no drop
CERTIFICATION
water use efficiency
REGULATION

Guideline for the No Drop Assessment Program

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ACRONYMS

ADD	Average Daily Demand
DWS	Department of Water and Sanitation
IWA	International Water Association
KPA	Key performance area
KPI	Key performance indicator
MNF	Minimum night flow
NDP	National Development Plan (2011)
NWRS2	National Water Resource Strategy 2 (2013)
NDRR	No Drop Risk Rating
NDRR/NDRR	No Drop Risk Ratio
NRW	Non-revenue water
PAT	Progress assessment tool
SIV	System input volume
SLA	Service level agreement
SWPN	Strategic Water Partners Network
WDM	Water demand management
WSA	Water services authority
WSI	Water services institution
WTW	Water treatment works
WUE	Water use efficiency
WUL	Water use licence

Introduction

No Drop objectives

Underlying the "No Drop" philosophy, is the requirement for ***measurement*** and, more importantly, ***revealing performance*** with regard to the achievement of water use targets, water losses, non-revenue water and water use efficiency, which Water Services Authorities (WSA) are obligated to comply with through legislation.

The No Drop assessment enables the Regulator to measure the performance of WSAs, and subsequently to reward (or penalise) the institution upon evidence of their excellence (or failures) according to the minimum standards or requirements that have been defined.

To achieve this, the Department of Water and Sanitation defines and communicates a basis for measuring performance across the key areas pertaining to water use efficiency as managed by municipalities and regulated by the Department. The Department is using a scorecard as a tool to identify and assess the core competencies (criteria) that enable acceptable performance in water demand management in the municipal sector. It also generates feedback for participating municipalities to define risk profiles and inform turnaround plans. It further generates baseline data that can accurately provide the quantum of losses, metering and billing proficiencies, which in turn can be used to identify municipal areas in need of targeted support, as well as elevating priority regions where collective intervention actions are required.

The ***No Drop Assessment*** is a comprehensive audit and gives an inclusive view of the Water Demand Management business of the WSA, based on the use of a wide range of Key Performance Areas (KPAs). It answers questions on planning, finance, technical skills, performance, etc. In the longer term, the No Drop assessment scorecards will become a high value source of data and information in specific areas, or in attaining a holistic view of the WSA's capacity, capability and performance in addressing Water Demand Management (WDM) successfully.

The No Drop assessment and evaluation process has been designed to provide **focus points,** and to **channel effort and energy to build competencies** and positively impact on current performance pertaining to WUE.

For this reason, 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 non-revenue water 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, non-revenue water and improve efficiency
- Incorporate the full water services cycle of the WSA by targeting political and management levels, finance and technical departments and users
- Reduce duplication
- Align and complement the Blue Drop, Green Drop and RPMS, as shown in the table below.

blue drop		no drop		green drop	
1	WSP	1	Strategy, planning & implementation	1	W_2RAP
2	Asset management	2	Asset management	2	Asset management
3	Technical skills	3	Technical skills	3	Technical skills
4	Credibility and accountability	4	Credibility and accountability	4	Credibility and accountability
5	Compliance	5	Compliance & Performance	5	Compliance
		6	Local regulation	6	Local regulation
		7	Customer care		

Guideline objective

The objectives of this guideline are as follows:

- Provide background to the No Drop scorecard
- Focus on the first three criteria of the No Drop scorecard, namely the development of a raw water resources diagram, IWA water balance and strategy. The first three criteria are the main building blocks for the remainder of the scorecard
- Provide additional information and guidance for WSAs to successfully complete their No Drop assessment and maximise scoring

Must read

- Provide practical guidelines to improve water loss management and water use efficiency
- Provide recommended and optional reading references from the Department of Water and Sanitation (DWS), Water Research Commission (WRC) and International Water Association (IWA). All reading references are available free of charge from these organisations.

Legal and policy requirements

This manual should be read in conjunction with the following South African legislation and strategies:

- National Development Plan (NDP) – Vision for 2030
- National Water Resource Strategy (NWRS2) – Water for an equitable and sustainable future (DWS, June 2013 Second Edition)
- National Water Act, Act no 36 of 1998
- Water Services Act, Act no 108 of 1997

- Regulations no R509 of 2001, relating to Compulsory National Standards and Measures to Conserve Water Under the Water Services Act, 1997
- Municipal Structures Act, Act 117 of 1998 as amended
- Local Government: Municipal Systems Act, Act no 32 of 2000
- Municipal Financial Management Act, Act no 56 of 2003.

Why water demand management?

Water demand management has several potential direct and indirect benefits as summarised in **Figure 1**.

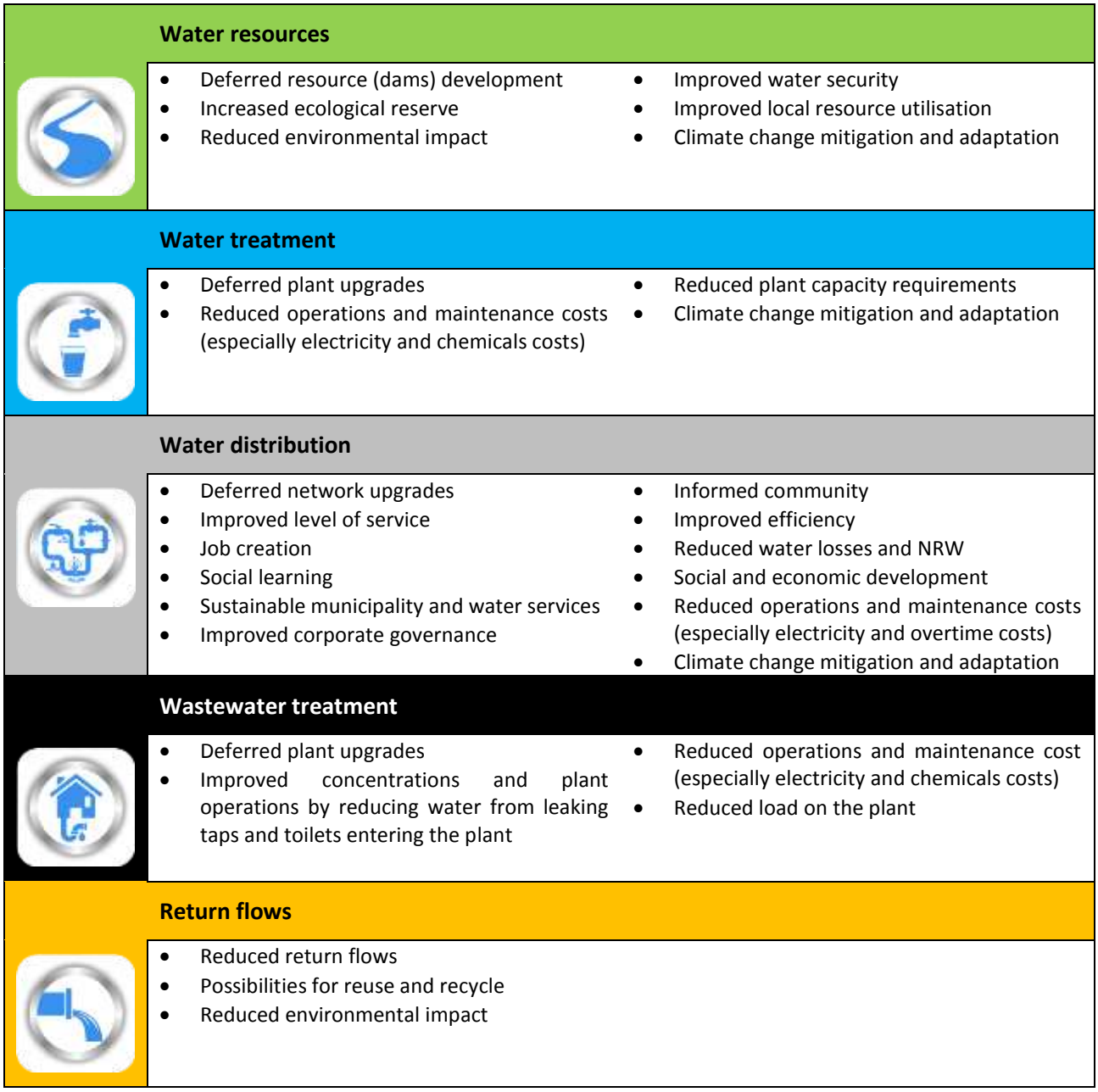


Figure 1: Benefits of water demand management during the water services cycle

Basic principles

The basic principles that underlie the No Drop assessment are as follows:

- All information provided should have an audit trail. For example, the system input volume used in the IWA water balance is based on a certain volume. To determine the volume, the WSA must provide monthly meter readings for each bulk meter, be able to indicate the meter on site to verify the latest meter reading, and verify the meter accuracy
- The water resource balance diagram (Criteria 1.1) and the IWA water balance (Criteria 1.2) are critical components of the scorecard and form the basis for Criteria 5: Compliance and Performance. The WSA should prepare its water balance on a monthly basis to ensure the data is correct as it influences KPIs
- The scorecard could be used as a manual, as it follows international best practice and targets excellence. By following the scorecard, WSAs should be able to reduce their water losses, NRW and SIV to ensure water security
- The scorecard targets the whole WSA and measures the involvement and accountability of politicians, executive management, technical, finance, housing, communications, customer care, and any other department involved with water supply services. The scorecard measures the effectiveness of the whole WSA to provide water services in an efficient, equitable and sustainable manner. Sufficient for subsistence and sustainable economic activity in accordance with the Water Services Act, Act 108 of 1997
- The WSA should refrain from performing a “tick box” exercise and rather demonstrate ownership, accountability, progress and results
- The No Drop assessment focusses on water loss management and efficiency and does not attempt to replace other regulatory and audit processes which will analyse certain components of the scorecard in a more detail.

Multi-Year Scoring Projection

Increasingly comprehensive and stringent criteria are applied from cycle 1 onwards to facilitate an incremental and continuous improvement approach to water use efficient practices as illustrated in **Table 1**. Initially priority will be given to criteria which reflect a WSA’s understanding of its current situation, strategy and planning and performance against compliance related criteria. In subsequent cycles focus will fall on areas of proactive care such as strategy and planning and asset management. Scoring against the Compliance and Performance criterion remains as a substantial feature in the score weighting.

Table 1: No Drop progressive scoring regime

Criteria	Description	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	WDM strategy and planning	30	20	20	20	20
2	Asset management	10	10	15	20	20
3	Technical skills	10	10	5	5	5
4	Credibility	15	15	10	10	10
5	Compliance and performance	35	35	35	30	30
6	Local regulation	0	0	5	5	5
7	Customer care	0	10	10	10	10
Bonus		(17%)	(17%)	(17%)	(17%)	(17%)
Qualifiers		None	none	(100%)	(100%)	(100%)
TOTAL		**100**	**100**	**100**	**100**	**100**

The multi-year scoring projection is subject to change.

Due to the scope and depth of the audits, and the significance of its findings, WSIs generally require time between audits to react on the findings. Similarly, the Regulator needs time to analyse its findings and to implement corrective measures which need to find traction before the next round of audits can present a meaningful indication of the sector's response to the newly implemented initiatives. Both the Blue Drop and Green Drop programme have therefor adopted a two year cycle between audits with the intent that the sector uses the time to work toward continued improvement.

While this "break" is meaningful and necessary, it is critical to keep fingers on the pulse of the water sector on a year to year basis. For this reason the Regulator has introduced a Progress Assessment Tool (PAT) which is run annually in order to continuously measure progress in the water sector. The PAT sets out to measure risk levels in the sector in a consistent and objective manner and allows for the trending of sector movement on a year to year basis. The trending data further informs WSIs and the Regulator regarding the need for certain short- and long term interventions.

No Drop scorecard and the No Drop PAT

The No Drop audit and No Drop PAT are two different ways of measurement and although they are linked, they also stand completely independent from each other.

The ***No Drop assessment*** is a comprehensive audit and gives an inclusive view of the Water Demand Management business of the WSI, based on the use of a wide range of Key Performance Areas (KPAs). The assessment scorecards will become a high value source of data and information in specific areas, or in attaining a holistic view of the WSI's capacity, capability and performance in addressing WDM successfully.

The ***ND PAT*** is a concise and focussed benchmarking exercise which extracts some of the key risk areas that would individually and collectively, give a hard and fast snapshot view of the status of the WSI's WDM

business. The PAT is 'hard and fast' in terms of measuring a limited number of essential focus areas which would indicate if WDM successes are being achieved over time in the particular WSI, in a specific province or nationally. The PAT is an indicator of 'progress or digress' which can be run efficiently and accurately, annually or at any given time, without having to go through a comprehensive assessment process.

It is important to note that a PAT will not be specifically executed in a full audit year. The Audit and the PAT are designed such that the PAT process will be able to mine data from the ND Audit Process in order to continue with a year-to-year benchmarking exercise without expending additional effort. Therefore a close link will always remain between the Audit and the PAT.

The PAT will consist of two elements:

- Collection of high level data
- Calculation of a No Drop Risk Rating or NDRR

The PAT vs. the No Drop Risk Rating (NDRR)

The PAT will be used to collect information on the against the WSI's Water Demand Management Plan as well as the WSIs team tasked with the implementation and management of the WSI's water demand management initiatives.

The PAT will however also focus on the calculation of a risk index or risk rating called the ***No Drop Risk Rating*** (NDRR). The key risk indicators selected for the calculation of the NDRR are selected based on their ability to describe the risk exposure of the sector or an individual role-player in the sector. The indicators therefore have to cover the following risk areas:

- *Surety* of water supply;
- *Sustainability* as measured in terms of total water use; and
- *Performance* as measured in terms of water loss, NRW and water use efficiency indicators.

