

Analysis of challenges affecting access to water in rural communities within the Greater Giyani Municipality

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ABSTRACT

Rural communities in the Greater Giyani Municipality (GGM) are facing water access challenges for over a decade. Intervention measures were taken by the national government to ensure access water, however, the rural communities in GGM are still in dire need of water. The research methodology adopted the qualitative approach which deployed literature review, document analysis, interviews, case studies and observations for data collection. Thematic analysis was adopted to present the results and findings of the study. It was found that water sources, bulk water distribution, water reticulation, implementation of plans, policy and legal documents, and compliance with the blue drop and green drop programme were the major challenges affecting access to water. Therefore, the study recommended the implementation of resource-directed measures, review of water use authorisations, adoption of adaptive water management approach, implementation of preventive and corrective maintenance, upgrading of water infrastructure, implementation of water conservation and water demand management strategy, employment of water law enforcement officers, enhancement of public participation for women, and improvement in the implementation of water planning and legal documents.

Keywords: water access, water availability, water quality, water infrastructure, water management, and climate change.

ABBREVIATIONS AND ACRONYMS

ANC	African National Congress
BD	Blue Drop
BDRR	Blue Drop Risk Rating
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
COVID-19	Coronavirus Disease 2019
CMA	Catchment Management Agency
DMA	District Metered Areas
FBW	Free Basic Water
GD	Green Drop
GGM	Greater Giyani Municipality
GPW	Government Printing Works
IDP	Integrated Development Plan
IWRM	Integrated Water Resource Management
JUSCO	Jamshedpur Utilities and Services Company
MDM	Mopani District Municipality
MSA	Municipal Systems Act
NMAR	Natural Mean Annual Runoff
NRW	Non- Revenue Water
NWA	National Water Act
NWRS	National Water Resource Strategy
O&M	Operation and Maintenance
RDM	Resource Directed Measure
RQOs	Resource Quality Objectives
SAHRC	South African Human Rights Commission
SAM	Strategic Adaptive Management

SANS	South African National Standards
SDG	Sustainable Development Goals
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
WC/WDM	Water Conservation/ Water Demand Management
WHO	World Health Organization
WTW	Water Treatment Works
WUC	Water User Committee
W2RAP	Wastewater Risk Abatement Plan
WSA ₁	Water Services Authority
WSA ₂	Water Services Act
WSDP	Water Service Development Plan
WSP ₁	Water Service Provider
WSP ₂	Water Safety Plan
WSSD	World Summit on Sustainable Development
WWTW	Wastewater Treatment Works

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CHAPTER 1: INTRODUCTION

Challenges over access to water have become a global phenomenon characterised by myriad socioeconomic ills largely affecting rural communities. According to Winkler (2012:3), there are noticeable characteristics of inequality that determine the level of access to water. In concurrence of the latter, Turton (1998:2) state that those who are denied access to water become marginalised socially, economically, and politically and gradually wither away, scientifically referred to as ecological marginalization. The Sustainable Development Goals (SDG) Report 2022 acknowledges that water shortage is increasing mainly due to overwhelming population growth, rapid urbanization, agricultural activities, industrial and energy sectors. The report predicts that the 2030 target of equal access to drinkable water will be missed given the current progress rate, estimating 81 percent coverage, leaving 1.6 billion people without access. To achieve the target by 2030, the current progress rate needs to increase fourfold (United Nations, 2022:38).

Despite South Africa being an arid region, access to water was based on discriminatory apartheid ideologies which left a vast majority of the population excluded from the basic to date. Post-1994, the African National Congress (ANC) introduced democratic legal and policy frameworks to redress the water challenges. Section 27(1)(b) of the Constitution of the Republic of South Africa Act 108 of 1996 states that everyone has a right of access to sufficient water (Dugard, 2021). This section of the Constitution is seldomly realised in most rural communities of South Africa as a basic human right contained in the Bill of Rights. The National Water Act (Act 36 of 1998) of the Republic of South Africa was established in line with the Constitution to exacerbate robust transformation of legal access to water to address economic inefficiencies. Section 43(1) of the NWA promotes fair water reallocation, beneficial water use, resource management, and protection of water quality and ecosystems amongst other things (Schreiner & Hassan, 2011:98).

Furthermore, Section 3 of the Water Service Act (Act 108 of 1997) of the Republic of South Africa emphasises that “everyone has a right of access to basic water supply and basic sanitation”. The Act promotes the development of Water Services Development Plans (WSDP) to provide for measures to put these rights into practice. Despite the

establishment of all democratic legal and policy frameworks, South Africa is still largely confronted with harsh water challenges, especially within the rural communities.

1.1. Problem statement and rationale for the study

Over decades of misuse, poor management and the over-extraction and contamination of freshwater and groundwater supplies exacerbated water stress and deteriorated water ecosystems across the globe leading to poor access to water (United Nations, 2022:38). According to the United Nations (2022:38), the SDG report of 2022 state that eight out of 10 people who lack even basic drinking water service live in rural areas, and about half of them live in Least Developed Countries (LDCs). A collaborative report by the World Health Organization and United Nations Children's Fund (2000:17) revealed that African and developing countries are faced with poor access to water resulting in extreme socioeconomic challenges such as poverty. Immurana et al., (2022) stated that poor access to water compounds to severe health risks especially in the wake of the Coronavirus disease 2019 (COVID-19) pandemic. The United Nations (2022) further echoed that lack of access to water affects African countries the most which results in health challenges such as cholera epidemics and other waterborne diseases among others. Approximately 2.2 million people in developing countries die from diseases every year, the majority being children. Information regarding the quality of water served to the populations is seldom made available (United Nations, 2022).

South Africa is a semi-arid region, and it is no exception from these global and regional challenges. Access to water in the country is further worsened by inadequate rainfall patterns among others, which affects both urban and rural communities (Cullis, 2015). Seven of eight metros in South Africa implemented water restrictions in the summer of 2016/2017 due to low dam levels leaving residents without access to water (Ziervogel, 2019:2). According to MDM-IDP (2023), the water supply in GGM is below the Rural Development Plan (RDP) level (25 litres per person per day) due to the shortage of pipeline reticulation within the villages. Infrastructure vandalism, poor maintenance, unwillingness to pay for water services, and unauthorised connections contribute to the lack of access to water (MDM-IDP, 2023).

Furthermore, the inadequate capacity of Wastewater Treatment Works (WWTW) and Water Treatment Works (WTW) followed by poorly implemented sector plans such as the Water Service Development Plan (WSDP) and the lack of an infrastructure master plan

compromises the ability of the WSA₁ to provide water effectively. The WSA₁ is grant dependent and fails to generate sufficient funds for operation and maintenance due to low revenue collection. This plethora of challenges facing the rural communities leads to ongoing poor access to water (MDM-IDP (2023)).

In consideration of the problem statement, it is anticipated that access to water is an ongoing challenge affecting these rural communities. The water infrastructure intervention projects are still facing challenges in resolving the water access problem. The national and provincial Department of Water and Sanitation (DWS) has not made tangible interventions in addressing the challenges at a higher level, as well as ensuring adherence to the Bill of Rights. Failure to implement water management plans and laws has resulted in “tragedy within the tragedy”. There is therefore a need to strengthen implementation of the constitutional mandate to ensure adequate access to water for all.

1.2. Research aim and objectives

1.2.1. Research aim

To analyse the challenges affecting access to water in rural communities within Greater Giyani Municipality.

1.2.2. Research objectives

- To discuss the fundamental aspects of providing access to water in South Africa.
- To investigate the existing challenges in the provision of water in the Greater Giyani Municipality.
- To recommend effective mechanisms in improving access to water in the Greater Giyani Municipality.

1.3. Structure and outline of the dissertation

Table 1 below presents a descriptive summary of each chapter discussed in this study. This research is composed of five chapters as tabulated, and it is envisaged that each chapter played a distinctive role towards achieving the aim of the study.

Table 1: A descriptive chapter summary and dissertation outline.

Chapters	Description
Chapter 1: Introduction	Chapter one presented an overview of the study, problem statement, and rationale for the study. The chapter further discussed the research aim and objectives, and a descriptive chapter summary and dissertation outline.
Chapter 2: Literature Review	Chapter two was envisaged to respond to the first research objective which broadly discussed possible fundamental aspects of providing access to water in South Africa. Various relevant theories and approaches to water management, legislative and policy framework, Dublin water management principles, and case studies were discussed. And major challenges affecting access to water were discussed.
Chapter 3: Methodology	The third chapter of the research presented the research methodological framework adopted to carry out the study. A qualitative approach targeted participants, data collection methods, sampling methods, data presentation methods, and study limitations were discussed.
Chapter 4: Results and Discussion	This chapter was earmarked to provide answers to the second research objective by investigating the existing challenges in the provision of water in the Greater Giyani Municipality. A thematic approach was adopted to present numerous results about water sources, bulk water distribution, water reticulation infrastructure, implementation of sector plans, policy and legislative frameworks, blue-drop and green-drop status.
Chapter 5: Conclusions and Recommendations	This final chapter was dedicated to the third and last research objective which aimed at providing overall conclusions of the study and further recommended effective mechanisms to improve access to water in the Greater Giyani Municipality.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter was envisaged to respond to the first objective of the study which was set to discuss the fundamental aspects of providing access to water in South Africa. In this context, fundamental aspects refers to key activities that lays foundation in terms of how municipalities can enhance access to water in rural communities. The study deemed it necessary to conduct a literature review to explore effective fundamental aspects that can be committed to enabling access to water, particularly in the rural communities within GGM. The literature discussed possible approaches and mechanisms that various scholars and governments across the world have tested to successfully provide sufficient access to water within communities.

2.2. Tragedy of the common's theory

This theory was published by Hardin in 1968 and has since been widely utilised in various disciplines, especially within the natural resource trajectory (Anabo, 2013: 311). The theory was deemed relevant to the study due to its capability to promote the sustainable use of natural resources and its character to generate regulatory mechanisms on the use of the resource. According to Gouws (2008:253), water is regarded as one of the common resources that the ecosystem and all people need for survival. Gouws (2008: 253) further explained that the “common” resources are at high risk of depletion, hence the need to develop restrictions to manage and control the usage of water resources. It is significant to acknowledge that South Africa has developed globally acclaimed legal and policy frameworks to manage and protect the water resource from the tragedy of depletion. However, the occurrence of tragedy within a tragedy is prevalent as the developed frameworks also struggle to mitigate threats imposed to water resources (Anabo, 2013).

As indicated in the demographics of the study the population growth rate is high in GGM, Hardin (1968:1243), argues that there is no possible technical solution to population growth. He is of the view that communities need to extensively engage in moral-oriented initiatives to reflect on human values and ideas. This approach generates collective solutions on how society can share the common resource more responsibly. It can be

suggested that to address water provision challenges in the rural communities of GGM, a moral-based community with stakeholder involvement is required in dealing with water resource management. Hardin (1968: 1244) stated that “*Freedom in a common brings ruin to all*”, meaning that without restricting the use of water resources, everybody is bound to suffer, and in the same vein, Gouws (2008: 256) affirmed that exercising restrictions and morality towards resources can preserve lives.

2.3. Integrated water resources management

The Integrated Water Resources Management (IWRM) is a systematic approach that integrates and coordinates social, economic, and environmental aspects of water resources in a sustainable manner. It is understood that human beings are part of the ecosystem and play a crucial role in influencing the flow and use of water resources (Bavington, 2002).

IWRM seeks to ensure that water resources are used optimally and sustainably for socioeconomic development without compromising the protection and management of the ecosystem. The IWRM has numerous approaches which also take into consideration the Dublin principles as they play an integral role in water management (Bavington, 2002):

- Encourages equitable allocation of water resources
- Integrates water and environmental management
- Promotes stakeholder involvement
- Considers capacity building
- Water sustains lives
- Encourages participative interventions in managing water resources
- Water resources as an economic good
- The important role of women in water management

The IWRM approach is highly comprehensive as it cuts across all economic, social, and environmental factors. It promotes sustainable management and use of water resources without depleting the environment. This management approach is universal, and it is expected to address certain challenges affecting water provision in the rural communities within Greater Giyani Municipality.

The role of municipalities in IWRM

According to Haigh, (2008:21), municipalities have a crucial role to play in ensuring effective implementation of the IWRM activities within their areas of jurisdiction and within their local and regional watersheds. The provision of water security in communities as well as industrial areas lies with municipalities. Haigh (2008) further alluded that local authorities are likely to affect the aquatic ecosystems caused by energy supply, land use development, pollution, waste drainage and construction activities, among others. The municipalities have a responsibility to support the implementation of IWRM through decentralised and democratised planning approach and resources management. There is an expectation for municipalities to establish and facilitate local communities to engage in robust public participation forums. It can be beneficial for municipalities to adopt internationally acclaimed programmes such as the Local Agenda 21 to enhance communication through dialogue among stakeholders within local communities. It is noteworthy that municipal bylaws can also be used as an effective regulatory instrument to protect and improve the implementation of IWRM at the local level (Haigh, 2008).

However, according to Burke (2007), the implementation of IWRM is not a legally binding mandate to municipalities. Water supply services remains a mandatory role for municipalities. The direct authority functions of municipalities that may contribute to implementation of IWRM can be summarised as follows:

- To restrict development within 100 year flood-line and protection of sensitive environment i.e. wetland and riparian areas.
- Manage floods and droughts through effective disaster management
- Protection of water contamination in rivers through controlling litter, refuse, solid waste removal and spillages of hazardous materials.
- Ensure provision of sanitation services and safe drinking water through effective water quality monitoring.
- Uplift water conservation and demand management by all water users being supplied by the municipalities.

In light of the above, GGM has a fundamental role to play in supporting the implementation of IWRM within rural communities. It is understood that implementation of IWRM is not the principal legislative mandate of the municipalities. However,

municipalities have direct authority functions which can contribute indirectly in the implementation IWRM as outlined above if exercised. It is also noted from Burke that a municipality such as GGM can establish forums for public participation to enhance communication and information dissemination concerning water resources.

2.4. Water Demand Management

According to Strandstrom and Singh (2004), the Water Demand Management (WDM) approach focuses on the efficient use of water through developing mechanisms that foster the behavior and attitude to consume water sparingly as a scarce resource. It ensures that water is used to meet requirements of future growth and development through the adoption of water-efficient methods such as:

- Water demand management and conservation
- Management of surface water resources i.e. Dams
- Water reuse and recycle
- Water re-allocation
- Water pricing
- Eradication of alien vegetation i.e., Water hyacinth

This approach also focuses on water distribution management considering repair of leakages and flowing taps. This approach is deemed suitable to deal with water access challenges in the rural communities within Greater Giyani Municipality.

2.5. Adaptive Water Management

In general terms, adaptive management refers to the improvement of management in a systematic process and by learning from outcomes of implemented management strategies that take into account external dynamics proactively (Pahl-Wost, 2008). In other words, a water management system must be resilient enough to withstand any external changes such as drought, high temperatures, population shift etc. As indicated in Chapter one, the GGM experiences low rainfalls, high temperatures, and severe drought conditions. This implies that adaptive water management tools must be developed to ensure that water provision is uninterrupted during unfavourable climatic conditions which are mainly climate change effects. Pahl-Wost (2008) further stated that adaptive management is more effective when water managers are knowledgeable to

develop management programmes that can experiment and compare various policies through the evaluation of alternative hypotheses concerning the system being managed. Doing so can enable water managers to adopt suitable programmes and management systems to address contemporary water challenges.

2.6. The Constitution of the Republic of South Africa (1996)

It is enshrined in Section 27(1)(b) of the Constitution of South Africa 1996 that everyone has a right of access to sufficient water. This framework promotes the equitable provision of water among all South Africans as stated in Section 9 of the Constitution that there should be no unfair discrimination in the provision of services (Dugard, 2021). It is provisioned in Section 33 that every citizen has a right to just administration action which is further expressed in detail through the Promotion of Administrative Justice Act 3 of 2000 (PAJA). The section promotes administrative protection and procedural fairness which means that WSAs must adhere to administrative justice requirements (Dugard, 2021). Water is regarded as a human basic right in the country and for that reason, all citizens are obliged to receive water equally, irrespective of elements such as geographic location, economic status, race, and gender.

In Part B of Schedule 4 of the Constitution, local government is mandated to take responsibility for potable water supply systems. Finally, Section 153(a) makes a provision that local government must prioritise the basic needs and services of communities through effective administration, budgeting, and planning to uplift socioeconomic development. However, the South African Human Rights Commission (2023) recently investigated access to water in GGM. The commission has stated in the report that the WSA₁ is not compliant with provisions of the Constitution, as ordinary people are deprived of access to basic services such as potable water in the GGM. The National Water Act of 1998 was therefore developed and dedicated to give effect to Section 27(1)(b) of the Constitution of the Republic of South Africa 1996, and to further regulate and ensure that everyone has a right of access to sufficient water in the country.

