PAPER 5

FLOWING FORWARD WITH A RAPID RESPONSE UNIT: SUSTAINABLE ENGINEERING SOLUTIONS THROUGH STRATEGIC MIG-FUNDED REFURBISHMENTS

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ABSTRACT

Many municipalities across South Africa are under increasing pressure to improve water supply reliability and compliance, particularly where infrastructure failures at water treatment works (WTWs) and distribution systems which can result in service interruptions, poor water quality, and increased operational costs and health risks. Loadshedding, lack of standby equipment, ageing infrastructure, and limited operator support and underfunded routine operations and maintenance activities all contribute to unsustainable system performance.

In response, Amathole District Municipality (ADM) took a pro-active approach to the challenge by developing a structured, engineering-led strategy to unlock a portion of Municipal Infrastructure Grant (MIG) funding-specifically the provision in Schedule 5, Part B of the 2023 National Treasury Guidelines, which allows municipalities with non-compliance directives from the Department of Water and Sanitation to allocate up to 10% of their MIG funding toward urgent repairs and refurbishments, provided asset-based evidence such as an Infrastructure Asset Management Plan is available.

Using existing Asset Management Plans, Water Safety Plans and Process Audits, along with condition assessments from engineering site inspections, JG Afrika, the project consultant, formulated a data-driven prioritisation framework. This framework was used to identify, justify and package high-impact infrastructure upgrades for rapid implementation. Priority interventions included the installation of standby pumping and dosing systems, safety enhancements for plant operators, and targeted refurbishment of critical mechanical and electrical components. These measures were designed to restore operational resilience, improve compliance with water quality standards, and reduce unplanned downtime. The initiative also included cost projections, implementation strategies, and socio-economic upliftment opportunities through supporting local suppliers and contractors where possible. This multi-layered strategy successfully enabled the unlocking of MIG funding and partnership with the Amathole District Municipality and JG Afrika developed a Rapid Response Unit which accelerated implementation timelines and initiated the stabilisation of water supply systems previously reliant on unsustainable emergency measures such as water tankering.

This work illustrates a scalable and replicable model for municipalities aiming to convert regulatory directives into actionable engineering solutions. The development of the ADM Rapid Response Unit demonstrates an approach that other municipalities can replicate to turn regulatory non-compliance into targeted investment opportunities. By aligning technical evidence and investigations with funding eligibility criteria, municipalities can reframe infrastructure risk as an opportunity for investment, while reinforcing broader goals of sustainability and service delivery equity.

INTRODUCTION

Across South Africa, the reliable provision of potable water remains a critical developmental and public health priority. However, many municipalities face increasing difficulties in meeting national standards for water quality and supply reliability due to widespread infrastructure degradation, operational inefficiencies and financial resources. Water Treatment Works and pump stations have become focal points of concern. These facilities are increasingly plagued by infrastructure failures that contribute to frequent service interruptions, a decline in treated water quality, and a rise in operational costs. (Department of Water and Sanitation, 2023). These challenges are further compounded by recurrent electricity outages, vandalism, and ageing mechanical and electrical components. In addition, there are insufficient standby systems. This refers both to a lack of backup power generation capacity, such as diesel generators, and to inadequate or earlier failure of standby infrastructure in critical treatment processes. Together, these factors significantly compromise the operational resilience of these facilities (SALGA, 2022).

Recognising these sector-wide risks, the National Treasury introduced a key amendment to the 2023 Municipal Infrastructure Grant (MIG) Guidelines. Schedule 5, Part B of the Division of Revenue Act (DoRA) (Government Gazette No. 48017 of 10 February 2023) which enables municipalities to allocate up to 10% of their MIG allocation for urgent repairs and refurbishments of water infrastructure, provided the interventions are supported by data from Asset Management Plans and non-compliance pre-directives or directives from the Department of Water and Sanitation (DWS).

The paper provides a replicable framework and approach that municipalities across the country can use to unlock conditional MIG funding, based on evidence-based prioritisation aligned with national compliance and sustainability goals. The framework contributes to the shift from reactive maintenance towards proactive, risk-informed investment in municipal water infrastructure improving water quality, service continuity, and public health outcomes.