In considering the available for the development of the NDRR it is important to consider the track record of the GD and BD related risk ratings, how they are being used by the Department and what their intended purposes are. The key issues are:

- A risk rating indicator must be an objective measure,
- that can be easily, independently and objectively compiled by the Department,
- using, as far as possible, information that will be continuously available to the Department,
- in an updated form.

Adopting the above-mentioned definition of risk indicators will allow the Department quick and regular access to automatically calculated progress information based on information regularly reported to the Department.

The NDRR is intended to indicate the amount of risk the sector of sector player is exposed to at a specific point in time. The gains made or ground lost by the sector over a period of time is determined by looking at the risk ratio at the start of the period and again at the end of the period.

The risk rating calculation is aligned to the successful track record of the Blue and Green Drop assessments as indicated in the table below.

NO DROP	GREEN DROP	BLUE DROP
Equation: NDRR = A x B + D	Equation: CRR = A x B + C + D	Equation: BDRR = A + C + D
Where the indices represent: A : Water Use Targets (Recon and All-Town Strategy Targets) B : System Input Volume (SIV) D : Performance indicators (ILI + Commercial water losses + NRW + Efficiency)	Where the indices represent: A : Design capacity of the WWTW B : Operational flow of the WWTW C : Technical skill of the supervisor, process controllers and maintenance team D : Effluent quality performance	Where the indices represent: A : Treatment capacity of the WTP C : Technical skill of the supervisor, process controllers and maintenance team D : Water quality performance
All risk elements (A, B, C, D) are weighted according to their respective risk representation.		

Reporting levels and Audit process

The WSA is expected to present the necessary information per system, region or WSI. It is accepted that a system referred to in the Blue Drop audit might differ from a system referred in the No Drop audit. The sum of the systems adds up to provide the results for the WSA, district municipality, province and national levels as shown in Figure 2.

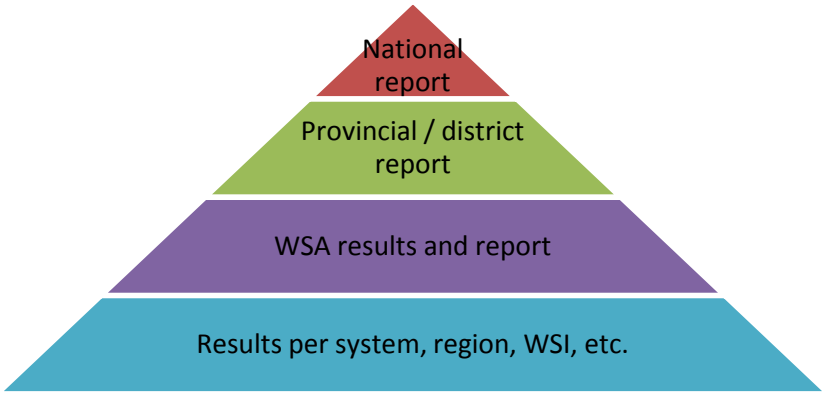


Figure 2: Building blocks for reporting

The No Drop audit process is summarised in **Figure 3**.

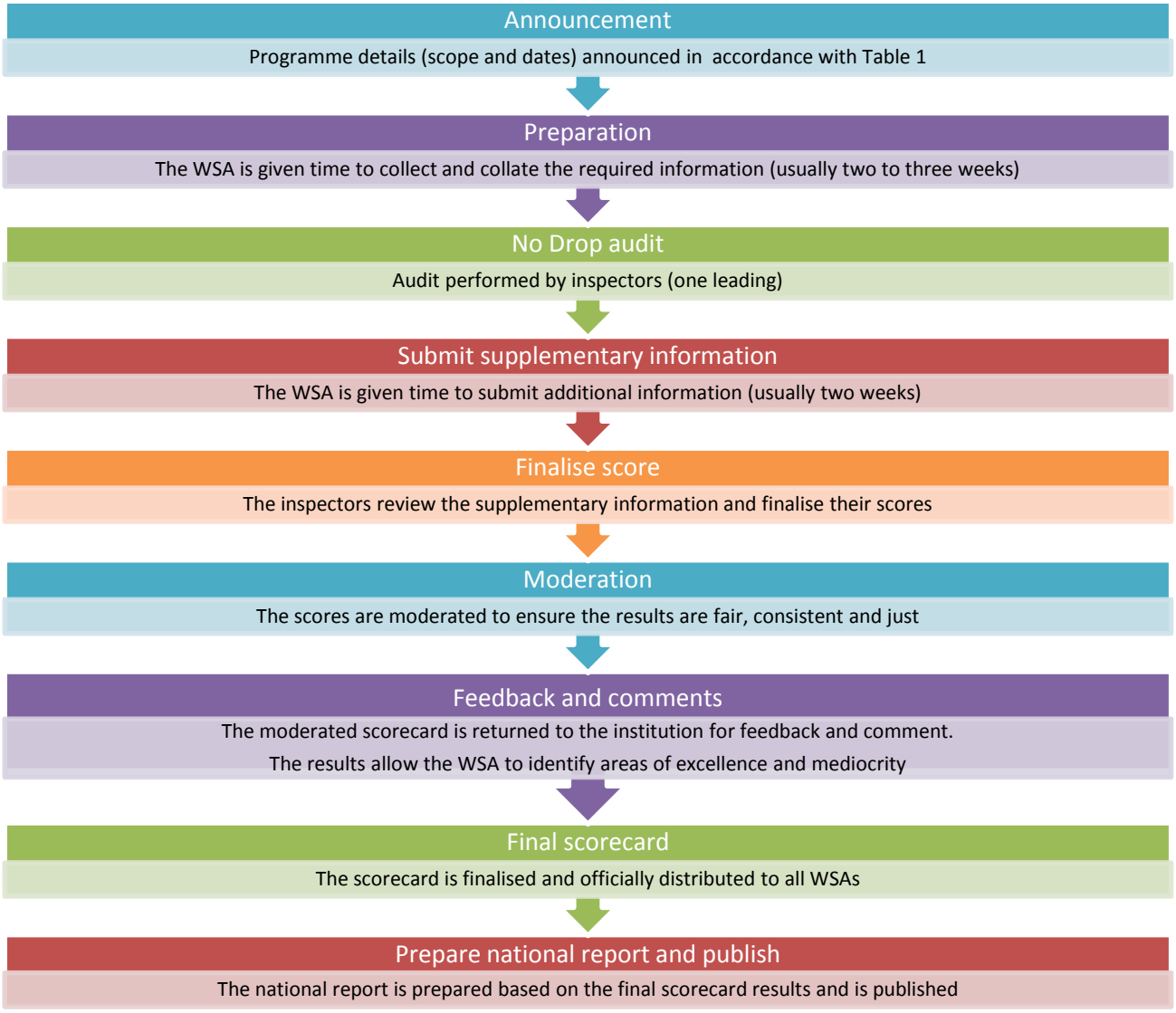


Figure 3: The audit process

Results

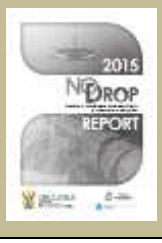
The following three No Drop reports have been published:

2015 No Drop Report - First order assessment of water loss, water use efficiency and non-revenue water in municipalities, DWS and SWPN, Oct 2015

The study provided a national overview of the status of municipalities as pertaining to their water losses, non-revenue water and water use efficiency, based on the 2012/13 financial year. This report comes with nine separate reports, one for each province.

2015 No Drop Report - The status of water loss, water use efficiency and non-revenue water in metropolitan municipalities, DWS and SWPN, Oct 2015

This report provided the results from the first full No Drop audit of the eight metropolitan municipalities in South Africa based on the 2012/13 financial year.



Benchmarking of Water Loss, Water Use Efficiency and Non-Revenue Water in South African Municipalities (2004/05 to 2012/13), DWS and SWPN, Oct 2015

This study provided an update on The State of Non-revenue water in South Africa 2012 (WRC, 2012) and included data from 2004/05 until 2012/13.

Building blocks

If you fail to plan, you plan to fail

Many water demand management programmes have been undertaken with very good intentions but often fail because of the following problems:

- Strategies are vague and based on assumptions
- Limited or no status quo information is available to inform the strategy, especially a detailed IWA water balance and water resources balance diagram
- No benchmark and target system input volume, water loss or non-revenue water figures are provided. The savings can therefore not be measured
- Targets are often unrealistic which create expectations and result in disappointment if not achieved
- Strategies are often unaffordable and no business case is presented
- Funding organisations complain that they cannot find bankable projects whereas water institutions complain that they cannot obtain funding
- Interventions are often implemented based on hearsay and assumptions, resulting in the installation of inappropriate technology and interventions which do not address the real problem. The programmes usually yield limited results and subsequently, council is reluctant to fund future programmes
- Incomplete or unused interventions. For example, pressure reducing valves are installed but never properly commissioned because the zone is not discrete, new consumer meters are installed but never loaded on to the billing system or bulk meters are installed but never read, monitored and analysed
- Political interference, especially with regards to metering, billing and tariff structures
- Textbook implementation which turns out to be impractical. For example the implementation of small district metered areas (500 to 2000 properties) which cannot be maintained
- The water services institution lacks the human resources to implement and maintain the programmes
- No budget allowance is made to sustain interventions such as community awareness programmes, operations and maintenance of control valves, zone discreteness tests and meter maintenance.

Several of these problems could be overcome through proper planning. Proper planning entails a detailed understanding of the available water supply versus the demand, water losses, non-revenue water and water use efficiencies which should inform the development of the WDM strategy and business plan. The first three criteria of the No Drop assessment namely Criteria 1.1: Raw water resource balance diagram, Criteria 1.2: IWA water balance diagram and Criteria 1.3: WDM Strategy and business plan, provide the foundation for proper planning and WSAs should allocate time and effort to these three criteria to ensure the outcome is specific, achievable, measurable, realistic and timely.

Water resources balance diagram

Criteria 1.1 assesses the WSI's raw water resources balance diagram. The water resource balance diagram provides an indication of the water demand against the available supply as per the Water Use Licence (WUL) or Service Level Agreement (SLA). Water security could be compromised if the demand is nearing or exceeding the supply and water restrictions should be considered if not already implemented.

The National Water Act, 1998 (Act No. 36 of 1998), states that the development of water management strategies are required to facilitate the proper management of water resources. In 2004, a National Water Resource Strategy (NWRS) was published which provides a framework for the protection, use, development, conservation, management and control of water resources of the country as a whole. The DWS identified the need to develop detailed strategies that will ensure adequate future reconciliation of water availability with water requirements for the large and all town water supply systems. A second National Water Resource Strategy (NWRS2) was developed in 2013 which includes summaries of the Reconciliation and All Town Strategies and highlighted the need to implement WDM to balance the water supply and demand.

Figure 4 shows the raw water resources balance diagram for a typical town. In 2012, the WSI established a projected demand with and without WDM. The licensed abstraction from the local dam is 350 million m^3/annum and the treatment capacity of the water treatment plant is 400 million m^3/annum. The resource balance diagram indicates that if the WSI can achieve its targets with WDM, no new resources would be required before 2026. If the WDM targets are not achieved, new boreholes will have to be sunk by 2019 to balance the supply and demand and to ensure water security.

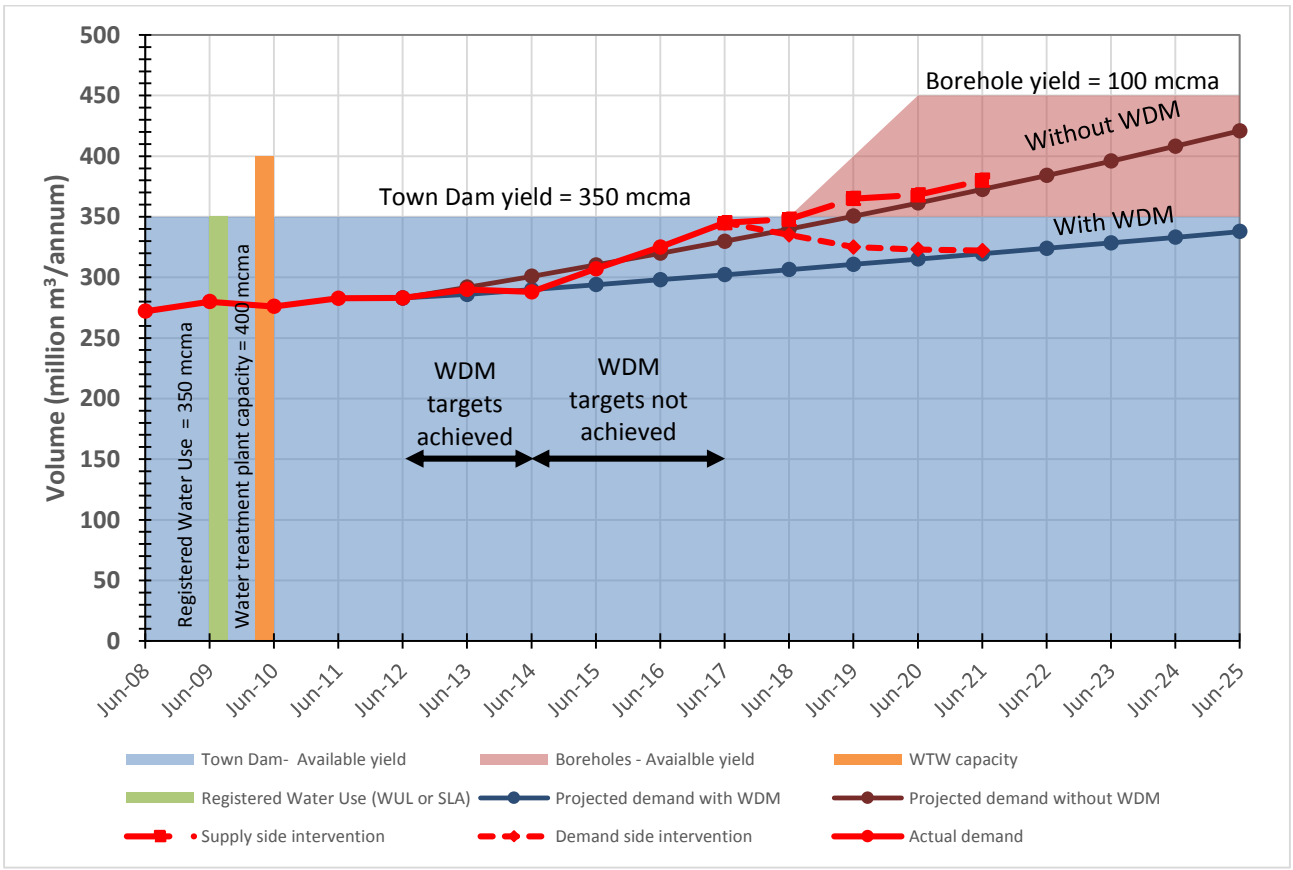


Figure 4: Example water resources balance diagram

Between 2012 and 2014 the WSI managed to achieve its WDM targets. From 2014, the programme failed and by 2017 the WSI reached the safe yield capacity of the Town Dam. To ensure water security, the WSI must develop new borehole resources (supply side intervention) or implement WDM (demand side intervention) to reach the projected demand with WDM. By implementing demand management, the WSI should be able to defer the development of new resources.

