

# Strategic reduction of Non-Revenue Water in rural Rwanda

Operational and financial insights from Gicumbi and Rulindo Districts

## Technical Note

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## Executive Summary

This technical note presents a detailed analysis of Non-Revenue Water (NRW) in the rural Water Supply Systems (WSSs) of Gicumbi and Rulindo Districts from April to June 2025 and proposes strategic measures to reduce it. All assessed WSSs are found to be losing significant amounts of water to leakage, theft, and inefficiency - well above the national benchmark of **≤25% NRW**. Below are the key findings:

- **Critical NRW levels:** All assessed systems significantly exceeded the 25% national benchmark for NRW, with quarterly averages ranging from 27.5% to 100%.
- **Widespread infrastructure gaps:** Most of the gravity-fed systems lack bulk meters, preventing NRW measurement for 111 out of 141 total assessed systems
- **Data collection challenges:** Only 16 (11.3%) out of 141 systems provided full quarterly data, 5 out of 141 provided partial data in the evaluated quarter, while others didn't have data due to meter malfunctions, billing irregularities, and inadequate monitoring.
- **Systemic performance issues:** Average NRW levels are at 72% (Rulindo) and 69% (Gicumbi), indicating substantial water losses.

The high NRW is attributed to both technical and non-technical failures. The primary issues are not just physical leaks, but a systemic breakdown in management and oversight. This includes a prevalent lack of essential infrastructure, such as bulk meters, persistent administrative errors in billing, a failure to utilize Customer Management Systems correctly, and poor reporting by private operators.

The findings underscore the urgent need for coordinated intervention across technical, operational, and regulatory dimensions to achieve a sustainable reduction in NRW below the 25% national target.

The paper proposes a clear, phased roadmap to address these challenges. Short-term actions focus on immediate data cleanup and enforcement of reporting. Medium-term efforts involve critical infrastructure investment and active leak detection. Long-term sustainability requires a fundamental review of the management model to embed accountability and ensure all stakeholders, local government, regulators, and private operators have the capacity and oversight to maintain NRW at or below the national benchmark.

## Background

Sustainable water supply in rural Rwanda is a key national priority, but many service providers and authorities fail to deliver high-quality and reliable water. This case study focuses on water systems managed by private operators under contract with Water and Sanitation Corporation (WASAC). WASAC is the national implementing entity of the Ministry of Infrastructure on all matters related to water and sanitation. By law, WASAC has the responsibility to manage all water systems in the country, however WASAC has chosen to delegate management responsibilities for rural systems to contracted private companies known as private operators to provide services. Private operators must be licensed by Rwanda Utility Regulatory Authority (RURA) before signing the contract with WASAC. Before this new management approach, the district local governments directly contracted with private operators; now districts remain WASH infrastructure owners and act as the voice of the communities.

The long-term viability of these services is threatened by high Non-Revenue Water (NRW). NRW is the volume of water produced that is not billed to customers and is a critical indicator of operational efficiency. It encompasses both physical losses (leaks, bursts, etc.) and commercial losses (inaccurate billing, illegal connections, etc.). Controlling NRW is essential for conserving scarce water resources, strengthening the financial status of water utilities, and ensuring reliable service delivery.

NRW is addressed in the 2016 National Water Supply Policy implementation strategy, which sets the minimum NRW target at  $\leq 20\%$  for countrywide and  $\leq 25\%$  for urban WSSs managed by WASAC. The 2018 Water and Sanitation (WATSAN) Sector Strategic Plan sets the target at  $\leq 22\%$ , but a more forgiving benchmark of  $\leq 25\%$  is widely used as a national target and is therefore used in this study.

This study asks what current NRW levels are in Gicumbi and Rulindo Districts, diagnose the root causes, and presents a clear strategy for sustainable reduction of losses. With a reduction in NRW, operators will collect more revenue and be able to provide more reliable water supply as well as improve overall trust and accountability in the water sector.

## Methodology

The NRW assessment covered the period of April to June 2025. It was led by a newly formed District NRW Task Force whose activities were launched on April 1, 2025, during the presentation of NRW baseline levels on piloted WSSs from both Gicumbi and Rulindo Districts. This task force, formed with the support of Water For People, includes representatives from WASAC (which leads the Task Force), the District governments, and private operators.