MUNICIPAL INFRASTRUCTURE CHALLENGES IN THE WATER SECTOR

Municipal water-services authorities (WSAs) are grappling with mounting Blue-Drop non-compliance, electricity instability, aging assets, and asset failure. In 2023 only 26 of the country's 958 water-supply systems (2,7%) achieved full Blue-Drop certification, while 277 systems (29%) were rated "critical" and 46% of all supplies failed microbiological quality limits (DWS, 2023a). These Water Treatment Works are operating beyond their design life with severely degraded mechanical, electrical, and civil components. As a result, municipalities face increasing difficulty in meeting the compliance requirements of the Department of Water and Sanitation in terms of the SANS 241 National Standards for Drinking Water Quality and Blue Drop Certification Programme (DWS, 2023b).

A key challenge is the prevalence of equipment failures in critical treatment infrastructure, particularly at smaller or rural WTWs. Ageing pump sets, corroded pipelines, outdated electrical switchgear, and dosing systems

lead to frequent process interruptions and compromised water quality. In many cases, these facilities lack functional standby units, meaning that a single point of failure such as a dosing pump or motor control centre (MCC) panel can result in complete process failure. The absence of duty-standby configurations significantly reduces system resilience, forcing municipalities to revert to costly and temporary emergency measures such as water tankering or borehole abstraction.

Electricity outages have further exacerbated the situation. Unpredictable power disruptions impair the continuity of treatment processes, including chemical dosing, filtration, and disinfection. Many WTWs are not equipped with reliable backup power systems or automated switchover functionality, making them highly vulnerable to power supply interruptions. The resulting downtime undermines the municipality's ability to meet basic service delivery mandates, while also exposing communities to water quality risks. This is further compounded over time by increased population and subsequent water demand in the supply system which has reduced the designed buffer storage in command and distribution reservoirs.

From a financial perspective, most municipalities face severe budget constraints, with operational expenditure prioritised for salaries, fuel, and emergency responses rather than long-term asset renewal. The misalignment between operational needs and capital budgeting processes means that critical infrastructure often remains unrepaired until it reaches total failure (National Treasury, 2023).

In some contexts, infrastructure vandalism and theft are a challenge. The lack of perimeter fencing, lighting, and security guards at water treatment facilities exposes critical assets to theft of cables, motors, and pipes often shortly after repairs have been completed. The resulting losses deepen the financial burden on municipalities and delay infrastructure recovery.

The cumulative effect of these challenges is a growing infrastructure backlog and a declining service delivery and operational performance in municipal water services.

Addressing these challenges requires a systematic and controlled approach rather than isolated technical interventions. It necessitates a structured, engineering-led approach to identify, prioritise, and implement infrastructure repairs based on risk, compliance, and service impact. The framework presented in this paper responds directly to this need, offering a methodology to operationalise the 10% MIG allocation in a manner that is both technically sound and administratively defensible.

ENGINEERING-LED PRIORITISATION FRAMEWORK FOR MIG FUNDING

Schedule 5, Part B of the Division of Revenue Act (DoRA) (Government Gazette No. 48017 of 10 February 2023) states "Municipalities with non-compliance pre-directives or directives from the Department of Water and Sanitation may use up to 10% of their MIG allocations for urgent repairs and refurbishments, provided data is based on asset management plans". This enables municipalities to divert a portion of their capital MIG funding toward urgent refurbishment and rehabilitation works, traditionally not funded through MIG. This provision is not arbitrary but conditional, requiring municipalities to demonstrate regulatory non-compliance (e.g., Blue Drop failures or DWS directives) and to present supporting asset-level evidence in the form of a verified Infrastructure Asset Management Plan (IAMP).

The approach undertaken is structured around a framework that integrates compliance requirements, asset management systems, and technical condition assessments to support municipalities in unlocking MIG funding for urgent repairs and refurbishments.

The process is initiated through the identification and analysis of non-compliance pre-directives and directives issued by the Department of Water and Sanitation. These directives serve as formal notifications of infrastructure deficiencies or regulatory breaches and are explicitly referenced in the Division of Revenue Act as a necessary condition for MIG allocation. As such, they provide both a regulatory imperative and a prioritisation mechanism for remedial investment.