The DWS, as custodian of the nation's water resources, is responsible for the determination and allocation of water use licences. The raw water resources balance diagram should therefore be in line with latest DWS reconciliation or all town strategies. See https://www.dwa.gov.za/projects.aspx for copies of the latest reconciliation strategies and https://www6.dwa.gov.za/DocPortal/ for copies of the latest all town strategies.

Common Pitfalls and Mistakes

- Water Use Licence information or actual demand is unknown
- No relationship between licensed abstraction, demand projections and DWS reconciliation or all town strategies
- The licenced abstraction volume in the WUL of the bulk water service provider is not proportionally distributed and cascaded down to WSA level

IWA Water balance

Criteria 1.2 assesses the WSI's IWA standard water balance diagram. The International Water Association, developed the standard water balance to benchmark and evaluate the performance of water distribution systems and it is being promoted across the world as best practice. The IWA standard water balance was slightly modified for South Africa to allow for free basic water. The modified IWA water balance is shown in **Figure 5**.

<table>
<tr><td rowspan="9">System input volume

(Water security and efficiency)</td><td rowspan="3">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 metered</td></tr>
<tr><td>Connection</td><td rowspan="5">Commercial / Apparent losses</td><td>Unauthorised consumption</td><td rowspan="5">Non-Revenue water

(Financial sustainability of the WSI and promotion of water use efficiency)</td></tr>
<tr><td rowspan="5">Water Losses

(All losses before the connection on municipal side)

(Environmentally and financially unattractive)</td><td>Meter inaccuracies</td></tr>
<tr><td>Transfer errors</td></tr>
<tr><td rowspan="3">Physical / Real losses</td><td>Leakage on distribution pipes</td></tr>
<tr><td>Leakage & overflows on storage tanks</td></tr>
<tr><td>Leakage on connection pipes up to point of connection</td></tr>
</table>

Figure 5: Modified IWA water balance

Each component of the water balance is significant as it highlights various important issues. The system input volume 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 WSI. 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 WSI'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 consumed by users, the WSI and others who are implicitly or explicitly authorised to do so by the WSI, for residential, commercial and industrial purposes
- *water loss(es)* 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 WSI and paid for by the user
- *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 of the unauthorised consumption (theft or illegal use), plus all technical and administrative inaccuracies associated with user metering.
- If commercial losses are reduced, generally more revenue will be generated by and for the WSI
- *real losses* are the physical water losses from the pressurised system, up to the point of measurement of the connection. 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 WSI 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
- *NRW* is the volume of water supplied by the WSI but for which it receives no income. NRW incorporates unbilled (metered or unmetered) authorised consumption, apparent / commercial losses and real / physical losses.

Key points

- A connection is defined as any point of water supply by the WSI and can be formal, informal or unauthorised. A formal connection has been installed by the WSI and is controlled with a service level agreement. An informal connection has been installed by the user but is accepted by the WSI. 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 WSI should be considered unmetered connections, unless the WSI intends to remove these connections. Connections that are not accepted by the WSI 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 non-revenue water 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. Non-revenue water is a function of real losses, commercial losses and unbilled consumption and resolved by addressing water losses and unbilled consumption.

Information required

Table 2 summarises the standard water balance spreadsheet developed by the DWS and included in **Appendix A**.

Table 2: Key water balance information required

Basic input data	Water balance
Population served..... No	**System input volume**
Households served ..... No	Own sources.....kl/annum
Connections	Other sources.....kl/annum
Metered domestic (and non-domestic) ..... No	**Authorised Consumption**
Metered non-domestic..... No	**Billed authorised**
Connections - unmetered..... No	Billed metered
Length of mains ..... km	Domestic (and non-domestic) .....kl/annum
Average system pressure ..... m	Non-domestic .....kl/annum
Time system pressurised ..... %	Export volume .....kl/annum
Apparent losses	Billed unmetered.....kl/annum
Consumer meter age..... %	**Unbilled authorised**
Illegal connections..... %	Unbilled metered .....kl/annum
Data transfer..... %	Unbilled unmetered .....kl/annum
Additional info	**Additional info**
Households billed on flat rate ..... No	Proven wet industries .....kl/annum
Connections – metered and billed ..... No	

The information should be provided for the current and previous assessment periods, on a monthly basis for each supply system. The previous assessment period is required to measure the improvement or decline of the various systems. To ensure maximum score, it is recommended that time and effort are put into compiling this information as it forms the backbone of Criteria 1 and 5, which account for 50% to 65% of the overall scorecard (see **Table 1**). The information provided in **Table 2** is used throughout the scorecard to calculate KPIs and other indicators.

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 WSIs and usually depend on the level of service and development. **Table 3** and **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 WSI. 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 **Table 4**, 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 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 WSI, an improvement of one or two levels over a 5 year period is considered realistic.

Table 5: No Drop Key Performance Areas

Overall No Drop Score:

	90-100%	Excellent situation, need to maintain via continued improvement
	80-<90%	Good status, improve where gaps identified to shift to 'excellent'
	50-<80%	Average performance, ample room for improvement
	31-<50%	Very poor performance, need targeted intervention towards gradual sustainable improvement
	0-<31%	Critical state, need urgent intervention for all aspects of water use efficiency

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

Apparent / Commercial loss (%) performance categories

	>40%	Extremely high commercial water loss
	30-40%	Poor performance in commercial water loss
	20-30%	Average commercial water loss performance
	10-20%	Good commercial water loss performance but some improvement may be possible subject to economic benefit
	<10%	Excellent commercial 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 WSI. If the results are not within range, the water balance calculations should be checked or there should be very good reasons for the anomaly.

WDM Strategy and business plan

Criteria 1.3 assesses the council approved WDM strategy and business plan. The building blocks for a successful water demand management strategy and business plan are having a clear understanding of the status quo, the problems and identifying suitable interventions to address these issues. The problems are different for each WSA as shown in **Figure 6** that shows the water balance for various systems.

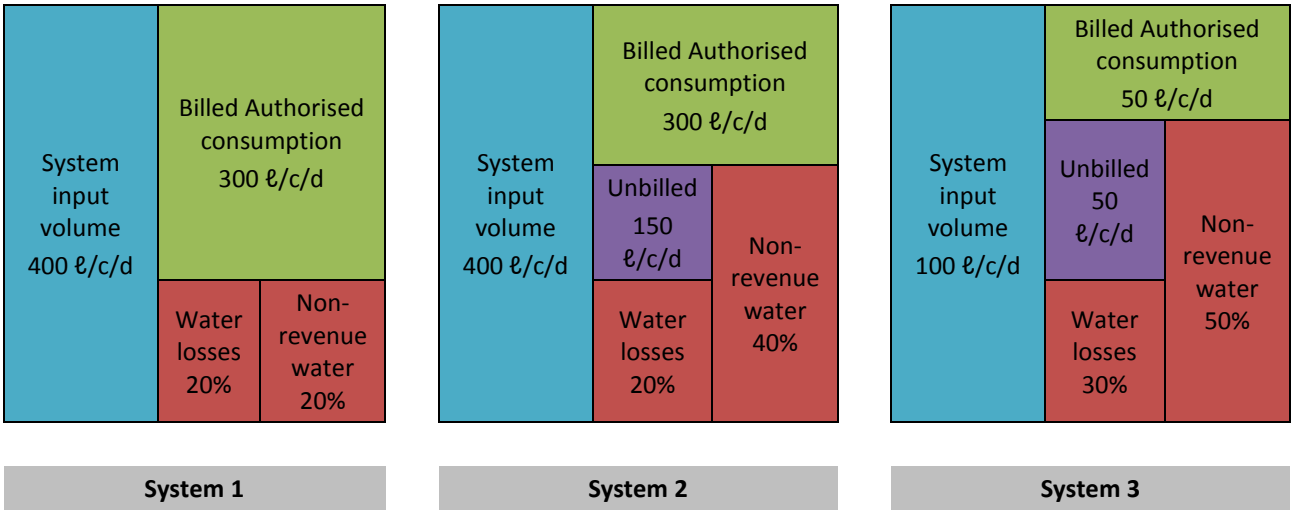


Figure 6: Water balance scenarios for various systems

- **System 1** has poor water use efficiency but low non-revenue and water losses. In this case, the WSI should improve efficiency through tariff setting and awareness campaigns. These interventions should reduce the system input volume (demand side management) and improve water security. Supply side management (development of new resources or increasing the licensed abstraction) is not recommended until the WSI has improved its efficiency.
- **System 2** has poor water use efficiency and high non-revenue water. In this case the WSI should improve efficiency, as with scenario 1, but also address non-revenue water by reducing the unbilled authorised consumption. These intervention should reduce the system input volume (demand side management) and improve water security. Supply side management (development of new resources or increasing the licensed abstraction) is not recommended until the WSI has improved its efficiency and non-revenue water.
- **System 3** has good water use efficiency but high water losses and non-revenue water. In this case, the WSI should address the high water losses through the fixing of visible leaks. Addressing the non-revenue water is not a priority because water use efficiency is already good and metering and billing are uneconomical. Because of the high efficiency, it is unlikely that reduced water losses will reduce the system input volume and supply side management (development of new resources) should be considered. Should the efficiency deteriorate once a new resource has been developed, consideration should be given to reducing the NRW.

The three scenarios illustrate that every system is unique, the importance of preparing a proper water balance, understanding the underlying problems and identifying suitable interventions. Suitable interventions include minimum requirements to implement WDM, authorised consumption interventions, commercial loss interventions and physical loss interventions as shown in **Figure 7** and described in the following sections.

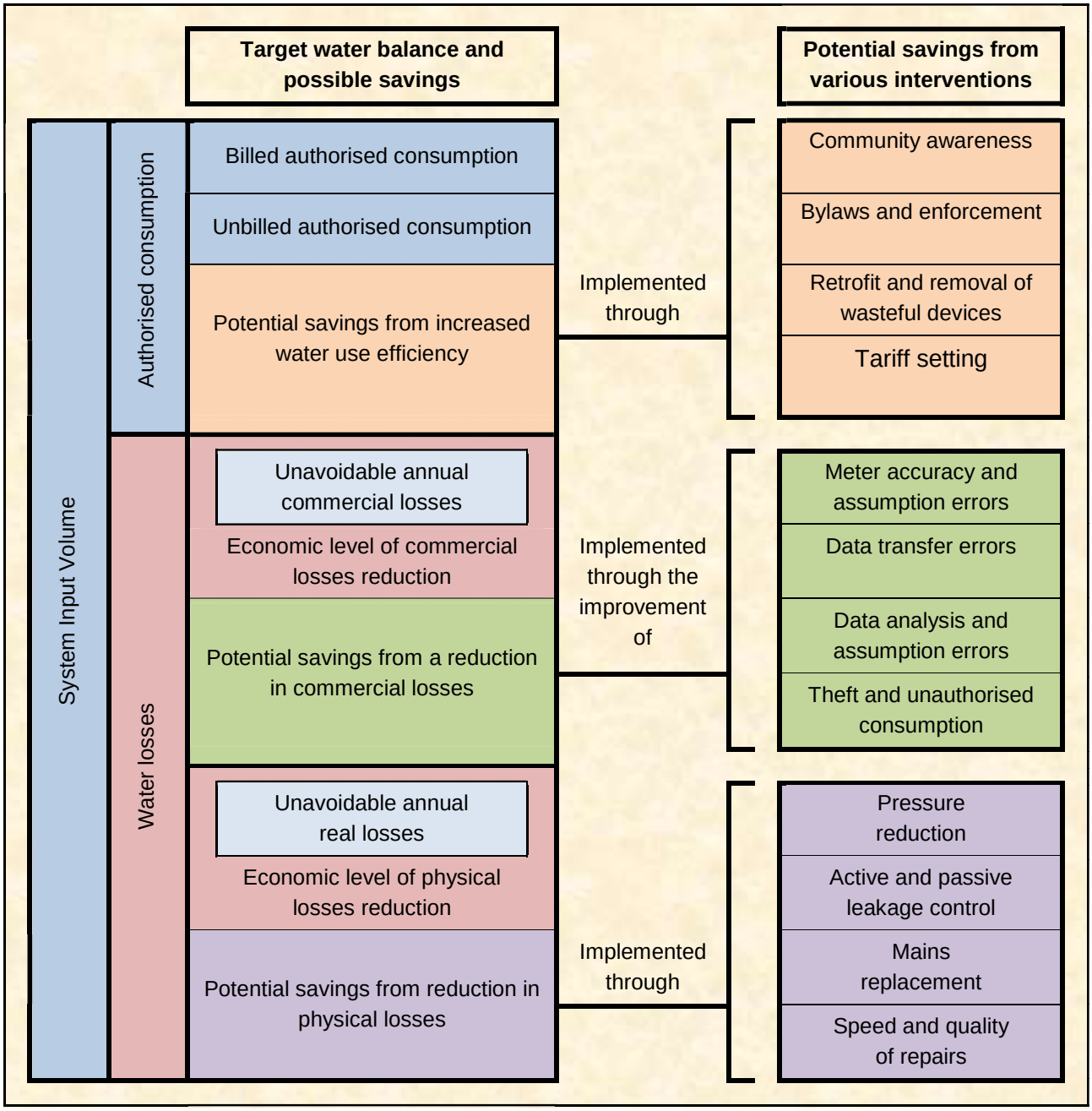


Figure 7: Alignment of the IWA water balance with interventions

Minimum requirements

Bulk metering, sectorisation and continuous supply are prerequisites for implementing WDM. Consumer metering is considered important and should be implemented as a priority, otherwise authorised consumption has to be estimated.

