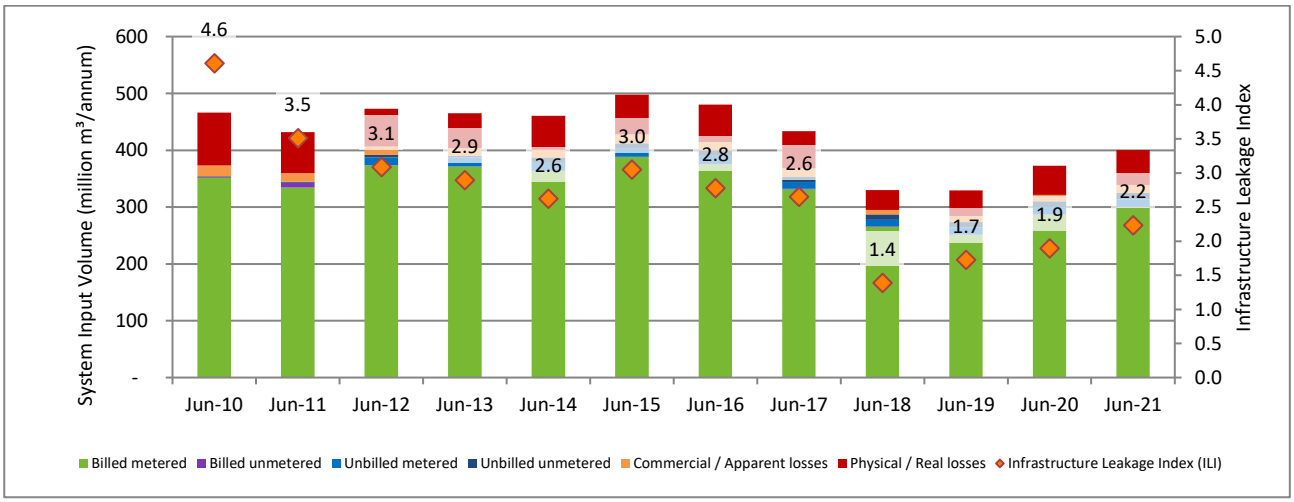
It is commendable that municipalities in the Western Cape managed to reduce their SIV in 2018 and 2019 by approximately a third without resorting to intermittent supply to curb the impact of the severe drought and the looming “day zero”. The NRW has increased slightly since then, however the trend remains well below the projected demand with WCWDM. The consistently low NRW can also be attributed to the continuous execution, monitoring and reporting, by both the DWS regional office and municipalities.



The per capita consumption for the Western Cape consistently decreased between 2015 and 2019, hitting record lows during 2018 and 2019. The per capita consumption increased in 2020 and 2021 but continues to track well below the population growth trends indicating the high-water use efficiency of the region in general.



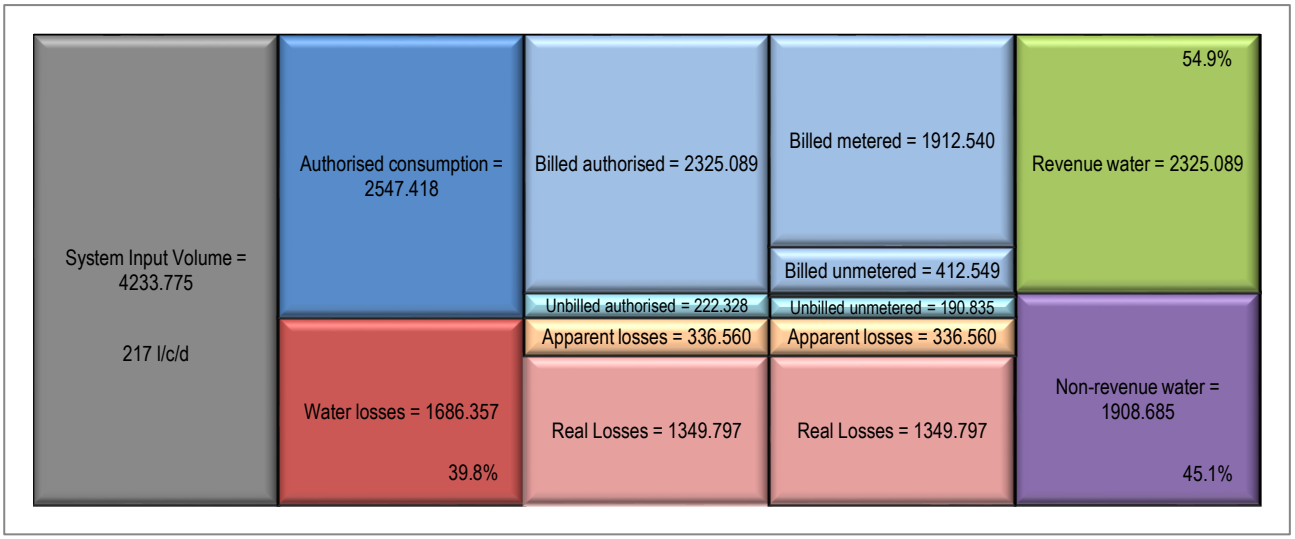
Based on the current trends, the Western Cape has managed to keep the distribution losses low with an ILI of 2.2 which is inline with well managed systems. Significant strides have been made since 2010 in reducing the ILI which has started off at 4.6 in 2010. Given the notable progress, the municipalities in the region should continue their efforts and avoid complacency in keeping up the maintenance and management of the water supply infrastructure and to mitigate the devasting impact of changing climatic conditions observed in the region in recent times.

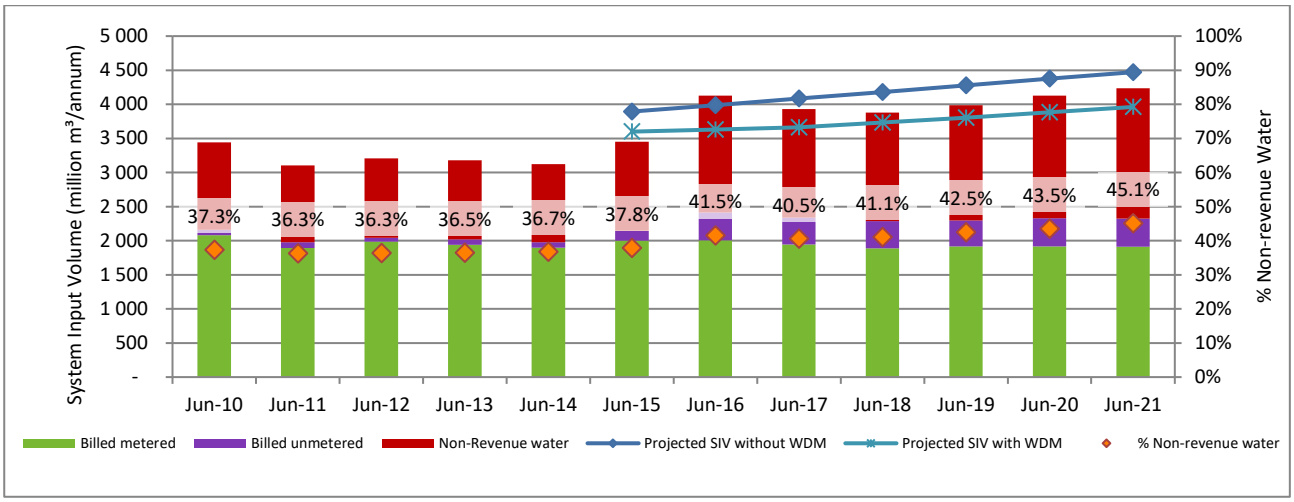


4.11 NATIONAL WATER BALANCE

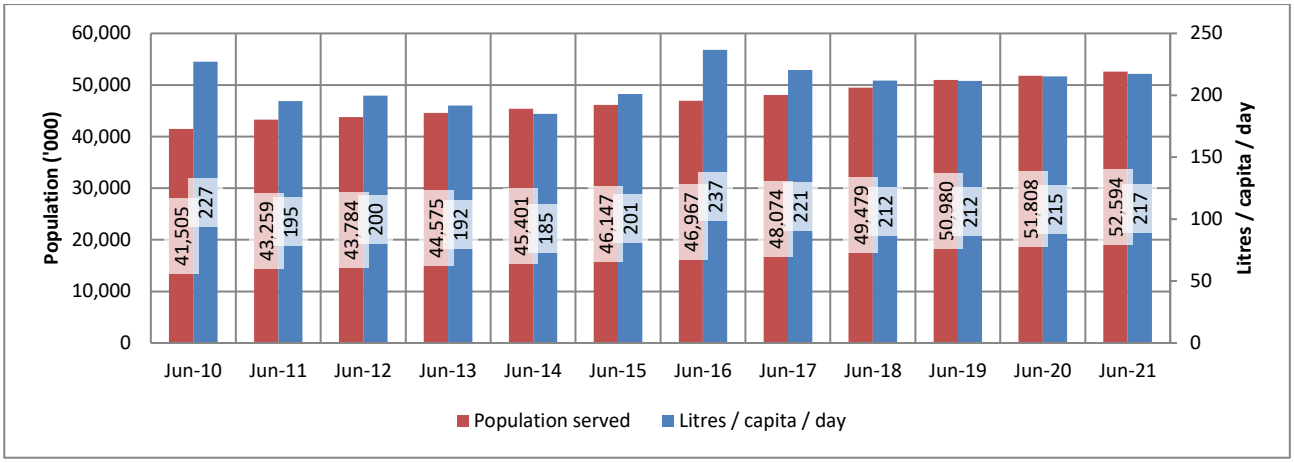
The 2020/21 national water balance indicates a SIV of 4233.8 million m³/annum, NRW of 1908.7 million m³/annum (45.1%) and water losses of 1686.4 million m³/annum (39.9%). The NRW and water losses have increased by a notable 3.5% and 3.4% respectively from June 2016, however, the greatest increase was in the past two years and attributed to the COVID-19 pandemic. The fluctuation between 2016 and 2019 was generally less than 1%.

There has been a noticeable increase in billed unmetered consumption as a result of incorporating free basic water supply in the estimated water balances for especially rural municipalities. Unbilled unmetered consumption remains lower than expected, considering the high number of unbilled properties in the country. Municipalities need to correct their water balance calculations and show any water use after an accepted connection as authorised consumption and not water loss.