In parallel, the municipality must develop/have an Asset Management Plan (AMP) to consolidate information on the condition, function, and criticality of water infrastructure assets. The AMP includes asset registers, age profiles, maintenance histories, and performance indicators forming the data foundation for subsequent funding justification. This plan ensures that infrastructure interventions are not isolated responses, but part of a structured asset life-cycle management process.

With the municipalities AMP in place, targeted condition assessments were conducted across identified WTWs and pump stations which had been identified as high-risk assets. These assessments, led by civil, mechanical, and electrical engineering teams, evaluated the operational state of process units such as:

- Raw and clear water pumps
- Dosing equipment
- MCC panels and electrical switchgear
- Clarifiers and filters
- Pipework and valves
- Reservoirs
- Site security, staff facilities, lighting and fencing

An assessment team from the project consultant comprised civil, mechanical, and electrical engineers supported by the municipality's operational staff, with field observations visited various strategic sites. The assessment validated against available historical incident logs, operators interviews and visual inspections.

The prioritised scope of work is then used to compile the MIG funding submission. This submission includes the AMP, directive documentation, technical assessment reports, cost estimates, and an implementation plan that outlines procurement strategies and EPWP job creation targets. Risk mitigation measures, environmental compliance considerations, and monitoring indicators are incorporated to ensure alignment with regulatory and transformation objectives.

Once approved, the implementation phase is managed using standard project controls, with progress tracked against defined performance indicators. Local SMMEs and community-based labour are prioritised, linking capital investment to local economic development.

Recognising the high incidence of theft and vandalism at remote and unsecured sites, the implementation sequence was adjusted, where possible, to first secure the physical environment before introducing high-value mechanical and electrical equipment. As such, initial interventions focused on installing perimeter fencing, security lighting, and access control measures to safeguard the sites. These preventative works were essential to reduce the risk of asset theft and reoccurring damage, common issues that had previously resulted in repeated service interruptions and financial losses.

Once adequate site security had been established, the project proceeded with the installation of priority mechanical and electrical components, including pump refurbishment, MCC panel replacement, dosing system reinstatement, and the provision of standby pumps to restore core treatment functionality. This staged approach improved the longevity of the repairs and ensured that newly installed infrastructure would be protected from immediate compromise. Civil repairs, such as reservoir rehabilitation, the replacement of damaged doors and windows, and the repair of roof structures, were undertaken as a subsequent phase to restore

the structural integrity and operability of the facilities. This staged and risk-informed implementation strategy ensured that critical infrastructure was both protected and functional, enabling a sustainable return to service for affected Water Treatment Works and pump stations.

This framework transforms infrastructure non-compliance from a liability into a structured investment opportunity. It provides municipalities with a replicable, engineering-led approach to infrastructure renewal that is rooted in evidence, aligned with national policy instruments, and responsive to both technical and socio-economic imperatives within a prioritised approach.

RAPID RESPONSE UNIT – DEMONSTRATING IMPACT THROUGH URGENT INFRASTRUCTURE INTERVENTIONS

In support of the MIG-funded engineering prioritisation framework, the municipality's and project consultant's Rapid Response Unit provided fast-tracked, technically informed interventions at high-risk water infrastructure sites. This response was able to stabilise failing water systems through evidence-based, phased and prioritized refurbishment works, especially in areas where water supply disruptions pose an immediate risk to public health, education, or basic services.

The following implementation examples demonstrates this Rapid Response Unit approach in action.

1. Rehabilitation of a Vandalised Rural School Pump Station

A remote booster pump station supplying a public school with 220 students had become fully inoperative due to extensive vandalism and theft. The site inspection revealed that only a single pump casing remained, stripped of its motor, with no functional MCC panel and no standby pump in place. The command reservoir, designed to provide gravity-fed water to the school, was reportedly leaking and out of use, forcing the school to depend on a private borehole that was unable to meet demand. To address this, the Rapid Response Unit of the project consultant and the municipality executed an intervention. The site was first secured through the installation of fencing and solar lighting.