Intervention	Motivation
Bulk metering	To "accurately measure is to know" is a minimum requirement for any water supply system. The main objectives of bulk metering are to determine the total supply and the minimum night flow (MNF) into an area. Bulk meters should be installed in the following order of priority: • SIV: the first priority is determining the SIV. Usually this will include the WTW outlet, springs and the total supply from boreholes, followed by individual borehole meters. If budget is a limitation and all supply points cannot be metered immediately, the Pareto principle (80-20 rule) should apply whereby the main sources should be metered first followed by the secondary sources • zones: the second priority is measuring the supply to the various zones. Installing meters on the reservoir outlets will enable the WSI to measure MNF and prioritise zones • transmission mains: the third priority is to measure water losses on the transmission mains, especially in areas where the transmission mains are long and run through open fields where leaks cannot be easily detected • district metered areas: the fourth priority is to install meters on each of the DMA's inlets and outlets. Bulk meter installations must be maintained and read on a regular basis. The meter readings should be analysed and monitored to determine an accurate SIV.
Area of supply and details	Clause 11 of the *Regulations Relating to Compulsory National Standards and Measures to Conserve Water* (DWAF, 2001a), states that a water services institution must measure the quantity of water provided to each supply sector or DMA within its supply area, and determine the quantity of water lost on a monthly basis. Bulk metering and sectorisation are therefore not only a prerequisite for implementing WDM but are also a legal requirement. The area of supply must be known, otherwise it will not be possible to analyse the bulk supply to the system. If a larger area than anticipated is supplied, then water loss and efficiency will be underestimated and conversely, if the area is smaller than anticipated, loss and efficiency will be overestimated. Details of the area, including information on the population and households served, length of mains, average system pressure and number of connections are required to calculate KPIs. The size of the supply area depends on the ease of implementation, operations and maintenance. Larger zones are generally easier to manage and require less maintenance; in the smaller zones, targeting 2 000 properties, it is easier to identify an increase in MNF, something which would be difficult to pick up in the larger zones. Step testing is an alternative to small DMAs and can be used to locate leaks and prioritise DMAs. Step testing is the process of temporarily isolating parts of the distribution network, while monitoring the MNF water loss.

Intervention	Motivation
Intermittent supply	Water utilities should avoid intermittent or rationed water supply at all costs for the following reasons: • positive and negative (vacuum) pressures damage pipe seals and shorten the design life of the pipelines. These pipe seals can only be repaired through total pipe replacement • air drawn into the distribution network during depressurisation is released mainly through consumer meters. Air passing through a consumer meter does not only damage the meter but also corrupts the meter reading. Corrupted meter readings will impair the metering and billing system and upset consumers • dirt, sewage and other contaminants can enter the water distribution network when depressurised with a subsequent high risk of causing water borne diseases • increased burst frequency and discomfort to consumers • intermittent supply is expensive to operate and maintain through increased overtime and number of bursts • infrastructure, such as isolating valves, is damaged when operated outside its intended use • over time it becomes increasingly difficult for the WSI to pressurise the distribution system. It is almost impossible to fill pipes, reservoirs and towers when users leave taps open in anticipation of filling buckets, bathtubs and tanks • users quickly adapt to their new supply conditions and inevitably revert to on-site storage to mitigate the inconvenience caused by the disruption in supply. Once on-site storage is established, consumers revert to their usual lifestyle, oblivious of the disruption in supply, with very little reduction in actual demand • intermittent supply affects the local economy as businesses cannot plan and operate as intended. 

Authorised consumption interventions

Intervention	Motivation
Community and schools awareness	Community awareness plays an integral part of any WDM project. The community can save water through the reporting of leaks, fixing household plumbing and using water efficiently in the home and garden. Community awareness could be undertaken through outreach activities and schools awareness campaigns. Outreach activities are usually undertaken at public gatherings such as clinics, sport events, shopping centres and public meetings. The political leadership of the WSA should participate in all awareness activities and lead by example. Community awareness programmes should be supported by proper training and awareness material such as brochures, T-shirts, fridge magnets, licence disk holders, water bottles, etc. A knowledge, attitude and perception (KAP) survey should be undertaken before and after the implementation of the awareness programme to identify the key challenges in the community, contribute possible solutions and to measure the effectiveness of the programme. These measures contribute towards: • A better understanding of community challenges • Creation of local jobs • Improved communications between the WSA and the consumer which generally lead to improved relationships • Informed community and understanding of roles and responsibilities • Promoting the WSA and its activities in the community • Promoting water wise behaviour and payment for water services • Dissemination of information received at schools to friends and family members • School management, staff and learners being effectively mobilised through school competitions. • Community awareness programmes coinciding with technical programmes such as retrofitting and repair of internal plumbing leaks in areas without metering and billing. • Awareness programmes being focused on the specific challenges experienced by individual communities. For example, awareness material for rural communities should address water use at standpipes, fixing of taps and toilets, etc. whereas material for urban users should address the use of washing machines, dishwashers, water wise and xeriscape gardening. • Activities that cannot be supported should not be promoted. For example, the reporting of visible leaks should not be promoted if the municipality does not have an effective call centre and programme to fix reported leaks, especially when the reporting of leaks increases as a result of such a campaign.
Bylaws and enforcement	The Constitution and the Municipal Systems Act recognise bylaws as the only instrument through which a municipality could exercise its legislative authority.

Intervention	Motivation
	Bylaws must be reviewed on a regular basis to ensure that they are still relevant and encourage water conservation and water demand management. Bylaws are pointless if not enforced.
Retrofitting and removal of wasteful devices	Retrofitting and removal of wasteful devices should be targeted at a specific sector. These sectors typically include: • Low income communities: These programmes usually involve the fixing of leaking taps, toilets and any other pipework on the premises by the WSI • Medium to high income communities: These programmes usually involve the promotion of low flow shower heads and dual flush toilets which are installed by the owner • Schools and government buildings: These programmes usually involve the retrofitting and/or removal of automatic urinals, installation of dual flush toilets, etc. and are performed by the WSI or the owner. • Retrofitting and removal of wasteful devices contributes positively towards job creation • Reduced water losses • Reduced load and improved concentrations at waste water treatment works  • Municipalities should develop a policy on the long term sustainability of retrofitting and removal of wasteful devices. Once-off programmes should be followed up with effective metering and billing otherwise a continuous programme should be introduced to control internal plumbing leakage • The potential savings could be measured by calculating the difference between the current water use and the expected (design) water use. Typical expected water use can be obtained from *Guidelines for Human Settlement Planning and Design* – Chapter 9 Water Supply. CSIR Boutek Report No. BOU/E2001
Tariff setting	Tariffs should comply with the requirements of Notice 1153 of 2015 - *Revised Norms and Standards in Respect of Tariffs for Water Services* in terms of Section 10 (1) of the Water Services Act (Act no. 108 of 1997) as published in the Government Gazette, 13 November 2015, of which the main objectives are: • Economic regulation will be applied throughout the water value chain • The scope and functions of economic regulation encompasses the making of rules to set, control, monitor and enforce water tariffs and charges that support the government's social, environmental and economic policies and the technical regulation of water infrastructure.

Intervention	Motivation
	In summary, the objectives are to develop cost effective water and sanitation tariffs that are in line with the Water Services Act (Act 108 of 1997) that requires all spheres of Government to ensure water services are provided in an efficient, equitable and sustainable manner which is sufficient for subsistence and sustainable economic activity. Pitfalls include: • Unaffordable water tariffs for low income users • Water tariffs that do not promote water use efficiency • Inequitable metering and billing practices supported by unaffordable water tariffs to the extent that it becomes unaffordable for medium to high income users
Potential savings from improved efficiency	**Education and awareness** • Saving $_{awareness}$ = 5 to 10% of ADD depending on the current levels of efficiency **Water wise gardening** • Saving $_{water\ wise}$ = 40% of the ADD for medium to high income areas **Retrofitting and removal of wasteful devices** • Saving $_{retrofit}$ = Current consumption – target authorised consumption **Tariff setting** • Saving $_{tariffs}$ = 3% reduction in demand for a 20% increase in the water tariff Where ADD = Average Daily Demand

Commercial loss interventions

Meter accuracy and assumption errors	A proper metering strategy is usually based on the assumption that connections are metered, that all meters are properly installed and in working condition, and that the average meter error is within economic limits and in line with the latest legislation. It is recommended that domestic meters should be considered for replacement before they have been in use for 10 years and bulk meters before 5 years. Water utilities should therefore endeavour to replace 8 % to 12 % (8 to 12 years design life) of consumer meters per annum to avoid possible meter replacement backlogs, resulting in having to replace all meters at once. Consumer meters should be repaired, replaced and maintained on an ongoing and regular basis. Regular in-situ meter testing should be undertaken to assess meter accuracy.
Data transfer errors	Data transfer errors represent the difference between the actual meter readings on site and the meter readings on the billing system. Meter manufacturers have made tremendous strides with new technologies to address this problem through automatic meter reading, pre-paid metering, smart metering and electronic data

	collection systems. Each new technology has its own challenges and water utilities should strive towards achieving a balance between staff competence and the latest technologies. Data transfer errors could be reduced and maintained through monthly meter reading audits and training of meter readers.
Data analysis and assumption errors	A WSI should have clear guidelines on the processing of meter reading exception codes. Exception code investigation should take preference over averages and assumptions. Meter readings may be correct but reflect readings that are much higher than recordings in the billing system because readings have been averaged for a long time. The billing system operator then questions the high consumption and because it is not further investigated, reverts back to an estimated reading. Meter reading exception codes should be clearly understood by the meter readers, billing system operators and technical staff. Any meter reading with an exception code should be referred to the technical department for meter repairs or replacement. If no problems are found, the meter reader confirms the meter reading.
Unauthorised connections	Unauthorised connections and theft related instances occur where consumers deliberately tamper with their metered connection to reduce or eliminate flow. Unauthorised connections and theft can be determined by analysing the billing database for a sudden drop in consumption, connections with zero consumption, recording of any suspicious activity at the meter by the meter reader, such as fresh scratch marks on the meter connection points or signs of digging around the meter. An advanced programme can include a zero pressure test on the property by closing all the known connections and then checking each water point on the property to ensure it is dry.
Potential savings from commercial water loss interventions	**Meter accuracy and measurement** • Saving $_{\text{meter error}}$ = % meter error x metered consumption, or • Saving $_{\text{meter error}}$ = (Current % – Target % meter error) x water loss* **Data transfer errors** • Saving $_{\text{transfer}}$ = % transfer error x metered consumption, or • Saving $_{\text{transfer}}$ = (Current % – Target % data transfer error) x water loss* **Data analysis and assumption errors** • Included in data transfer errors **Theft and unauthorised consumption** • Saving $_{\text{theft}}$ = number of unauthorised connections x average consumption for area, or • Saving $_{\text{theft}}$ = (Current % – Target % unauthorised consumption) x water loss*

	* where *current %* and *target %* are obtained from **Table 4** but the results should be treated with caution and compared against the results obtained from using metered consumption and field investigations.

Real loss interventions

Pressure management	The purpose of pressure management is to reduce the pressures in a distribution system to between 25 and 50 m, or lower, with the installation of pressure reducing valves (PRV). Depending on the topography and layout of the zone, advanced pressure control could be considered. Advanced pressure control is complex and should only be considered if the WSI has the necessary technical expertise. Pressure management is a very effective measure to quickly reduce water losses and should be the focal point in the initial stages of the project to gain quick wins. • Reduced number of burst and background leakage • Prolong the design life of the infrastructure • Improved level of service and reduced disruption in supply • Resolving pockets of low pressure in the distribution system and optimised pressure management
Active and passive leakage control	Active leakage control (ALC) and passive leakage control ensure that all leaks and bursts are located, reported and repaired as soon as possible. ALC involves sending maintenance teams to actively identify leaks, while passive leakage control relies on the public to report leaks through call centres. Continuous monitoring enables the WSI to timeously identify and repair leaks. Active and passive leakage control programmes result in: • Reduced real losses • Improved Municipal image and lead by example • Call centres being the single point of contact; available 24/7; improved commitment to service; increased service/quality of service • Positive public image, • The number of complaints logged is an indication of performance. If no calls are received, does it indicate that all leaks have been fixed or that people have lost confidence and interest in the call centre?
Mains replacement	All pipelines have a limited design life and should be replaced on an ongoing and regular basis to prevent backlogs. The WSI would be expected to implement a water mains replacement or repair programme as part of their asset renewal and replacement programme. The replacement priority should be based on sound engineering principles and case specific historical data.