NRW was calculated on a monthly and quarterly basis using the standard formula:

$$NRW\% = \frac{\text{Volume Produced} - \text{Volume Billed}}{\text{Volume Produced}} \times 100$$

Data on water production was collected from bulk meters at WSS sources (at the pumping stations for motorized systems), while billed volumes were extracted from the private operators' Customer Management Systems (CMS) as provided by the private operators themselves. The national benchmark of  $\leq 25\%$  NRW served as the performance threshold for identifying underperforming systems.

A notable methodological limitation was the significant data gaps. Many gravity-fed systems lack bulk meters, making it impossible to calculate the "Produced Volume." This highlights a fundamental challenge in accurately monitoring performance.

## Findings on operator performance

The assessment revealed a critical failure to meet the national NRW benchmark across all monitored systems in both Gicumbi and Rulindo Districts. Cases of 100% NRW were linked to months with no billing; negative NRW values resulted from cumulative billing anomalies. Data inconsistencies in Customer Management Systems (CMS) are prevalent like some WSSs are not in the CMS (e.g. Nyakabizi WSS in Rulindo), while for others the tariff is not set properly (e.g. for Ngoma and Musenge, the set tariff is for gravity, while these are motorized systems, thus operator couldn't bill them into the CMS), which causes not billing those systems in the CMS. The chart below (Figure 1) illustrates this widespread underperformance.

## Rulindo District

Data was obtained from only one of the two private operators, **COWBE Ltd**, as the other operator (Owen Lord) failed to submit data throughout the assessment period. Out of 44 WSSs (36 gravity-fed, 8 motorized) managed by COWBE, only five had the necessary bulk meters for a complete assessment. As the chart (Figure 1) below shows, all five systems have a quarterly NRW average significantly above the 25% benchmark. A particularly alarming finding was the **Musenge** system, which reported 100% NRW for all three months due to billing failures, while high month-to-month variability for most of the WSSs suggests irregular billing practices (refer to Annex 1).