2.7. The National Water Act 36 of 1998

The National Water Act was developed to ensure effective integrated management and protection of water resources in South Africa. It is hinged on the objectives and principles of the White Paper on a National Water Policy which ensures that water is shared equally,

redresses the past socioeconomic imbalances, promotes effective protection and management of water resources, and promotes sustainable use of water without compromising the health of the ecosystem. It further facilitates socioeconomic development and adherence to international obligations (Pejan, et.al, 2011:4). A balanced allocation of water resources among all users such as ecological and human requirements is among the major responsibilities of this Act. This piece of legislation ensures that no user consumes more water whilst the other user is not equally benefiting from the resource. This is achieved through the provision of water use authorisations to users e.g., domestic, agricultural, and mining. The Act influenced the development of Resource Directed Measure strategy (RDM) to enhance protection and sustainable use of water resources and the strategy was briefly discussed as follows:

Resource Directed Measure (RDM) strategy

According to Parsons and Wintzel (2007: 7), Resource Directed Measure (RDM) was developed as a strategic tool and approach dedicated to implementing the National Water Act. The RDM strategy was developed by the then Minister of Water Affairs to expedite the implementation of Chapter 3 of the NWA concerning the protection and use of water resources. The strategy bears legally binding decisions for the attainment of a sustainable balance between the protection and use of water resources. The relevance of the RDM in this study is to establish the linkage between water resource management and protection, with access to water in rural communities of Giyani. The RDM strategy was established from the three interdependent components enshrined in the NWA, being the Classification System, Resource Quality Objectives, and the Reserve for comprehensive protection and use of water resources. The mentioned three interdependent components are discussed as follows:

Classification System: The role of this component is to place each water resource under one of the three defined classes using 7-step regulated procedures which are highly complex and time-consuming to conduct. Each of the three classes determines the level of protection required for the management of respective water resources based on the extent to which such water resource is utilized. The first Class (I) depicts minimal use of water resources, the Second Class (II) depicts moderate use of water resources, and the

last Class (III) depicts extreme use of water resources. It is significant to determine the class of a water resource to set a proper management class for a resource.

Resource Quality Objectives: According to the Water Resource Commission (2012a) Resource Quality Objectives (RQOs) facilitate the implementation of the determined class and reserve by imposing conditions to ensure that the class is uncompromised, and the set reserve is met accordingly. The Minister of DWS has the responsibility to determine the RQOs for each water resource of significance based on the classification level. The objectives determine the amount of water required to keep a water resource healthy, the expected water quality, and what the conditions of plants and animals should be.

Reserve: According to the Water Resource Commission (2012a), a reserve is the principal component of the RQOs which must be set immediately after class determination for each significant resource. The RQOs play an essential role in determining the reserve requirements based on the water resources demands. Any integral national water resource under the control of the Minister must have a Reserve set aside to:

- provide for basic human needs which must be 25 L per person per day, and
- protect water ecosystems (sustain healthy ecosystems).

The Reserve is the only right to water in the National Water Act. It therefore has a priority over all other water use. In other words, the amount of water required for the Reserve must be met before water resources can be allocated to other water users (Water Resource Commission, 2012a). Furthermore, the Act developed a mechanism to regulate water authorisation by all levels of users in the following manner:

Water Use Authorisation Mechanism

The NWA and the NWRS 2004 developed the four main authorization mechanisms to regulate water use. Before authorisation of any water use, a certain amount of water must be set aside for the Reserve to comply with international obligations and for strategic and future use. The Minister of DWS is responsible for ensuring the effective allocation of water before authorisation and allocation of the remaining water balance to users by Catchment Management Areas (CMAs) (Parsons and Wintzel, 2006).

The four established mechanisms for water authorisation depict that the more water is used, the more risk is posed to the water resource. However, DWS does not have sufficient resources to authorise all the water resources through issuing licenses, hence different mechanisms were established to address the challenge as depicted in Figure 1 below:

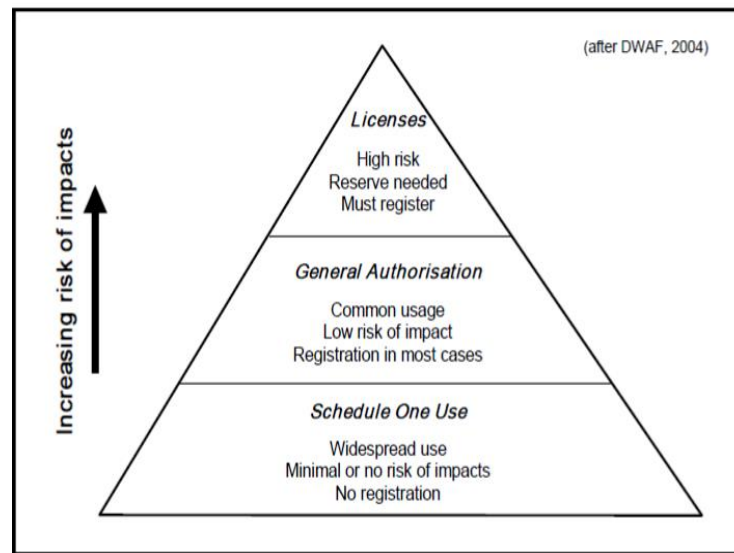


Figure 1: Levels of water use authorisation based on usage. (Parson et al., 2006:8).

- Schedule 1 Use – The NWA authorises people who consume minimal amounts of water for basic human needs or household use, gardening and domestic animals, and rainwater harvesting from roofs. No limitations have been set under Schedule 1 Use.
- General Authorisation – Section 39 of the NWA provides users permission to use water without any license provided such use is within the permissible General Authorisation conditions. The General Authorisation conditions were published in the gazette of 8 October 1999 and reviewed on 27 February 2004. The users are expected to register their water use, however, there is no obligation to apply for a license.
- Continuations of Existing Lawful Use – Part 3 of the NWA provides a transitional arrangement to all users that were granted water use authorisation between 1 October 1996 and 31 September 1998 through the repealed legislation to proceed using water until licensing is issued.

-
- Licensing – All water users outside the three mentioned authorisation mechanisms, usually the productive or commercial users are required to apply for a water use license valid for 40 years maximum. Licensing provides water use conditions that users must adhere to, and such conditions are due for review after every 5 years. It is noteworthy to state that a letter of compliance can be issued, the license can be withdrawn, and prosecution can be executed if the conditions are not adhered to. Should a resource be considered “stressed” due to insufficient water to supply all users, “a process for compulsory licensing can be invoked”, and this can result in the withdrawal of all water use authorisations except for Schedule 1 users (Parsons and Wentzel, 2006:8).

2.8. The Water Services Act

The Water Services Act 108 of 1997 was established to fulfil the mandate of Part B of Schedule 4 of the Constitution vested upon local government which states that water and sanitation services consisting of drinking water, and domestic wastewater and sewage disposal services are the function of municipalities (Winkler, 2012:147). As highlighted in the preamble of the Act, the most relevant provisions for this study are as follows:

- The right of access to basic water supply, which complies with section 27(1)(b) of the Constitution. The WSA₁ echoes the provisions of the Constitution to ensure that adequate access to water is provided to all citizens.
- It provides for the setting of national standards and norms and standards for tariffs. The user-pay principle in water services is significant to enable service delivery and this Act makes provision for the imposition of water tariffs to the users.
- It provides for the preparation of Water Service Development Plans (WSDP) by Water Service Authorities such as the Mopani District Municipality. The WSDP is a significant tool for all Water Service Authorities which provides guidance in investment planning for water resources development. It further assists with a futuristic plan for the delivery of water services to the growing population. and changing climate conditions.
- It enables a regulatory framework for water services institutions and water services intermediaries. Municipalities are vested powers to establish legal tools such as

the water by-laws amongst others to regulate water services within their area of jurisdiction.

2.9. The National Water Resource Strategy 2004

According to the Department of Water and Sanitation (2004) the National Water Resource Strategy is the legal instrument hinged onto the National Water Act of 1998 to ensure the effective protection, conservation, management, development, and use of national water resources. The NWRS vision is to ensure equitable and sustainable use of water for both human and environmental needs which is aligned with the 2030 National Development Plan vision (Department of Water Affairs, 2004:12). The first objective of the NWRS is key in this study as it strives to ensure that water supports development and elimination of poverty and inequality. Equity in access to water services and resources is among the priorities of the strategy. This means that equity must be achieved from the allocation of water from the catchments, dams, rivers, etc for social, economic, and environmental needs. It further requires all sectors of the economy to take cognisance of water resource requirements to attain a balanced and sustainable use of water resources.

2.10. The Municipal Systems Act

It is understood that water is among the basic needs which people must have access to. Section 73(2) (c) of the Municipal Systems Act (MSA) mandates municipalities to ensure that every member of a community must have access to minimum basic services. As Schedule 4 Part B of the Constitution clearly states potable water supply systems are a function and responsibility of local government. Most importantly, Section 74 of the Act states that the poor must also have access to basic services and the tariffs must cover costs only, special tariffs, or other means of subsidization, which supports the status quo at GGM. It further expresses that money paid for services must be proportional to the service received.

2.11. The Free Basic Water Policy

The government of South Africa made a controversial decision in 2001 to develop an indigent policy intended to allocate a free basic quantity of potable water to the marginalised populations of South Africa. The rationale was to improve equitable access to water as many citizens could not afford to pay for water services (Muller, 2018:67).

This policy was developed in line with the concept of “basic water supply” as defined in the Water Services Act. The WSA₂ laid the foundation for the Free Basic Water (FBW) policy through the regulations which detailed that each household must be within a distance of 200 meters to access water and the quantity of potable water per person must be at least 25 liters per household. Furthermore, the minimum flow rate must not be less than 10 litres per minute and no citizen must be without access to water for more than seven days in a year (Department of Water Affairs, 2001:2).

2.12. Municipal Water Bylaws

According to Steytler et.al (2000:8) a municipal council is tasked by the Constitution to pass by-laws. This statement is grounded on Section 160(6) of the Constitution which states that a municipal council must be able to make its by-laws dedicated to providing rules and orders in the business and proceedings of the municipality. Furthermore, Section 21(1) of the Water Services Act expects water services authorities to establish by-laws to guide and restrict the use and provision of water services. The Water Services Act provides a detailed guide of what a municipal water bylaw must entail, and this should enable the WSA₁ (Mopani District Municipality) to effectively regulate water services through bylaw enforcement. It is common knowledge that enforcement of municipal bylaws is a major challenge faced by municipalities. The credibility of these bylaws is also a matter of concern which makes them unenforceable.

2.13. Municipal water sector plans

Table 2 below descriptively discusses fundamental water sector plans that every WSA₁ should develop to address various essential components of water services. Essentially, the water sector plans assist WSAs with long- and short-term planning affecting water services. Thus, Table 2 identified key water sector plans and their respective purposes or contributions to providing access to water:

Table 2: Fundamental municipal water sector plans to improve water provision.

Waster Sector Plans	Purpose
Water Service Development Plan (WSDP)	<p>The WSDP is a fundamental planning document that every WSA₁ must develop in terms of Section 12 of the Water Services Act, No 108 of 1997 to ensure informed planning within the water sector. The plan facilitates an integrated approach to planning for effective water services and must be reviewed after every 5-year cycle. The plan takes a comprehensive approach by consolidating aspects of human resources, population, water resources, water sources, and the capacity of existing water infrastructure (Du Plessis 2007:20).</p>
Water and Sanitation Masterplan (WSMP)	<p>The WSMP is a fundamental plan that concerns water and sanitation infrastructure for water institutions to prepare an implementation strategy that contains goals and objectives. The WSMP is attached to a business plan which further defines the objectives and how implementation of the prioritised projects can be. Some of the key objectives of WSMP are:</p> <ul style="list-style-type: none"> • Evaluation of water and sanitation infrastructure status quo. • Determination of engineering aspects for bulk-water distribution, reticulation, and storage as well as sanitation. • Short to long term project prioritisation for water and sanitation, and • Consolidation and coordination of planning actions for WSAs (Du Plessis 2007:20).
Water Conservation Demand Management Strategy (WCWDM)	<p>According to Department of Water Affairs (2003:44), a WCWDM strategy is a significant tool that water institutions must develop to conserve and manage water use effectively. The WCWDM strategy must find expression in the WSDP and it must be based on the following principles:</p> <ul style="list-style-type: none"> • Water loss reduction and efficient water consumption must be encouraged. • The demand for water must be monitored and managed by the WSAs. • Water demand management must be integrated with the water resources and water services plans.
Water Safety Plans (WSP ₂)	<p>The WSP₂ is a principal tool that water institutions require to ensure that drinking water is safe for human consumption. The plan applies effective risk management measures by imposing risk management and assessment actions. It takes account of water safety from the source to communities, by managing current and unforeseen risks. The water institutions are expected to develop WSP₂ to comply</p>

Waster Sector Plans	Purpose
	with the Blue Drop Certification in relation to the SANS 241:2015 (Water Resource Commission, 2009).
Wastewater Risk Abatement Plan (W ₂ RAP)	W ₂ RAP is a wastewater-based plan that monitors and ensures that wastewater quality is within acceptable numerical limits of the WWTW licences through adoption of comprehensive risk management plan from the collection of wastewater to the discharge of effluent into the ecosystem. The plan identify risks and proposes mitigation measures to mitigate these risks. The major aspect of the plan comprises of identifying control measures, management plans and risk management (Botha and Manus, 2011:2).

2.14. The Dublin Principles

The Dublin principles have been adopted by various researchers especially in the water management sector. These internationally acclaimed principles were found to be relevant in improving access to water in the rural communities of GGM. Therefore, each of the four principles were discussed to provide insight to the study as follows:

Principle 1: Water as a finite and vulnerable resource

This principle acknowledges the adoption of a holistic approach to water management or IWRM which considers the characteristics of the hydrological cycle and how it interacts with the ecosystem and other natural resources. The principle recognizes that water is finite, and must be used for various purposes, services, and functions, hence the adoption of a holistic water management approach is necessary to stabilize demand exerted on the resource and possible threats (Gumbo and van der Zaag, 2001). It is significant to maintain freshwater resources to ensure a sustainable provision of water to desired services. A holistic water management approach also requires coordination of human activities that contribute to water demand, determine land use, and generate waste that results in water-borne diseases. It requires a water-sensitive political economy to facilitate policy development across the three spheres of government. Regulatory mechanisms to ensure that water costs and sustainability factors are considered when economic sectors make consumption decisions (Gumbo and van der Zaag, 2001:10).

Principle 2: Participatory approach

The second Dublin principle of water management suggests that any decision-making processes in the water sector must be informed by the collective contributions of all stakeholders. Local communities must come together to make water management their responsibility and not merely for government authorities. Water management leaders must be democratically elected, and the have-nots must be heard without any form of discrimination (Gumbo and van der Zaag, 2001:5). In support of this principle, the study discussed a ladder of citizen participation developed by Sherry Arnstein. According to Arnstein (1969:19), the extent to which citizens are involved in decision-making processes can determine the public perception of legitimacy and governance. Therefore, the categories of citizen participation shown in Figure 2 were discussed below:

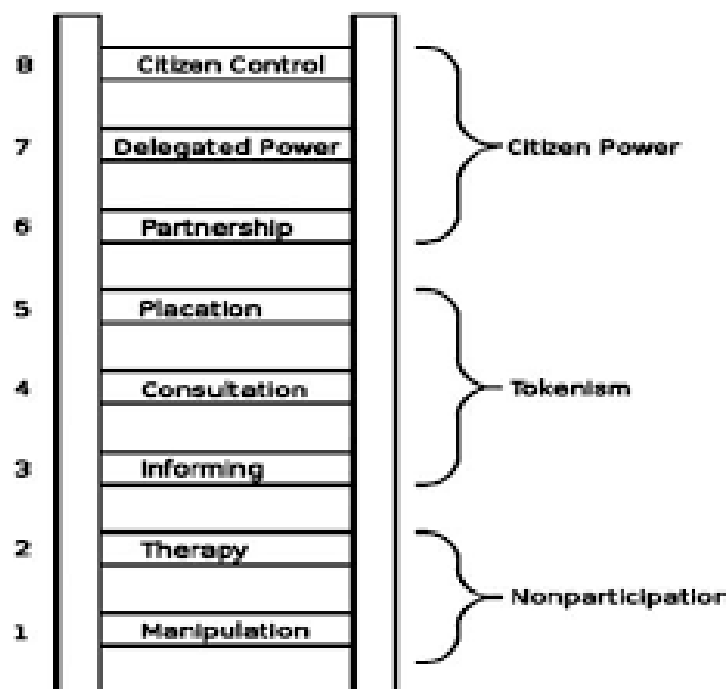


Figure 2: The ladder categories of citizen partnership in government (Arnstein: 1969).