	Care must be taken to distinguish between mains leaks and connection leaks. Often the pipe is still in a good condition and it is only necessary to replace the connections.
Speed and quality of repairs	Regulation R509 states that a water services institution must repair any major, visible or reported leak in its water services system within 48 hours of becoming aware thereof. The quantity (volume) of water loss from a leak depends on the time it takes to be detected, located and repaired. Mains bursts are often visible and disruptive, with the result that they are fixed quickly, whereas connection leaks tend to be invisible and could take months before they are detected, located and fixed. The losses from a typical mains burst and connection leak are as follows: • Mains burst @ 50 m^3/h running for 4 hours = 200m^3 water loss • Connection leak @ 0.5 m^3/h running for 6 months = 2 160 m^3 water loss Fixing leaks on old reticulation systems could be challenging as the soil and old pipework are disturbed when repaired, often resulting in more leaks up or downstream of the repair. Excavation and backfilling should be performed carefully and to specification and the correct repair clamps should be used.
Potential savings from physical water loss interventions	**Leakage control** • Expected MNF $_{\text{mixed residential / industrial / commercial areas}}$ = %MNF × ADD where the %MNF ranges between 20 and 50% depending on the levels of leakage • Expected MNF low cost housing and yard tap areas = %MNF × ADD where the % MNF ranges between 50 and 80% depending on the levels of leakage • Saving excess MNF = Current MNF – expected MNF **Pressure management** • Saving pressure reduction = MNF × %MNF reduction × HDF Where the average Hour Day Factor = 20 hours **Mains replacement** • Savings $_{\text{mains replacement}}$ = 80 ℓ/km/h • Savings $_{\text{connection replacement}}$ = 5 ℓ/connection/h **Speed and quality of repairs** • Potential saving included as part of leakage control assessment **Reservoir overflow** • Savings $_{\text{reservoirs}}$ = (0.5 × ADD / 24) × duration of overflow × frequency of overflow

Stakeholder engagement

It was mentioned in the introduction that the scorecard targets the whole WSA and measures the effectiveness to provide water services in an efficient, equitable and sustainable manner. It is recommended that management and departments take an active role in the execution of the various WCWDM interventions and partakes in the assessments to maximise scoring.

No	Critria	Council	Executive council	Engineering	Finacnace	Administration	Customer care	Communications
1	Strategy, planning & implementation	X	X	X	X			X
2	Asset management			X	X			
3	Technical skills	X	X	X	X	X	X	X
4	Credibility and accountability			X	X			
5	Compliance & Performance			X	X			
6	Local regulation	X	X	X	X	X		
7	Customer care	X	X	X	X		X	X

Criteria 1: WDM strategy planning and implementation

The objectives of Criteria 1 are to measure:

- the state of water consumption and security, water losses and non-revenue water in the water services institution
- the plans of the water services institution to reduce system input volume, water losses and non-revenue water
- progress made in the implementation of these plans.

Sub-criteria 1.1 to 1.8

Criteria	Sub-requirement
(1.1) Water resource balance diagram	Provide a detailed **raw water resource balance diagram** complete with: a) current demand, b) available supply as per WUL or SLA, c) projected (5 year) demand estimates with and d) without implementing WDM. Note: A water balance must be provided per system if water is abstracted from more than one catchment. 
Comments	*The water resource balance diagram provides an indication of the water demand against the available supply as per the Water Use Licence (WUL) or Service Level Agreement (SLA). Water security could be compromised if the demand is nearing or exceeding the supply and water restriction should be considered if not already implemented. Ensure that the following information can be provided:* • *Current licensed abstraction according to the WUL or SLA* • *Current abstraction* • *Water use target for the period under review*

National Water Resource Strategy - Water for an Equitable and Sustainable Future - Second Edition. DWS, June 2013

NWRS2 is to ensure that national water resources are protected, used, developed, conserved, managed and controlled in an efficient and sustainable manner.

1.2 **Modified IWA Water Balance**	 Provide MONTHLY and ANNUAL composite IWA water balance diagrams and supporting documents for the complete system as part of the water audit (as a component in the WSDP) as per Reg 509 of 2001 Clause 10 of the Water Supply Regulations. Balance diagram to specify as a minimum the main components of the IWA balance including Water Losses broken down into: a) System input volumes (potable water), b) Billed metered and unmetered usage, c) Unbilled Authorised Consumption, d) Water losses broken down into Real and Apparent Losses, e) Free Basic Water, and f) Non Revenue Water and to be supported by a schematic or layout drawing showing bulk meters, zones and main infrastructure components.
Comments	*The International Water Association (IWA) water balance diagram provides details of the system input volume, authorised consumption, water losses and non-revenue water. The water balance and basic information on population, length of mains, etc. are used to calculate KPIs to measure progress and performance.* *Refer to the* Guideline for the preparation of an IWA water balance for the water services sector *(DWS, 2017) and the DWS standard water balance spreadsheet. A copy of the standard water balance spreadsheet is included in* ***Appendix A****.* **Common Pitfalls and Mistakes** • Limited or no supporting information to verify water balance • Monthly or individual system water balances not available • "Looks good" water balance that cannot be substantiated or supported

	Guideline for the preparation of an IWA water balance for the water services sector. DWS, 2017 The purpose of this guideline document is to discuss the technicalities, standardise the water balance calculation for the country and provide a guideline which can be used and understood by politicians, officials and the public. 

<table>
<tr><td>(1.3)
WDM Strategy and business plan</td><td>a) Evidence must be provided of a Council approved (or signed by MM, Director or Executive Director or CFO, or included in the IDP) WDM strategy and business plan consisting of at least the following:
• Background and Context
• Situation Assessment including a Needs Statement
• Key Issues and Challenges
• Focus Areas of Intervention
• List of Proposed Interventions
• Set targets for demand, NRW, commercial and real losses.
• Allocation of responsibilities to specific persons/positions in the organisation (not departments)
• Investment plan (Budget) and Multi-year Implementation Timeline
b) Provide details on the actions, investment plan, timelines and progress of water demand management activities undertaken. Reg 509 of 2001 Clause 10.</td></tr>
<tr><td>Comments</td><td>The WDM strategy provides the details of the water resources balance diagram, IWA water balance, challenges, targets, prioritised interventions, budget and timelines. To maximise scoring, the WSA must provide the following information for their top five WDM projects.
<table>
<tr><td>List below the Top 5 Priority Initiatives from the WDM Plan which need to be implemented in order to achieve the required water use savings - be brief but provide sufficient information to describe the project scope</td><td colspan="2">State below the water use savings to be achieved in kl/annum through each of the stated initiatives by the 2017 and 2022 target years.</td><td>State the total required budget for each initiative</td></tr>
<tr><td>e.g. Install pressure management to the Townsville reticulation system. The installation will consist of two PRV installations with dynamic control.</td><td>e.g. 50 000 kl/annum</td><td>e.g. 50 000 kl/annum</td><td>e.g. R3 500 000</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>The total for all 5 initiatives :</td><td>50 000</td><td>50 000</td><td>R 3 500 000</td></tr>
</table>
Common pitfalls and mistakes
• No status quo. The strategy is based on assumptions with no proper water balance or motivation why certain interventions are proposed
• No baseline to measure saving against
• Targets are not aligned to the DWS reconciliation and all town strategies.
• No results can be shown for completed interventions
• The strategy is outdated and not relevant anymore</td></tr>
</table>

Guidelines for Reducing Water Losses in South African Municipalities, WRC, Report TT 595/14, April 2014.

Assess the potential and status quo of water conservation and water demand management interventions in municipal systems" Report TT 523/12, WRC, July 2012.

(1.4) Number of metered customers	Percentage of customers who are metered including those who have been supplied with a measuring control device as calculated from the data presented in the summary section:
Comment	*Provide details of the average number of billed and unbilled metered accounts distributed for the financial year under consideration. Alternatively provide details of number of water meters installed or connections. The inspector should be able to extract this information from* **Table 2** *if properly completed.*
(1.5) Percentage of metered connections billed	Number of customers billed against actual meter readings.
Comments	*Provide details of the average number of billed metered accounts, from the municipal financial system, distributed for the financial year under consideration. The inspector should be able to extract this information from* **Table 2** *if properly completed.*
(1.6) Quantification of illegal connections	Provide a detailed assessment of the number of illegal connections to the distribution system
Comments	*Commercial losses are a function of the percentage illegal connections, meter and transfer errors.* **Table 4** *provides a guideline for estimating illegal connections but WSAs are encouraged to improve on this and determine the percentage illegal connections using sampling or active control programmes. See the* Guideline for the preparation of an IWA water balance for the water services sector *(DWS, 2017) for more information.*
(1.7) Flat rate or deemed	Households billed on a flat rate or on a deemed consumption method as a percentage of all households (not only metered households) in order to indicate percentage or rate of unconfirmed billing.

consumption billing rate	
Comments	*Provide details of the average number of billed unmetered (deemed) accounts distributed for the financial year under consideration. This information will be obtained from* **Table 2** *if properly completed.*
(1.8) Tariffs	Provide a copy of all DOMESTIC water use tariffs a) for the past three years b) indicating rising block tariff that would discourage high water use. Clause 10(2)d of the Water Services Act (Act no. 108 of 1997). Also in terms of Local Water Supply Bylaws
Comments	*Provide details of gazetted water tariffs for the past three years. The criteria are not specific in terms of the number of blocks or rates but the WSA should implement water tariffs that comply with Notice 1153 of 2015: Revision of the Norms and Standards for Setting Water Services Tariffs in terms of Section 10 of the Water Services Act, (Act no. 108 of 1997). A maximum water tariff, which is at least double the minimum tariff and targets the above average water user, is recommended. Water tariffs should be easy accessible via the municipal website or other sources.*

NOTICE 1153 OF 2015: Revision of the norms and standards for setting water services tariffs in terms of section 10 of the Water Services Act, (Act no. 108 of 1997)

Bonuses and penalties

Criteria 1 Bonus (a): Multi-year water balances	Water balances for multiple years in line with Reg. 509 of 2001 Clause 10
Comments	*All WSAs should be able to provide balances from 2003 since the Regulations stipulate that monthly water balances should be prepared within two years of promulgation of these Regulations which were published in 2001.*
Criteria 1 Bonus (b): Household leak repair programme	Provide details of household leak repair programme for both indigent and non-indigent households including **a)** Households visited **b)** Methodology **c)** Policy **d)** Costs (audited)

	e) Proof of efficacy of the programme
Comments	*The War on Leaks Programme was announced by President Jacob Zuma in August 2015, which was designed to train 15 000 artisans or plumbers who would fix leaking taps in their communities. WSAs should either measure and control or fix leaks on private properties, but government cannot continue to fund new infrastructure projects to supplement leakage as a result of poor operations and maintenance.*
Criteria 1 Penalty (a): WUL Regulatory compliance	Failing to provide evidence of water source availability through a valid Water Use Licence (or SLA with a WSP). The penalty will apply to a maximum of 50% of the total score achieved under Criteria 1.1
Comments	*Clearly summarised Water Use Licence (ground and surface water) information should be provided including the source, licensed abstraction, total licensed abstraction, etc.* *Bulk water service providers should allocate a portion of the WUL to each end user or WSA. The WSA will be penalised if the bulk water service provider exceeds its WUL and the WSA cannot prove otherwise.*
Criteria 1 Penalty (b): Inclusion in the IDP	Components under Criteria 1.3 have not been included in the IDP or WSDP
Comments	*It is critical that the water demand management strategy (Criteria 1.3) is included in the IDP to obtain funding. WDM projects must be clearly defined in the IDP and be linked to the WDM strategy or Water Services Development Plan.*

Further reading

Integrated Water Resource Planning For South Africa: A Situation Analysis 2010. JA van Rooyen and DB Versfeld

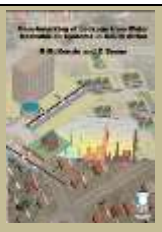
Thinking and planning of the Department of Water Affairs, and includes a summary of the water resource situation for all the identified growth areas in the country as at 31 May 2010.

Latest reconciliation strategies: https://www.dwa.gov.za/projects.aspx

Latest all town strategies: https://www6.dwa.gov.za/DocPortal/

Development of a simple and pragmatic approach to benchmark real losses in potable water distribution systems in South Africa. Report TT 159/01, WRC, 2002

This report introduced the standard International Water Associations water balance methodology to South Africa and recommended that it be implemented.



Benchmarking of Leakage from Water Reticulation Systems in South Africa. Report TT 244/05, WRC, 2005

The study included assessment data from approximately 60 water supply systems and after careful screening the sample data set was reduced to 30 systems.

Non-Revenue Water in South Africa. *Report TT 300/07, WRC, 2007*

The study included water balance information from 62 systems which was extrapolated to provide an indication of the overall water losses from municipal reticulation systems for the whole of South Africa.

The State of Non-revenue Water in South Africa (2012). *Report TT 522/12, WRC,* 2012

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

Aqualite water balance software and user guide. Report TT 315/07, WRC, 2007

This study included the development of the software version 2.1 and user manual for the AquaLite Benchmarking Software towards a standard terminology and approach to calculate water losses, non-revenue water and key performance indicators

Reducing Water Losses in Municipalities – Key Issues and Pointers to Implementation. Water Information Network South Africa, WIN-SA, May 2015

This study contains extracts from (WRC) research report entitled *Guidelines for Reducing Water Losses in South African Municipalities*. It focuses on section 2 of the guidelines which provides a comprehensive and easy to understand overview of the key issues in reducing water losses in municipal water supply systems.