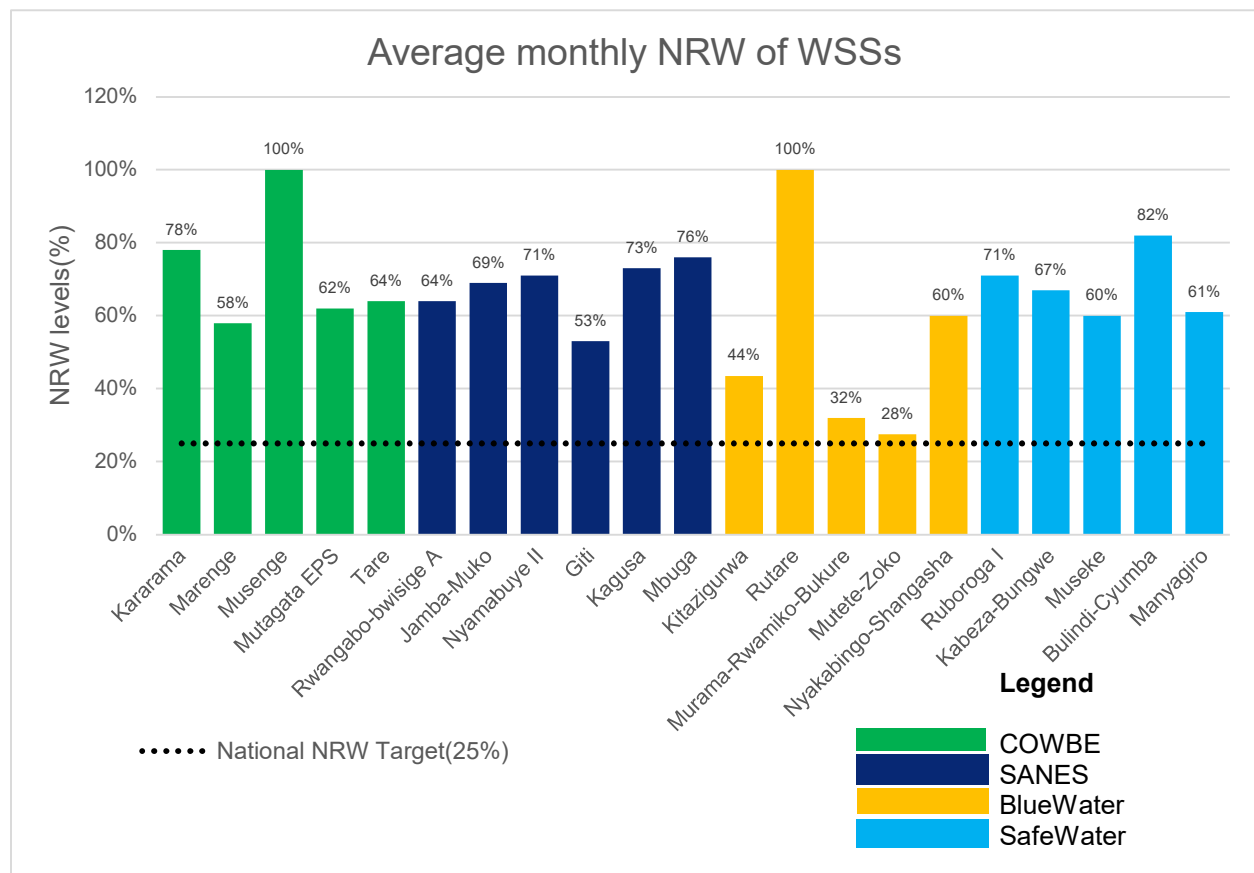


Figure 1: Quarterly average NRW per WSS, with the national benchmark of 25% marked for reference in both Rulindo and Gicumbi Districts, 2025.

## Gicumbi District

The assessment in Gicumbi covered all three private operators operating in the district. Like Rulindo, all systems with sufficient data are well above the NRW benchmark. The chart (Figure 1) presented above illustrates the performance of the assessed systems. The results show significant fluctuations and failures, with systems like **Kagusa** and **Mbuga** reporting 100% NRW for specific months (refer to Annex 1) due to a complete absence of billing. **Zoko-Mutete** system, with a 27.5% quarterly average, was the best performer but still fell short of the national target.

Below are the private operators and WSSs managed in the district:

- **SANES Ltd:** manages 39 Water Supply Systems, among which 33 are gravity-fed without bulk meters, while 6 are motorized and equipped with functioning bulk meters.
- **Bluewater Supply Company Ltd:** manages 26 Water Supply Systems, where 20 are gravity-fed without bulk meters and 6 are motorized, of which 5 of them have bulk meters.
- **Safe Water Supply Company Ltd:** manages 32 Water Supply Systems, among which 27 are gravity-fed without bulk meters, while 5 are motorized with functioning bulk meters.

The chart (Figure 2) below shows the private operator ranking considering the average NRW level for the two districts. It shows how the NRW issue is alarming and should be treated as an emergency case across private operators to sustain the WASH Sector.

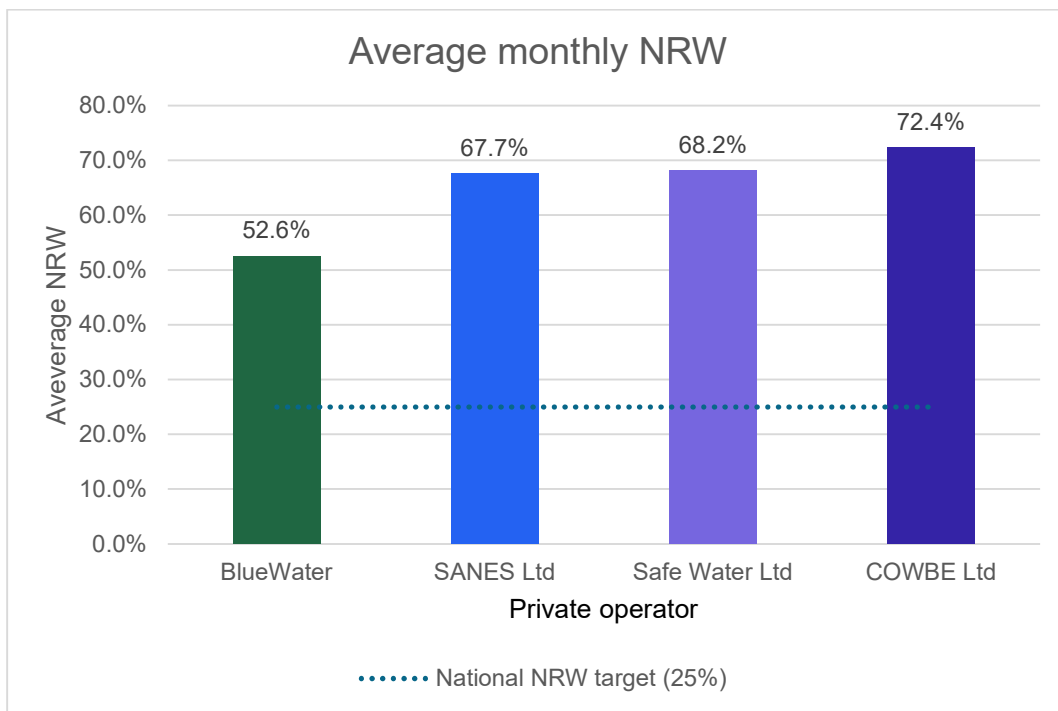


Figure 2: Private operator NRW monthly averages for Rulindo and Gicumbi District, 2025.