(a) Nonparticipation (Manipulation and Therapy)

It represents a sense of non-participation, characterised by low levels of genuine community engagement. Community members are often manipulated in this stage and

participate without understanding the purpose and their roles. This level does not guide community members and it has no interest to hear issues affecting them (Arnstein: 1969)..

(b) Tokenism (Informing, Consultation and Placation)

This category is known as tokenism, whereby communities are merely informed to participate and to provide inputs. However, the targeted population may not represent the interests of the community, and the inputs provided may also not be considered for decision-making. Community members can advise and seem to negotiate toward finding solutions, however, the powerholders are still the deciding authority (Arnstein: 1969)..

(c) Citizen Power (Partnership, Delegated Power and Citizen Control)

The citizen power level represents thorough negotiations and transparent information sharing between the communities and authorities. It equally delegates decision making powers to the haves and have nots without discrimination. Community members have a sense of control and ownership over decisions made. Ordinary community members are involved in the management to enhance the implementation of decisions and improve service delivery within communities (Arnstein, 1969). This study is of the view that the Dublin principle of “participatory approach” may not lead to the desired public participation in water management if the degree of citizen participation is not clearly stated. There must be an effective partnership and delegation of powers between the authorities and communities. The important role of women in water management and water as an economic good Dublin principles were further discussed in the following sections.

Principle 3: The important role of women

The role and involvement of women in decision-making is of paramount importance in ensuring water management spectrum. Women are expected to be at the forefront of water management at all levels within government to contribute towards Integrated Water Resource Management (IWRM). This principle promotes gender awareness to swiftly expose women to decision-making responsibilities and to widen the spectrum of various activities through which women can actively participate in IWRM initiatives. Women are water users and have a great responsibility to participate in social, economic, and cultural activities (Winkler, 2012:5). Water management in most households is often the women’s responsibility, as related to the gendered nature of household roles in rural communities

(Ray, 2007:427). The lack of access to water can mean that a woman's core household tasks, such as cooking and cleaning, cannot be completed as desired. This principle further finds support within the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), which facilitates the realisation of human rights by ensuring gender equality through democratic public policies. CEDAW laid the ground for all the states to consider and promote the rights of women to fairly participate in water management affairs (Winkler, 2012:55).

Principle 4: Water as an economic good

The last Dublin principle suggests that water must be viewed as an economic good to enhance its management. However, the interpretation of the concept of 'water as an economic good' holds different views. According to Savenije (2002:741), water professionals view water as an extraordinary economic good with numerous and distinctive characteristics than other normal economic goods. In support of the latter, Gumbo and van der Zaag (2001:12), mentioned that water is a resource of higher economic value that must not only be viewed as a mere good but one that goes beyond monetary value. This suggests that how water is allocated and used for various uses must have a bearing on determining its intrinsic value.

While on the other hand economists argue that water is a normal good and is the same as any other economic good. According to Billi et al., (2007:230) there is a water demand, therefore its production and supply determine its economic value like any other good. This view is monetary-based with little interest in sustainable use and understanding that water is a finite resource. It is understood that water needs to encompass a wide range of aspects that goes beyond a mere water charge. Amid different interpretations of 'water as an economic good', the combination of aspects described by economists and water professionals is essential to make water a very special good. This suggests that in the allocation and use of the good, both perspectives must be considered to enable a holistic approach and to enhance applicability of this principle.

2.15. Case studies

Problem solving as a springboard for IWRM implementation: A case study of Nigeria

According to Smith et al., (2017) the Komadugu Yobe river basin which supplies water to the semi-arid northern Nigeria and south eastern Niger was affected by a severe drought hazard. As a result, the poor rural communities surrounding the basin had no access to water. Excessive abstraction of water for irrigation and regional drying of climate exacerbated the water challenges in the communities. Communities were unable to feed themselves through fishing, subsistence farming and livestock. This challenge was due to failure of the Nigerian government to coordinate development of water resources.

An initiative was therefore taken by the Nigerian government Ministry of Water Resources and relevant stakeholders to support implementation of IWRM and proposed interventions to address water challenges. The government of Nigeria disseminated information to all stakeholders to expedite problem solving and inputs. Project solving projects were launched to address water access challenges in the rural communities. Among others, the actions taken included clearing of aquatic weed infestations that blocked the river flow, dredging of channels, improved flood early warning and conflict resolution. IWRM committee was formed to enhance water resource management and multi-stakeholder involvement for catchment management plan aiming to restore and ensure sustainable development of water resources. The restoration of the Komadugu Yobe basin in 2007 and improved consensus was a success, and the lesson triggered the then Nigerian President Olusegun Obasanjo to announce the IWRM implementation nationally (Smith et al., 2017).

Non-revenue water reduction: A case study of Jamshedpur India

The community of Jamshedpur in India was severely affected by rising water demand due to rapid population growth. It is also reported that the community recorded water losses of over 36% due to a lack of enforcement leading to a high number of illegal water connections that went unaccounted for (Marques, 2022). These challenges reduced the efficiency of the existing reticulation system as water supply was minimal. The Jamshedpur Utilities and Services Company (JUSCO) developed a water management model which was composed of three phases. The preparatory focused on igniting public awareness to encourage water conservation through water-oriented marches,

workshops, and seminars. This initiative was crucial as it advanced attitudinal change, enhanced accountability, and instilled the culture of paying for municipal services. JUSCO introduced water meters and developed water policies which were communicated through media platforms and public exhibits. An intense involvement of stakeholders and community engagements were conducted through dedicated discussion and workshop sessions.

The second phase of the JUSCO model assessed water leakages and monitored illegal connections within the District Metered Areas (DMA). Managers responsible for each DMA received adequate training in detecting water leakages and analysis. The households were incentivized with three months of unbilled water services for their willingness to allow the municipality to install water meters. The final phase of the JUSCO model focused on the implementation and operations and maintenance phases. The non-revenue water reduction programme was carried out, consisting of the installation of DMA meters, conversion, and authorization of illegal connections. Monitoring and analysis of leakages were conducted monthly, especially the non-revenue water in the rising mains and distribution networks. Walk-through surveys were also conducted to detect water leakages with the aid of leakage detection equipment. Electromagnetic meters capable of frequently checking data were installed to assist with monitoring and supervision. A night flow technique was also used to detect physical losses. Furthermore, a 24-hour helpline was established to enhance communication in dealing with community complaints and grievances.

Ikapa water leaks project: A case study of Cape Town, South Africa

According to (Muller et al, 2008:58), in the year 1997, officials of the City of Cape Town were concerned about the growing water scarcity. The city, through the Ikapa Water Leaks Project, took the initiative to devise mechanisms for revenue recovery by conducting public awareness and cooperative engagements. The project was envisaged to reduce water leaks and to garner community buy-in to transition from flat rate to metered volumetric for charging for water. The City had a plan to install water meters in the black local authority areas, however, it recognized that it could be futile without a public awareness campaign. This was the first time in history a formerly segregated black local authority area received a direct contact consultation through a house-to-house visit

by the City officials. These visits were significant to communicate with the residents transparently regarding the newly proposed changes for water services which most of the residents had never experienced before. The residents had to agree to pay for water services once the administrative billing system was installed and put in place.

Challenges were also experienced in the process. The project tends to focus on the number of meetings held with the residents as opposed to taking cognizance of the impact of each meeting held in terms of broadening understanding of what the project entailed. Inadequate involvement of municipal councilors affected the project after realizing that they were not actively involved in the decision-making process but only informed about the project. Thus, the politicians felt undermined and did not mobilize their constituencies to effectively participate in the project. The residents received water bills and were therefore expected to pay based on the consumption recorded in the meter reading, but the significant step of engaging with these historically marginalized residents as citizens first and customers second was compromised. Nonetheless, the city was able to print bills in the vernacular to accommodate illiterate residents within communities, and given that South Africa has eleven official languages, it was a democratic action to communicate in a language understood by residents (Muller et al., 2008:58).

Effective water allocation – A Case Study of Brazil

Figure 2 below provides a categorical illustration of how an effective water allocation can be conducted through a hierarchy of instruments as depicted. The major instruments that were adopted by the Brazilian government for successful allocation consist of robust user involvement and ownership, in a stakeholder engagement approach to deliberate on issues before the formal involvement of the water resources authorities. The hierarchy emphasizes the importance of adopting formal rules that are flexible, present to guide the behavior of users, easily accessible for monitoring, and information systems that keep reliable records on how allocated water is used on smaller to larger timeframes. Analytical tools are used to influence user negotiation and decision-making to determine possible alternative withdrawals and to identify trade-offs including social dimensions. Finally, these instruments are adopted through honest dialogue and transparent involvement of all parties, as well as rule enforcement officers to strengthen trustworthiness. This hierarchy calls for user capacity building to enable them to participate with an

understanding of the actions under implementation and to equip them to collaborate at a strategic level in the water management processes (Marques 2022:169).

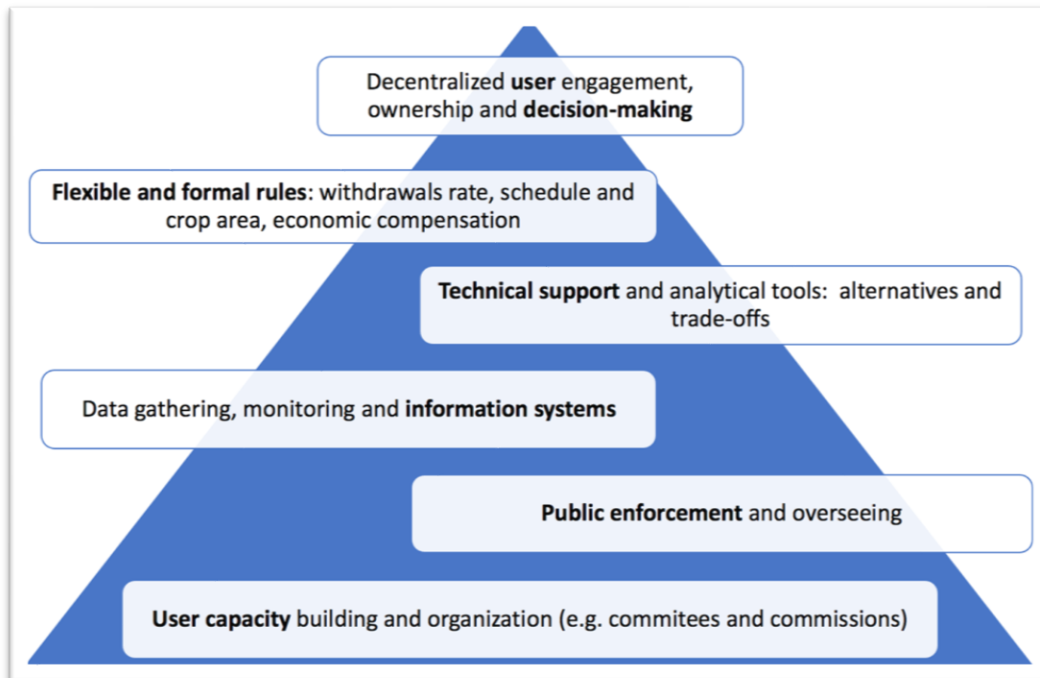


Figure 3: Hierarchy of steps to consider in water allocation (Marque, 2022:169)

The allocated water use license authorisation can also be indefinitely suspended, fully or partially, and without liability to the public authority in case of the following:

- Non-compliance from the user on the water permit terms.
- Water not been used for three consecutive years.
- Water is needed to meet other priorities or under calamities caused by adverse weather conditions.
- Water is needed to prevent or reduce severe environmental impact.
- Water is needed to maintain navigation conditions. Extracted from (Marques 2022: 163)

From supply to demand approach water governance: A case study of rural Uganda

Over the years, the Ugandan government changed its institutional frameworks to improve access to water in rural communities. According to Naiga et al., (2015) a major policy shift from supply to demand approach governance was implemented to redress water challenges caused by colonialism in the 19th century. Water provision was solely a responsibility of the government and there was no consideration for community members to participate in water governance. It emerged that the state was unable to make progress required to provide the majority of rural communities with water. This supply driven approach which was led by the states was considered fragile and less fiscally sustainable. Thus, in the year 1990, post-colonisation, the government took a radical decision to implement the demand driven approach which enabled various stakeholders to participate fully in decision-making processes. Key stakeholders such as the private sector, water users, NGOs and local authorities worked together in unison to improve access to water in rural communities. The national water governance framework enabled all stakeholders to engage in decision-making, management, and Operations and Maintenance (O&M) functions. A local based Water User Committee (WUC) was democratically elected to provide monetary contribution and skilled personnel to improve access to water. The state partnered with the WUC when purchasing major water infrastructure and O&M. The WUC further nominated local based people for training by the local authorities to equip them with O&M technical skills.

However, government acknowledged that some rural communities may not have capacity to take full responsibility of major infrastructure installations. Nonetheless, the gender mixed WUC was able to run daily O&M to ensure uninterrupted and reliable operation of installed facilities. The Ugandan government acknowledges that access to water in rural communities improved abruptly since the implementation of the demand driven approach (Naiga et al., 2015).

Women and water management: A case study of in An-Giang Province, Mekong Delta, Vietnam.

Involvement of women in the domestic water management in An-Giang Province, Mekong Delta, Vietnam was assessed based on the Dublin principles where women are expected to take part in water management processes. According to Thai & Guevara (2019) the Vietnam women were deprived of their rights to fully participate in water management activities and from playing a role in decision making. Despite the fact that women are the primary water users within households, there is an existing gap between water management and these users (Winkler, 2012:55). Thai & Guevara (2019) found that the Vietnam women spent 8-10 hours daily collecting water and doing other domestic activities while men spent much less time on the same activities. Thus, women tend to have little time to participate meaningfully in water management activities in terms of the Dublin principles. The Vietnam women showed willingness to participate in water management activities, however, they further indicated that due to workload created by various domestic responsibilities, it becomes difficult to add more activities of water management. According to Thai & Guevara (2019), a dedicated policy framework should be established at local level to enable a fair representation of women in water management as primary water managers. Water policy must make it an obligation that no decision is taken without women involvement in the process. The Vietnam women are envisaged to participate in planning, implementation, operation and maintenance of water sources through ensuring gender representation in decision making and policymaking (Thai & Guevara, 2019).

2.16. Provide adequate water infrastructure

According to Biswas and Tortajada (2010), water infrastructure is a principal component that enables access to water. They stated that water infrastructure plays a fundamental role in ensuring access to water when institutions implement policies and regulations to enhance service delivery and show resilience to provide water to growing populations. According Grimm (2012:20) water infrastructure system must meet the most needed basic human needs. The system is composed of four subsystems consisting of the environment, water source of supply, treatment works, and distribution as illustrated in Figure 4 below:

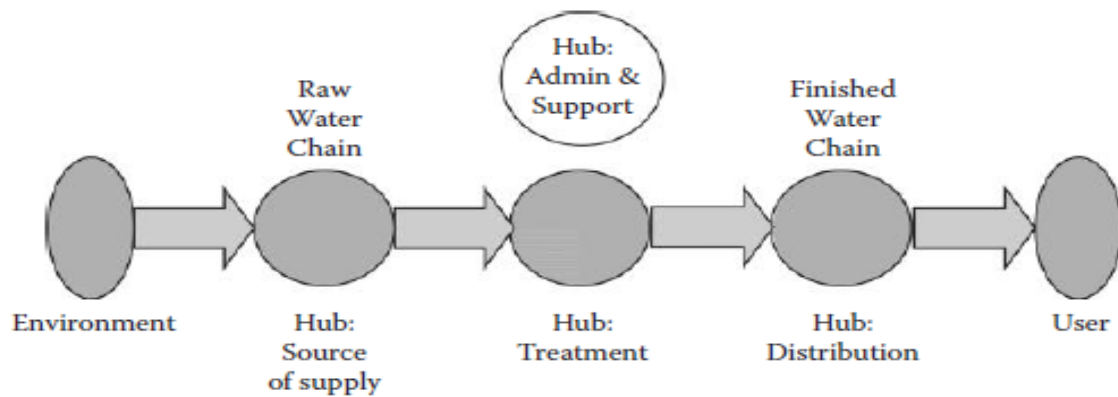


Figure 4: Value chain of infrastructure supply system (Grinn, 2012: 21).

These subsystems are interdependent, thus, to ensure access to water in the rural communities of Greater Giyani Municipality, the entire water infrastructure value chain must be functional. Grimm (2012:20) further expressed that the basic purpose of a water infrastructure system is to provide adequate access to water of high quality, at adequate pressure for domestic, commercial, industrial, municipal, and firefighting uses. These needs must also be met during high-demand periods, drought seasons, and during average supply-and-demand periods (Grimm, 2012).