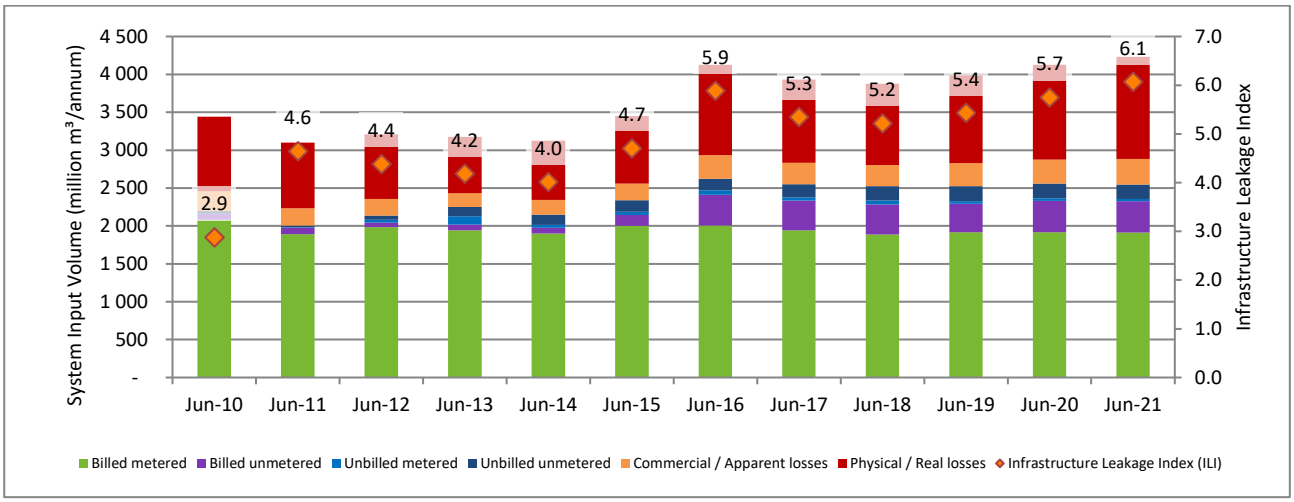




The national NRW and water loss trends show a steady increase in NRW over the past 10 years and gradual exceedance of the SIV projections with WCWDM scenario. The figures are highly influenced by the category A, B1 and B2 municipalities, most of which have made significant strides in improving NRW management, reducing water losses and managing the demand in line with reconciliation strategy targets. There is significant scope for improvement of NRW and all municipalities would benefit from targeted demand management programmes including community education and awareness, leak repair, infrastructure refurbishment, pressure management, installation of bulk meters amongst other measures.



National trends suggest that the per capita consumption has remained almost constant over the past 10 years, which is commendable, however, WCWDM efforts must be elevated considering the level of service, inefficiencies and the country is one of the 30 driest in the world. The per capita consumption is however significantly lower than the previous national average of 237 ℓ/c/d presented in June 2016.



The ILI deteriorated slightly from 2016 to 2021 and showed signs of improvement in 2017 and 2018. The COVID-19 pandemic has played havoc with municipal water losses and this trend is expected to improve once municipalities have return to normal and have eliminated the leak repair back-logs and improved revenue collection.

The results indicate increased NRW, water losses and ILI but a significant decrease in the national per capita consumption. Given the increases on three key NRW metrics, WCWDM must be implemented as a matter of urgency in all regions, especially considering that a number of regions have NRW and water losses above 50%. There is significant scope for improvement in reporting levels, data accuracy and a reduction of SIV, NRW, water losses and improved efficiency across the country. Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM can be measured.

5 BENCHMARKS

5.1 INTRODUCTION

SIV, volume NRW, percentage NRW, litres per capita per day and ILI benchmarks for the country are shown in the following sections. For the last three indicators, the national average and the national weighted average are shown. In all previous benchmark studies, the weighted average was used. The weighted average is highly influenced by the metropolitan and secondary city WSAs as shown in the calculations below:

$$\%\ \text{NRW average} = \text{AVERAGE}\ (\%\text{NRW1}, [\%\text{NRW2}], \ldots) \quad \text{(average of the averages)}$$

$$\%\ \text{NRW weighted average} = \frac{\text{SUM VOLUME}\ (\text{NRW1}, [\text{NRW2}], \ldots.)}{\text{SUM VOLUME}\ (\text{SIV1}, [\text{SIV2}], \ldots)} \times 100$$

5.2 SYSTEM INPUT VOLUME

The SIV distribution per municipal category is shown in **Figure 9** and per WSA in **Figure 10**. The metropolitan municipalities are by far the biggest water users in the country followed by category B1, B2 and B3 municipalities respectively. The results are very similar to previous assessments. The rural B4 and C2 municipalities' estimated water use is higher than previous assessments. Category A, B1 and B2 municipalities represent almost 75% of the total water use while Gauteng and KwaZulu Natal 55% of the total use.

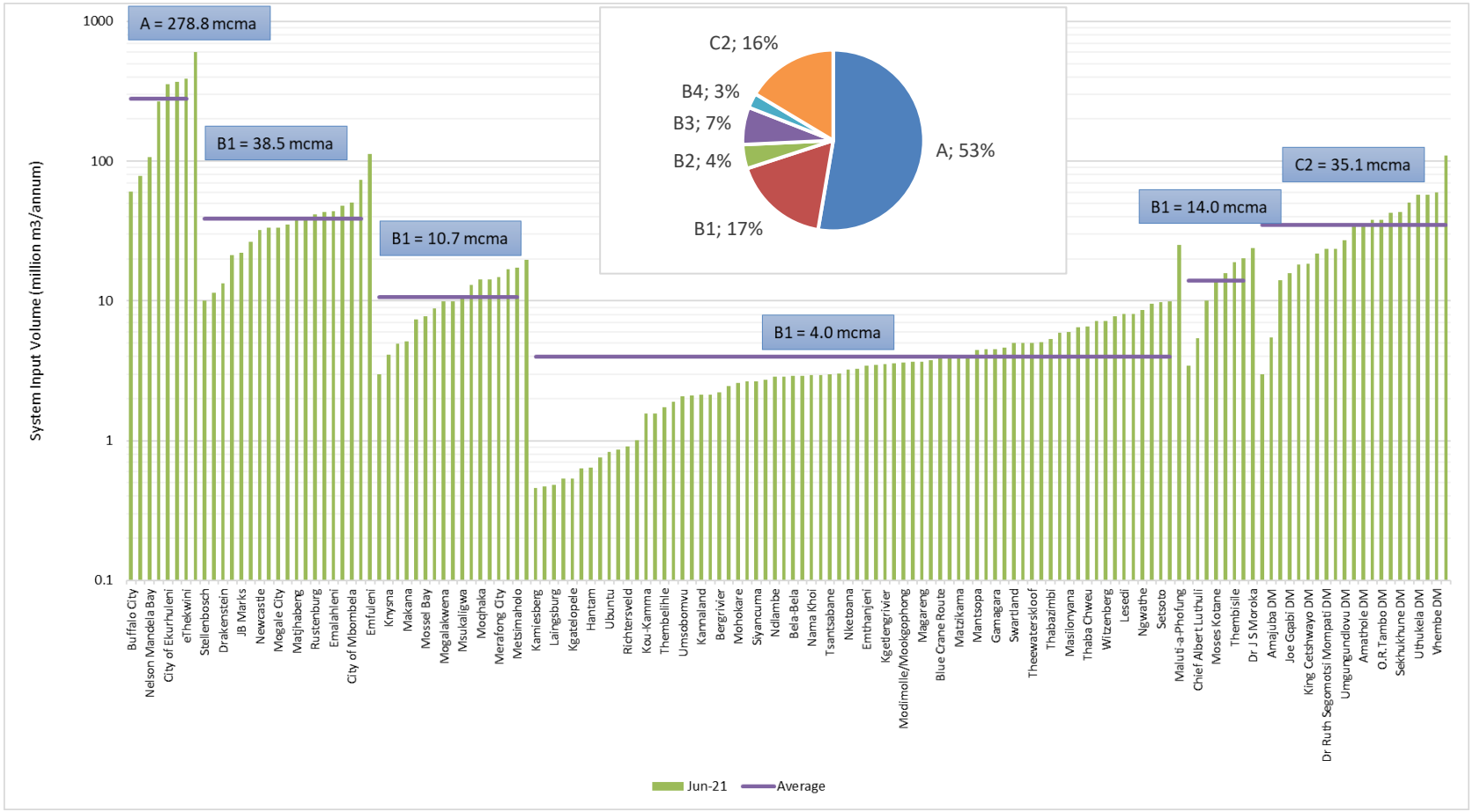


Figure 9: SIV distribution per municipal category

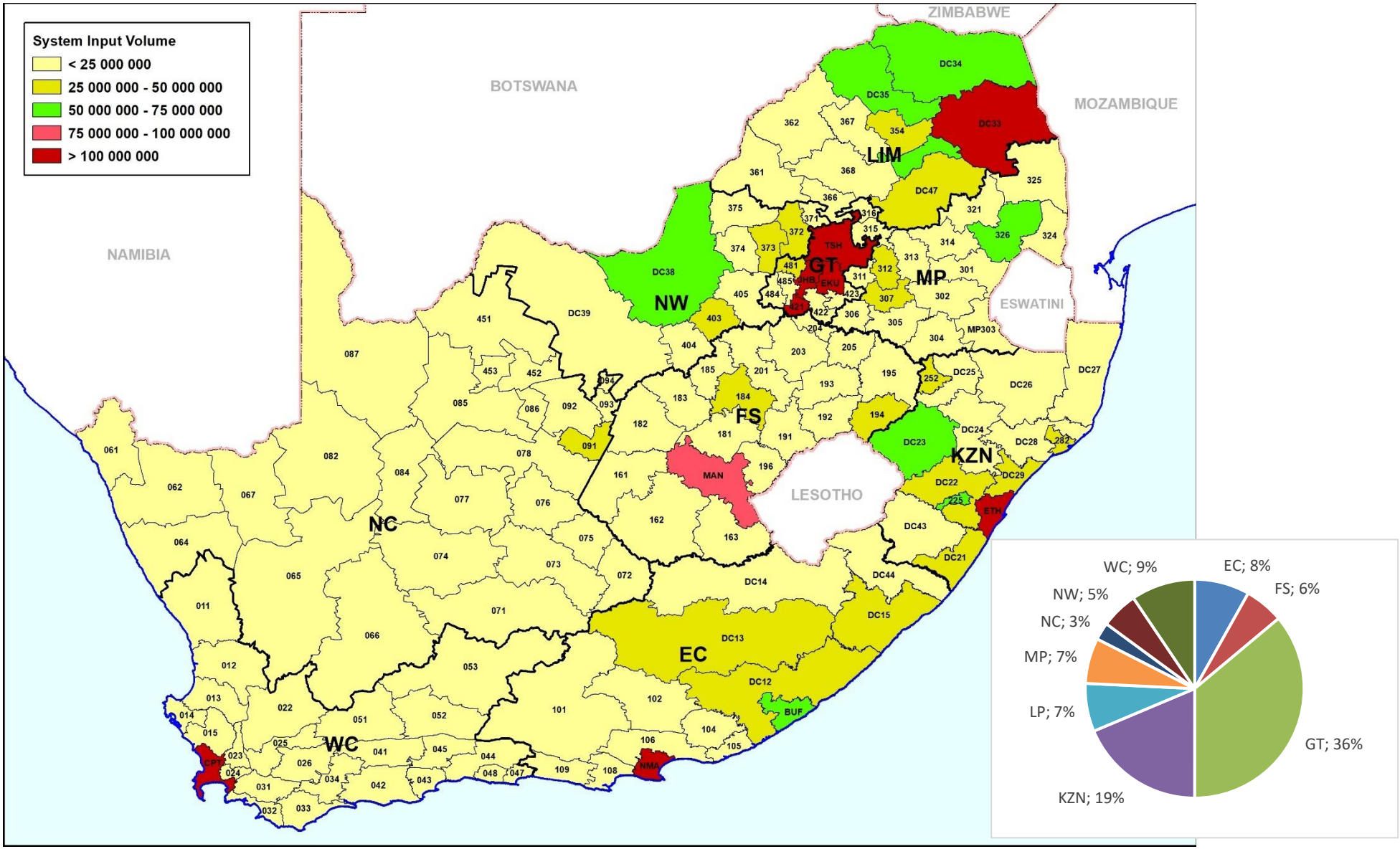


Figure 10: SIV distribution per WSA

5.3 VOLUME NON-REVENUE WATER

The volume NRW for the municipal categories is shown in Figure 11 and per WSA in Figure 12. The volume NRW in the category A, B1 and B2 municipalities accounts for almost two thirds of all the NRW in the country and should be a focus area of the national WCWDM programme. Gauteng and KwaZulu Natal accounts for more than 50% of the national volume NRW.