Assessing Non-Revenue Water and its component – A Practical Approach. IWA Water Loss Task Force, June 2003

This article highlights practical developments over the decade in managing water losses in public water supply distribution systems.

The Status and Use of Drinking Water Conservation and Savings Devices in the Domestic and Commercial Environments in South Africa. Report TT 358/08, WRC, August 2008

Commercial environments were limited to public institutions such as schools, prisons and hospitals as well as shopping complexes and the hospitality industry. The report excludes water efficient devices in industrial settings.

Criteria 2: Asset Management

The objectives of Criteria 2 are to measure:

- the location and conditions of water services infrastructure that has a direct impact on water losses and non-revenue water
- whether the water services infrastructure is operated and maintained in an efficient, affordable, equitable, economical and sustainable manner. The focus of the scorecard are on bulk meters and control valves
- whether the flow, pressure and other operational data is gathered, analysed and acted upon.

Sub-criteria 2.1 to 2.6

Criteria	Sub-requirement
(2.1) Asset register	The Institution must present a complete Asset Register. The asset register must provide: a) details of the relevant equipment and infrastructure b) an asset description c) the location d) the condition (remaining life) e) the replacement value The asset register must be supported by up-to-date network drawings inclusive of the entire supply and storage system.
Comments	*Provide evidence of the municipal asset register providing the information as listed above.*
(2.2) Mains replacement programme	Provide evidence of a pipe replacement plan with evidence of implementation as measured in terms of length of pipes installed in the previous financial years against the overall length of the entire primary and secondary distribution network. Evidence of pipe aging from the asset register must be included to support the replacement plan.
Comments	*WSAs should have a continuous mains replacement programme to avoid backlogs and total collapse of the system. To allow for budget, staff, procurement, etc. deficiencies, the length of bulk and distribution mains replaced in the past 5 years must be provided. Information should be provided in the following format:*

Total km of pipework replaced in year of assessment=	*0.0 km*
Total km of pipework replaced in 1st year prior to the assessment period =	*0.0 km*
Total km of pipework replaced in 2nd year prior to the assessment period =	*0.0 km*

	Total km of pipework replaced in 3rd year prior to the assessment period = — *0.0 km* *Total km of pipework replaced in 4th year prior to the assessment period =* — *0.0 km* *Average replacement over previous 5 periods =* — *0.0 km* *Details of the basis for the mains replacement programme should be provided.*
(2.3) Consumer meter maintenance and replacement programme	Provide details of compliance with Reg 509 of 2001 Clause 10(e) (Meter installation and testing details), including at least: • number of new meters installed (as a % of total) • Meters replaced (as a % of total) • Meters tested and results (as a % of total) • Removal of unlawful connections (as a % of total) • Details of both proactive and reactive meter maintenance programme. Evidence must be presented on responses to exception reports.
Comments	*The WSA should have a proactive and reactive meter replacement programme. With a proactive programme 8% to 12% (8 to 12 year design life) of existing meters should be replaced per annum. With a reactive replacement programme only meters that are found faulty during normal operations and maintenance are repaired or replaced. Information should be provided in the following format for the year under assessment:* *Number of meters repaired or replaced proactively:* *Number of meters repaired or replaced reactively:* *Total number of meters repaired or replaced:* *Total number of meters operated by WSA:* *Number of meters tested:* *Number of illegal connections removed:*
(2.4) Control valve and Bulk meter maintenance	a) Provide a copy of control valve and bulk meter register and map indicating at least the • make, model and size, • GPS co-ordinates, • settings, • service schedule, and • performance monitoring along with b) an associated maintenance plan (cleaned, replaced, tested, etc.) with proof of implementation. 
Comments	*Control valves and bulk meters are critical for the effective operations, monitoring and evaluation of the water distribution system. Main control valves include:*

<table>
<tr><td></td><td>

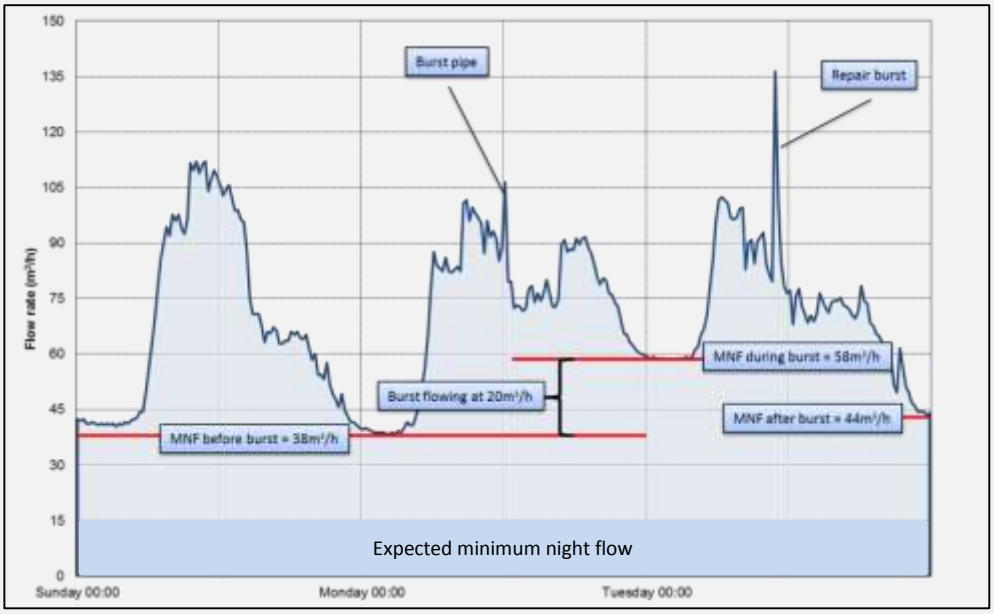
Pressure reducing valves (PRV) – prevent excessive pressures in the distribution network and transmission mains
Altitude and level control valves – prevent reservoirs and towers from overflowing
Pump control valves - prevent surges from pumps starting and stopping
Other control valves include pressure relief and sustaining valves, fixed ratio valves, flow control valves or a combination of the above.

Information should be provided in the following format:
<table>
<tr><td>Total number of bulk meters:</td><td></td></tr>
<tr><td>Number of bulk meters repaired or replaced:</td><td></td></tr>
<tr><td>Total number of control valves:</td><td></td></tr>
<tr><td>Number of control valves serviced:</td><td></td></tr>
</table>
</td></tr>
<tr><td>(2.5)
Monitoring and analysis of, and response to high water loss supply zones</td><td>
Provide details in accordance with Reg 509 of 2001 Clause 11 on:
a) active monitoring (at least monthly) of ALL supply zones in terms of at least 4 of the performance indicators listed below:
• flow and pressure logging,
• MNF analysis,
• pressure analysis,
• burst frequencies,
• bulk meter readings,
• use of SCADA systems and
• pipe replacement.

b) evaluation of data and
c) response protocols and processes when anomalies are identified (excessive pipe leakages, reservoir overflows, illegal or unmetered connections, etc.) (works order will be accepted as evidence that the protocols have been implemented).
</td></tr>
<tr><td>Comments</td><td>
The benefits of continuous monitoring and evaluation of zones and districts are as follows and shown in the typical logging result below:

Calculate the minimum, average and maximum flow rates
Assess the flow profile and determine if it is in line with the area characteristics
Identify leaks, bursts and open boundary valves from a sudden increase or decrease in the minimum night flow
Assess if the zone has a leakage problem from the minimum night flow and prioritise zones
Long term logging results could be used to calculate peak factors and calibrate network models

</td></tr>
</table>



A burst and leak repair register should preferably include:

- *Date of leak or burst*
- *Position of leak or burst (mains pipe, pipe connection, saddle, connection pipe)*
- *Pipe material, size and condition*
- *Possible cause (poor construction, aging material, traffic, previous repair, etc.)*
- Estimated leakage rate (the time it takes to fill a bucket can be used)

Development of a standardised approach to evaluate the potential bursts and background losses in water distribution systems in SA. Report TT 109/99, WRC, June 1999

This study incorporated the development of software and user guide for SANFLOW

Introduction to Operation and Maintenance of Water Distribution Systems. Report TT 600/14, WRC, July 2014

This study aims to assist service delivery by making information on proper operation and maintenance practices available in a practical and accessible way.

(2.6) O&M Budgets and Expenditure	The Institution must present credible evidence of: a) Maintenance Budget (as part of Operations Budget) b) Maintenance Expenditure (as part of the Operations Expenditure) c) Maintenance Expenditure should be more than 50% of the Operations Expenditure in total for the preceding Financial Year.

	The financial reporting below must be substantiated by the figures reported to National Treasury in the form of "Table A2 (Consolidated Budgeted Financial Performance Revenue and Expenditure by Standard Classification)" in the Municipal Regulations on a Standard Chart of Accounts (mSCOA).
	Budget information should be provided in the following format:

*From Table A2 - State the figure **budgeted** for Trading Services/Water/Water Distribution (R million):*	*R mil*
State value of Capital Projects included above (R million):	*R mil*
State value of Water Purchases if included (R million):	*R mil*
State value of Depreciation if included (R million):	*R mil*
State value of other expenses to be deducted from the budget figure that should not be considered in evaluating the Reticulation Operation, Maintenance and Repair cost budget (R million)	*R mil*
*Reticulation Operations, Maintenance and Repair **actual expenditure** calculated on the same basis as the figure above (R million)*	*R mil*
Reticulation Maintenance and Repairs expenditure (must be inclusive of materials, labour, equipment and workshops as well as external service provision) (R million)	*R mil*
Estimated reticulation replacement value (R million)	*R mil*
State the actual expense associated with new asset installation in the review period (R million)	*R mil*
State the actual expense associated with planned and unplanned asset renewal in the review period (R million)	*R mil*

Bonuses and penalties

Criteria 2 Bonus: Cathodic Protection	A bonus will be allocated if the WSA can provide evidence and maintenance records of a cathodic protection installed to protect its bulk mains. Evidence is to be presented in the form of a schedule of all steel bulk mains and the cathodic protection systems installed to protect each system. In addition to this monitoring results must be presented to the efficacy of each of the cathodic protection systems.
Comments	*Cathodic protection (CP) is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection connects the metal to be protected to a more easily corroded "sacrificial metal" to act as the anode. The sacrificial metal then corrodes instead of the protected metal. For structures such as long pipelines, an external DC electrical power source is used to provide sufficient current. (Wikipedia).* *Information should be provided in the following format:*

	Length of bulk steel mains:	*km*
	Number of bulk lines requiring protection:	
	Number of lines with CP units :	
	Number of CP units operational:	
Criteria 2 Penalty: None	None	

Further reading

Infrastructure Asset management Toolkit. Version 1. Report TT413/09, WRC and SALGA, April 2009

The toolkit aims to provide a greater understanding of infrastructure asset management and the benefits of its use in the water supply sector.

The Manager's Non-Revenue Water Handbook for Africa - A Guide To Understanding Water Losses. USAid and World Bank Institute, March 2010

The manual gives managers and technical staff the opportunity to understand the factors that influence NRW and the solutions for managing it.

Assessment of the Feasibility of Using a Dual Water Reticulation System in South Africa. Report No 1701/1/09, WRC, March 2009

This study assessed the feasibility of implementing dual water reticulation systems in South Africa based on local and international experience.

Criteria 3: Technical skills – Overview

The objectives of Criteria 3 are to measure whether:

- water demand management is a responsibility across the water services institution and is it included in performance agreements
- the water services institution has the necessary capacity and skills to implement water demand management
- water demand management is promoted and implemented in a co-ordinated manner within the organisation.

Sub-criteria 3.1 to 3.4

Criteria 3 :	Technical skills
3.1 Availability and competence of the water loss manager and team	a) The Institution must present evidence of a competent Water Loss Management Team indicating the WDM responsible persons (in form of an Organogram) with % positions vacant in accordance with Clause 66 (Staff matters) of the Municipal Systems Act 32 of 2000. b) Proof required of team manager competency (Qualification & Experience) with the following additional requirement: Manager to have suitable tertiary qualification with suitable experience. c) The Institution must present evidence of a competent structured Maintenance Team (in form of an Organogram with well-defined positions and job descriptions; Contract or Invoice). Logbook with maintenance entries will serve as adequate evidence. d) Additional proof required of team competency for the team presented under (c) above (e.g. Qualification & Experience & Trade-test) e) Indicate information on the type and number of technical competencies as provided for in the approved organogram. Alternative to a) and b) above: In WSAs where the WDM function is the responsibility of a number of different teams, the following must be provided: * Organograms of all key teams including Financial, Metering, GIS, IT, Reactive and Proactive Maintenance, Asset Management, Risk Management, WDM and others as relevant. Involvement of the sections must be proven. * Competency of the managers.
	Provide a copy of the approved organogram indicating positions, vacancies, qualifications, etc. Information should be provided in the following format: *Number of staff positions presented in the organogram:* | *Number of positions vacant in the organogram:* |

	Number of professionally qualified engineering staff positions presented in the organogram:	
	Number of engineering staff members (not professionally qualified) presented in the organogram:	
	Number of qualified plumbers presented in the organogram:	
	Number of persons doing plumbing work but who are not certified plumbers	
	Number of qualified artisans (other than plumbers, e.g. fitters, boilermakers, etc.) presented in the organogram:	
	Details of outsourced services. Copies of SLAs must be presented.	
3.2 Water loss meeting	**a)** Provide, for the period under review, minutes and reports of inter-departmental (tech & fin) **bi-monthly Physical water loss** and **Commercial loss** meetings as per Municipal Systems (Sec 9: Performance management) Act 32 of 2000. **b)** Provide evidence that the **outcomes** of the meetings are **actioned**.	
Comments	*A task group should be set up in a municipality to steer the implementation of the WDM strategy. The task group should be represented by the WSA's Department of Community and Social Services, Finances, Wastewater, Water, Housing and political leadership. Other stakeholders could include Department of Basic Education, Public Works, Health, CoGTA and DWS. The task group, or sub-task groups, should meet on a regular basis to discuss progress, funding, stumbling blocks, etc. Provide copies of minutes, attendance registers, reports, etc.*	
3.3 Training and capacity building	Provide, for the period under review, details of WDM training and capacity building programme for personnel, officials and politicians. Clause 68 (Capacity building) Municipal Systems Act 32 of 2000. **a)** Provide information on **course title, duration, accreditation status**. **b)** Provide evidence on **number of individuals (including officials and politicians)** attending the training.	
Comments	Training and capacity building in the WSA should be continuous. A balance between theoretical and practical training as well as internal and external training should be obtained. Provide copies of training certificates and attendance registers as evidence.	
3.4 Meter readers	**a)** Provide details of: • qualification criteria, • compliance to the criteria, • training provided and • performance monitoring. to meter readers (both in-house and external). **b)** The WSA will provide evidence on: • the number of meter readers employed and • its meter reading strategy. Refer the Municipal Finance Management Act (56/2003) in this regard.	