2.17. The preventive and corrective maintenance

Water infrastructure maintenance plays a critical role in determining the adequacy of access to water in communities. The condition of water infrastructure requires dedicated maintenance to ensure sustainable water provision. The literature has revealed both the preventive and corrective maintenance categories applicable to water infrastructure. Preventive maintenance is a continuous program that monitors the condition of water infrastructure consistently and timely to prevent unforeseen defects from occurring. The preventive maintenance is conducted in terms of the Operations and Maintenance (O&M) manual. Whereas corrective maintenance refers to immediate action to repair or replace deteriorated infrastructure (Grimm, 2012). Both the preventive and corrective maintenance categories are deemed ideal in this study to turn around the state of water infrastructure in the rural communities of Greater Giyani Municipality.

2.18. Blue Drop and Green Drop Programme

According to (Department of Water and Sanitation, 2022) this programme is an incentives-based regulation programme introduced in 2008 by the then Minister of DWS as the regulator of the water sector in terms of both the National Water Act and Water Services Act. Blue Drop and Green Drop regulatory programs aim to improve the potable water quality, management of wastewater, and water conservation and demand management. Water institutions that comply with the programme are recognised by DWS. Treated water from the water boards and WSAs is expected to meet the required standards of the South Africa Bureau of Standards in South African National Standard (SANS) 241. Water institutions are expected to run regular laboratory tests to ensure compliance with SANS and improve safe drinking water for communities. The effluent released from the Wastewater Treatment Works (WWTW) into the rivers must also comply with the standards of the DWS. Both the green drop and blue drop assessments consider the following key aspects:

- Infrastructure condition
- Infrastructure capacity against the demand
- The status of infrastructure maintenance
- Whether the infrastructure is operated correctly
- How treatment processes are conducted
- Whether monitoring and control measures are implemented
- Skills and qualifications of the staff

When the WSA₁ or water board fails to adhere to the above assessment criteria, DWS issues a notice of non-compliance instructing that corrective action plans to deal with challenges identified in the report. The department has a right to take legal steps by issuing directives to those who fail to submit corrective action plans in terms of the NWA. Once the corrective action plans are submitted, DWS monitors the implementation of the plans (Department of Water and Sanitation, 2022). It is worth noting that the assessment criteria used by the department cover largely the areas where existing water challenges are found within the WSA₁. Should the WSA₁ comply with these criteria, the majority of the existing water challenges can be mitigated.

2.19. Major challenges affecting access to water

The aim of this study is to analyse the challenges affecting access to water in rural communities within the GGM. Thus, this section identified major challenges in the literature that affects access to water focusing in rural communities:

2.19.1. Impact of climate change to water availability

According to Cameron and Walther (2022), climate change coupled with growing global population and increasing water demand has severely affected semi-arid regions across the world. South Africa is no exception to other countries that are experiencing the effects of climate change. Cullis (2015) stated that South Africa is a semi-arid and water scarce country where certain areas are frequently affected by severe droughts and floods. In 2018, the Western Cape of South Africa experienced the worst drought condition since 1904 due to low rainfall between 2015 and 2018. The City of Cape Town released a statement of “Day Zero” with unfamiliar water use restrictions since the taps were running dry (Cameron and Walther, 2022). In the MDM-IDP (2022) it was also stated that GGM is generally affected by low rainfall and high weather temperatures, and this can be associated with climate change effects. According to Nhamo and Agyepong (2018) the Western Cape drought significantly threatened the surface water as overall dam levels dropped from 92% to 23% between 2014 and 2017. The water resources under the City of Cape Town ran dry, coupled with a population growth of 67% between 1996 and 2017. Huang et al., (2016) suggested that semi-arid areas are highly sensitive to climate change and if no action is taken, these areas are likely to experience extreme drought conditions as a result of low rainfall, excessive evaporation and low precipitation.

2.19.2. Mismanagement of water resource management

According to Molobela and Sinha (2011), almost every South African citizen is affected by the consequences of water resource mismanagement. They stated that those who resides in rural areas are mostly affected by poor access to water due to badly managed water resources. Water managers, policymakers and academic researchers believes that water must begin at the river basins as the first natural unit for water management. According to Ivey et al.,(2004) water availability is not the only solution to water problems, but the manner in which it is managed plays a significant role in enhancing the sustainable

use of the resource. Levite et al., (2003) stated that failure to prioritise water allocation in an efficient, sustainable and equitable manner leads to resource mismanagement. It was further emphasized that water allocation often focuses on domestic, agricultural, industrial and other productive demands, but neglects the ecological water requirements, being the aquatic ecosystems and the ecological reserve. Molabela and Sinha (2011) further stated that the South African government has developed a robust policy and legislative framework since the dawn of democracy to enhance water resource management. However, they acknowledged that poor implementation by the spheres of government remains a challenge (Molabela and Sinha, 2011).

2.19.3. The state of O&M and water infrastructure

The overall state of O&M of water infrastructure is concerning especially within the South African rural municipalities (Motsoeneng, 2022). The challenge facing O&M is caused by governance related failures. Political interference in finances and planning in municipalities severely threatens the O&M. Masindi and Duncker (2016) claims that financially struggling municipalities have a tendency of reducing the budget dedicated for O&M. According to the Auditor General's Report (2018), the lack of technical expertise such as engineers and scientists in municipalities creates a backlog in service delivery. Majority of the municipalities are therefore forced to outsource technical services for reactive maintenance incidents (Ncube and Monnakgotla 2016:75). There is a decline in the number of engineers employed since 2007 as municipalities fail to pay market related salaries (Motsoeneng, 2022). The challenges that significantly affects O&M in municipalities are many and are not limited to the ones discussed in this section.

According to Hutton and Clause (2016), water infrastructure that is not regularly maintained has a shortened lifespan and deteriorates easily. Ageing water infrastructure is not only a South African phenomenon but it cuts across the globe. However, this challenge mostly affects the poorest municipalities that are unable to collect revenue for water services and those that are exclusively grant dependent. Lederman et al., (2001) further stated that lack of political will to support the implementation of water infrastructure projects by municipal water engineers is also a major contributing factor.

2.19.4. Infrastructure theft, vandalism, and illegal water connection

According to Cobbing et al., (2014) theft and vandalism of infrastructure remains a serious challenge to water access in rural areas. Theft of electricity transformers, cables and other critical components of the system are targeted by criminals (Johannessen et al., 2014). The acts of theft and vandalism contributes immensely in water interruptions as municipalities can take long to procure the stolen or vandalised infrastructure components. Most of the rural municipalities are dependent on groundwater sources, which becomes impossible to pump water to communities once theft or vandalism occurs. Frauendorfer and Liemberger (2010) stated that illegal water connections are costly to municipalities as the water cannot be billed for revenue collection purposes. The municipalities use their resources for production and supply of water to communities, hence every volume supplied must be accounted for. Illegal water connections are also caused by poor monitoring and lack of enforcement within municipalities. It also emerged that some municipal officials have a tendency of taking bribes from those who connect water illegally (Detroz and da Silva). Illegal water connections also results to reduction in water pressure and leaves some parts of community without access to water.

2.20. Public participation and women involvement

According to Potter (1985), poor public participation is a serious challenge contributing to water access challenges in rural communities. The rural poor is often overlooked during water management and decision making processes. It is stated that majority of those that are affected by water access challenges are not empowered to participate meaningfully due to their low educational, economic and social levels (Potter, 1985). He further stated that women are often excluded from public participation as they are traditionally expected to focus on childcare and households. It is perceived that management and decision making is men's responsibility especially in the rural communities. According to Kanetsi (1994), when women are empowered through education and training, they are more likely perform better than men in water management and infrastructure maintenance. This perception is in line with the Dublin principle which suggests that women must be involved as water managers. Women are the main domestic water users and their exclusion in the strategic and technical affairs of water management is unjustifiable. Most of the water policies are in support of meaningful public participation and women involvement, however, implementation remains a concern (Thai & Guevara, 2019)

CHAPTER 3: METHODOLOGY

3.1. Introduction

This chapter aimed to discuss a suitable research methodology adopted to conduct the research. As Sapsford (2006: 175) stated that research methodology can be viewed as a systematic guide that provides direction on how a study can unfold and the most suitable approach that can be taken. The chapter introduced the study area and demographics where the methodological framework is applied. Babbie and Mouton (2001:32) expressed that a research methodology provides a set of ideologies that guides how a study can be carried out most effectively through a selection of relevant methods, tools, techniques, and procedures employed in the process of implementing a research design.

3.2. Study area and demographics

The Greater Giyani Municipality (GGM) is located on the eastern side of Limpopo Province in South Africa. The Municipality is predominantly rural, and the land is largely communal under the administration of traditional leadership (GGM-IDP, 2023). The study mainly focused on the 97 villages or rural communities with a high population growth rate currently sitting at approximately 256,300 people (GGM-IDP, 2023). The Municipality is one of the five local municipalities known as Ba-Phalaborwa, Greater Letaba, Greater Tzaneen, Maruleng, and Greater Tzaneen under the Mopani District Municipality (MDM). The district is both the Water Services Authority (WSA₁) and Water Services Provider (WSP₁) for all the local municipalities within its jurisdiction. The GGM has only one town called Giyani which is the key economic hub for the Municipality (GGM-IDP, 2023). The study area is shown below in Figure 1:

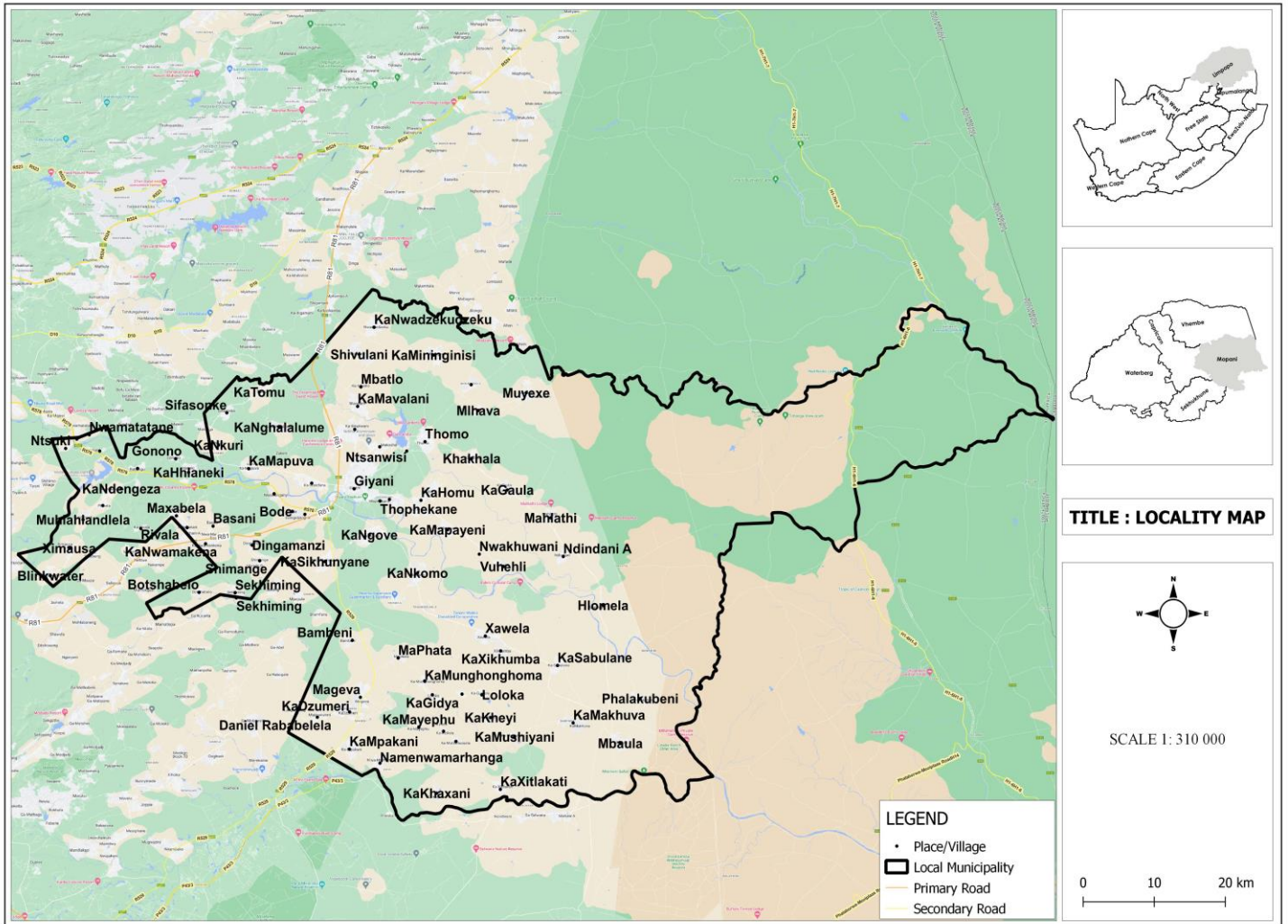


Figure 5: Map of Greater Giyani Municipality with the all the 97 villages.

Table 3 below depicts a demographic overview of all individuals within the Municipality based on monthly income categories. Approximately 50% of the population receives no income, sitting at 130547 individuals. The majority of the individuals who receive monthly income earn between R1 and R3200 which is approximately 80% of all income earners. The individuals who earn R3200 and above are 24115 which is the minority sitting at approximately 20%.

Table 3: Individual monthly income status by population (GGM-IDP, 2023).

Income (R)	2011	2016
0	185284	130547
R1 – R400	19631	62076
R401 - 800	18131	9968
R801 – R1600	4668	24584
R1601 - 3200	4867	5010
R3201 – R6400	3216	5586
R6401 – R12800	1257	4280
R12801 – R25600	143	773
R25601 – R51200	76	56
R51201 – R102400	70	59
R102401 – R204800	58	65
Over R204801	35	127
Total	244217	256300

As shown in Table 4, only 336 indigent households have access to free basic water and 40537 being the majority have no access to water. Water is the most needed service amongst others and yet only the minority is considered to have access.

Table 4: Indigent households receiving free basic services (MDM-IDP, 2022).

Access/ Backlog on Free Basic Services (Indigent H/H)		
Access/ Backlog	Access	Backlog
Water	336	40537
Electricity	13874	25508
Sanitation	767	38532
Waste Management	140	39242

3.3. Climatic condition

According to the GGM-IDP (2022), the area receives extremely high temperatures and low rainfall rates during summer seasons. It is recorded that the municipal area receives approximately 200ml to 400 ml of rain annually. The IDP further stated that low rainfall impacts negatively on surface water shortages within the municipality. The WSA₁ is situated within the Letaba and Olifants Catchment areas with the former covering an estimated 13400 km² and the latter covering an estimated 54550 km² (MDM-IDP, 2022).

3.4. The methodological framework

The research methodology adopted a theoretical approach to underpin and provide direction on how the study can be best conducted. The schematic methodological framework below illustrates the relationship between theories and the adopted research design. This section further discussed the relevance of philosophical perspective in the study.