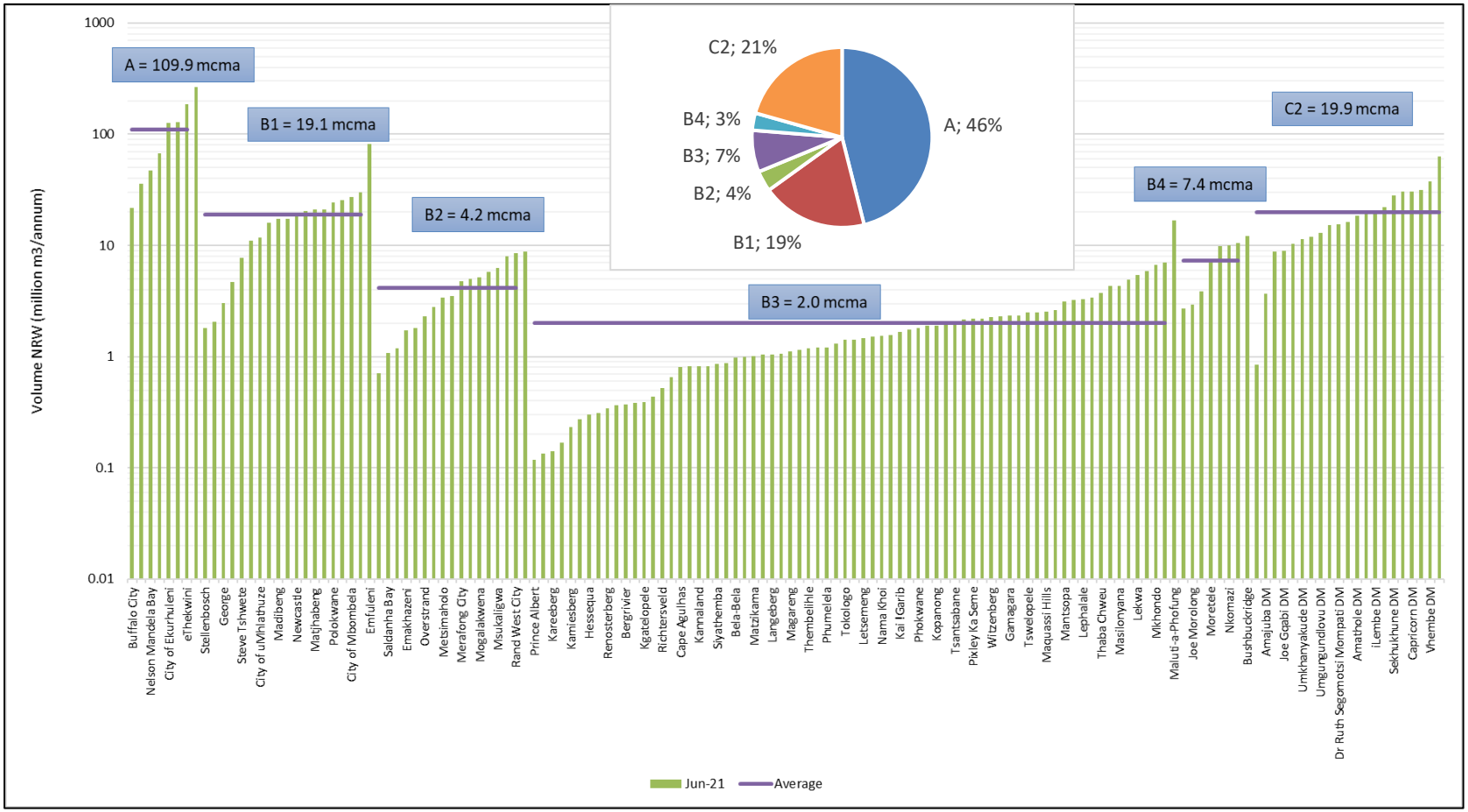


Figure 11: Volume NRW distribution per municipal category

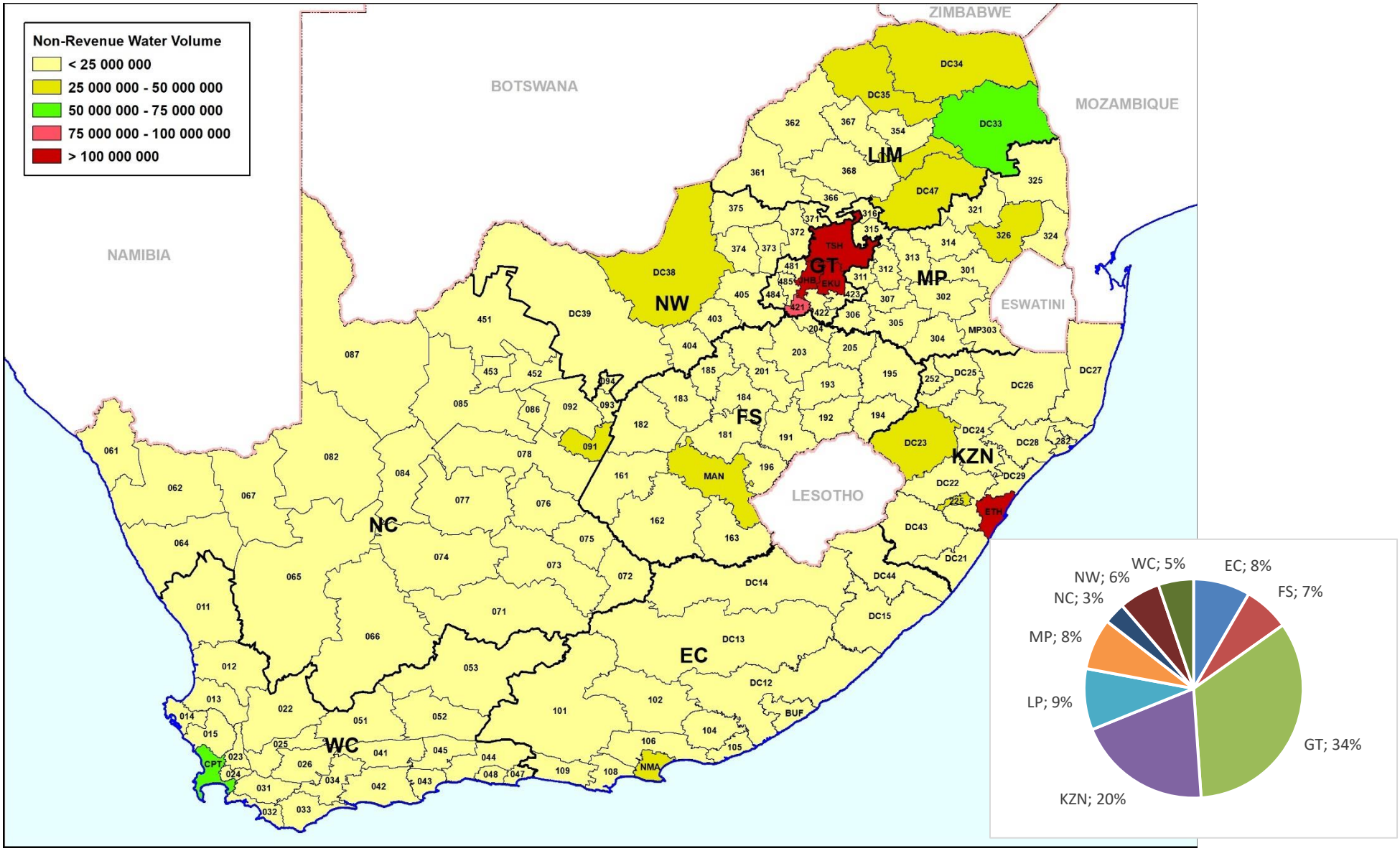


Figure 12: Volume NRW distribution per WSA

5.4 % NON-REVENUE WATER

The percentage NRW distribution per municipal category and per WSA is shown Figure 13 and Figure 14. In all categories the performance varies from very good to very poor. Category A and B2 municipalities are performing the best and it is assumed have sufficient budget and resources to implement effective WCWDM programmes. Category B1, B3and rural municipalities face significant budget, cost recovery and resource challenges and have higher NRW.