## Trend analysis and patterns

- **Monthly variability:** Most systems showed high month-to-month NRW fluctuations, indicating irregular billing practices rather than consistent operational issues. For example, Marengé WSS varied from 11% to 97% across the three months. (refer to Annex 1 for monthly NRW per WSS).
- **Billing irregularities:** Multiple instances of 100% NRW indicate complete billing failures rather than physical water losses, particularly evident in Musenge and Rutare systems.

- **Baseline comparisons:** Where baseline data were available, most systems showed deteriorating performance. Jamba-Muko increased from 46% to 69%, while Murama-Rwamiko-Bukure improved significantly from 87% to 32%.
- **Infrastructure correlation:** Systems with functioning bulk meters and active billing showed more consistent (though still high) NRW levels compared to systems with billing irregularities.
- **Gravity fed systems:** It was observed that most of the gravity-fed systems don't have bulk meters and therefore their respective performance couldn't be monitored.

The findings revealed systemic challenges that extend beyond individual operator performance, indicating the need for comprehensive interventions that address both technical infrastructure and operational management practices.

## Root cause analysis and proposed interventions

The high NRW levels are a result of intertwined technical and non-technical issues. This section directly links each problem to a clear set of proposed interventions as follows:

### Infrastructure and data gaps

- **Issue:** Most rural WSSs lack bulk meters, making it impossible to measure water production and accurately calculate NRW. Historically, bulk meters were not installed on new water systems.
- **Technical intervention:** Prioritize the installation of bulk meters on all WSSs, especially gravity-fed systems. Once there is sufficient meter coverage, encourage the formation of District Metered Areas (DMAs) which are discrete sections of a water distribution network with defined boundaries that can be closely monitored, to track and reduce NRW effectively.
- **Non-technical intervention:** Enforce mandatory and timely data submission on water production and consumption from all private operators during their regular monthly reporting. This can be a compulsory input into the CMS during each billing cycle.

### Administrative and billing failures

- **Issue:** Widespread administrative errors, including inconsistent billing, incorrect tariffs in the CMS on some WSSs, while others are not present in the CMS, and unbilled periods are major contributors to high NRW.
- **Intervention:** Conduct a joint data cleanup exercise to verify customer lists and WSS, correct tariffs, and ensure consistent monthly billing as a contractual obligation. Ensure that all WSSs are correctly entered into the CMS with accurate attributes.

### Inadequate oversight and enforcement

- **Issue:** Water and Sanitation Corporation (WASAC) and Rwanda Utilities Regulatory Authority (RURA) have not effectively enforced contractual and license obligations on private operators, leading to a culture of non-compliance with reporting and maintenance requirements.
- **Intervention:** WASAC and RURA should establish a clear enforcement mechanism with penalties for non-compliance. Regular, rigorous technical and financial audits of private operators should become standard practice and be enforced by a competent authority.

### Aging infrastructure and physical losses

- **Issue:** Physical water losses due to leaks, bursts, and poorly maintained infrastructure are a known issue that contributes to high NRW.
- **Intervention:** Implement proactive leak detection surveys and establish a rapid response team for repairs with essential plumbing accessories. Operators must develop and adhere to preventive maintenance schedules for all system assets.

### Limited operator capacity

- **Issue:** Many operators lack the institutional capacity for professional record-keeping, billing, and technical maintenance.
- **Intervention:** Provide targeted training and capacity-building support to operator staff on best practices in management, billing, and technical operations.