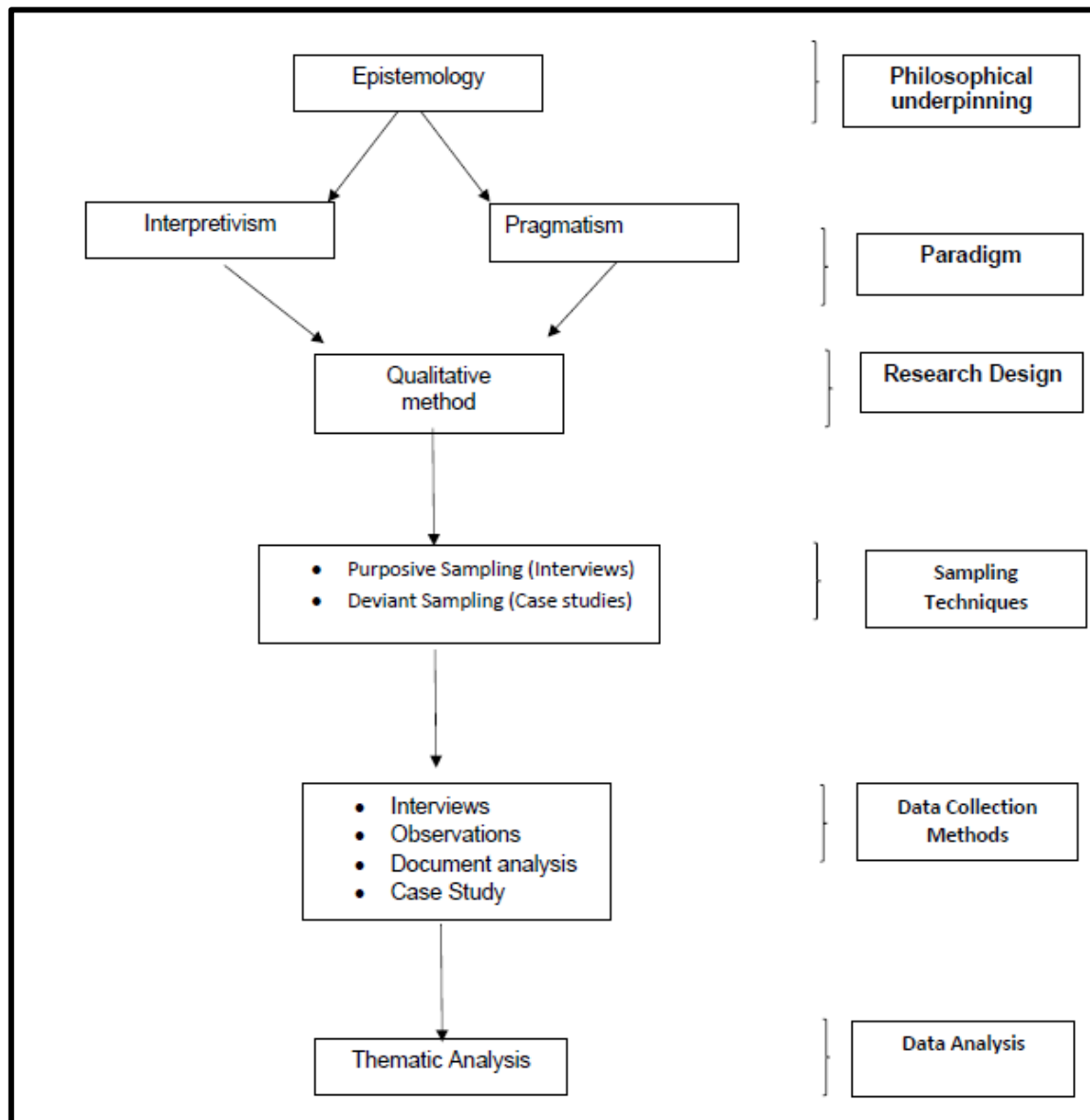


Figure 6: The schematic methodological framework.

This research methodology is underpinned by the philosophy of epistemology which is concerned about human knowledge or understanding and the mind's relation to reality or

particular experiences (Crotty, 1998: 3). Epistemology was adopted due to its explorative nature to acquire knowledge about a phenomenon at hand. This decision was in line with the research aim as it seeks to know the challenges affecting access to water in rural communities within GGM through analysis. Thus, the research methodology is underpinned by epistemology theory to provide a firm foundation in its quest to focus the study on the research aim mentioned in Chapter one.

To give effect to the philosophy of epistemology, an interpretivism paradigm was adopted to develop knowledge uniquely by prioritising subjective and descriptive methods in dealing with complex circumstances (Remenyi et al., 2005). Interpretivism is an approach often adopted in social research that describes the significance to understand and interpret people's perspectives to their lived experiences. According to Al-Ababneh (2020: 80), this approach enables a researcher to gather adequate and legitimate knowledge of lived experiences. Through this approach, the study conducted interviews to gather complex information affecting access to water in GGM. This was seconded by the adoption of pragmatic approach to foster the adoption of a methodological approach that works best to address a particular research problem under investigation (Maxcy and Spencer, 2003: 234). This approach is flexible and accommodates various methods, thus it can be applied in both qualitative and quantitative research Creswell et al., (2011). To address the research problem of the study, the pragmatic approach enabled the researcher to conduct document analysis, observations, and case studies as the best methods to gather adequate and legitimate data required.

3.5. Research Design

According to Leedy and Ormrod (2001:12), a research design refers to an approach a researcher adopts to carry out a study and it determines tools and techniques to be used. Thus, this study has reviewed qualitative and quantitative research designs to select the most suitable approach for the research. According to Newman (2014:107), both qualitative and quantitative designs differ and may also complement each other in a study. In social research, both designs systematically collect and analyse empirical data and examine data patterns to understand and explain social life. However, the nature of data collected in both approaches may differ and this influenced the selection of qualitative research design in this study. The nature of data in the study is scientifically known as

'soft data' in the form of impressions, words, sentences, photos, and symbols. Whereas the quantitative design consists of 'hard data' in the form of numbers and bias to scientific research which is not the focus of this study (Newman, 2014:108).

3.6. Purposeful sampling

According to Tracy (2013:155), purposeful sampling means choosing a suitable sample that can respond to the research aim. The technique was adopted to purposefully choose participants involved in the interviews during data collection. Vasileiou, et al (2018) stated that qualitative samples are purposive and are adopted by virtue of their ability to provide rich and relevant information. Understanding what the study seeks to achieve necessitated that a sample of all respondents that were perceived to be case-oriented be purposefully chosen to provide in-depth and rich information relevant to the phenomenon under investigation. Thus, a sample of twenty-one respondents was targeted to provide reliable information and in-depth discussions of issues affecting access to water in rural communities within GGM. Table 5 below depicts all the chosen respondents based on their respective institutions, positions and section where they are employed.

Table 5: Targeted population for interviews.

Institution	Position	Section	Population
Mopani District Municipality (WSA ₁)	Director	Water Services Technical Services	2
Mopani District Municipality (WSA ₁)	Plant Superintendent	Water Services	16
Greater Giyani Municipality (WSP ₁)	Director	Water Services & Sanitation	1
Department of Water & Sanitation (National & Provincial)	Director	Water Supply Support	2

3.7. Deviant sampling

According to Newman (2014), deviant sampling is a technique for selecting relevant case studies. It is a purposive case-sampling technique used by qualitative researchers to select distinctive or special cases of notable outcomes (Neuman, 2014). This technique was adopted due to its ability to purposefully select different case studies to learn from

distinctive experiences from each case examined. The selected case studies brought new dimensions and lessons practiced from other areas to enhance this study.

3.8. Data collection

This study has selected various data collection methods within a qualitative research approach. Through intensive analysis of the study, various methods were selected to gather relevant data in response to the research problem statement, aim, question and objectives. The study has therefore selected document analysis, case studies, observations, and interview data collection methods under qualitative research design in terms of Leedy and Ormrod (2001:32) and are described below as follows:

3.8.1. Document analysis

Document analysis was defined by Leedy and Ormrod (2001:155) as a detailed analysis of content within various types of document materials to identify patterns or themes. In this study, the method was deemed relevant to collect published government documents such as policy and legal frameworks, plans and strategies, and literature in the form of articles, journals and books published by various scholars.

3.8.2. Literature review

According to Cronin et al., (2008) a literature review is regarded as a data collection method that seeks to research, read, analyse, evaluate, and summarise academic journal articles and books about a particular topic. Thus, this study has conducted literature review to learn from other researchers who studied a similar topic. The literature review further contributed significantly in providing viable recommendations to enhance access to water in the rural communities within GGM.

3.8.3. Case study

According to Newman (2014:7), a case study method is commonly qualitative, often used by researchers to explore one or numerous cases by examining a particular phenomenon in great depth. Neuman (2014:40) further expressed that a case study enables the researcher to follow various complex issues that unfold or develop over time and locate a case within a historical or cultural context. Therefore, the study took advantage of case

studies by conducting an in-depth examination of various experiences that can contribute to improving access to water in the rural communities of GGM.

3.8.4. Observations

Leavy (2017:134) stated that conducting observations enables the researcher to experience real-time unfolding activities on the phenomenon under investigation and to possibly record such systematic observations. The study investigated the status quo regarding the state of water provision in the rural communities of GGM. Conducting observations enabled the researcher to validate the data collected with what was unfolding on the ground.

3.8.5. Interviews

According to Kvale and Brinkmann (2009:2), interviews refer to guided questioning and answering between two people about a particular theme of interest. The interviews are based on open-ended questions as Newman (2014:14) stated this type of interview provides respondents an opportunity to answer questions in a manner they deem fit. Open-ended questions enabled the respondents to share experiences that were crucial to them. The study envisaged that respondents may not be readily available for face-to-face interviews due to work commitments, hence telephone and email interviews were used as an alternative method. According to Leavy (2017:163) conducting interviews telephonically limits the researcher to read the interviewee's gestures, however, probing questions can assist in grasping the intended responses. Written interviews enabled the researcher to gather information from various respondents within a short space of time and granted respondents enough time to respond comfortably.

3.9. Thematic data analysis

According to Braun and Clarke (2006:82), a thematic analysis captures distinctive data about research questions that can provide a patterned response presented in topics. The study established and discovered themes to ignite data analysis as well as respond to the research question. Thematic analysis was selected due to its ability to discover and explore a phenomenon through the interpretation of data (Namey et al., 2008).

3.10. Research Matrix

The research matrix provides linkages between the research objectives, the suitable type of data collection methods and the rationale for selecting such methods. It is significant to link these factors to demonstrate how research objectives can be achieved in the study through the selected research methodology. Table 6 below illustrates the research methodology matrix.

Table 6: Matrix of how research objectives were achieved.

RESEARCH OBJECTIVES	DATA COLLECTION METHOD	JUSTIFICATION
Research objective 1: To discuss the fundamental aspects for providing access to water in South Africa.	Literature Review	Empirical data was required to set the scene and deepen understanding within the body of knowledge regarding the phenomenon. Only published documents were deemed reliable to source relevant data to discuss fundamental aspects of providing access to water.
Research objective 2: To investigate the existing challenges in the provision of water in the Greater Giyani Municipality.	Literature review, document analysis, observations, and interviews.	It was crucial to measure the existing challenges to recommend effective intervention mechanisms to improve access to water.
Research objective 3: To recommend effective mechanisms in improving access to water in the Greater Giyani Municipality.	Literature review, document analysis, case studies, observations, and interviews	Both empirical and field data were deemed effective in providing recommendations in improving access to water. Case studies also provided the best local and international practices to draw lessons from.

3.11. Ethical considerations

According to Leavy (2017:31), ethical considerations emerge during the process of developing a research topic. It seeks to protect research participants and requires necessary consent and approvals before the involvement of humans in the study. This

study underwent ethical processes and obtained approval from the Faculty of Natural and Agriculture Sciences. The University allocated ethics number NWU-01229-23-A9 to commence the research process. The level of risk towards the respondents was proven to be minimal and the data required is not sensitive. To ensure optimal protection of respondents, the study also did not reveal the names of participants to present interview data. It was justified through the research proposal that this study promotes new learning and has no potential to create any form of conflict in society.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Introduction

This chapter aimed to achieve the second research objective by investigating the existing challenges in the provision of water in the Greater Giyani Municipality. Data collected through document analysis, interviews and observations was presented in this chapter. The challenges identified in the literature review were also linked to the findings made to better analyse the results of the investigations conducted. As stated in chapter 3 of this study, themes were created to clearly present and discuss the results under a common topic and pattern.

4.2. Thematic data analysis

A thematic data analysis approach was adopted to present data collected in an orderly manner, focusing on the existing challenges for providing access to water in rural communities within Greater Giyani Municipality. As Braun and Clarke (2006:82) mentioned thematic analysis captures distinctive data about research questions through a provision of a patterned response presented in titles. The matrix in Table 8 categorised the existing challenges in themes and sub-themes to present the results and discussions of the data collected through document analysis, interviews, and observations in the following manner:

Table 8: Matrix of themes and sub-themes indicating the existing water challenges.

THEMES	SUB-THEMES
Water source challenges	Low dam levels
	Poor implementation of resource management class
	Low yield and dysfunctional boreholes
	Climate change effects
Bulk water distribution challenges	Inadequate infrastructure and Insufficient bulk water distribution
	Dilapidated water infrastructure and poor maintenance

THEMES	SUB-THEMES
	Inadequate water services personnel
Water reticulation challenges	Inadequate water reticulation Infrastructure
	Mushrooming water businesses
	Theft and vandalism of water infrastructure
	Illegal water connections
	Indigents and grant-dependent communities
	Non-revenue water collection
Poor implementation of planning and legal documents	Poor implementation of water legislative frameworks
	Poor implementation of municipal water bylaw
	Poor implementation of water sector plans
Poor involvement of women in water management matters	
Non-compliance with the Green and Blue Drop Programme	

4.3. The water source challenges

The study has revealed various challenges affecting the ability of water sources to provide water to the rural communities in the GGM. Maake and Holshausen (2015:267) stated that there is no effective level of planning and management that can succeed when the source of water is inadequate. It was therefore significant in this study to first investigate the state of water sources and their ability to provide the required water to the communities. The following sub-themes were developed to discuss the state of water sources in detail:

4.3.1. Low dam levels

According to the data collected from the Mopani WSDP, there are over 20 dams under the WSA₁, and 9 of the dams are primarily used for domestic use and the rest are used for irrigation purposes (Mopani WSDP, 2021). However, for this study, rural communities within GGM are dependent on two dams as the major surface water sources known as Middle Letaba and Nsami. The capacity attributes of the Middle Letaba and Nsami dams are depicted in Table 8 below:

Table 7: Middle Letaba and Nsami dam's capacity (Mopani WSDP, 2021).

Dam	Location	Length (km)	Height (m)	Capacity (M m ³)	Surface Area (ha)
Middle Letaba	Middle Letaba River	2.6	38	172	1 878.7
Nsami	Nsami River	1.254	21	21.9	515

The Middle Letaba dam has the largest capacity out of over 20 dams in the district and Nsami dam is the 4th largest dam. However, it was reported in the MDM-IDP (2022) that slits deposits reduce the river capacities, and most dams and rivers have their water-holding capacities reduced. The latter suggests that the above-mentioned capacity in Table 9 is less and may not be able to accommodate the expected water volumes. It is also worth noting that the distressed Middle Letaba dam also supplies water to parts of the neighboring municipality known as Makhado Municipality.

Table 8: Low dam levels for Letaba and Nsami (DWS, 2023)

Name of the source	Current (2023) Dam Level (%)	Treatment Works Supplied
Middle Letaba Dam	3.4	Giyani & Makhado
Nsami Dam	51.7	Giyani

According to the data depicted in Table 9, the Middle Letaba dam is severely distressed as the water level is currently at 3.4%. Nsami dam is approximately at 51.7% which is currently not severely affected; however, it runs a risk of drying out in the event of common

severe droughts and extreme hot weather conditions (Department of Water and Sanitation, 2023).



Figure 7: Middle Letaba dam at an extremely low water level.

According to the observations conducted, it is evident that the dam level at Middle Letaba is extremely low as depicted in Figure 7. The Middle Letaba dam is designed to supply water to the Middle Letaba WTW for purification and distribution to rural communities within Greater Giyani Municipality. The Giyani area is extremely hot and receives low rainfall which results in drought and exacerbates water loss in the distressed dams (GGM-IDP, 2022). According to Querner et al., (2016), the Letaba catchment is under severe pressure as it experiences excessive water demands with less availability.



Figure 8: Nsami dam at an average dam level.

Nsami Dam was identified as one of the major dams to supply rural communities with water. Figure 8 depicts the amount of water observed during fieldwork which has shown that dam levels are moderate as also shown in Table 9 in terms of data collected from the Weekly Limpopo Provincial State of Dams. The GGM-IDP (2023) states that the dam is expected to receive additional water from the Nandoni dam situated within Vhembe District Municipality. The SAHRC also expressed concerns over delays in completing the 2014 Nandoni-Giyani Bulk Water project which is envisaged to supply over 55 villages within GGM (South African Human Rights Commission, 2023).

According to the report by Nhamo and Agyepong (2018), GGM is not the only one that experienced low dam levels. It was reported that the Western Cape drought significantly threatened the surface water as overall dam levels dropped from 92% to 23% between 2014 and 2017. The water resources under the City of Cape Town ran dry, coupled with a population growth of 67% between 1996 and 2017 (Nhamo and Agyepong, 2018). A similar water challenge was experienced in Komadugu Yobe river basin in the rural regions of Nigeria due to severe drought hazard. As a result, rural communities in the vicinity had no access to water. The IWRM implementation was therefore introduced by the Nigerian government to improve the situation (Smith et al., 2017). The IWRM implementation included the restoration of the Komadugu Yobe river basin and establishment of local based stakeholders to collaborate in water resource management (Smith et al., 2017).

4.3.2. Poor implementation of water resource management class

According to the National Water Act (1998), the Reserve provides water rights and has priority over all other water uses. Before allocation of water use, an exercise for Reserve determination on the quantity and quality of water required for Reserve must be set aside. It was reported in the Mopani WSDP (2021) that the licensed abstraction volume for each dam is unknown. The classification for the Nsami catchment is unknown and unavailable. The Mopani WSDP (2021) estimated that the agricultural sector uses approximately 70%, leaving 30 % for all the other water users within the Letaba catchment. Querner et al., (2016), also stated that most of the water from the Letaba catchment is used for irrigation, particularly by smallholder farms. It was reported that little is known about the water

quantity used for irrigation by communities from the Letaba catchment (Querner et al., 2016).