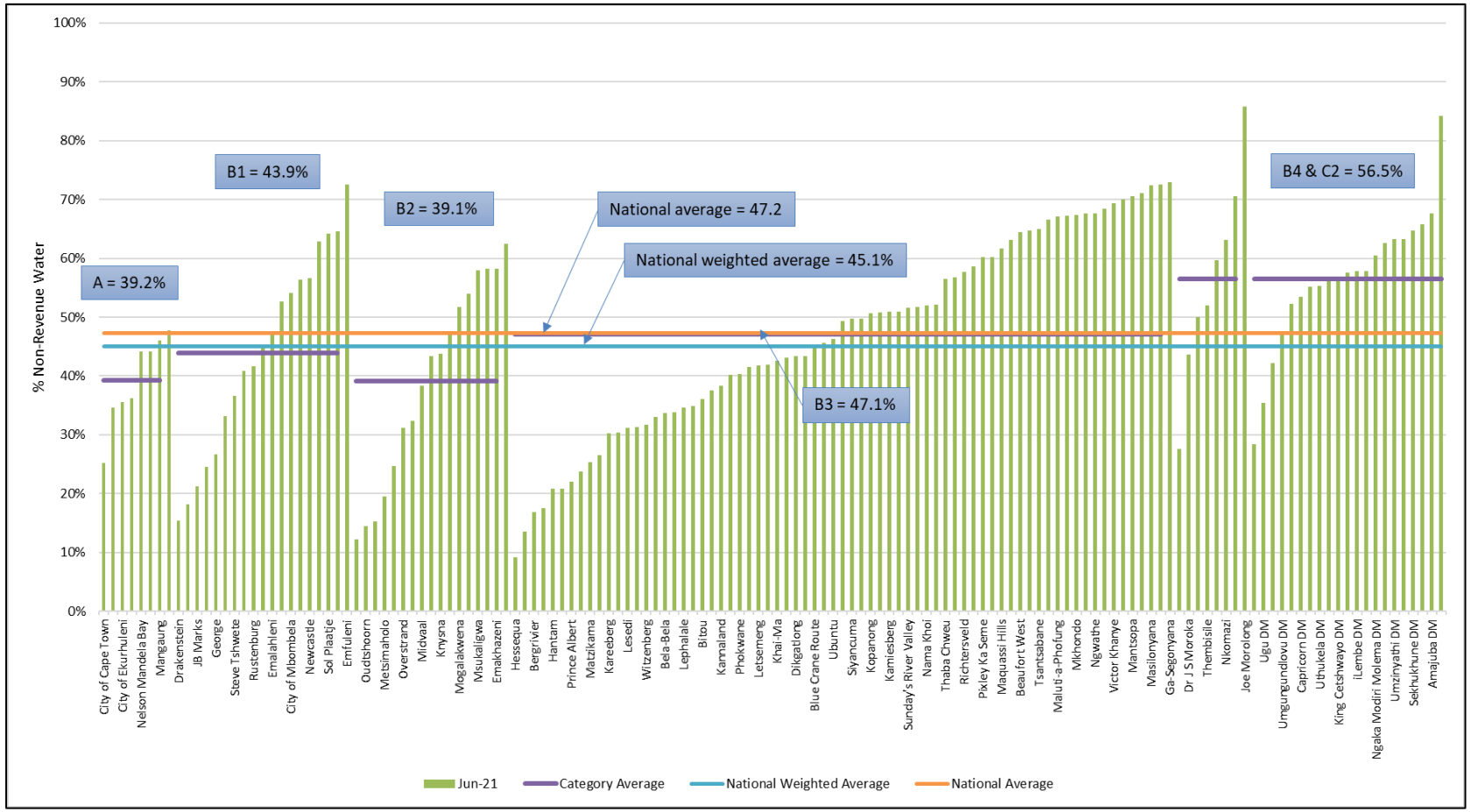
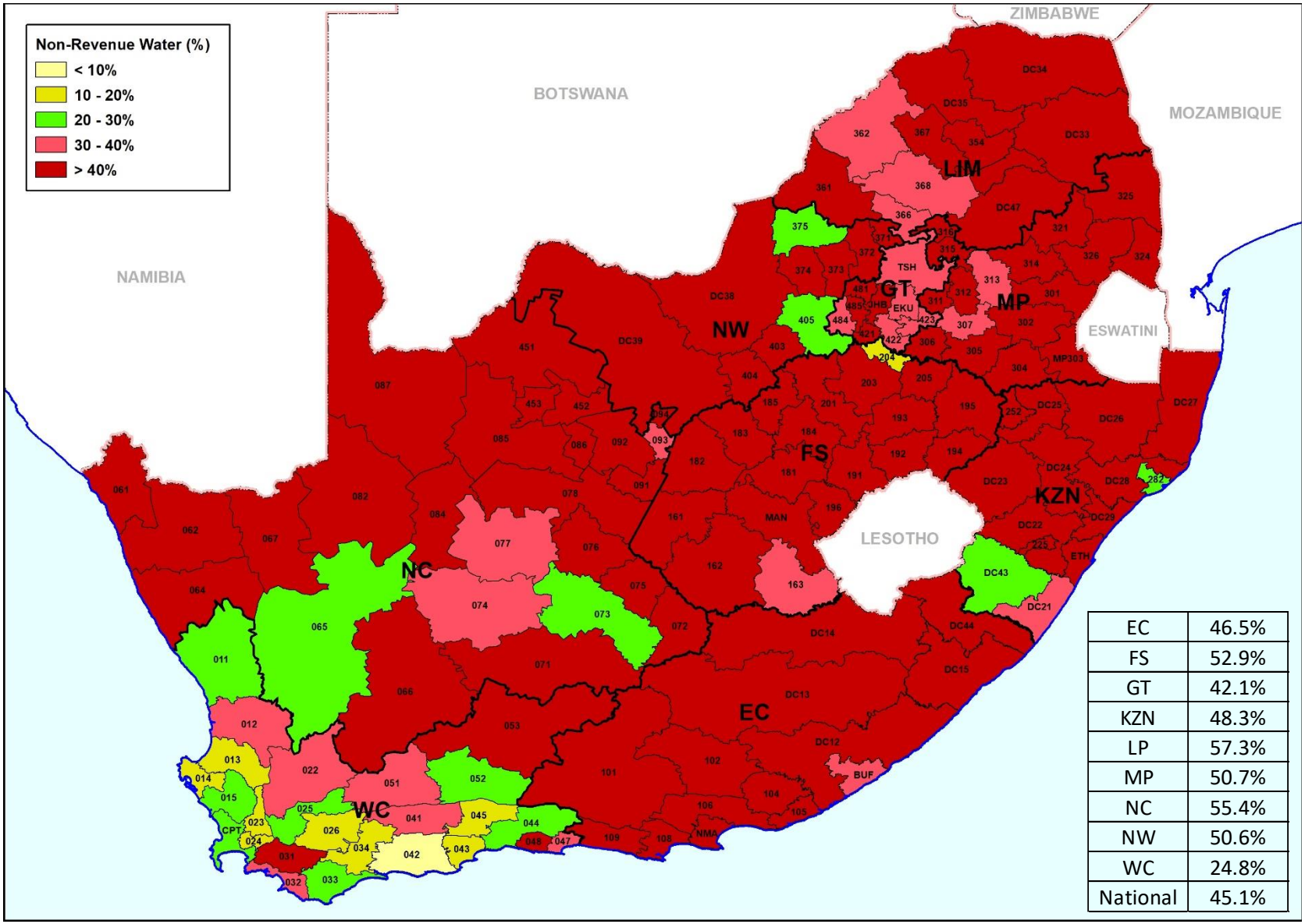


Figure 13: Percentage NRW distribution per municipal category



EC	46.5%
FS	52.9%
GT	42.1%
KZN	48.3%
LP	57.3%
MP	50.7%
NC	55.4%
NW	50.6%
WC	24.8%
National	45.1%

Figure 14: Percentage NRW distribution per WSA

5.5 LITRES PER CAPITA PER DAY

The water use efficiency, in litres per capita per day, are shown **Figure 15** and **Figure 16**. The metropolitan municipalities have the highest per capita consumption and also highest number of wet industries. Category B1 and B2 municipalities have slightly lower consumption figures which is above the national average of 186 ℓ/c/d. The national weighted average of is highly influenced 217 ℓ/c/d by the category A and B1 municipalities. The litres per capita per day in some municipalities are extremely high and needs further investigation to ensure the population served is correct.