Comments	*Meter readers play an important role in the metering, reading, billing and cost recovery cycle. Information on tampered, cycled, damaged, no access, etc. meters should be forwarded to the technical department for rectification to avoid reporting the same problem. Meter readers can also be used to report reticulation leaks and water theft. Information must be provided in the following format:*

Number of meter readers in full time employ or on full time contract:	
Number of meter readers in part time employ or on part time contract:	
Meter reading frequencies for domestic and non-domestic consumers:	

Bonuses and penalties

Criteria 3 Bonus : Demonstrated political support	Active involvement of executive council and councillors to promote WDM as evidenced by: a) their active promotion of efficiency, b) assisting with disconnections, c) assisting with credit control procedures, d) involvement in steering committees, and e) other (detail to be provided).
Comments	*WDM cannot be implemented successfully without the support of the executive and council. The No Drop assessment is therefore targeted at the WSA and not just the engineering or finance departments.*
Criteria 3 Penalty : Performance Targets for Senior Officials	Progressive WUE targets aligned to the latest WDM strategy are included in the performance contracts of the following senior officials: MM, CFO and Technical Director. Non-conformance will attract the following penalties against Criteria 3.1 as per Sec 9: Performance Management of the Municipal Systems Act 32 of 2000.
Comments	*The executive should be held accountable if targets are not achieved. The targets set in the WDM strategy should therefore be included in the performance agreements of senior officials.*

Further reading

Water and Sanitation Business. The Roles and Responsibilities of Local Government and Related Institutions. Department of Water Affairs and Forestry, Revised August 2005.

The purpose is to inform municipalities (both councillors and officials) of the different water sector institutions, link to the water and sanitation business cycle and the associated costs and legislative roles and responsibilities of the different water sector institutions, in particular the water services authority and the water services provider.

Criteria 4: Credibility

The objectives of Criteria 4 are to measure the:

- basis of the IWA water balance information provided in Criteria 1 with focus on the system input volume and authorised consumption breakdown
- number of metered and unmetered connections
- accuracy of bulk and consumer meters
- accuracy of monthly meter readings
- billing accuracy against actual consumption and appropriate water tariff code.

Sub-criteria 4.1 to 4.4

<table>
<tr><th>Criteria 4 :</th><th>Credibility</th></tr>
<tr><td>4.1 Meter readings and billing system</td><td>Provide monthly reports indicating :
a) readings,
b) consumption (kl) per tariff code,
c) summary report of monthly units sold,
d) amount in Rands,
e) number of corrections after billing
as per the Chapter 9 (Credit control and debt collection) of the Municipal Systems Act 32 of 2000.
  </td></tr>
<tr><td>Comments</td><td>Summarised billing information for each month should be presented. The inspector will select a month for evaluation purposes and should be able to extract the following information:
<table>
<tr><td>a) Year and month used for verification =</td><td></td></tr>
<tr><td>b) Total consumption for all tariff codes =</td><td>kl</td></tr>
<tr><td>c) Monthly units sold =</td><td>kl</td></tr>
<tr><td>d) Amount in Rand =</td><td>R mil</td></tr>
<tr><td>e) Number of adjustments made for the month to correct incorrect metering and billing information =</td><td></td></tr>
<tr><td>f) Linked to (e) above, state the adjustment made for the month to correct incorrect metering and billing information in terms of volume (kl) affected =</td><td></td></tr>
</table></td></tr>
<tr><td>4.2 Record keeping</td><td>For the preceding 3 year period, provide details on monthly meter readings, calculation sheets, comments on anomalies, etc. to comply with Reg 509 of 2001 Clause 11 (2) "Municipalities must keep record of the quantities of water measured and of the calculations made."</td></tr>
</table>

Criteria 4 :	Credibility
Comments	*The Regulations R509 were introduced in 2001 and state that municipalities "must within two years of the promulgation of these Regulations, every month, measure the quantity of water provided to each supply zone within its supply area". All municipalities should therefore be able to present at least 15 years of data.*
4.3 Independent Investigation	Provide evidence of independent investigations (outside of the normal metering and billing process) in order to confirm metering and billing information against a check of unmetered connections, meter accuracy, illegal connections, etc. (e.g. top consumer audits, random consumer audits and indigent consumer audits, etc.) to ensure that all users of the supply system are correctly billed. Investigation reports with recommendations and evidence of implementation of findings are to be presented for assessment.
Comments	*The objective of this criterion is to assess processes and procedures undertaken by the WSA to verify metering and billing accuracies, illegal connections, etc. Typical procedures include meter audits, top consumer audits, monthly sampling of meter readings to check meter readers, etc.*
4.4 Flow meter verification	WSA is to present evidence on the flow meter verification or replacement practices employed on all meters excluding consumers' meters. At least 30% of meters need to be evaluated per annum. 
Comments	*Flow meter verification processes could include replacement of meter mechanisms at regular intervals, installation of check meters and comparing results, calibration certificates, installation of potable clamp-on meters, etc.*

Introduction to Integrated Water Meter Management, Edition 1. WRC, Report TT 490/11, October 2011

This report covers all the aspects of water meters and water metering in municipalities. It incorporates the theoretical principle of meters, legal and metrological requirements, meter types, best practice guidelines as well as practical aspects of water meter management.

Bonuses and penalties

Criteria 4 Bonus : None	None
Criteria 4 Penalty : Inaccurate meter readings	The penalty will be applied if an excessive number of volume adjustments are reported under item 4.1 as considered over the full year of the assessment.
Comments	*Municipalities should introduce programmes whereby a certain percentage of meter readings is audited on a monthly basis to improve accuracy and efficiency. Fines could be considered if a minimum standard is not achieved. A proactive approach should be followed whereby suspicious meter readings are corrected before the client is billed to avoid an excessive number of journal corrections.*

Further reading

Optimal water meter selection system. EH Johnson Water SA Vol. 27 No. 4 October 2001

The comparison of the particular accuracy envelope of a water meter with a consumer's diurnal demand pattern by means of a common reference, facilitates the optimal selection of water meters.

In situ calibration of large water meters. Report No 871/1/98, WRC, April 1999

The establishment of a flow reference standard for the cost-effective in situ calibration of large inline water meters consists of the combined accuracy of point velocity measurements within pipes, a velocity-area method and a velocity-profile function.

Criteria 5: Compliance and Performance

The objectives of Criteria 5 are to measure:

- whether all leaks are fixed within 48 hours of becoming aware thereof
- performance of the WSA against international best practice benchmarks and the water demand management regulations
- the implementation of aggressive pressure management and ensuring pressures in the distribution system do not exceed 90m.

Sub-criteria 5.1 to 5.6

Criteria 5 :	Compliance and Performance
5.1 Repair of reticulation leaks	Provide details of leak repair schedule indicating a) date reported, b) date fixed, c) repair time, d) backlogs e) % repairs exceeding 48 hours to comply with Reg 509 of 2001 Clause 12  Target : All reticulation leaks must be repaired within 48 hours of becoming aware thereof.
Comments	*Provide evidence of leak repair turnaround time based on call centre information, open and completed job cards, etc. Information from manual systems will be accepted.*
5.2 Physical water losses	Physical (real) water loss key performance in terms of the ILI as per Sec 6. (Performance Management) of the Municipal Systems Act 32 of 2000. • CARL = Current Annual Real Losses • UARL = Unavoidable Annual Real Losses ILI is calculated below.
Comments	*Scoring is a function of knowing your status, showing improvement over the previous year and actual score in terms of international benchmarks. See* **Table 5** *for benchmarks.*
5.3 Commercial water losses	Commercial water loss key performance indicators as per Sec 6. (Performance Management) of the Municipal Systems Act 32 of 2000.
Comments	*Scoring is a function of knowing your status, showing improvement over the previous year and actual score in terms of international benchmarks. See* **Table 5** *for benchmarks.*
5.4 Non-revenue water	Non-revenue water key performance indicators as per Sec 6. (Performance Management) of the Municipal Systems Act 32 of 2000.

	Note: Evidence must be provided that the consumption of informal settlements is included in the non-revenue water calculation.
Comments	*Scoring is a function of knowing your status, showing improvement over the previous year and actual score in terms of international benchmarks. See* **Table 5** *for benchmarks.*
5.5 Per Capita Consumption	Per capita consumption as a key performance indicator as per Sec 6. (Performance Management) of the Municipal Systems Act 32 of 2000.
Comments	*Scoring is a function of knowing your status, showing improvement over the previous year and actual score in terms of international benchmarks. See* **Table 5** *for benchmarks.*
5.6 Pressure Management	Provide a copy of reticulation drawing along with records of pressure monitoring records indicating pressure distribution is not exceeding 900 kPa (Reg 509 of 2001 Clause 15).
Comments	*Provide number of properties, households or length of distribution mains exceeding 900 kPa. It is assumed this information will be obtained from the water network model.*

Guideline for the principles, implementation and potential savings from pressure management, Report TT 186/02, August 2002

The report provides practical guidelines for the implementation of pressure management

Bonuses and penalties

Criteria 5 Bonus (a): Performance	A bonus will be awarded if the WSA is meeting the Recon/All Town targets. A partial target will be allocated if the WSA can show performance indicating a progressive path to meeting the Recon/All Town targets.
Comments	*WSAs are expected to adopt and achieve their targets set under the reconciliation and all town strategies. A bonus point could be allocated if the actual demand in the year under review is within range of the target. Information must be provided as follows from the water resource diagram (criteria 1.1):*

Actual demand for year under review (kl/annum)	
Target demand for year under review (kl/annum)	

Criteria 5 Bonus (b): Additional pressure management	Bonus on aggressive pressure management	
Comments	*Regulation R509 states that the pressure in a distribution network may not exceed 900 kPa but this should not prevent WSAs from introducing their own standards. Pressures not exceeding 600 kPa are recommended to extend the design life of the pipe network and reduce the number of bursts. Scoring is based on the setting, implementation and monitoring of new maximum allowable pressures in the distribution network.*	
Criteria 5 Penalty : Section 82	Penalty will apply should the Department find proof during / post assessment that the WSA is guilty of an offence as per Section 82 of the Water Services Act, by only submitting partial information (in any form) in order to present a false impression of WUE Performance and/or compliance. The penalty will apply to a maximum of 70% of the total score achieved under Criteria 5	

Further reading

Apparent Water Losses Related to Municipal Metering in South Africa, Report No. 1998/1/12, WRC, August 2012

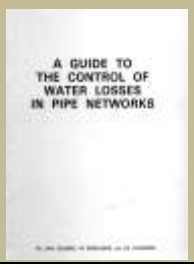
This study estimates the extent of apparent losses due to water meter under-registration and unauthorised consumption in South Africa.

Development of a pragmatic approach to evaluate the potential savings from pressure management in potable water distribution systems in SA, Report TT 152/01, March 2001

This study incorporated the development of software and user guide for PRESMAC

Calculating Hour-Day Factors for potable water distribution systems in SA, Report TT 184/02, WRC August 2002

This study incorporated the development of software and user guide for HDI model



A Guide to the Control of Water Losses in Pipe Networks. University of Pretoria Department: Water Utilization Engineering and Environmental Science.

This study investigated various methods of leak detection and water loss prevention in pipe networks and the cost implications of water losses from the pipe networks.

Criteria 6: Local Regulation

The objectives of Criteria 6 are to measure whether the:

- water services institution have the necessary policies and bylaws in place to support their water demand management programme
- policies and bylaws promote water use efficiency among consumers
- policies and bylaws are enforced
- WSA actively repair leaks within their area of jurisdiction.