Nonetheless, it was found that DWS published a notice (Notice 823/2014) on the government gazette in September 2014 when Class (III) was proposed in terms of section 13(1) of the NWA (Department of Water and Sanitation, 2014). The proposed Class indicates that the Letaba catchment is heavily used and significantly altered from its pre-development status, therefore it requires high-level protection and management conditions. After that, DWS released a notice (Notice 932/2018) on the government gazette in September 2018 indicating the results of the Reserve determination and ecological determination for the Letaba catchment in terms of section (16)(1) of the NWA (Department of Water and Sanitation, 2018). The results indicated that the Reserve determination for Ecological Reserve is 24.30% and the Reserve determination for Basic Human Needs is 0.014% (NMAR), total Reserve sitting at 24.314% (Department of Water and Sanitation, 2018).

A respondent at the managerial level reported that both catchments have not been classified by DWS. The contradiction suggests that the officials at the managerial level have insufficient knowledge regarding the catchments. It is therefore concerning whether the DWS is implementing the proposed management class on the Letaba catchment and whether the set reserve is being monitored to resolve the existing challenges. Making reference to the literature review, Molobela and Sinha (2011) stated that almost every South African citizen is affected by the consequences of water resource mismanagement. They stated that those who reside in rural areas are mostly affected by poor access to water due to badly managed water resources. It is concerning that despite all the government policies in place, there is still a significant lack of implementation.

4.3.3. Dysfunctional boreholes

The rural communities within GGM are highly dependent on groundwater as an alternative water source due to the scarcity of surface water. According to the GGM-IDP (2022), there are 361 boreholes dedicated to over 1485 households in the rural communities of Giyani and only 200 boreholes are currently operational which compromises the expected amount of groundwater supply. The dysfunctionality of boreholes is due to various challenges such as theft and vandalism. Meissner (2015)

indicates that in Greater Sekhukhune District Municipality criminals target not only water infrastructure but also electricity cables that supply power to equipment such as boreholes pumps.

According to data collected during interviews, it was indicated that vandalism and theft contributed to the dysfunctionality of boreholes. Furthermore, the respondents indicated that load shedding and high diesel costs exacerbated water supply interruptions in rural communities. According to the study conducted by the Water Resource Commission (2011) in Cederberg Municipality, power outages have been reported to severely affect groundwater abstraction in communities that rely on boreholes to supply potable water.

4.3.4. Climate change effects

According to the MDM-IDP (2022), the climate of Giyani is characterized by low rainfall with a very hot summer. The geographical location of the municipality is within the lowveld area and rain is minimal. The annual rain which is received by the municipal area is between 200- 400ml. The general low rainfall patterns have a direct impact on socioeconomic development, especially on the rural communities and agricultural sector. The amount of heat during the year ranges between 27 – 40 degrees Celsius which leads to a high loss of water in the dams through evaporation (GGM-IDP, 2022). It was also indicated that the lack of drought mitigation plans and water security plans contributes to the provision of water.

According to the research conducted by Cullis (2015), South Africa is likely to experience potential impacts of climate change which can severely affect the national water supply should the current trend persist. It was indicated that climate change effects vary significantly in South Africa, with certain regions experiencing floods and others experiencing droughts. Pahl-Wost (2008) stated that an adaptive water management system can be more effective through the implementation of effective policies and programmes dedicated to addressing climate change effects. The WRC adopted the Strategic Adoptive Management (SAM) system as suggested by Pahl-Wost in park management and water resources management. The commission was able to develop flexible and yet resilient community-centred plans that enabled management that is purpose and vision driven. The commission concluded that this adaptive management can also be useful in stable and functional municipalities to overcome the challenges of

water management. Knysna Municipality and City of Cape Town are some of the municipalities which successfully adopted the adaptive management system in water management (Frame, et al. 2018).

However, Cullis (2015) further argued that the effects of climate change may not be mitigated by 2050 should drastic measures not be taken. The findings show that the Greater Giyani area is largely affected by high temperature levels which results in drought. Thus, adaptive water management policies and programmes will be necessary to mitigate the effects of climate change.

4.4. Bulk water distribution challenges

The limited infrastructure in GGM is due to the fact that the villages are geographically scattered, making installation of the required bulk water infrastructure costly (GGM-IDP, 2022). According to the MDM-IDP (2023), the sudden drop in water levels at the Middle Letaba dam in 2009 was unexpected and the communities were left devastated since then. The interviews have also revealed that societal ills such as infrastructure theft and vandalism, and illegal water connections are the contributing factors to the existing challenges. According to the respondents, the mentioned challenges are often experienced in the rural communities. It was also reported that water consumption exceeds 150 litres per person per day when water is available, which is over the acceptable quantity (MDM-IDP, 2023:75).

4.4.1. Inadequate infrastructure and insufficient bulk water distribution

The existing infrastructure in Giyani is reported to be inadequate to distribute the expected bulk water to the rural communities (GGM-IDP, 2023). The WSA₁ supplies approximately 56 mL/d to GGM. The Middle Letaba dam and its treatment water works capacity at 24mL/d and Nsami dam and its treatment water works capacity at 28 mL/d. Water demand in rural communities has risen and the carrying capacity of the bulk pipeline and the water treatment works is disproportional to the number of household beneficiaries.

The existing water infrastructure in figure 9 does not conform to the required capacity to supply the existing population in the rural communities of Giyani. Should bulk water supply be adequately available, the existing bulk pipeline and schemes do not have enough capacity to supply the communities efficiently. Maake and Holtzhausen (2012)

indicated that an increase in water supply in the system may not resolve the existing challenge without upgrading the inadequate and dilapidated water infrastructure.

A respondent responsible for water operations stated that the Middle Letaba WTW is operating below design capacity where out of twenty filters only three are operational due to insufficient water supply from the dam.



Figure 9: Middle Letaba WTW operating below capacity due to insufficient water.

During observations, it was also found that certain components of the WTW had no water available for treatment. It was confirmed that only three filters had water and the other 17 filters were completely dry. According to interview data collected from the Plant Superintendent, certain villages do not have water infrastructure linked to the water treatment works. It was also discovered that most South African townships and hinterlands that were set aside during apartheid continue to face a lack of infrastructure provision (Weaver et al., 2017).

4.4.2. Dilapidated Water Infrastructure and Poor Maintenance

Water infrastructure has been dilapidated due to poor maintenance over the years. This challenge contributes to water leakages and frequent pipe bursts. The Mopani WSDP (2021) reported that over 50% of water is lost within the system which reduces a significant amount of bulk water. Ring-fencing of funds for operations and maintenance has proven to be a challenge for the WSA₁. There is no dedicated asset management plan and register that provides detailed information such as the lifespan and maintenance plan of the existing water infrastructure. The WSA₁ implements corrective maintenance

more than preventive maintenance which creates recurring defects, The Department of Water and Sanitation has since taken over the responsibility of the WSA₁ to implement some major bulk water projects and refurbishment of key infrastructure.



Figure 10: Water leakage from damaged booster pumps.

Amongst others, water gushing out of the booster pump shown in Figure 10 was discovered during observations. A respondent working at the plant indicated that the incident occurred over a month ago and the technical team had not attended to the problem yet. The respondent mentioned that the booster pump defect affects water pressure resulting in water not reaching some villages.

As shown in Figure 10 below it is evident that the leaking water pumps are not being maintained regularly and play a significant role in poor water provision. The leaking water pipe above is surrounded by green vegetation indicating that the situation has been ongoing. It was also found in a study conducted by Kola (2018) that the City of Johannesburg is experiencing frequent pipe bursts due to old water infrastructure. According to Kola (2018), the City has failed to conduct regular infrastructural refurbishment, upgrade and maintenance to ensure uninterrupted access to water. The study further suggested that the lack of reporting and communication channels between the City and members of the community exacerbated delayed maintenance of water leakages.



Figure 11: Unattended water pipe leakage.

The majority of the respondents responsible for operations and maintenance have indicated that the WSA₁ does not implement preventive maintenance. Participants also stated that the lack of skilled and qualified technical officials affects the maintenance department negatively. A plant supervisor reported during interviews that serious defects such as pipe bursts can take over a month without maintenance. The finding is that delayed maintenance plays a significant role in denying rural communities' access to water. Furthermore, old water infrastructure is not being maintained nor replaced accordingly, hence water leakages and pipe bursts are prevalent.

The overall state of O&M of water infrastructure is concerning especially within the South African rural municipalities (Motsoeneng, 2022). The challenge facing O&M is caused by governance related failures. Political interference in finances and planning in municipalities severely threatens the state of water infrastructure. A finding emerged at Makana Local Municipality which expressed that improper mapping, poor maintenance, and upgrading of water infrastructure has led to recurring infrastructure breakdown (Weaver et al., 2017). Similarly, a study was conducted at Makhuduthamaga Local Municipality in Limpopo Province, which found that maintenance of water infrastructure was absent, especially in rural communities. This was due to users' unwillingness to pay for municipal services (Selala et al., 2019:303). Considering the results presented above,

the study found that maintenance of water infrastructure is also a challenge in some rural municipalities.

4.4.3. Inadequate water services personnel

According to the Mopani WSDP (2021), the WSA₁ has inadequate human resource capacity to provide water due to a lack of relevant skilled personnel to run water operations and maintenance indicated in Table 10. Failure to expedite the recruitment of skilled personnel played a critical role in exacerbating the water service delivery backlog. The WSA₁ does not have adequate technical capacity to conduct project supervision on large-scaled water infrastructure projects. Thus, certain turnkey water projects take longer to complete due to a lack of engineers to undertake project planning and implementation within the WSA₁ (Mopani WSDP, 2021). According to the WSDP, the WSA₁ requires the following staff complement as tabled below:

Table 9: Vacancies for water O&M staff at MDM (Mopani WSDP, 2021:11)

Position	Vacancies
Water operations	
Superintendent	39
Process Controller	85
Assistant Process Controller	137
General Workers	107
Water maintenance/technical	
Administrator	1
Artisan Plumber	73
Artisan Fitter	1
Booster Pumpstation Operator	60
Borehole Volunteers	37
Chief Operations Superintendent	34
Deputy Manager	7
General Worker	52
Risk Practitioner	1
Satellite Manager	5
WDM Technician	174
Total Headcount	813

According to the WSDP (2021), 813 vacancies for both operations and maintenance must be filled to enable the WSA₁ to perform effectively. Respondents under operations and maintenance also reported that there are few officials responsible for operations and maintenance which leads to delays in resolving water challenges.

A study conducted by UNESCO has found that poor access to water in Africa is exacerbated by a lack of personnel and skilled staff responsible for water services at the technical and operational levels (United Nations Educational, Scientific and Cultural Organization, 2012:12). The study further revealed that technical and vocational education and training (TVET) has not found expression in the national and international education policy agenda over the years. According to the Auditor General's Report (2018), the lack of technical expertise such as engineers and scientists in municipalities creates a backlog in service delivery. Furthermore, it was reported that majority of the South African municipalities are forced to outsource technical services for reactive maintenance incidents (Ncube and Monnakgotla 2016:75).

4.5. Water reticulation challenges

It was reported in the MDM-IDP (2023) that, failure to provide water in terms of the RDP requirement of 25 litres per person per day is due to inadequate water reticulation infrastructure. Mdanisi (2010) argued that the RDP has not fulfilled its purpose of providing a better life to all citizens of South Africa as the majority of rural communities still do not have access to free basic water. It was observed during fieldwork that water reticulation remains a challenge in rural communities due to a lack of access to the 25 litres per person per day in terms of the RDP. Majority of the respondents have also indicated that the RDP does not apply to most rural areas due to various challenges discussed below:

4.5.1. Inadequate water reticulation infrastructure

According to the observation undertaken, the majority of the rural communities lack reticulation infrastructure which hinders access to water in various areas. Figure 12 below was taken during fieldwork at Ngove village, 15 km away from Giyani town. The Figure depicts a woman who travels over 3 km to access potable water. Murwirapachena (2022) stated in his research stated that most households in South Africa continue to access water over 200 m away from their homes. These results contradict the White Paper on the Water Supply and Sanitation (1994) which states that a person should cart a maximum distance of not more than 200 m from their dwelling. Winkler (2012) stated that except for travelling long distances, women also spend long hours standing in slow-moving queues for water.



Figure 12: A woman travels over 200 m to access water.

A participant stated that load-shedding affects daily production and water reticulation since borehole and plant operation is solely dependent on electricity. The plant is unable to supply water to communities during power outages as there is no power backup to ensure uninterrupted water supply to communities. It was also reported that the WSA₁ has purchased power generators to energise some WTW during power outages but barely operate due to the unavailability of diesel. According to the Water Resource Commission (2011), load shedding in South Africa contributes to water supply interruptions since it affects the entire production and supply system. Water abstraction, treatment, distribution, and reticulation require electricity to energise boreholes, pressure pumps, treatment plants, and other related machines (Water Resource Commission, 2011).



Figure 13: Women standing long hours to access water.

According to Omarova et al., (2019) in a study conducted at Central Kazakhstan, it was discovered that women walked approximately 17km to collect potable water. The water reticulation system installed by the government was insufficient to cover the entire rural population. They study further revealed that the villagers used alternative sources of water due to unreliable supply of tap water by the government. Thus, the use of unsafe open water and underground sources for domestic use became eminent in the village of Kazakhstan (Omarova et al., 2019)

4.5.2. Mushrooming water businesses

Figure 14 below depicts the commercialized rural water cartage caused by lack of basic water services. It was observed during fieldwork that some community members who drilled boreholes were operating water businesses. Members of the community at Maswanganyi Village purchased water from big tanks to use for the long term in their households. In terms of Section 22 of the Water Services Act, an authorisation or nomination must be applied for and granted by the relevant Water Services Authority before performing any water transaction.



Figure 14: Commercialised rural water cartage.

At Homu village just outside Giyani town, a donkey cart was observed transporting water as depicted in Figure 14. The owner of the donkey cart is in the business of transporting water for villagers due to the long distance to where water can be accessed. A respondent responsible for water operations at the WSA₁ stated that rural communities are suffering the most from a lack of basic services such as water. It was mentioned during interviews that the majority of rural households are headed by grant dependant pensioners who are compelled to spend little income for survival. The South African Human Rights Commission report was released in October 2023, clearly stating that poor and insufficient access to water is a recurring challenge faced by communities in Limpopo Province (South African Human Rights Commission, 2023). The commission further stated that despite the increase in water provision across the country, Limpopo province is still lagging.

4.5.3. Theft and vandalism of water infrastructure

It was reported in the GGM-IDP (2023), that vandalism of water reticulation infrastructure is rife in the rural communities. The municipal IDP indicated that projects for reticulation infrastructure were completed and vandalized by community members before operation as shown in Figure 15 below:



Figure 15: Vandalised water tap by community members.

Theft of reticulation equipment such as boreholes, diesel, electricity cables and transformers, booster pumps, and taps is a major setback to sustainable water reticulation in rural communities. Electrical copper cables and transformers are targeted by criminals for reselling (MDM-IDP 2022). As depicted in Figure 16 below, the transformer meant to energize the borehole was found missing.



Figure 16: Transformer meant to energise the borehole was missing.

During the interviews, an overwhelming majority of the respondents reported that theft and vandalism of water infrastructure contribute significantly to the failure to provide water to rural communities. A respondent at a managerial level from Greater Giyani Municipality

reported that vandalism and theft often occur in areas where the taps are dry. It was also alleged by one of the respondents that due to poverty, community members removed standpipes to trade at the scrapyards. According to Cobbing et al., (2014) theft and vandalism of infrastructure remains a serious challenge to water access in rural communities. Theft of electricity transformers, cables and other critical components of the system are targeted by criminals (Johannessen et al., 2014). According to a study conducted by Kwati (2022), when there are water interruptions, some community members demonstrate their frustrations by vandalising water infrastructure in Limpopo Province. Meissner (2015) conducted a similar study at Greater Sekhukhune District Municipality and found that theft and vandalism are prevalent in the area. It was reported that criminals mainly target water infrastructure such as pipelines, electrical cables, and equipment within treatment plants. It was suggested that poverty and unemployment could be the major factors leading to the challenge. However lack of law enforcement was stated to have exacerbated the criminal activities.

4.5.4. Illegal water connections

The results have shown that illegal water connections play a significant role in destabilizing water reticulation. Rural communities that are located far from the reservoirs and tanks hardly receive water due to reduced pressure and flow caused by illegal connections (MDM-IDP, 2023). Respondents stated that poor yard connections of water taps result in community members connecting illegally into the main pipeline. These connections result in excessive water leakages and reduce pressure due to poor workmanship during the connection of pipelines.