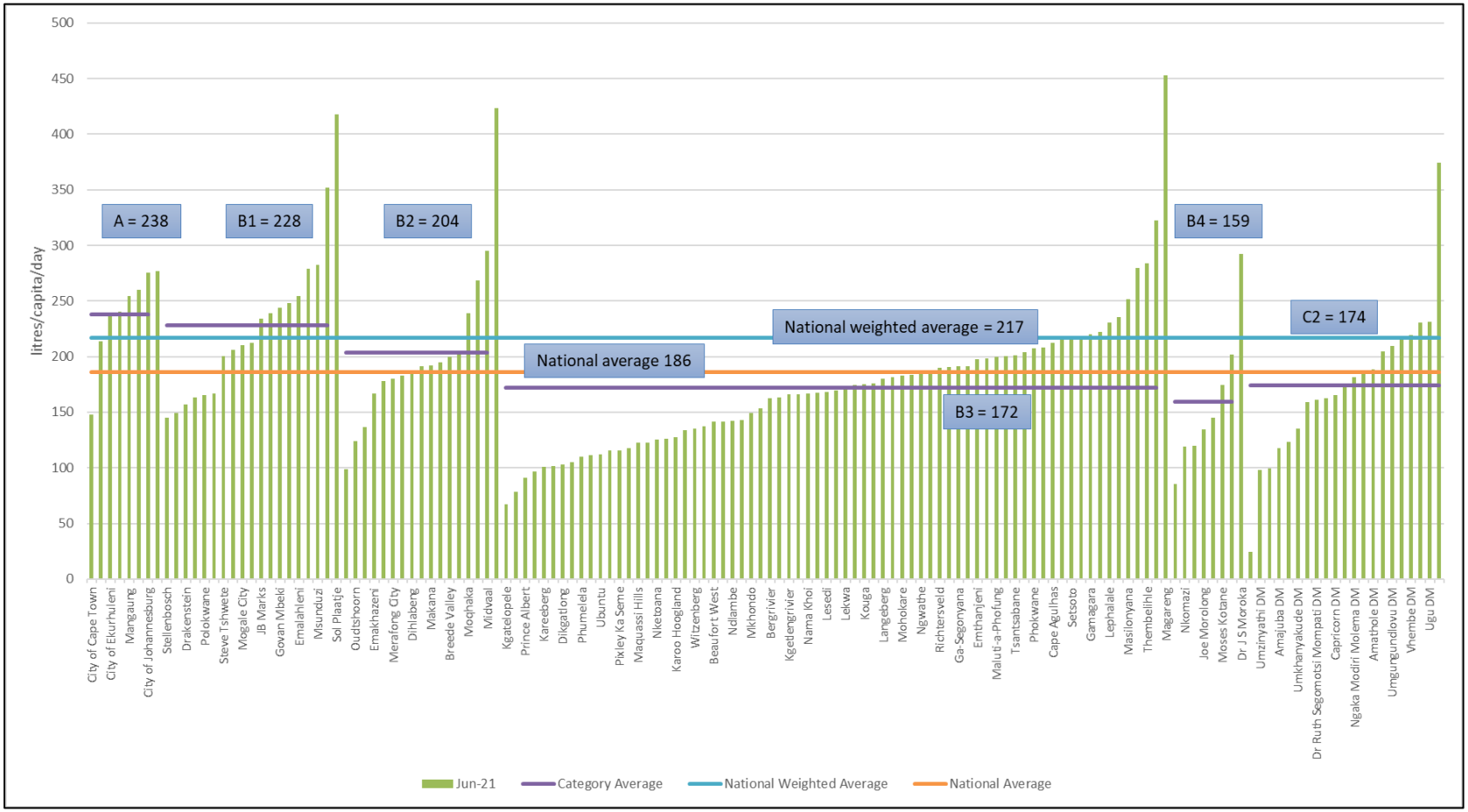


Figure 15: Litres per capita per day distribution per municipal category

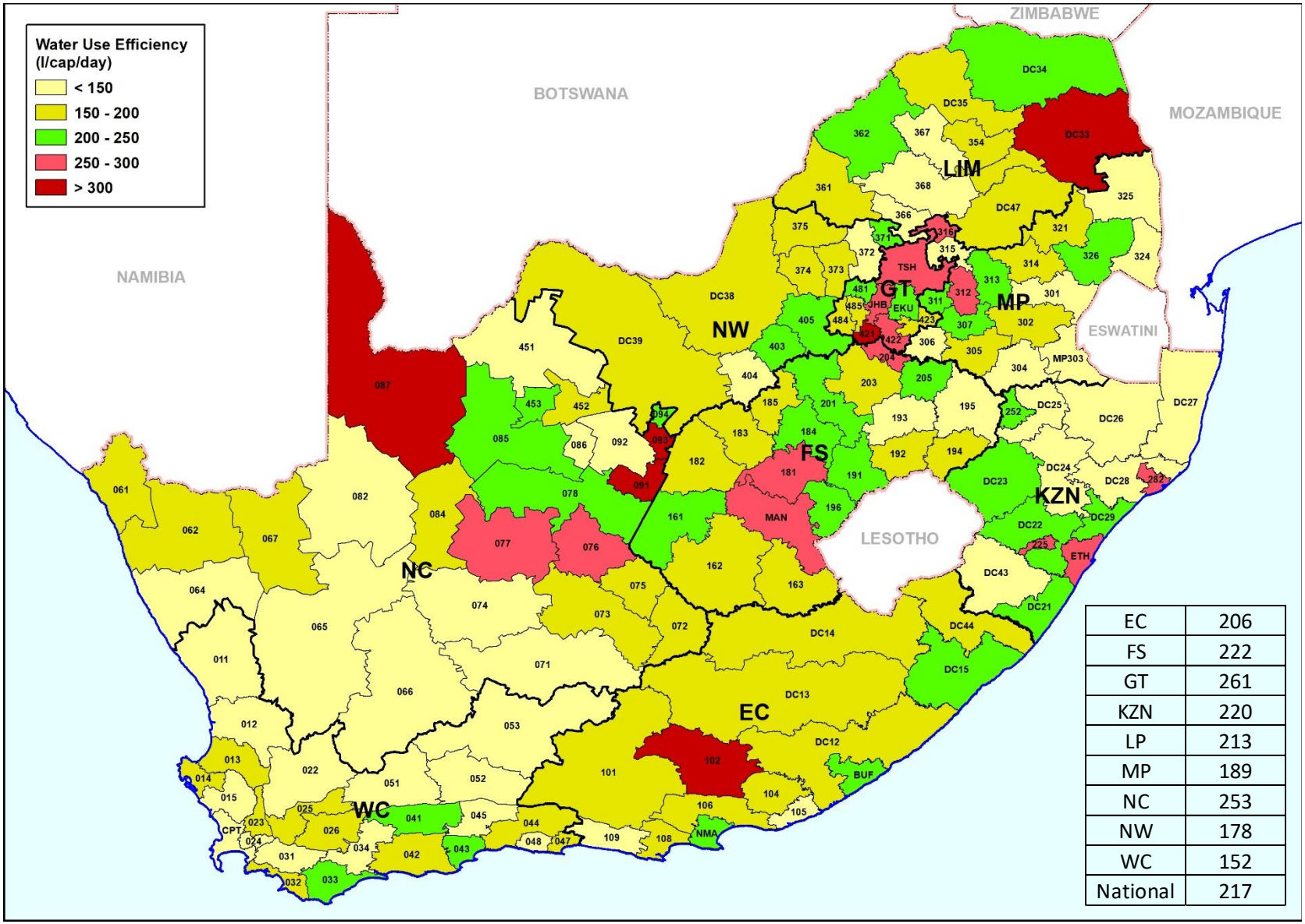


Figure 16: Litres per capita per day per WSA

5.6 INFRASTRUCTURE LEAKAGE INDEX

The ILI for the municipal categories is shown in **Figure 17** and for WSAs and **Figure 18**. Physical water losses are the highest in the Category A and B1 municipalities and should be addressed through active leak detection and repair programmes. The extremely high ILIs in the category B1 municipalities need further investigation and can be as a result of average pressure, length of mains or reporting unbilled consumption as water loss errors.

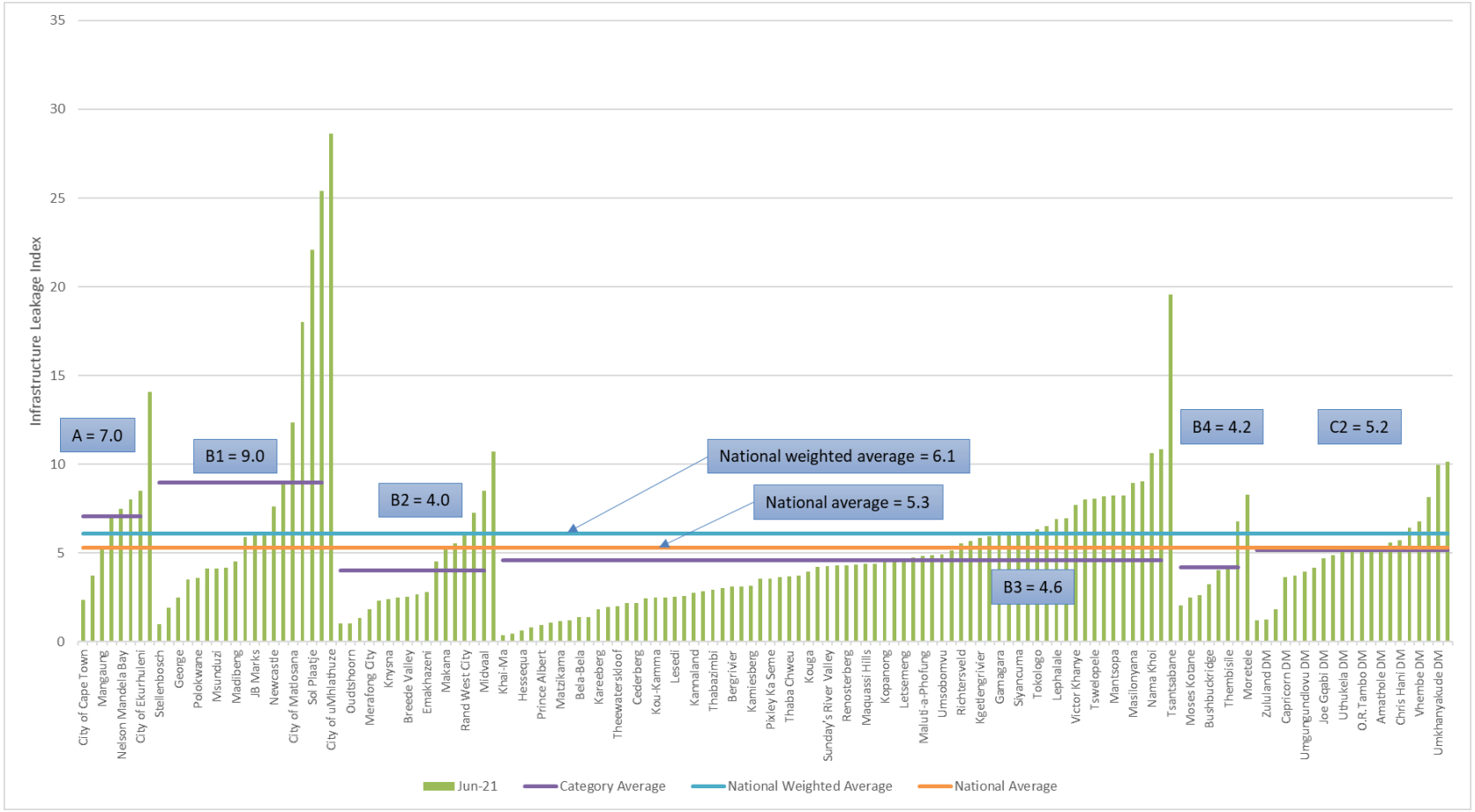
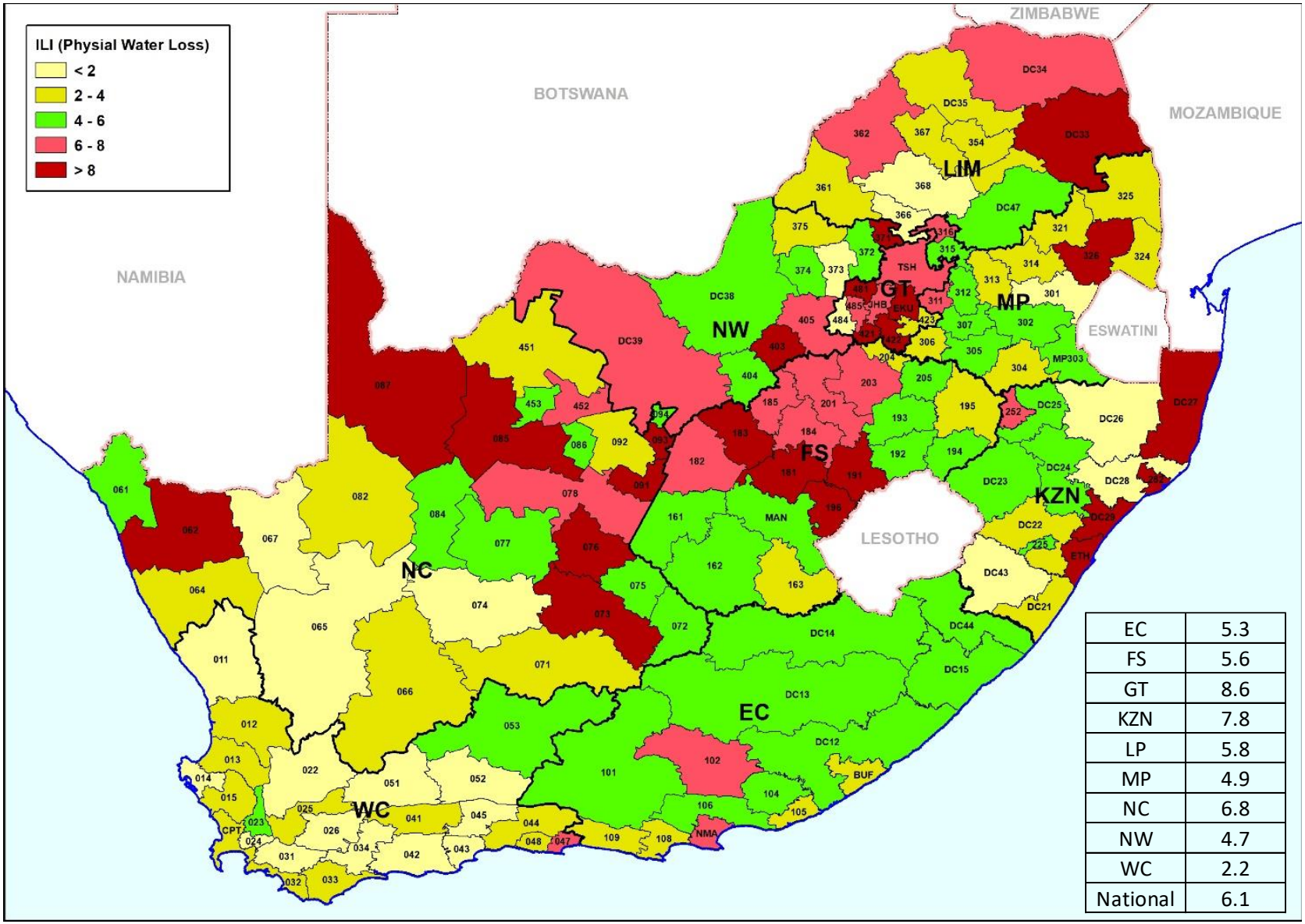


Figure 17: ILI distribution per municipal category



EC	5.3
FS	5.6
GT	8.6
KZN	7.8
LP	5.8
MP	4.9
NC	6.8
NW	4.7
WC	2.2
National	6.1

Figure 18: ILI per WSA

6 FINANCIAL ANALYSIS

The Medium Term Revenue and Expenditure Framework (MTREF) submitted by municipalities on an annual basis provides valuable information on the revenue and expenditure for the current year, past three years and projected three years. This financial analysis attempted to align the actual revenue and expenditure on water with the IWA water balance to assess the cost of water and the potential revenue. Focus was placed on Table A2 Budgeted Financial Performance (revenue and expenditure by functional classification) and Table SA1 Supporting detail to 'Budgeted Financial Performance'. Examples are shown in Table 7 and Table 8.