## Strategic recommendations and action plan

To transition from diagnosis to action, the following phased recommendations, along with a clear action plan, are proposed for all key actors involved in the WASH sector. According to the actions to be undertaken, three phases are proposed, which are firstly the **short-term** that covers the first 6 months, the **medium-term** which spans from the 6 months to 18 months, and the **long-term** phase which spans beyond the 18 months as described below:

### Short-term (0-6 months)

- **WASAC and District:** Empower the District NRW Task Force to enforce immediate data compliance from all private operators and apply contractual penalties for failures.
- **Private operators:** Cooperate with WASAC-led data audit to correct tariffs, customer records, and billing practices to ensure the CMS content reflects the reality on the ground.
- **WASAC and RURA:** Provide technical guidance to the District Task Force on data validation and compliance enforcement.

- **Community groups:** Report issues (leaks, illegal connections, outages, etc.) and be engaged in water governance.

### Medium-term (6-18 months)

- **WASAC and District:** Mobilize resources and lead the installation of bulk meters at all WSSs.
- **Private operators:** Actively implement district-wide leak detection campaigns and establish a rapid repair mechanism to keep the response time to a minimum.
- **WASAC, RURA, and Local Government:** Institutionalize NRW Task Forces across all districts and integrate NRW control into licensing framework and operator performance indicators.
- **RURA:** Link NRW performance to private operator license renewals.
- **WASAC and Development Partners:** Provide technical and financial support for capacity-building workshops for operator staff and the implementation of new infrastructure.

### Long-term (18+ months)

- **RURA and WASAC:** Undertake a comprehensive review of the rural water management model to create a more robust, accountable, and sustainable framework. Mainly leading to the **performance-based management systems** that incentivize sustainable NRW reduction and service improvement.
- **RURA:** Review and potentially adjust the rural water tariff structure to ensure financial sustainability while balancing affordability for communities. This should go along with monitoring compliance and enforcing penalties for persistent high NRW.
- **Central Government and Development Partners:** Organize an annual competition among private operators and reward those who performed well in NRW reduction as per the National threshold.
- **Central Government:** Include in the policy framework the mandatory NRW  $\leq 25\%$  as it is enforced on electricity consumption at the water pumping stations, where the power factor should be  $\geq 0.9$ ; otherwise, a penalty is applied.

The success of these recommendations depends on sustained commitment from all stakeholders, adequate resource mobilization, and effective coordination through the established Task Force mechanisms. Regular monitoring and adaptive management will be essential to ensure interventions remain relevant and effective as conditions change and improvements are achieved.

## Financial analysis: Revenue impact of reducing NRW

This financial analysis complements the NRW technical aspect by quantifying the monthly revenue gains that private operators could achieve if they reduce Non-Revenue Water (NRW) to the national benchmark of 25% and to the aspirational target of 20% with consideration of only the water supply systems discussed in the technical section for each private operator (refer to Annex 2 for detailed data). The figure below is an illustrative comparison of average monthly additional revenues per private operator under the two NRW reduction scenarios:

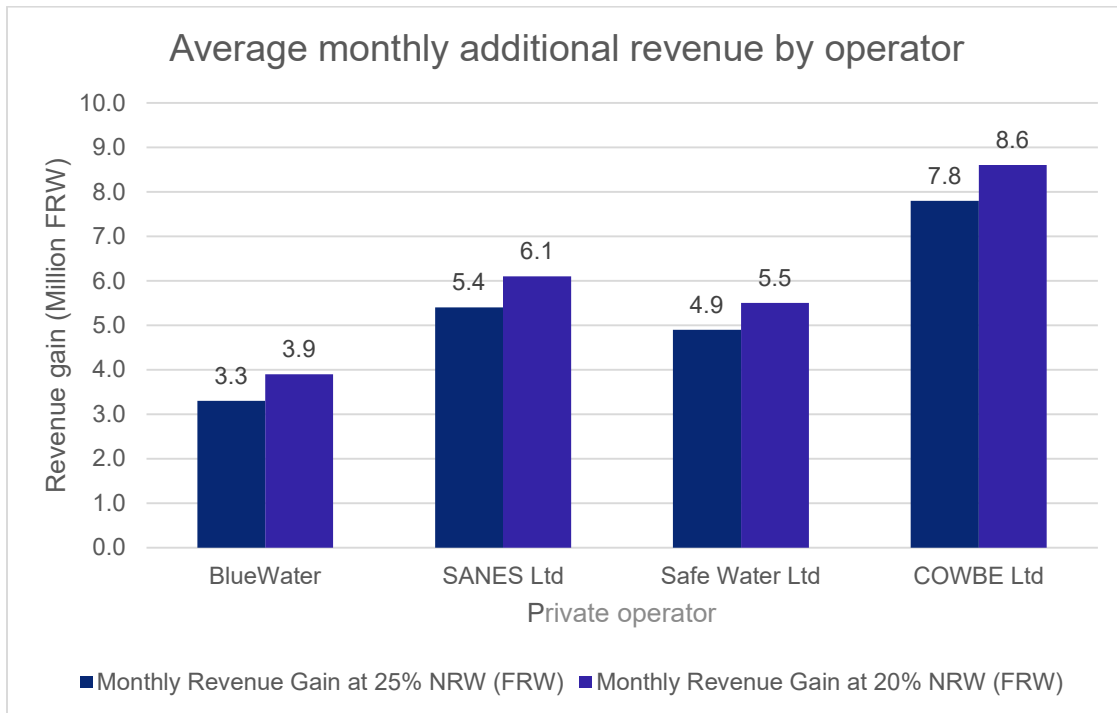


Figure 3: Comparative illustration of financial gain for two scenarios per each private operator

### Key financial insights

- **Direct revenue gains:** Each private operator can significantly boost revenues from 7 to 9 million FRW monthly for the largest water producer (COWBE Ltd).
- **Marginal benefits of going beyond 25%:** Pushing NRW reduction from 25% to 20% yields an extra 0.5–0.8 million FRW monthly per private operator.
- **Operational efficiency:** Higher billed volumes mean improved cost recovery, better capacity for maintenance, and reduced reliance on subsidies.
- **Reinvestment opportunity:** Additional revenues could fund bulk meters, leak detection, and preventive maintenance, enabling sustained low NRW.

This financial analysis revealed that reducing NRW to 25% ensures strong financial improvement for each operator, while moving further to 20% unlocks even greater benefits. These gains can transform the financial sustainability of rural water supply systems in Rwanda, providing private companies operating water services with the resources needed for reinvestment, improved service delivery, and long-term sector resilience.

## Performance monitoring and evaluation framework

Effective performance monitoring and evaluation are critical to achieving sustainable reductions in Non-Revenue Water (NRW). This framework outlines key performance indicators and robust monitoring mechanisms to track progress, ensure accountability, and guide data-driven decision-making. It aims to improve service delivery, enhance financial sustainability, and promote transparency across all operations.

### a. Key Performance Indicators:

- **NRW levels:** For all systems, all private operators should score  $\leq 25\%$  by the end of year 2, and  $\leq 20\%$  by the end of year 5.
- **Data completeness:** All operators should achieve 100% monthly data submission within 6 months through CMS and other required reporting channels, as per the contract and license.
- **Customer satisfaction:** All private operators will register  $\geq 80\%$  customer satisfaction with service reliability by the end of year 2. A customer satisfaction survey should be regularly conducted using an agreed-upon tool(s).
- **Financial sustainability:** All operators should strive to achieve cost recovery to cover infrastructure maintenance and OPEX by the end of year 3.

### b. Monitoring mechanisms:

- Monthly NRW performance tracking with automated reporting systems through CMS. This can be achieved by obligating the insertion of bulk meter indices with their pictures in the CMS on a monthly specified date, then NRW will be automatically calculated once the billing cycle is closed.
- Quarterly NRW Task Force meeting for NRW performance review with official reporting.
- Annual comprehensive sector performance assessments at the district level.
- Quarterly customer satisfaction surveys and community feedback systems.

## Conclusion

The high levels of Non-Revenue Water in Gicumbi and Rulindo Districts present a clear threat to the long-term sustainability of rural water services. This analysis has exposed the critical need for a holistic approach that addresses both technical deficiencies and, more importantly, the systemic non-technical failures in management and oversight. The proposed recommendations and action plan provide a clear and actionable path forward. By focusing on data integrity, infrastructure investment, and stakeholder accountability, the service providers can take a decisive step towards achieving the national NRW benchmark and securing a more sustainable future of water service for the communities.