A simplified MCC panel was supplied and commissioned along with a new duty pump, electrical cabling, float switches, and pressure protection controls. To restore water access while long-term reservoir repairs are scoped, two elevated 2,500L Plastic tanks were installed and connected to a 600 m HDPE bypass pipeline. Structural works were also completed, including the repair of the pump house roof, doors, and windows to prevent future asset damage. This intervention restored water delivery and significantly reduced the risk of further theft.

2. MCC and Suction Header Replacement at a Water Treatment Works

A critical Water Treatment Works (WTW) was operating under significant risk due to corroded suction pipework and an outdated MCC panel with no active protection mechanisms. The condition of the infrastructure posed a high likelihood of unplanned shutdowns and pump motor failures, threatening the continuity of potable water supply to the surrounding

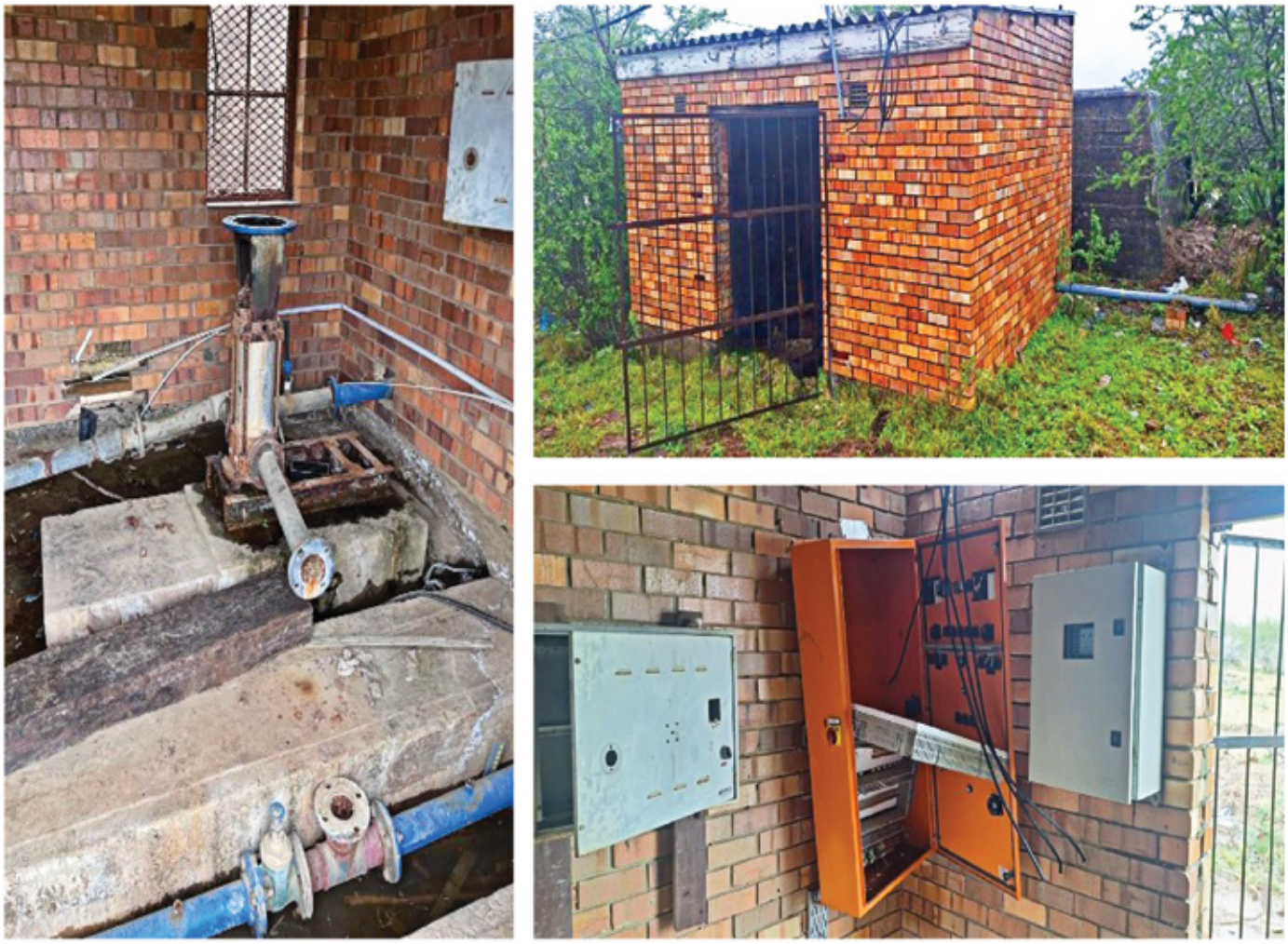

FIGURE 1: *Non-Operational Pump Station with damaged and missing infrastructure*

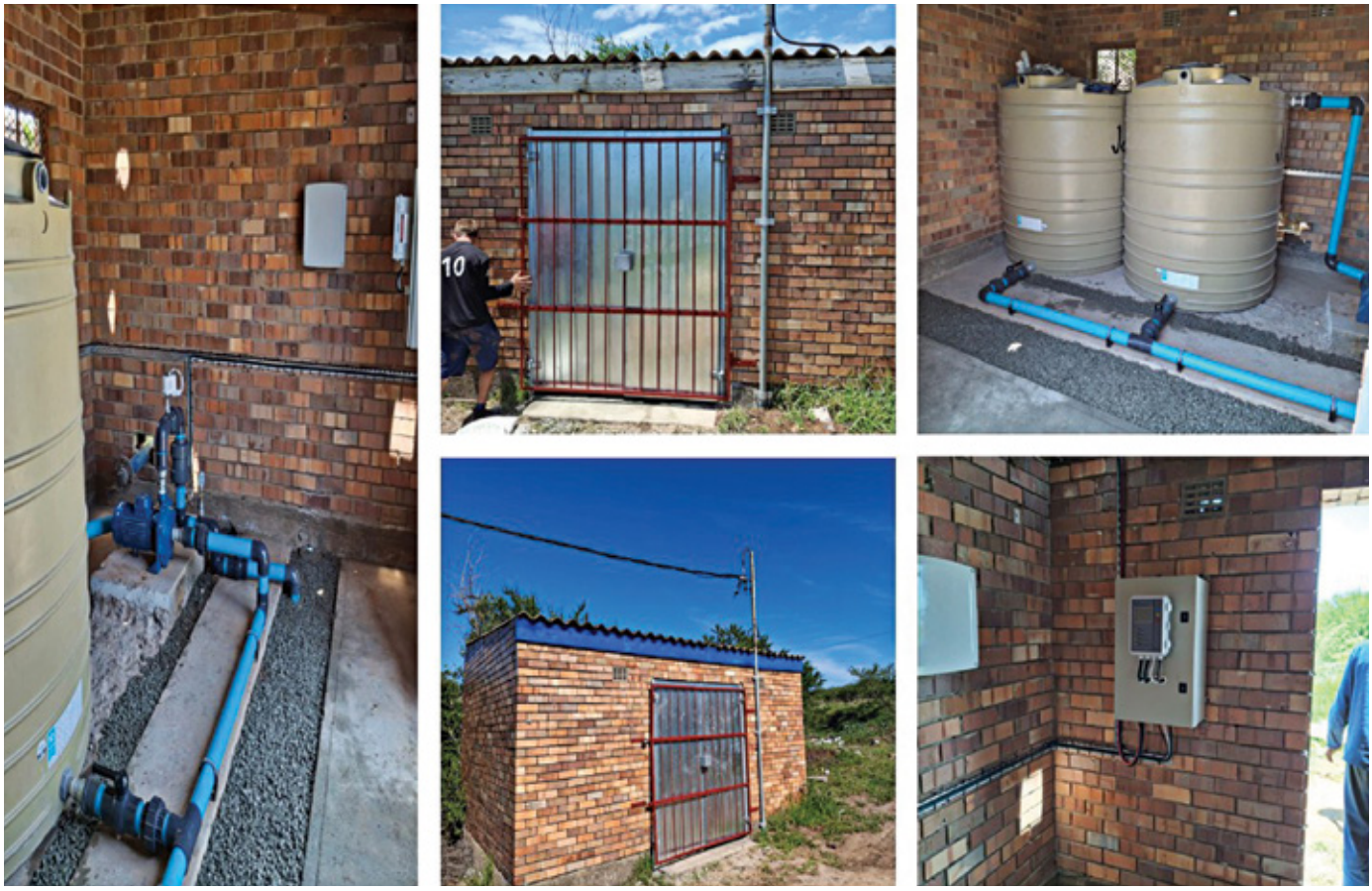

FIGURE 2: *Rehabilitated and operational pump station after Rapid Response Unit works*