Table 7: MTREF Table A2 Budgeted Financial Performance

Functional Classification Description	2016/17	2017/18	2018/19	Current Year 2019/20			2020/21 Medium Term Revenue & Expenditure Framework		
R thousand	Audited Outcome	Audited Outcome	Audited Outcome	Original Budget	Adjusted Budget	Full Year Forecast	Budget Year 2020/21	Budget Year +1 2021/22	Budget Year +2 2022/23
Revenue - Functional									
Trading services	**195 102**	**217 956**	**247 828**	**288 792**	**295 383**	**295 383**	**359 027**	**377 858**	**397 677**
Energy sources	125 614	126 679	151 759	176 205	183 874	183 874	224 902	236 709	249 136
Water management	29 451	58 974	62 164	73 663	71 411	71 411	80 282	84 497	88 933
Waste water management	25 024	14 810	15 674	18 644	18 576	18 576	32 197	33 887	35 666
Waste management	15 012	17 493	18 232	20 279	21 523	21 523	21 646	22 765	23 941
Expenditure - Functional									
Trading services	**245 051**	**369 576**	**196 708**	**373 086**	**332 303**	**332 303**	**435 000**	**461 230**	**489 382**
Energy sources	166 734	238 243	181 881	242 379	221 869	221 869	306 793	323 900	341 352
Water management	39 197	55 886	14 687	72 200	60 726	60 726	66 247	69 724	73 385
Waste water management	12 871	47 670	140	26 693	22 258	22 258	26 132	27 504	28 948
Waste management	26 248	27 776	–	31 814	27 449	27 449	35 828	40 102	45 697
Surplus/(Deficit) for the year	**-49 949**	**-151 620**	**51 120**	**-84 294**	**-36 920**	**-36 920**	**-75 973**	**-83 372**	**-91 705**

Table 8: MTREF Supporting Table SA1 Supporting detail to 'Budgeted Financial Performance'

Description	2016/17	2017/18	2018/19	Current Year 2019/20				2020/21 Medium Term Revenue & Expenditure Framework		
R thousand	Audited Outcome	Audited Outcome	Audited Outcome	Original Budget	Adjusted Budget	Full Year Forecast	Pre-audit outcome	Budget Year 2020/21	Budget Year +1 2021/22	Budget Year +2 2022/23
REVENUE ITEMS:										
Service charges - water revenue										
Total Service charges - water revenue	**29 379**	**59 056**	**63 242**	**95 648**	**100 256**	**100 256**		**81 141**	85 401	89 884
less Revenue Foregone ***(in excess of 6 kilolitres per indigent household per month)***										
less Cost of Free Basis Services (6 kilolitres per indigent household per month)	–	–	1 078	28 845	28 845	28 845		1 172	1 234	1 299
Net Service charges - water revenue	**29 379**	**59 056**	**62 164**	**66 804**	**71 411**	**71 411**	**–**	**79 969**	**84 167**	**88 586**

The Water Management Functional Expenditure from Table 7 divided by the SIV provides an indication of the cost of water supply as shown in Figure 19. Based on the functional expenditure and SIV of 49 WSAs, the average cost of supplying water is R 12.41/kl. This ranges from R 14.38/kl for metropolitan municipalities to R 10.30 for category B3 municipalities. It seems the cost of supplying rural municipalities (category B4 and C2) is the highest, ranging from R 13.21/kl to R 16.33/kl. This is a meaningful change from previous assessments that suggested that cost of supplying water in the rural schemes are cheaper that the large municipalities. The higher cost can be justified considering that these schemes often consist of many small systems with boreholes which are expensive to operate.

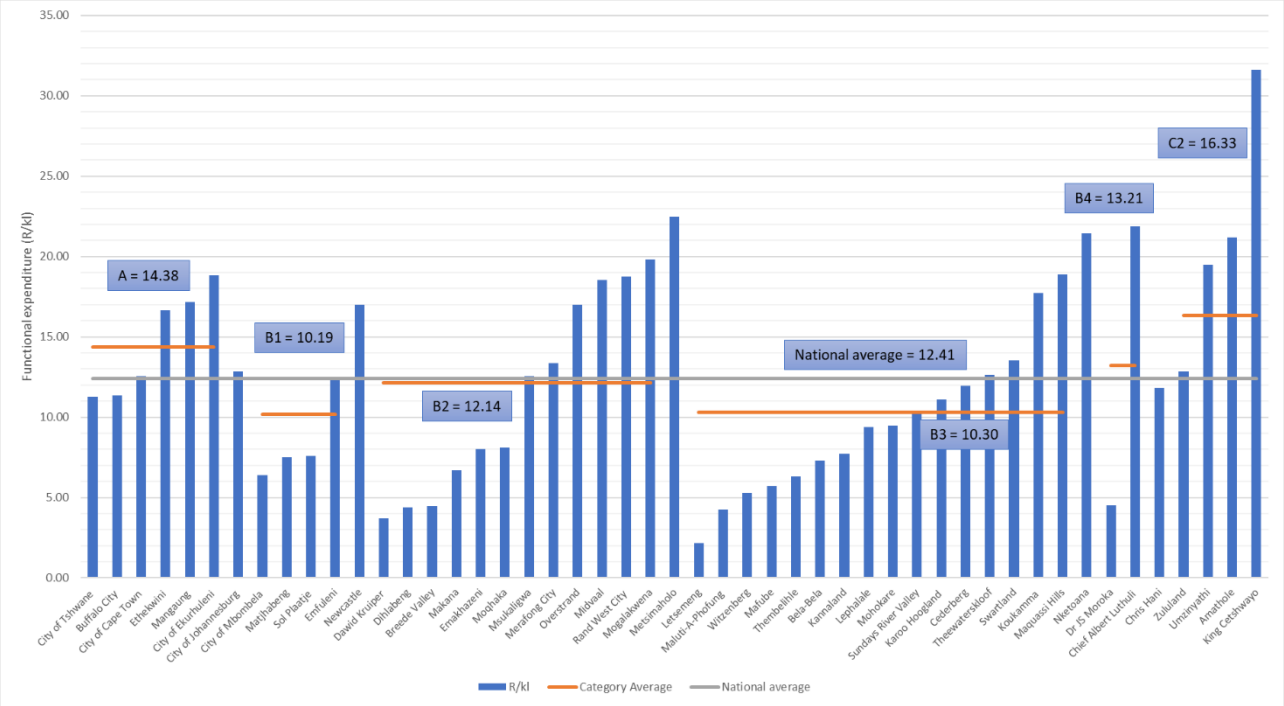


Figure 19: Cost of water supply (functional expenditure per kl)

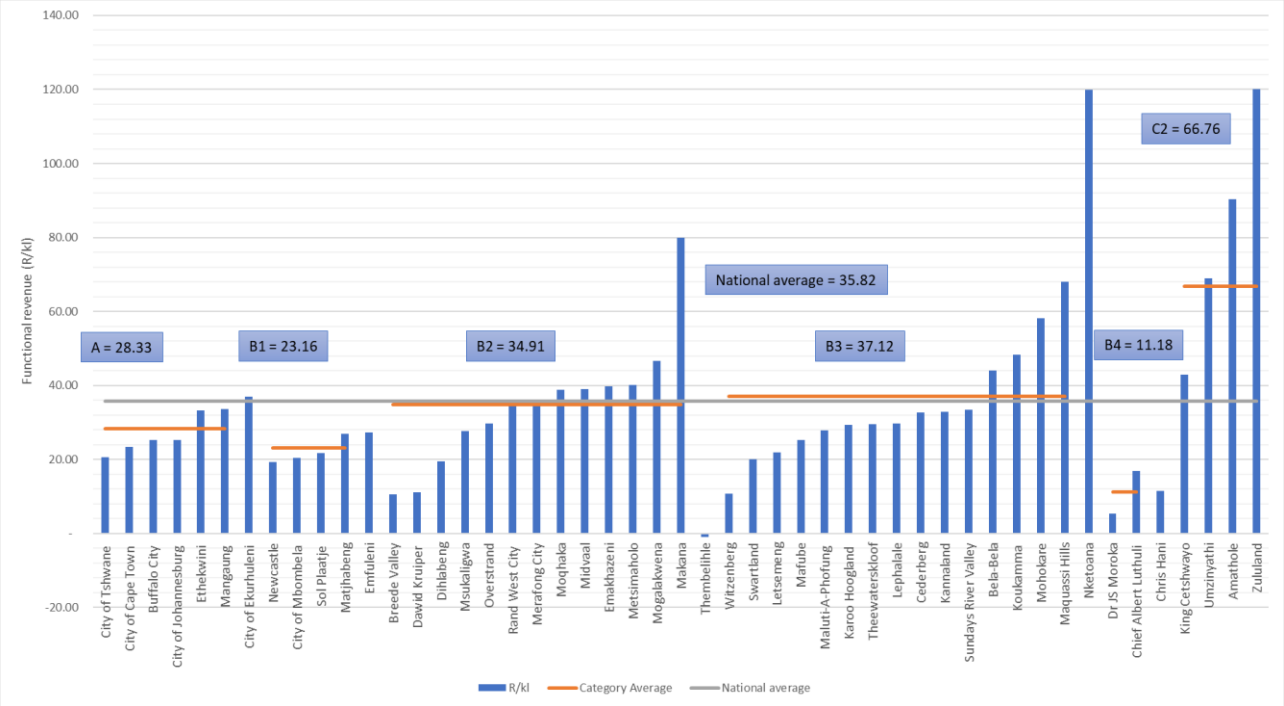


Figure 20: Functional revenue per kl

The functional revenue per kilolitre is shown in Figure 20 and is based on the water total service charges – water revenue generated by the municipality plus national government grants. The national average is R 35.82/kl and increases to R 66.76 for category C2 municipalities. The rate for rural municipalities is very high because of the large grants versus the small volume billed consumption.

The Service Charges - Water Revenue from Table 8 divided by the revenue water provides an accurate indication of the revenue generated from water services as shown in Figure 21. The national average charged for water services is R 19.49/kl/, meaning that for every kilolitre supplied at R 12.41 the WSA receives R 35.82/kl which includes national government grants or R 19.49/kl excluding national government grants.