Sub-criteria 6.1 to 6.5

Criteria 6 :	Local Regulation
6.1 Metering, billing and credit control policy	Provide a copy of the municipal metering, billing and credit control policy. The score will be maximised if implementation can be demonstrated by way of evidence.
Comments	*The municipal metering, billing and credit control policy should comply with Chapter 9 - Credit Control and Debt Collection of the Local Government: Municipal Systems Act 32 of 2000. Implementation can be demonstrated by means of illegal connections removed, final demands issued, disconnections, fines, etc.*
6.2 Consumer meter replacement strategy	Provide evidence of a meter management programme addressing at least the following: • Age at which a meter is replaced, • Testing procedure to be followed for meters that are queried as being faulty by consumers, • Estimated number of meters that are to be replaced per annum with allocated budget, • Procedures followed in managing metering of large consumers, • Adoption and use of an electronic meter management database or system, and • Procedure followed in capturing meter information on the billing system.
Comments	*It is recommended that domestic meters should be considered for replacement before they are 10 years old, and bulk meters before 5 years. Water utilities should therefore endeavour to replace 8 % to 12 % (8 to 12 years design life) of consumer meters per annum to avoid possible meter replacement backlogs, resulting in having to replace all meters at once. Consumer meters should be repaired, replaced and maintained on a continuous basis. Regular meter testing should be undertaken to assess meter accuracy.*
6.3 Bylaws	a) Provide a copy of the latest (not older than 10 years) promulgated water supply bylaws highlighting clauses which: • promote water use efficiency such as removal of wasteful devices (automatic urinals),

	• show unlawful use of water, • indicate consumers' responsibility to repair leaks and conserve water, • use Measuring Control Devices including Prepayment meters, and • impose water restrictions in emergency situations b) Provide evidence of implementation of the bylaws (Compliance with Reg 509 of 2001 Clause 14.) NOTE: If the bylaws are older than 10 years the bylaws may be accepted if proof can be provided that the bylaws have been communicated to consumers in the last 5 years.
Comments	*Bylaws are laws drafted and promulgated by the municipality to enforce policies. Bylaws must be up to date, address water conservation and water demand management and be easily accessible via the municipal website or other sources.*

Model By-Laws Pack - Model Credit Control and Debt Collection By-laws & Model Water Services By-laws. June 2005. Published by the Minister of Water Affairs and Forestry in terms of section 21(4) of the Water Services Act No. 108 of 1997.

The purpose of the pack is to provide guidance to, and assist municipalities in, drafting and promulgating water services by-laws and credit control and debt collection by-laws.

6.4 Indigent database	Provide a copy of the latest indigent database and definition of indigent status.
Comments	*The indigent database must be continuously updated by the WSA and preferably not be older than two years.*
6.5 Consumer installations other than meters	The WSA must show commitment to the installation of quality fixtures to all households, particularly low cost housing schemes, by providing evidence that all fittings comply with the requirements below: 1) All plumbing components are to be JASWIC compliant (Joint Acceptance Scheme for Water Installation Components) and/or 2) Every consumer installation must comply with SABS 10252: Water Supply and Drainage for Buildings and SABS 10254: The Installation of Fixed Electric Storage Water Heating Systems Provide copies of building inspection reports indicating compliance.
Comments	*The WSA must demonstrate how standards and specifications are included in the bylaws, local building regulations, etc. and the enforcement thereof.*

Bonuses and penalties

Criteria 6 Bonus : War on Leaks	The removal of wasteful devices, such as automatic urinals, is actively pursued by the municipality in line with the requirements of Reg 509 of 2001 Clause 10(g). The evidence provided must include the following: **a)** Strategy **b)** Impact assessment of strategy and prioritisation in place **c)** Proof of implementation **d)** Proof of achievement of targeted goals 
Comments	*Wasteful devices, such as automatic urinals, should be actively removed by the WSA or included in the bylaws and enforced.*
Criteria 6 Penalty : None	None

Further reading

Revision of the Pricing Strategy for Water Use Charges in Terms of Section 56(1) of the National Water Act, 1998. Government Notice: GN 1154 in GG 39411 of 13 November 2015

The pricing strategy provides the framework for the pricing of the use of water from South Africa's water resources, i.e. the use of raw (untreated) water from the water resource and / or supplied from government waterworks and the discharge of water into a water resource or onto land.

Recommendations Towards Pricing and Debt Management in Water Services Delivery

- Report 1: A Literature review on Pricing and Debt Management of Water Services (WRC Report No. 1811/1/10)
- Report 2: A Gap Analysis on the state of Water Services Debt Management (WRC Report No. 1811/2/10)
- Report 3: Recommendations towards Pricing and Debt Management in Water Services Delivery (WRC Report No 1811/3/10)

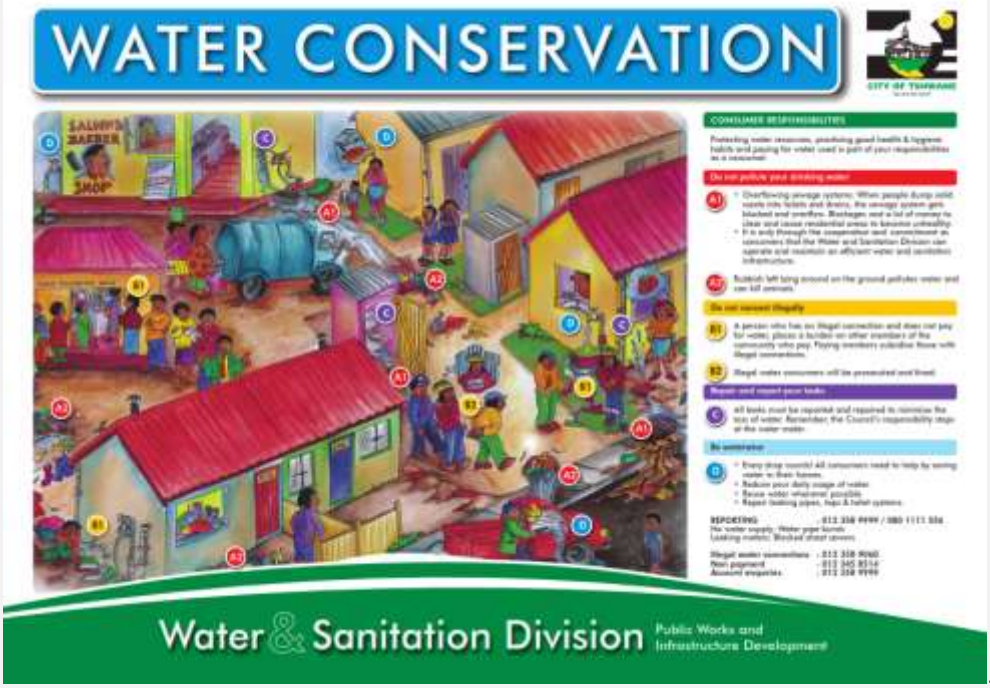
Criteria 7: Customer care

The objectives of Criteria 7 are to measure:

- whether the water services institution is actively promoting water use efficiency among its users
- the status of customer care centres and charters
- community and schools awareness campaigns
- stakeholder engagement
- the innovations to enhance revenue
- innovative water supply options.

Sub-criteria 7.1 to 7.5

Criteria 7 :	Customer care
7.1 : Customer Charter	**a)** Provide a copy of the municipal customer charter as approved by the Executive Director and the Portfolio Committee. The Charter should state • the type, • nature and • timeframe within which a response can be expected from the municipality, by a customer, to queries and complaints (telephonic and written) regarding various service delivery failures and events **b)** The charter must specifically include: • Service level standards • The responsibilities of the municipality with respect to WUE • The responsibilities of the consumer with respect to WUE
Comments	*A section of the water conservation component of City of Tshwane's customer charter is shown below as an example. It highlights the responsibilities of the WSA and consumer.*

Criteria 7 :	Customer care
	 *Negative scoring applies if any of the items under Item b) are not addressed.*
7.2 Customer Care Centre	Provide copy of water related customer service report indicating at least: a) number of queries, b) number resolved, c) outstanding (monthly aging going back 6 months), d) type of queries, as per Chapter 6 (Performance Management) and Chapter 9 (Credit Control and Debt Collection) of the Municipal System Act 32 of 2000.
Comments	*The call centre plays an important role in the reporting of visible leaks (passive leakage control), resolving of billing queries and reporting of water supply problems. The WSA should operate an effective call centre and conveying of problems by the public to councillors and the executive should be avoided. The work flow should be clearly defined and councillors and senior officials should not deal directly with plumbing teams.*
7.3 Informative Billing	Provide a copy of a typical monthly water bill showing **a)** at least the last two meter readings with dates, **b)** consumption with measurement unit, **c)** whether the "readings" are actual or estimated, **d)** 6 month historic usage trends for the specific consumer and **e)** highlighting of excessive usage against comparable consumer benchmarks as per Chapter 9. (Credit control and debt collection) of the Municipal System Act 32 of 2000.
Comments	*Evidence of separate letters highlighting excessive usage will be accepted, provided these letters are distributed consistently.*

Criteria 7 :	Customer care
7.4 : Community awareness campaign inclusive of indigent households	Provide, for the period under review, details of **on-going** **a)** public meetings, **b)** distribution of pamphlets and brochures, **c)** bill boards, **d)** local newspaper campaigns, articles and ads, **e**) local radio campaigns, spots and talks, and **f)** door-to-door education. (unmetered users and indigent households need to be included in the specific focus areas) to promote awareness on wastage, payment for services and leakage control (Reg R509 of 2001 Clause 3 & Municipal Systems Act 32 of 2000 Chapter 4.) 
Comments	*Copies of meeting attendance registers, materials distributed, advertising bills, door-to-door activity records, completion reports, etc. will be accepted as evidence. Emphasis is placed on unmetered users, indigent households and on-going activities to attract maximum score.*
7.5 Schools awareness campaign	Description of programme implemented by the municipality that provides **on-going** information on water issues at all schools in its jurisdiction by providing: **a)** a scheduled consultative interaction and awareness generation in at least 20% to 50% of schools in the municipal area, per annum, in order to attract a score. **b)** copies of materials used and distributed - **must include pamphlets or flyers to demonstrate commitment.**
Comments	*Copies of meeting attendance registers, materials distributed, advertising bills, completion reports, etc. will be accepted as evidence. Emphasis is placed on on-going activities.*

Bonuses and penalties

Criteria 7 Bonus (a): Sector awareness campaign and stakeholder forums	Provide details of an engagement activity schedule (minimum twice yearly) with **a)** industry, **b)** major consumers and **c)** institutions (Government, NGOs, etc.) to promote water use efficiency**.** Minutes of meetings will be accepted as evidence of the above.

Comments	*Large water users, industry and government institutions are often responsible for 50% to 80% of the total demand. The WSA must not only accurately meter and bill these institutions but also engage and promote the reduction and efficient use of water. These organisations can also be involved in public private partnerships, public and schools awareness campaigns, sponsor awareness material, etc.*
Criteria 7 Bonus (b): Revenue enhancements	Innovative strategies employed to enhance revenue, for example incentives to pay, amnesty on illegal connections, meter reading by consumer, etc. WSAs are encouraged to report on their out-of-the-box ideas related to WUE improvements.
Comments	*The objective is to identify **innovative** ideas to promote water use efficiency, payment for services, fixing of leaks, etc. Innovative ideas cannot be claimed twice. For example, if the WSA introduced online billing to improve cost recovery, a bonus can be claimed in the next No Drop assessment but not future assessments. Evidence of implementation and efficacy must be presented to attract full score.*
Criteria 7 Bonus (c): Innovative water supply	Innovative strategies and projects aimed at augmenting water supply volumes, at the required standard, through reuse, reclaim, recycle or other means of processed waters from alternative sources.
Comments	*The objective is to identify alternative sources that will reduce the stress on the conventional local and regional resources. Evidence of implementation and efficacy must be presented to attract full score.*

Further reading

	Towards standards for municipal invoices in South Africa - Sarah Slabbert Associates WRC Report No. TT 458/10, June 2010 Municipal invoices, if used properly, present a significant opportunity to engage users in water conservation, water regulation and planning. The Standards Document is an effort to steer municipalities, financial services, businesses and users towards quality and efficiency in water management.

Useful websites

- Papers and Publications on water conservation and water demand management can be found at http://www.leakssuite.com
- Papers and Publications on water conservation and water demand management can be found at http://www.watersummit.co.za
- Strategic Alliance for Water Loss Reduction provides background information, know-how and best practices on the reduction of water loss from supply networks. http://www.waterlossreduction.com
- DWS National Water Services Knowledge System (population, households, water and sanitation level of service per WSA, etc.) https://www.dwa.gov.za/wsks/
- DWS Directorate Water Use Efficiency portal to obtain water loss publications, news and submit water balance information online http://www.dwa.gov.za/dir_ws/ndrp/
- Water Research Commission www.wrc.org.za

Appendix A – water balance spreadsheet

IWA water balance spreadsheet copies from the DWS standard water balance spreadsheet.

	Item	Unit	Year ending
Input Data	**Population served**	**No**	
	Households served	**No**	
	Connections - total	**No**	**Calculated**
	Connections - metered	**No**	**Calculated**
	Domestic (and non-domestic)	No	
	Non-domestic	No	
	Connections - unmetered	**No**	
	Households / connection	**No**	**Calculated**
	Length of mains	**km**	
	Connections / km	**No / km**	**Calculated**
	Average system pressure	**m**	
	Time system pressurised	**%**	
	Apparent losses	**%**	**Calculated**
	Consumer meter age	%	
	Illegal connections	%	
	Data transfer	%	
Water Balance Calculations	**System input volume**	**kl/annum**	**Calculated**
	Own sources	kl/annum	
	Other sources	kl/annum	
	Authorised Consumption	**kl/annum**	**Calculated**
	Billed authorised	**kl/annum**	**Calculated**
	Billed metered	kl/annum	**Calculated**
	Domestic (and non-domestic)	kl/annum	
	Non-domestic	kl/annum	
	Export volume	kl/annum	
	Billed unmetered	kl/annum	
	Unbilled authorised	**kl/annum**	**Calculated**
	Unbilled metered	kl/annum	
	Unbilled unmetered	kl/annum	
	Projected SIV without WDM	**kl/annum**	
	Projected SIV with WDM	**kl/annum**	

Details of each calculation are summarised in the spreadsheet and should be read in conjunction with the Guideline for the preparation of an IWA water balance for the water services sector. DWS, 2017. The above information is used to calculate the IWA water balance and key performance indicators.

In addition to the table above, the following information will be required.

	Item	Unit	Year ending
Input Data	**Households billed on flat rate**	**No**	
	Connections – metered and billed	**No**	
	Proven wet industries	**kl/annum**	