## References

1. Rwanda National Water Supply policy implementation strategy (MININFRA,2016)
2. Rwanda National water and sanitation policy (MININFRA, 2023)
3. Rural water tariff decision (RURA,2017) - Tariff structure framework
4. Water tariff for end user (RURA, 2019)
5. WATSAN SSP 2018-2024 (MININFRA, 2018)

## Annexes

### Annex 1: NRW data tables per WSS/Operator/Month

#### a. Rulindo District

**Table 1: COWBE Ltd. NRW levels (April-June 2025)**

S/N	WSS Name	NRW Baseline (March 2025)	NRW April 2025	NRW May 2025	NRW June 2025	NRW Quarterly Average
1	Kararama		78%	88%	68%	78%
2	Marenge		68%	97%	11%	58%
3	Musenge		100%	100%	100%	100%
4	Mutagata EPS		80%	40%	67%	62%
5	Tare	25%	81%	76%	33%	64%

#### b. Gicumbi District

**Table 2: SANES Ltd. NRW levels (April-June 2025)**

S/N	WSS Name	NRW Baseline (March 2025)	NRW April 2025	NRW May 2025	NRW June 2025	NRW Quarterly Average
1	Rwangabo-bwisige A		-55%	40%	88%	64%
2	Jamba-Muko	46%	81%	79%	47%	69%
3	Nyamabuye II		69%	79%	64%	71%
4	Giti		50%	82%	27%	53%
5	Kagusa		44%	74%	100%	73%
6	Mbuga		44%	100%	83%	76%

**Table 3: BlueWater Supply Company Ltd. NRW levels (April-June 2025)**

S/N	WSS Name	NRW Baseline (March 2025)	NRW April 2025	NRW May 2025	NRW June 2025	NRW Quarterly Average
1	Kitazigurwa			34%	53%	43.5%
2	Rutare			100%	100%	100%
3	Murama-Rwamiko-Bukure	87%	16%	38%	42%	32%
4	Mutete-Zoko			29%	26%	27.5%
5	Nyakabingo-Shangasha			60%	-29%	60%

**Table 4: Safe Water Supply Company Ltd. NRW levels (April-June 2025)**

S/N	WSS Name	NRW Baseline (March 2025)	NRW April 2025	NRW May 2025	NRW June 2025	NRW Quarterly Average
1	Ruboroga I	90%	49%	77%	87%	71%
2	Kabeza-Bungwe		31%	81%	90%	67%
3	Museke		50%	59%	72%	60%
4	Bulindi-Cyumba		83%	79%	84%	82%
5	Manyagiro		40%	63%	80%	61%

## Annex 2: Financial analysis of NRW implications per private operator, considering the WSSs analysed

**Table 5: Average monthly water production per private operator, considering the WSSs analysed**

S/N	Private operator	Average monthly NRW(%)	Average monthly water production (m3)	Tariff(FRW/m3)
1	BlueWater	52.60%	13963.33	863
2	SANES Ltd	67.70%	14724.33	863
3	Safe Water Ltd	68.20%	13206.67	863
4	COWBE Ltd	72.40%	18965.1	863

**Table 6: Monthly revenue increase per private operator from the reduced NRW on the discussed WSSs, two scenarios analyzed**

Private operator	Current monthly Avg. NRW (%)	Monthly Revenue Gain at 25% NRW (FRW)	Monthly Revenue Gain at 20% NRW (FRW)
<b>BlueWater</b>	52.6%	3.3 million	3.9 million
<b>SANES Ltd</b>	67.7%	5.4 million	6.1 million
<b>Safe Water Ltd</b>	68.2%	4.9 million	5.5 million
<b>COWBE Ltd</b>	72.4%	7.8 million	8.6 million

### Annex 3: Key words used in the technical note

- **Bulk Meter:** Primary water meter installed at system intake or production point to measure total water produced.
- **Customer Management System (CMS):** Software system used by Private Operators to manage customer accounts, billing, and revenue collection. It is managed under the Rwanda Utility Regulatory Authority (RURA).
- **District Metered Area (DMA):** Discrete area of water distribution network with defined boundaries where water flow can be measured and monitored.
- **Non-Revenue Water (NRW):** The difference between the amount of water put into the distribution system and the amount of water billed to customers, expressed as a percentage of water produced.
- **Private Operator (PO):** Licensed entity by RURA and contracted by WASAC Group to manage rural Water Supply Systems, including operations, maintenance, and customer service.
- **RURA:** Rwanda Utilities Regulatory Authority (RURA) was established by the Government of Rwanda in 2001 with the mission to regulate certain public Utilities, including water supply services.
- **WASAC:** The Water and Sanitation Corporation (WASAC Group) was established by the Government of Rwanda in September 2023 to oversee the country's water and sanitation services.
- **Water Supply System (WSS):** Complete water supply infrastructure including source, treatment, storage, and distribution components serving a defined service area.



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