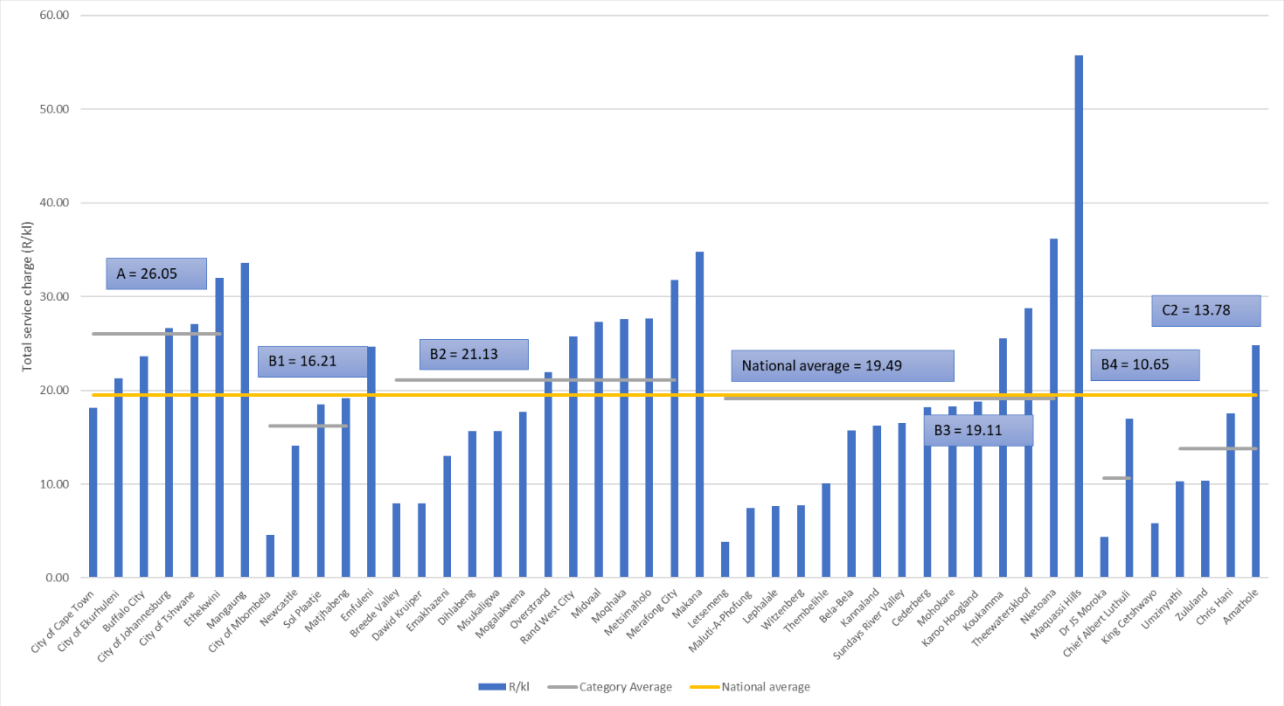


Figure 21: Total service charge per kilolitre

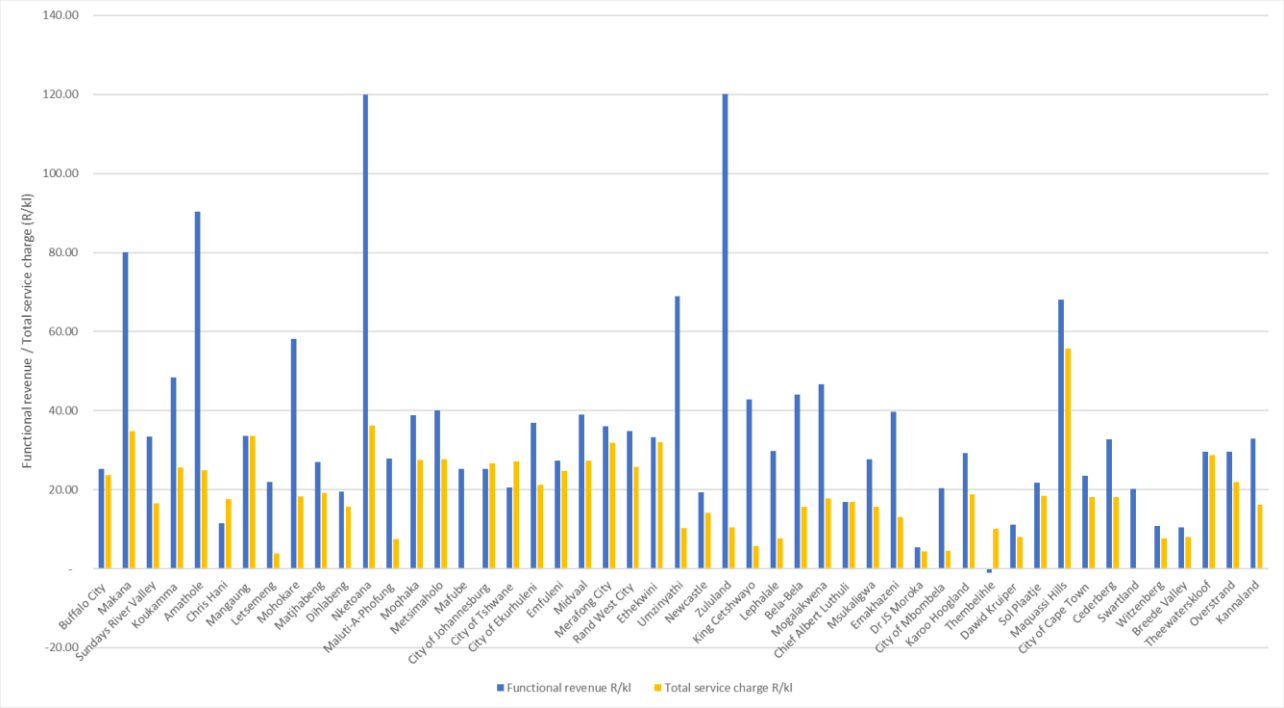


Figure 22: Functional revenue per kl versus Service Charges - Water Revenue per kl

The functional revenue per kl and the service charges – water revenue per kl is shown in **Figure 22**. The results indicate that some municipalities are highly subsidised and highly dependent on the equitable share to remain sustainable.

Using the average tariffs from **Figure 19** and **Figure 21**, it was possible the calculate the financial balance for the country as shown in **Table 9.** The results show that all regions, except the Western Cape operates at a deficit if government grants are excluded from the revenue tariff. Only Category A and B2 municipalities are operating at a surplus, excluding government grants, which enforces the policy that water tariffs should be cost effective and in accordance with Government Notice: GN 1153 in GG 39411 of 13 November 2015: Revision of the Norms and Standards for Setting Water Services Tariffs in terms of Section 10 of the Water Services Act, 1997.

Table 9: Monetary value water SIV, RW and NRW

Region	SIV (m^3/annum)	SIV @ R12.41 (R'000/annum)	RW (m^3/annum)	RW @ R19.49 (R'000/annum)	NRW (m^3/annum)	NRW @ R12.41 (R'000/annum)	Surplus/ deficit (R'000/annum)
EC	344 808 553	R 4 277 464	184 462 712	R 3 595 640	160 345 841	R 1 989 892	-R 681 824
FS	244 232 783	R 3 029 788	115 031 148	R 2 242 245	129 201 636	R 1 603 392	-R 787 544
GT	1 528 161 079	R 18 957 343	884 353 777	R 17 238 268	643 807 302	R 7 989 649	-R 1 719 075
KZN	789 651 151	R 9 795 883	408 162 169	R 7 956 102	381 488 982	R 4 734 278	-R 1 839 782
LP	301 294 971	R 3 737 664	128 581 534	R 2 506 376	172 713 437	R 2 143 374	-R 1 231 288
MP	284 877 859	R 3 534 004	140 491 650	R 2 738 534	144 386 209	R 1 791 833	-R 795 470
NC	109 220 337	R 1 354 914	48 680 415	R 948 903	60 539 922	R 751 300	-R 406 011
NW	231 128 407	R 2 867 224	114 267 940	R 2 227 368	116 860 467	R 1 450 238	-R 639 856
WC	400 405 600	R 4 967 164	301 057 990	R 5 868 373	99 347 610	R 1 232 904	R 901 210
Total	**4 233 780 739**	**R 52 521 449**	**2 325 089 335**	**R 45 321 808**	**1 908 691 404**	**R 23 686 860**	**-R 7 199 641**
A	2 230 299 626	R 32 075 726	1 351 201 711	R 35 199 156	879 097 915	R 12 643 012	R 3 123 430
B1	732 426 020	R 7 466 386	369 559 010	R 5 990 594	362 867 010	R 3 699 084	-R 1 475 792
B2	181 853 187	R 2 207 954	111 070 609	R 2 346 773	70 782 578	R 859 400	R 138 819
B3	282 674 566	R 2 910 412	139 466 885	R 2 665 812	143 207 680	R 1 474 464	-R 244 600
B4	111 732 728	R 1 475 647	52 810 993	R 562 182	58 921 735	R 778 175	-R 913 465
C2	694 794 612	R 11 348 269	300 980 127	R 4 147 094	393 814 485	R 6 432 279	-R 7 201 175
Total	**4 233 780 739**	**R 57 484 393**	**2 325 089 335**	**R 50 911 610**	**1 908 691 404**	**R 25 886 413**	**-R 6 572 783**

Using the average and category tariffs, the estimated cost to supply water in the country is between R 52 and R 57 billion per annum and revenue of between R 45 and R 51 billion is generated from water sales. The value of NRW is between R 23 and R 26 billion at R 12.41/kl which is considerably higher than previous estimates. The increase is due above inflation water tariff increases from water board and the under estimation of water supply costs to rural municipalities.

Using the average tariffs, the potential impact of increasing revenue water and reducing the SIV is shown in **Table 10**. The results show that approximately R 1 billion per annum could be saved if the SIV is reduced by 2% and municipalities will generate nearly R 1 billion per annum for every 2% increase in revenue. The nett benefit could be R 10 billion per annum is revenue is increased by 10% the SIV is reduced by 10%. Reducing the ISV by 10% and increasing the revenue by 10% would bring reduce the national NRW figure to 32.9% and the per capita consumption to 194 l/c/d as shown in **Table 11**.

Table 10: Potential impact of reducing NRW

Percentage reduction in system input volume @ R12.41 \ Percentage increase in billed consumption @ R 19.49	0%	2%	4%	6%	8%	10%	12%	14%	16%
0%	R 0	R 906	R 1 813	R 2 719	R 3 625	R 4 532	R 5 438	R 6 344	R 7 251
2%	R 1 051	R 1 957	R 2 863	R 3 770	R 4 676	R 5 582	R 6 489	R 7 395	R 8 301
4%	R 2 102	R 3 008	R 3 914	R 4 821	R 5 727	R 6 633	R 7 540	R 8 446	R 9 352
6%	R 3 152	R 4 059	R 4 965	R 5 871	R 6 778	R 7 684	R 8 590	R 9 497	R 10 403
8%	R 4 203	R 5 110	R 6 016	R 6 922	R 7 829	R 8 735	R 9 641	R 10 548	R 11 454
10%	R 5 254	R 6 160	R 7 067	R 7 973	R 8 879	R 9 786	R 10 692	R 11 598	R 12 505
12%	R 6 305	R 7 211	R 8 118	R 9 024	R 9 930	R 10 837	R 11 743	R 12 649	R 13 556
14%	R 7 356	R 8 262	R 9 168	R 10 075	R 10 981	R 11 887	R 12 794	R 13 700	R 14 606
16%	R 8 407	R 9 313	R 10 219	R 11 126	R 12 032	R 12 938	R 13 845	R 14 751	R 15 657