Similarly, Mdanisi (2010) found that due to poor reticulation, communities that lack sufficient water reticulation infrastructure resort to tempering with bulk pipelines to access water in their neighbourhoods. The study was conducted at Makoxa village within Mopani District Municipality in Limpopo. Ngcobo (2021) conducted an investigation of water tampering and illegal pipping connections in Folweni township under eThekweni Municipality within KwaZulu-Natal Province. It was found that commercial and domestic water users engage in criminal activities by connecting illegally into the water system which led to interruptions in supply. One of the recommendations of the study was to create a healthy relationship between community leaders and the municipality.

4.5.5. Indigents and grant dependent communities

The Municipality is predominantly rural and composed of indigents or grant-dependent communities who therefore cannot afford to pay municipal rates. According to the GGM IDP (2023), the level of unemployment is above 60%. It was further reported that the municipality did not meet the revenue collection target in the previous financial years due to high number of indigent registrations and increasing poverty which affects household affordability to pay for water services. Respondents have highlighted that the municipality does not collect revenue in rural communities. It was reported that even those that are employed use water for free.

According to Ruiters (2018), the government of South Africa introduced the Municipal Indigents Policy to identify poor households that cannot afford to pay for basic services such as water amongst others. Affording, households should be liable to pay for water services. Rural municipalities collect revenue mainly in urban areas as residents in rural areas live under poverty.

4.5.6. Non-revenue water collection

The households in rural areas do not have water meters, which makes it difficult to quantify water consumption for billing purposes (Mopani, 2022-2023: 43). It is difficult to plan for effective water management when water loss/consumption is unknown and unmeasured (Du Plessis, 2007: 23). The municipality cannot undertake water conservation and demand management in the absence of water meters (Mopani Water and Sanitation Master Plan, 2021). Table 11 below depicts an estimate of non-revenue water as well as the water losses through leakages:

Table 10: Water produced, consumed, lost, and meter connections (Mopani WSDP, 2021).

Municipality	Input volume (m3/annum)	%NRW	Litres/capita/day	Infrastructure Leakage Index (ILI)	Population served	Households served	Connections metered	Connections unmetered
Greater Giyani	19 136 393	54,5 %	328	9.0	159 642	43 927	29 841	14 086

According to the data in Table 11 above, 54.5% of water is not billed and no revenue is being collected to sustain water provision services. The GGM-IDP (2023) stated that

some employed residents living in urban areas of the municipality are also unwilling to pay for water services resulting in poor provision of water services. A respondent mentioned that inconsistent water provision could be the reason for non-payment of water services. Another respondent stated that the municipality has not developed any effective mechanism to recover revenue. However, according to the Water Resource Commission (2012b), non-revenue water in South Africa is generally dominated by water loss within the system due to pipe leakages, illegal connections, and inadequate infrastructure, as opposed to water consumed for domestic purpose.

4.6. Poor implementation of planning and legal documents

Amongst others, the most fundamental laws and plans that must be implemented to ensure sufficient access to water were discussed in this section. All pieces of legislation in South Africa give effect to the Constitution, hence the study made findings on water provision based on the legislative frameworks. The National Water Act and Water Services Act are the core legislative frameworks that guide how the Constitutional right can be realised. The development and implementation of municipal water bylaws and sector plans are aligned with the legislative framework and legally binding, hence a finding was made against the effectiveness of the Mopani Water Services Bylaw and Mopani Water Services Development Plan.

4.7. Poor implementation of the legislative framework

Document analysis revealed that South Africa has developed progressive and just laws to ensure that every citizen has sufficient access to water. Dugard (2021) stated that poor implementation of the legislative framework is a challenge in the country, and this was supported by the lack of access to water in the rural communities within GGM. An analysis of key water legislative frameworks was undertaken to establish whether the rights of rural communities in GGM are protected or violated. The Constitution of the Republic of South Africa, National Water Act and Water Services Act were identified, and findings were made about rural communities in GGM.

It is enshrined in Section 27(1)(b) of the Constitution that everyone has a right of access to sufficient water. Considering this constitutional right, it is noteworthy that the rural communities in GGM are deprived of access to sufficient water and that their human rights are violated. Section 43(1) of the National Water Act promotes fair water reallocation,

beneficial water use, resource management, protection of water quality and ecosystems amongst other things (Schreiner & Hassan, 2011:98). In the year 2018, the then Minister of the Department of Water and Sanitation published a notice in the gazette for reserve determination of the Letaba catchment. In contrast, respondents working for the Department are unaware of any classification being set which directly affects the implementation of the proposed management conditions. No information was found regarding the classification of the Nsami catchment, and this compromises protection and management. The Water Services Act 108 of 1997 was established to fulfil the mandate of Part B of Schedule 4 of the Constitution which requires local governments or municipalities to exercise their legal obligation by ensuring that water and sanitation services are provided effectively to ensure access to the potable water supply as well as domestic wastewater and sewage disposal systems (Winkler, 2012:147).

In contrast to the provisions of the Act, the South African Human Rights Commission (2023) investigated access to water in Greater Giyani Municipality. The commission stated that the WSA₁ is not compliant with the Water Services Act and does not meet the minimum requirements to provide 25 litres of potable water per day per person. The report revealed that consumers often spend over seven days without water. The Act provides the Water Services Authority powers to set national norms and standards for tariffs. The user-pay principle in water services is significant to enable service delivery and the GGM-IDP 2023 has stated that revenue collection is poor which means that this Act is not being implemented effectively. It provides for the preparation of WSDPs by Water Service Authorities. The WSA₁ has developed the WSDP, however, its implementation is questionable.

4.8. Poor Implementation of Municipal Water Bylaw

According to Steytler et.al (2000:8) a municipal council in South Africa is expected to pass by-laws as a legally binding document of the municipality. This statement is grounded in Section 160(6) of the Constitution which requires the municipal council to make laws to rule and make orders regarding its internal arrangements and functions. This implies that the Municipality is granted legal powers and authority over any business within its jurisdiction. The municipal IDP and WSDP highlighted numerous challenges pertaining to poor revenue collection, theft, vandalism, and illegal water connections. This suggests

that the WSA₁ has no will or capacity to implement and enforce the Mopani Water Services Bylaw to deal with existing challenges.

4.9. Poor implementation of water sector plans

According to the GGM-IDP (2022) for over a decade, rural communities have been facing recurring water challenges, and no tangible progress has been made to redress this ongoing affliction of human rights. The Water Services Act 1997, states that every water services authority must develop a Water Services Development Plan for its area of jurisdiction. The WSDP aims to enhance planning for water and sanitation provision through the integration of information and knowledge that integrates all topics about to provision of water and sanitation services. Considering the latter, the benefits of WSDP are yet to be realised in the WSA₁ since challenges about poor planning for water provision persist.

According to the observations made, the current state of water provision does not reflect proper planning in terms of what the WSDP stands for. A respondent in a managerial level responsible water services at the Mopani District Municipality stated that some officials within the water services section have no idea of what the WSDP seeks to achieve. Water provision challenges persist, and the finding is that the WSDP is not being implemented for the planning of water services provision. It is befitting to suggest that the WSDP was only developed for legal compliance purposes. Dyasi and Kanyangale (2018) emphasised that most credible WSDPs in the District Municipalities across South Africa are fruitless artifacts due to poor implementation. This was attributed to a lack of skilful and coordinated water managers, engineers, and financial managers to collectively plan for water service delivery based on the WSDP.

4.10. Poor involvement of women in water management matters

One of the Dublin principles advocates for women's participation in water management initiatives that affect their communities. An elder woman is shown in Figure 17 collecting water in a rural community. This principle finds support within the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), which lays the ground for all the member states to consider and promote the rights of women to fairly participate in water management (Winkler, 2012:55).



Figure 17: Women as major stakeholders in water management.

During observations, it was revealed that the majority of the people searching for water were women. However, the involvement of marginalized women in the planning processes remains questionable. A respondent in the interview stated that due to high poverty in rural communities, the public interest is vested in job opportunities in water projects as opposed to planning and management. The Convention is against women's discrimination and promotes their involvement in water management affairs. CEDAW fights against women having to spend long hours collecting water without being engaged by authorities in more gainful and beneficial activities. It was revealed during the Convention that poor African women in rural areas are struggling to access water as they look after the entire family (Winkler, 2012).

Thai and Guevara (2019) assessed a policy for women and water management in An Giang Province, Mekong Delta, Vietnam. The area is predominantly rural and women were not represented in water management and decision making processes. Women were only responsible for fetching water and taking care of other domestic responsibilities. The study concluded that poor involvement of women in water management and decision making exacerbated water shortages in Mekong Delta (Thai & Guevara, 2019).

4.11. Non-compliance with the blue drop and green drop programme

In the year 2022 Green Drop and Blue Drop reports were published by DWS and numerous findings of non-compliance with the assessment criteria were presented in each report. Table 12 below depicts the Green Drop audit history scores recorded since 2009:

Table 11: Green drop scoring history for Mopani (DWS, 2022_b)

Mopani Green Drop Score	
2021 Green Drop Score	32% ↓
2013 Green Drop Score	37%
2011 Green Drop Score	52%
2009 Green Drop Score	0%

According to the 2022 Green Drop Report, the latest audit scoring is at 32% which indicates that the performance of the WSA₁ is very poor and requires urgent attention. The preceding audit scoring was at 37% which shows that the performance of the WSA₁ has regressed since 2013. This means that the WSA₁ has not been complying with the entire assessment criteria of the programme. The green drop report stated that the WSA₁ is partially compliant on matters pertaining operation and supervision of staff at the WWTW. No qualified scientific, technical, or engineering staff was verified. The report found that the laboratory stationed in Giyani does not exercise any water quality assurance for compliance with DWS conditions. The asset registers of the WSA₁ were not produced and the maintenance plans were reported not to be informed by the condition and age of the asset. An incident of leaks and spillages along the sewer network in Giyani was reported. A backup generator was purchased but it has been reported to have no diesel. An extremely high turbid effluent was reported to discharge into the stream. Poor application of process control principles such as desludging of clarifiers. Poor implementation of Wastewater Risk Abatement Plan (Department of Water and Sanitation, 2022_b).

It was discovered that most of the findings made in the 2022 Green Drop report are like those of Ntombela et al., (2016). Challenges such as lack of qualified personnel lead to failure in preparing credible corrective plans as well as implementation of Wastewater

Risk Abatement plans. Poor working relationship between local municipalities and WSAs. Theft and vandalism of wastewater infrastructure also emerged as contributing factors towards non-compliance (Ntombela et al., 2016). The majority of the respondents had little knowledge of how the WSA₁ is performing in terms of the Green Drop scoring, however, they raised various challenges in line with the assessment criteria such as inadequate human resources, lack of maintenance, and training amongst others. It is evident that handling wastewater is a common challenge in the country and MDM is no exception.

Table 12: Mopani Blue Drop Low Risk Rating Score (DWS, 2022_a)

Municipal BDRR Score:	
2021 Mopani BDRR S	49.4%

According to Table 14, the WSA₁ has scored 49.4% for the Blue Drop Risk Rating (BDRR) which means that the overall risk is low. However, the report has identified certain areas that require interventions to improve the current BDRR. The 2022 blue drop report found that the WSA₁ has not submitted the verification documents for the design capacity of water supply systems. The WSA₁ has not appointed qualified staff for operations and maintenance. No Water Safety Plans were submitted for assessment from the Giyani WTW. It was also reported that none of the WTW in the WSA₁ has complied with the Chemical Monitoring compliance which becomes a health risk to communities.

According to Nealer and Mtsweni (2013), in their study of the Blue Drop Certification Programme in Nkangala District, Mpumalanga Province, similar findings to those in the Green Drop emerged. It was found that most challenges are prevalent in smaller municipalities. The identified challenges included a lack of skilled personnel, insufficient funding for water services, lack of capacity to implement water quality requirements, and poor access to laboratories. It is not surprising that the respondents also made no distinction between the Green Drop and Blue Drop. This can also be justified by the fact that the assessment criteria are almost the same for with few exceptions. Nonetheless, the WSA₁ is performing fairly well in dealing with WTW as compared to WWTW.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

In South Africa, everyone must have access to sufficient water as a basic human right expressed in Section 27 of the Constitution of the Republic of South Africa. As discussed in chapter one, the problem statement illustrated the violation of human rights due to poor access to water in the rural areas within Greater Giyani Municipality for over a decade. Thus, the need to analyse the challenges affecting access to water was established. In chapter two, the literature review was conducted mainly to discuss fundamental aspects required to ensure sufficient access to water. The literature review discussed in detail the water management theories and approaches, policy and legislative frameworks, Dublin principles of water management, and case studies among others. Chapter Three of the study proposed effective research methods to investigate existing challenges that affect water provision in rural communities within Greater Giyani Municipality. Chapter four of the study presented the results and discussed findings in themes. The last objective of this study was to provide recommendations based on the findings made in the preceding chapter. Therefore, this chapter provided recommendations in line with the findings to improve the status quo of water provision in the rural communities within Greater Giyani Municipality.

5.2. Conclusions

The analysis of challenges affecting access to water in rural communities of Greater Giyani Municipality was at the centre of the study. To achieve this, the study deemed it necessary to first understand the fundamental aspects required to provide access to sufficient water within the literature review. Therefore, the findings made were linked to the literature review to provide tested solutions to the investigated challenges. The following conclusions were made:

5.2.1. Water sources

The study made findings on both the groundwater and surface water sources that are expected to supply water to the rural communities within Greater Giyani Municipality. It emerged that the main surface water sources Middle Letaba and Nsami dams are distressed due to extremely low raw water levels. It was found that the dams are unable

to supply sufficient raw water into the WTW for reticulation into communities. Low dam levels were attributed to the failure of the National and Provincial Departments of Water and Sanitation to undertake classification and set a reserve for the resources in terms of the National Water Act. The extreme hot weather, low rain fall patterns, and drought conditions linked to climate change were found to have played a significant role in reducing water in the dams.

Findings were further made regarding groundwater supply challenges which are mainly due to low yield and dysfunctional boreholes. Certain boreholes run out of water as aquifers are over-abstracted without any conditions being adhered to. Some of the boreholes were not energized due to stolen electrical cables and transformers meant to supply power to the boreholes. The ongoing load-shedding was also found to exacerbate water supply interruptions.

5.2.2. Bulk water distribution

The research found that bulk water distribution was facing challenges caused by poor investment in infrastructure over the years, and unavailability of water. The distressed water sources had a direct effect on the bulk water distribution and the entire water supply value chain. The research revealed that bulk water infrastructure was old and dilapidated which led to regular water leaks and pipe bursts. A finding was also made that poor maintenance of infrastructure resulted in poor water provision. The municipality was found to focus more on corrective maintenance than preventive maintenance. It was also discovered that the municipality has no asset management plan and register for water infrastructure. The funds for maintenance were spent on other activities rather than ring-fencing them for maintenance purposes. It was found that the municipality has an inadequate number of personnel responsible for water operations and maintenance of infrastructure. It becomes challenging for the small maintenance team to deal with water incidents on time. A finding was also made that very few of the appointed personnel are skilled and qualified for the job, which compromises service delivery.

5.2.3. Water reticulation

It was revealed that infrastructure is inadequate for effective water reticulation in rural communities. Community members were observed walking over 3 km to fetch drinking water and donkey carts were also hired as a means of transport. The findings have reflected numerous challenges such as theft and vandalism of water infrastructure by community members which poses a question on enforcement of municipal water bylaws. Illegal water connections contributed immensely to water reticulation challenges as farmers took advantage of poor law enforcement.

It was found that households in the rural communities are predominantly indigent which triggers the Free Basic Water policy. The study has illustrated the importance of revenue collection in the municipality to enhance service delivery. However, a finding was made that even those who qualified to pay for water services were not willing to pay. The culture of non-payment for water services negatively affects the financial capacity of the municipality to reticulate water effectively.

5.3. Implementation of policy and legislative framework, and sector plans

It has emerged that poor implementation of policy and legislative frameworks is an ongoing challenge across all spheres of government. The implementation of Section 27 of the Constitution of the Republic of South Africa, the National Water Act, and the Water Services Act was the major challenge for the National and Provincial Departments of Water and Sanitation. The municipality developed sector plans such as the WSDP to enhance planning for water and sanitation services, however, the plan has made no tangible impact as provision for water worsens. The Water Services Bylaw was also developed to assist with enforcement and to provide legal guidance in the functions of water services. It was discovered that the municipality was unable to enforce the bylaw. All legal and planning documents are in place to ensure effective water provision; however, these documents are only developed for compliance purposes.