community. In response, the Rapid Response Unit conducted a scheduled 12-hour shutdown to facilitate the safe removal and replacement of deteriorated pipe sections and valves. Temporary pipework was fabricated on-site to allow continuous pump operation while coated permanent pipe spools were prepared off-site for future installation. A temporary MCC panel and distribution board were installed to maintain full power supply to the treatment units during the transitional phase. As part of the scope, Bermad pump control valves were serviced and calibrated to reintroduce pressure and flow regulation. This intervention ensured that operations remained uninterrupted throughout the works and set the groundwork for permanent system upgrades, pending access road improvements for equipment transport.

3. Emergency Roof Retrofit for Clear Water Reservoir

During a routine infrastructure assessment, a clear water reservoir servicing a local community was found to have a severely damaged roof, which compromised the quality of stored potable water. Holes in the roof allowed debris, insects, and light ingress, increasing the risk of microbial regrowth and non-compliance with potable water quality standards. The Rapid Response Unit prioritised an urgent retrofit to address the risk. The failing roof structure was dismantled and replaced with new galvanised portal steel frame and corrugated sheeting. A vapour barrier and wall-to-roof sealants were installed to ensure a hygienic storage environment. To improve ventilation and reduce condensation within the reservoir, passive roof vents were incorporated into the design. A lockable access hatch was

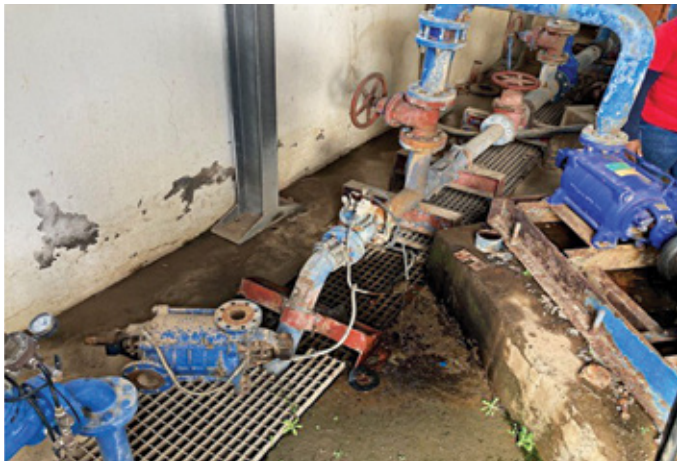

FIGURE 3: *Suction pipework in advanced state of corrosion (before)*

FIGURE 4: *MCC and new pipework in service (after)*

FIGURE 5: *Damaged Potable Water Storage Reservoir (before)*

also included to comply with confined-space entry regulations. This work restored structural integrity, reduced water quality risk, and supported improved compliance with the Blue Drop regulatory standards.

The successes documented in ADM's case are not solely attributable to the existence of the Rapid Response Unit (RRU), but rather to the enabling structure it provided. In principle, any municipality could achieve similar outcomes, provided it has internal capacity to undertake prioritised assessments, rapidly package compliant MIG submissions, and coordinate implementation in a phased, risk-informed manner. However, in practice, the RRU model significantly enhances agility, technical oversight, and accountability. By embedding engineering expertise, contractor coordination, and municipal liaison into a dedicated unit, the RRU bridges the institutional gaps that typically delay or derail refurbishment efforts. Without such a unit, municipalities would need to rely on standard internal processes, which are often fragmented across departments and not optimised for urgent works. Thus, while the RRU is not the only route

FIGURE 6: *New roof installation with passive venting and secure access (after)*

to success, it represents a replicable institutional mechanism to fast-track delivery and mitigate failure risk, especially under tight compliance and funding timelines.