Table 11: Target water balance KPIs

% Reduction	SIV (m3/annum)	% Increase	Billed consumption (m^3/annum)	NRW (m^3/annum)	% NRW	l/c/d
0%	4 233 780 739	0%	2 325 089 335	1 908 691 404	45.1%	217
2%	4 149 105 124	2%	2 371 591 121	1 777 514 003	42.8%	212
4%	4 064 429 509	4%	2 418 092 908	1 646 336 601	40.5%	208
6%	3 979 753 894	6%	2 464 594 695	1 515 159 200	38.1%	203
8%	3 895 078 280	8%	2 511 096 482	1 383 981 798	35.5%	199
10%	3 810 402 665	10%	2 557 598 268	1 252 804 397	32.9%	194
12%	3 725 727 050	12%	2 604 100 055	1 121 626 995	30.1%	190
14%	3 641 051 435	14%	2 650 601 842	990 449 594	27.2%	186
16%	3 556 375 821	16%	2 697 103 628	859 272 192	24.2%	181

6 CONCLUSIONS

The following conclusions are drawn from the assessment:

- A total of 88 datasets (61%) were received from WSAs which is the highest to date. Less than 50% of WSAs were able to submit water balance data in previous surveys. The confidence level of the data submitted varies between high (40%), medium (18%) and low (42%).
- **Category A** - Metropolitan municipalities continue to report consistently and most can provide a water balance on a monthly basis. This is encouraging considering that metropolitan municipalities represent 52.2% of the total water use and 46.7% of the population.
- **Category B1 and B2** - Most secondary city and large municipalities can provide a water balance on a regular basis although there is considerable room for improvement in some regions. The secondary city and large municipalities represent 21.3% of the total water use and 20.6% of the population. These municipalities are of economic significance and should have the necessary budgets and resources to implement WCWDM.
- **Category C2, B3 and B4 –** Less than 50% of the small and rural municipalities can provide an accurate water balance on a regular basis. Reasons for this include lack of budget, difficultly measuring the supply due to the large number of boreholes and large indigent consumer base. These municipalities represent approximately 26.5% of the total water use and 32.7% of the population.

- Water balance information is continuously updated and improved which means that the data shown in this report differs from the data presented in the Benchmarking of water losses, NRW and efficiency report (2004 to 2015/16).
- Water losses and NRW have increased in most municipalities since the onset of the Covid-19 pandemic in early 2020. The increase in NRW and water losses are attributed to reduced payment levels, operations and maintenance budget cuts and lack of capacity in municipalities to undertake repairs due to ill health and deaths.
- The 2020/21 national water balance indicates a SIV of 4233.8 million m^3/annum, NRW of 1908.7 million m^3/annum (45.1%) and water losses of 1686.4 million m^3/annum (39.9%). The NRW and water losses have increased by a notable 3.5% and 3.4% respectively from June 2016, however, the greatest increase was in the past two years and attributed to the COVID-19 pandemic. The fluctuation between 2016 and 2019 was generally less than 1%.
- There has been a noticeable increase in billed unmetered consumption as a result of incorporating free basic water supply in the estimated water balances for especially rural municipalities. Unbilled unmetered consumption remains lower than expected, considering the high number of unbilled properties in the country. Municipalities need to correct their water balance calculations and show any water use after an accepted connection as authorised consumption and not as water loss.
- The national NRW and water loss trends show a steady increase in NRW over the past 10 years and gradual exceedance of the SIV projections with WCWDM scenario. The figures are highly influenced by the category A, B1 and B2 municipalities, most of which have made significant strides in improving NRW management, reducing water losses and managing the demand in line with reconciliation strategy targets.
- National trends suggest that the per capita consumption of 217 ℓ/c/d has remained almost constant over the past 10 years, which is commendable, however, WCWDM efforts must be elevated considering the level of service, inefficiencies and the country is one of the 30 driest in the world. The per capita consumption is however significantly lower than the previous national average of 237 ℓ/c/d presented in June 2016.
- The ILI of 6.1 deteriorated slightly from 2016 to 2021 and showed signs of improvement in 2017 and 2018. The COVID-19 pandemic has played havoc with municipal water losses and this trend is expected to improve once municipalities have return to normal and have eliminated the leak repair back-logs and improved revenue collection.
- The results indicate increased NRW, water losses and ILI but a significant decrease in the national per capita consumption. Given the increases on three key NRW metrics, WCWDM must be implemented as a matter of urgency in all regions, especially considering that a number of regions have NRW and water losses above 50%. There is significant scope for improvement in reporting levels, data accuracy and a reduction of SIV, NRW, water losses and improved efficiency across the country. Only continuous monitoring and analyses will provide a credible benchmark against which the progress made with the implementation of WCWDM can be measured.
- All municipalities would benefit from targeted demand management programmes including community education and awareness, leak repair, infrastructure refurbishment, pressure management, installation of bulk meters amongst other measures.
- Based on the functional expenditure and SIV of 49 WSAs, the average cost of supplying water is R 12.41/kl. This ranges from R 14.38/kl for metropolitan municipalities to R 10.30 for category B3 municipalities. The cost of supplying rural municipalities (category B4 and C2) is the highest, ranging from R 13.21/kl to R 16.33/kl. This is a meaningful change from previous assessments that suggested that cost of supplying water in the rural schemes are cheaper than large municipalities. The higher cost can be justified considering that these schemes often consist of many small systems with boreholes which are expensive to operate.
- Using the national average and category average tariffs, the estimated cost to supply water in the country is between R 52 and R 57 billion per annum and revenue of between R 45 and R 51 billion is

generated from water sales. The value of NRW is between R 23 and R 26 billion at R 12.41/kl which is considerably higher than previous estimates. The increase is due above inflation water tariff increases from water boards and the under estimation of water supply costs to rural municipalities.

- The results show that approximately R 1 billion per annum could be saved if the SIV is reduced by 2% and municipalities will generate nearly R 1 billion per annum for every 2% increase in revenue. The nett benefit could be R 10 billion per annum if revenue is increased by 10% the SIV is reduced by 10%. Reducing the SIV by 10% and increasing the revenue by 10% would bring reduce the national NRW figure to 32.9% and the per capita consumption to 194 l/c/d.

7 RECOMMENDATIONS

The following recommendations are made to address the progress made with the reporting and implementation of WCWDM in the municipal environment:

- Maintenance of the reconciliation strategies must continue and used to monitor the progress made with the implementation of WCWDM. Municipalities must actively participate and report at these meetings and use the outcomes to prioritise resources and budgets.
- Municipalities should increase their efforts to achieve the targets set under the various water reconciliation strategies to ensure water security and targets need to be reviewed on a regular basis.
- Too many local municipalities are not aware of the reconciliation strategies or expect DWS to provide the necessary funding to implement these strategies. Municipalities must be reminded of their responsibilities in terms of the Water Services Act and actively participate, budget through the IDP process and implement the results from the reconciliation strategies.
- Budgets are allocated towards new infrastructure projects through ACIP, MWIG, RBIG, MIG, etc. funding programmes but the management of these funds are fragmented with emphasis on new infrastructure and insufficient focus on WCWDM.
- Ongoing monitoring and reporting of municipal NRW and water loss performance by DWS against determined targets and baselines are critical.
- Monitoring and reporting on water balances by municipalities could become more self-regulatory if a policy is implemented that no new infrastructure projects will be funded unless the municipality can provide actual consumption figures and proof that their water losses are under control. The IWA water balance should become the backbone of all water related management and decision support systems, especially grant application and awarding processes.
- Municipalities should increase their efforts to reduce NRW and the negative impact it has on their ability to generate own income and operate a viable water business.
- Metropolitan municipalities and secondary cities account for ??? of the water supply to ???% of the population.
- Municipalities should, through on-going awareness programmes, encourage the consumer to appreciate the value of water and enforce the user pays principal.
- Municipalities should resolve metering and billing issues to increase payment levels, encourage consumer fixing of leaks, and prosecution of illegal water connections and reduce theft of water.
- Municipalities should continue their effort to capitalise on the awareness created and sustain the savings achieved during the drought.
- Municipal asset management needs to be improved to ensure greater sustainability of water supply services.
- Closer involvement and collaboration with National Treasury is critical to ensure issues related to funding of WCWDM programmes, metering and billing issues are resolved with municipal finance departments.
- On-going provision of mentorship to municipalities through the DWS Regional Offices, CoGTA, SALGA and other institutions is critical.

- DWS Regional Offices / CMAs must upscale their skills and capacity to provide WCWDM support to municipalities, monitoring and reporting.
- All regional offices should establish reporting templates, schedule meetings with municipalities to confirm targets, analyse the water balance information and provide feedback. The reporting structures in well performing regions are now well established, managed by the regions and most municipalities are reporting on a quarterly basis. The initiative was supported by Regulations sending directives to municipalities who did not respond. A similar approach could be followed for all the other Regions to improve communications and water balance reporting.
- The Regulations Relating to Compulsory National Standards and Measures to Conserve Water (R509, 2001) states that a water services institution must fit a suitable water volume measuring device or volume controlling device to every user connection to control demand. Many municipalities do not comply with this regulation which results in excessive leakages on private properties through leaking taps and toilets as there is no incentive for consumers to fix their leaks. DWS should consider a policy whereby water services institutions are forced to either measure and control or fix leaks on private properties but government cannot continue to fund new infrastructure projects to supplement leakage. DWS is already encouraging the fixing of leaks through various programme.
- The national non-revenue water assessment completed between 2011 and 2017 suggests that 45% of municipalities cannot provide basic information such as monthly consumption figures. One of the key challenges with gathering the information is the poor communication channels with municipalities which includes resigned staff and a considerable number of private e-mails. Discussions also indicate that in some cases municipalities are unwilling to provide the information as it reflects badly on them or they feel that the information has already been submitted through the WSDP and various questionnaires. Government needs to re-look at communication channels with municipalities. Communications should be more formal, avoid duplication and targeted at senior management in the organization. In this regard, the circulars provided by National Treasury provides clear guidelines to municipalities and communications are only with the mayor, municipal manager and CFO.
- The No Drop incentive-based regulation programme should be rolled-out as planned with the other Drop programmes to elevate WCWDM regulation in the municipal environment. DWS should also enforce its regulatory mandate to penalise municipalities that do not comply.
- Closer involvement and collaboration with CoGTA and SALGA is critical to ensure issues related to human resources skills and capacity in municipalities, payment for services and unauthorised water use are resolved.
- Closer collaboration is required with other national, provincial and local departments that are big water users. These include Departments of Education, Correctional Services, Health, Public Works and Housing to ensure leakages and wastage are brought under control.
- The recommendations of the Second Edition of the National Water Resource Strategy (DWA, June 2013) must be implemented which calls for greater emphasis on meeting specific targets to reduce water loss. WCWDM measures will have multiple benefits in terms of the postponement of infrastructure augmentation, mitigation against climate change, support to economic growth and ensuring that adequate water is available for equitable allocation.
- The recommendations of South Africa's National Development Plan (Vision for 2030)(NPC, 2013) must be implemented which calls for clear national and local targets to be achieved by 2022.
- The National Water and Sanitation Master Plan (DWS, 2018) goes further and states that South Africa is facing a water crisis caused by insufficient water infrastructure maintenance and investment, recurrent droughts driven by climatic variation, inequities in access to water and sanitation, environmental degradation and resource pollution, and a lack of skilled water engineers. This crisis is already having significant impacts on economic growth and on the well-being of everyone in South Africa. The recommendations of the National Water and Sanitation Master Plan should be implemented as a matter of urgency.