5.4. Public participation

Public participation is at the centre of the Municipal Systems Act which promotes the involvement of all members of the community in any municipal planning processes. The importance of planning for the people with the people has been neglected in the municipality and community members were reduced to employment seekers. The undermining of rural communities by the municipality to participate meaningfully in decision-making has impacted water services negatively. Arnstein (1969) illustrated various levels of citizen involvement in planning and decision-making processes and the rural communities are deemed as non-participants according to the ladder of participation.

A finding was made that women are the dominating water users in the households which must be given first special involvement when planning for water as expressed in the Dublin Principles. Some of the existing challenges such as illegal connections, theft, and vandalism of water infrastructure can be reduced should public involvement be strengthened in the planning and management of water services.

5.5. Recommendations

One of the objectives of this study was to propose recommendations that can be adopted to resolve the existing challenges affecting access to water in rural communities within GGM. The proposed recommendations were made based on the findings and conclusions of the study in the following manner:

5.5.1. Implement the Resource-Directed Measures strategy

The investigations have found no information about classification of the Nsami catchment in terms of the NWA. The Middle Letaba catchment was classified in 2018 in terms of the NWA. However, the current condition of both catchments requires urgent management action. There is a dire need for their protection and to manage the use of water resources through the adoption and implementation of the Resource Directed Measures strategy. The decisions taken through the RDM strategy are legally binding for the attainment of a sustainable balance between the protection and use of water resources. The RDM strategy is made of three components enshrined in Chapter three of the National Water

Act 1998 which must be undertaken and implemented to improve the sustainability of the Middle Letaba and Nsami catchments.

The classification system: This component will determine suitable classes for the Middle Letaba and Nsami dams. The determined class will assist the Department of Water and Sanitation to understand the existing condition of the resources.

Resource Quality Objectives: This component will assist the Department of Water and Sanitation to develop conditions suitable for the management of the determined class. It will assist the Department to put classification and reserve into practice (Water Resource Commission, 2012a).

Reserve: This is an integral part of the RDM strategy which assists the Department to set aside required water for reserve before allocating water for any other uses. Setting aside the Reserve will sustain Nsami and Middle Letaba dams.

As part of enhancing water resources management, lessons were learned from the Nigerian case study. An initiative was taken by the Nigerian government Ministry of Water Resources and relevant stakeholders to support implementation of IWRM and proposed interventions to address water challenges. The government of Nigeria disseminated information to all stakeholders to expedite problem solving and inputs. Project solving projects were launched to address water access challenges in the rural communities. Among others, the actions taken included clearing of aquatic weed infestations that blocked the river flow, dredging of channels, improved flood early warning and conflict resolution. IWRM committee was formed to enhance water resource management and multi-stakeholder involvement for catchment management plan aiming to restore and ensure sustainable development of water resources. The restoration of the Komadugu Yobe basin in 2007 and improved consensus was a success, and the lesson triggered the then Nigerian President Olusegun Obasanjo to announce the IWRM implementation nationally (Smith et al., 2017).

5.5.2. Review water use authorizations and licenses

According to Parson and Wintzel (2006), the more water is used the more it poses a threat to the resource. It is recommended that a review of water use authorizations and licenses be undertaken to ensure that all users abstract water based on water availability. The conditions attached to water licences must be flexible for review from time to time depending on water availability and prioritization. The review of water use licenses of users such as commercial farmers abstracting water from Middle Letaba and Nsami resources needs to be reviewed and monitoring must be done to ensure adherence to the conditions of the authorisation.

A recommendation adopted from the Brazil case study on water use authorisation and licenses can be tested by the Department of Water and Sanitation. The allocated water use license authorisation can also be suspended, fully or partially, and without liability to the public authority in case of the following:

- Failure to comply with water license.
- Non-water usage for over three successive years.
- In the event where water is required following unexpected disasters.
- When water is needed to mitigate adverse environmental impacts (Marques 2022: 163)

5.5.3. Adaptive water management

It is recommended that all spheres of government must develop adaptive policies and plans that are resilient to current and future external changes such as climate change, drought, extreme hot temperatures, and population dynamics (Pahl-Wost, 2008). Greater Giyani Municipality needs to develop plans that are resilient to dry seasons and population growth. Water sector plans such as the WSDP must be future-oriented to take cognizance of population projections when planning for water.

The WRC adopted the Strategic Adoptive Management (SAM) system as suggested by Pahl-Wost in park management and water resources management. The commission was able to develop flexible and yet resilient community-centred plans that enabled management that is purpose and vision driven. The commission concluded that this

adaptive management can also be useful in stable and functional municipalities to overcome the challenges of water management. Knysna Municipality and City of Cape Town are some of the municipalities which successfully adopted the adaptive management system in water management (Frame, et al. 2018)

5.5.4. Implement preventive and corrective maintenance

The findings revealed that the rural communities within Greater Giyani Municipality are dilapidated and poorly maintained. According to Grimm (2012), preventive maintenance is conducted in terms of the operations and maintenance manual of the municipality. It is recommended that preventive maintenance be conducted to enable the replacement of the old and dilapidated water infrastructure and assets. An asset register and asset management plan will play a critical role in assisting the municipality with records of the installed assets and infrastructure, and how maintenance should be conducted. Corrective maintenance will also have to be implemented within 24 hours to avoid ongoing water interruptions.

5.5.5. Upgrade water infrastructure

It is recommended that existing infrastructure including WTW, bulk pipeline, reservoirs and reticulation system be upgraded to provide water sufficiently to the rural communities. The population has increased drastically over the years, however, little has been done to upgrade water infrastructure. A water and sanitation master plan must be implemented in line with the information contained in the WSDP to ensure that infrastructure investment serves the current and future populations.

5.5.6. Recruit skilled and qualified personnel

It was evident that the WSA₁ had inadequate skilled and qualified personnel to deal with water operations and maintenance. There is a need to recruit more qualified workers such as plumbers and electricians to deal with maintenance according to the required standards. Water operations vacancies should be filled to improve water production to supply the rural communities. It is also recommended that training courses be offered to current workers to equip them with relevant skills and knowledge to improve water provision.

5.5.7. Implement Water Conservation and Demand Management strategy

The implementation of WCDM is highly recommended to ensure the security of supply during drought given that rural communities are exposed to extreme summer seasons and severe drought. The strategy will enable the WSA₁ to adopt emergency water conservation measures including penalties and water restrictions. It should be taken into consideration that when water is scarce, tight restrictions must be implemented to ensure that the available water is used sustainably.

5.5.8. Establish a dedicated water law enforcement unit

To reduce the high rate of theft, vandalism of water reticulation infrastructure and illegal water connections, it is recommended that law enforcement officers be employed to deal with these challenges. Inspection of water infrastructure and assets should be conducted regularly with a dedicated team of law enforcement officers. A call center should also be established to enable community members to report any criminal activities to the officers.

5.5.9. Review indigent register

It is recommended that an indigent register be reviewed annually to correctly record community members who are eligible to receive free basic water. This will provide the WSA₁ with reliable information to plan for revenue and non-revenue water production.

5.5.10. Implement a non-revenue water reduction strategy

The water loss reduction strategy will assist the WSA₁ in reducing water losses through leaks and illegal connections. In India, a case study of Jamshedpur, non-revenue water loss reduction was successfully undertaken, and it can also be recommended that Mopani District Municipality adopts the strategy discussed as follows:

- Focus on igniting public awareness to encourage water conservation through water-oriented marches, workshops, and seminars.
- Introduce water meters and develop water policies that are communicated through media platforms and public exhibits.
- Initiate intense stakeholder involvement and community robust engagements.
- Assess water leakages and illegal connections.

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- Incentivize households with three months of unbilled water services for their willingness to allow the Municipality to install water meters
 - Establish a 24-hour helpline to enable the community members to lodge water-related incidents and complaints.

5.5.11. Develop cost recovery strategy

It is recommended that cost recovery should be applied to those who qualify to pay for water services. As Gumbo and van der Zaag (2001:12) stated in the literature review water is a resource of high economic value that must not be viewed as a free good but a good that must be used sustainably. This suggests that Mopani District Municipality must strive to ensure that affording community members are billed accordingly. The Municipality should offer incentives to community members who pay for water bills continuously.

5.5.12. Enhance implementation of water services plans and laws

The findings have shown that Mopani District Municipality has the legal and planning tools necessary to ensure access to water in rural communities. Implementation of sector plans, policy, and legislative framework is a challenge across the spheres of government. It is recommended that the WSA₁ should implement the WSDP as it provides reliable comprehensive information that can assist in planning for water services. The Water Services Bylaw needs to be enforced to protect and guide water operations, assets, and functions. Amongst others, section 27 of the Constitution of the Republic of South Africa must be realized through the implementation of the National Water Act 1998 and the Water Services Act 1997.

5.5.13. Enhance public participation and women involvement

According to Arnstein (1969), public participation has various levels and the effective one creates an environment for the marginalized to make decisions during planning, implementation, and management processes. It is recommended that rural community members must be actively involved in all water services matters. Involving community members in decision-making can reduce water mismanagement, improve the protection of water assets and infrastructure, and create a sense of ownership in water projects. The Dublin principles specifically promote the involvement of women in water management,

and it is recommended that the Municipality implement this principle to enhance effective water management. Lessons can also be learned from the case study of rural Uganda where a demand driven approach to water governance was adopted. This governance approach focused on engaging stakeholders such as the private sector, all water users, NGOs and local authorities to work together in unison to improve access to water in the rural communities of Uganda (Naiga, 2015). The demand driven approach further involved women in decision making and policy making processes. Water governance was more inclusive and local based committees were established with a balanced gender representation. The Ugandan government acknowledged that access to water in rural communities improved abruptly since implementation of the demand driven approach (Naiga et al., 2015).

5.6. Study limitations

It is normally expected that every research is subjected to certain limitations, and this research was no exception. Time constraint was a major limitation caused by the unavailability and delays from key respondents to participate in the interviews. Gaining access to municipal hard-copy documents that could not be accessed online was challenging and time consuming.

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ANNEXURE A: INTERVIEWS CONSENT FORM

You are being requested to participate in an interview to analyse the challenges affecting access to water in rural communities within the Greater Giyani Municipality. The purpose of the interview is to gather more in-depth responses from the Municipal officials of the WSA₁.

You were purposely selected as a possible participant in this study because your participation in the survey conducted in 2023 will enable the researcher to address three objectives to discuss fundamental aspects of providing access to water, to investigate the existing challenges in the provision of access to water and to recommend effective mechanisms in improving access to water in rural communities within Greater Giyani Municipality.

If you have agreed to participate in this interview, you have been requested to do the following:

- Indicate a time and date when you will be available for an interview in the months August and September. The interview should take no more than 45 minutes of your time.
- Indicate whether you prefer to be interviewed in person, telephonically, via email, or via Microsoft Teams.

Please also consider whether you agree to the recording (audio only) of the interview to ensure that it can be accurately transcribed. The recording will be deleted as soon as it has been transcribed. You will have the right to review and edit the audio recording if you so choose.

The recordings from this interview will be kept as confidential as possible. No individual identities will be used in any reports or publications resulting from the interview. All transcripts will be given codes (e.g., Respondent) and stored separately from any names or any direct identification of participants. The information gathered from this interview will be solely used for this research and nothing else.

Potential risks and discomforts

No risks or discomforts are foreseen. If a risk is identified, or discomfort is experienced, the interview will be stopped. You further have the right to end the interview at any time and for any reason.

The research will assist in identifying the key challenges that affect access to water in rural communities. It will further contribute to establishing sustainable solutions to ensure access to water by the rural communities in Greater Giyani Municipality.

No compensation can be offered for participation in the interview.

You may withdraw from the interview at any time and do not have to provide a reason.

The Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC) approved this study (Ref number: NWU-01229-23-A9) and classified it as falling into the risk category.

Contact details of the interviewer

Cell: 072 072 3029 / E-mail: cindyrevival@gmail.com.

INTERVIEWEE CONSENT

I _____ confirm that the above information was explained to me in a language and in a manner that I understood. I further confirm that I am older than 18 years of age and hereby volunteer to take part in the study.

Signature _____ Place _____ Date _____

RESEARCHER CONFIRMATION

I Baphidile Revival Ngobeni hereby confirm that the contents of this document were explained to the participant in a language and manner that he/she could understand.

Signature _____ Place _____

Date _____

ANNEXURE B: INTERVIEW QUESTIONS – DWS NATIONAL

TOPIC: ANALYSIS OF CHALLENGES AFFECTING ACCESS TO WATER IN RURAL COMMUNITIES WITHIN THE GREATER GIYANI MUNICIPALITY.

I am Ngobeni BR, doing a master's degree in Environmental Management specializing in Water at the University of Northwest. The title of the study is "**Analysis of challenges affecting access to water in rural communities within the Greater Giyani Municipality**". I hereby request your participation as the study's success relies on your valuable contribution. All the information provided will be treated as strictly confidential and for academic purposes only.

The interview questions are as follows:

Mopani District Municipality (WSA): Director
1. What are the main challenges that hinder the WSA from ensuring that all rural communities within Greater Giyani Municipality have adequate access to water?
2. What is the latest blue and green status of the WSA?
3. What can you say about the effectiveness of Operations and Maintenance of water services infrastructure?
4. How do you ensure that infrastructure is well maintained?
5. Which measures are in place to deal with non-revenue water collection?

5. Which water sector plans does the WSA have and to what extent are they being implemented?
6. How is the WSA addressing the culture of non-payment for water services?
7. What intervention measures does the WSA have to ensure that all rural Communities within Greater Giyani have adequate access to water?
8. How often do you engage with communities on water-related issues?

ANNEXURE C: INTERVIEW QUESTIONS – DWS LIMPOPO

TOPIC: ANALYSIS OF CHALLENGES AFFECTING ACCESS TO WATER IN RURAL COMMUNITIES WITHIN THE GREATER GIYANI MUNICIPALITY.

I am Ngobeni BR, doing a master's degree in Environmental Management specializing in Water at the University of Northwest. The title of the study is "**Analysis of challenges affecting access to water in rural communities within the Greater Giyani Municipality**". I hereby request your participation as the study's success relies on your valuable contribution. All the information provided will be treated as strictly confidential and for academic purpose only.

The interview questions are as follows:

Provincial Department of Water and Sanitation: Director
1. How do you ensure that water use license conditions are adhered to?
2. How do you ensure that grants provided for water projects are used accordingly?
3. How do you ensure that water is allocated equally and set aside for reserve from the source?

4. How do you ensure that groundwater is monitored?

5. Is the middle Letaba catchment classified, and Reserve set aside for BHN (Basic Human Need)?

ANNEXURE D: INTERVIEW QUESTIONS – MDM (WSA)

TOPIC: ANALYSIS OF CHALLENGES AFFECTING ACCESS TO WATER IN RURAL COMMUNITIES WITHIN THE GREATER GIYANI MUNICIPALITY.

I am Ngobeni BR, doing a master's degree in Environmental Management specializing in Water at the University of Northwest. The title of the study is "**Analysis of challenges affecting access to water in rural communities within the Greater Giyani Municipality**". I hereby request your participation as the study's success relies on your valuable contribution. All the information provided will be treated as strictly confidential and for academic purposes only.

The interview questions are as follows:

Mopani District Municipality (WSA): Plant Superintendents
1. What challenges is the WSA facing on daily water operations?
2. Is the capacity of existing water sources sufficient to supply water to all rural communities in Greater Giyani Municipality?
3. Does the WSA have enough qualified Process Controllers and Technicians to operate and maintain the Waste and Water Treatment Works to supply the rural communities within Greater Giyani Municipality?

4. How do vandalism, theft, and illegal connections affect the water supply in the area?

ANNEXURE E: INTERVIEW QUESTIONS- GGM

TOPIC: ANALYSIS OF CHALLENGES AFFECTING ACCESS TO WATER IN RURAL COMMUNITIES WITHIN THE GREATER GIYANI MUNICIPALITY

I am Ngobeni BR, doing a master's degree in Environmental Management specializing in Water at the University of Northwest. The title of the study is "**Analysis of challenges affecting access to water in rural communities within Greater Giyani Municipality**". I hereby request your participation as the study's success relies on your valuable contribution. All the information provided will be treated as strictly confidential and for academic purposes only.

The interview questions are as follows:

Greater Giyani Municipality (WSP): Technical Services Director
1. Does the WSP provide efficient services and perform the duties as required in the contract with the WSA and the mandates of the constitution ?
2. Is water supply efficient and financially sustainable?
3. Which plans are in place to enhance sustainable water provision?
4. Do you have qualified personnel to ensure a sufficient supply of water?

5. Is water by-law being implemented accordingly?

6. How often do you conduct public participation meeting with interested and affected parties?