OUTCOMES AND LESSONS LEARNED

The implementation of the engineering-led prioritisation framework for urgent water infrastructure refurbishment yielded a number of significant outcomes, both in terms of operational performance and institutional capacity.

Improved Infrastructure Resilience and Functionality

The phased and prioritised approach is key to preventing knee-jerk responses to infrastructure breakdowns. Instead, it enables the strategic investment of limited funds based on engineering risk assessments. By beginning with condition assessments and risk profiling, followed by physical site security, and then mechanical, electrical, and civil upgrades, the approach delivered measurable improvements in infrastructure performance. Targeted interventions at key water treatment works and pump stations restored core treatment capacity, improved process reliability during electricity outages, and reduced the frequency of emergency service disruptions such as water tankering. The inclusion of standby pumps and MCC panels allowed for more consistent service delivery even during adverse operating conditions.

Reduced Incidence of Theft and Vandalism

By addressing security vulnerabilities upfront, including fencing, lighting, and controlled access, the municipality was able to significantly reduce the reoccurrence of theft and asset damage during and after implementation. This not only protected the capital investment but also improved operator safety and community trust in municipal services.

Evidence-Based Decision-Making and Regulatory Alignment

The use of DWS directives, asset management plans, and structured condition assessments provided a credible and auditable foundation for the MIG funding application. This strengthened the municipality's engagement with national and provincial stakeholders, improved compliance with regulatory instruments, and fostered a culture of proactive maintenance planning rather than reactive response.

Scalability and Replicability

Most importantly, the framework has demonstrated that a replicable model for emergency water infrastructure recovery can be operationalised within existing policy and funding mechanisms. With appropriate project management & controls, technical support, and financial management municipalities elsewhere can adapt this model to develop their own regulatory, financial, and operational contexts in the form of a Rapid Response Unit.

CONCLUSIONS

Water infrastructure failure remains a persistent barrier to equitable service delivery in South Africa's municipalities. However, the revised MIG funding provisions offer Municipalities a significant opportunity to address these challenges through targeted technical interventions. These interventions are guided by risk rankings derived from asset condition assessments, compliance urgency (as indicated in DWS directives and Blue Drop audit findings), and implementation feasibility. Persistent non-compliance with SANS 241 National Standards for Drinking Water Quality and the low achievement of Blue Drop certification across the country underscore the urgent need for structured and timely upgrades (DWSc, 2023a; SANS, 2015). The Rapid Response Unit, developed in partnership with the Amathole District Municipality and JG Afrika, enabled the implementation of urgent infrastructure upgrades and repairs aimed at restoring both treatment functionality and regulatory compliance and ultimately improving service delivery to the consumers in the ADM supply region.

The development of the ADM Rapid Response Unit is an approach that can enable other municipalities to replicate to turn regulatory non-compliance into targeted investment opportunities. It uses operational risks, such as those highlighted in Blue Drop assessments, as a trigger to implement sustainable improvements in service delivery. By integrating existing asset management data, engineering expertise, and funding criteria, municipalities can proactively address infrastructure deficiencies while advancing broader developmental goals, including public health protection and service equity.

RECOMMENDATIONS

To strengthen municipal water infrastructure resilience and improve compliance with SANS 241 and the Blue Drop Certification Programme, it is recommended that future MIG-funded interventions adopt a structured, phased approach beginning with site security, followed by critical mechanical and electrical upgrades, and lastly, civil repairs. Municipalities should institutionalise Asset Management Plans (AMPs) as living tools to guide funding justification and ensure alignment with DWS compliance directives and Blue Drop audit requirements. Establishing dedicated Rapid Response Units can accelerate urgent works at high-risk sites, reduce system downtime, and safeguard infrastructure from recurring vandalism and theft. Furthermore, the integration of local SMMEs and EPWP labour should be prioritised to enhance socio-economic impact and community ownership. Standardising these practices across municipalities can enable national replication, improve service reliability, and support long-term, sustainable infrastructure recovery.

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