EXAMINING THE SOCIO-ECONOMIC IMPACTS OF WATER SERVICE DELIVERY IN THE ROOKDALE RURAL COMMUN ITY OF KWAZULU-NATAL, SOUTH AFRICA

By

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Declaration

This study was undertaken in fulfilment of an Applied Environmental Science master's degree and represents the original work of the author. Any work taken from other authors or organizations is duly acknowledged within the text and reference list.

06-02-2023

Signature (Student) Date

Mthokozisi Zwane

…… .....

Signature (Supervisor) Date

Romano Trent Lottering

Dedication

Dedicated to my father and Son

Plagiarism Declaration

I, Mthokozisi Njabulo Zwane declare that:

1. The research reported in this thesis, except where otherwise indicated is my original work.
2. This thesis has not been submitted for any degree or examination at any other university.
3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
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Acknowledgements

This project is possible through the support of several people. Their involvement is acknowledged and is much appreciated.

Firstly, to the Almighty God. I give you all the praise for blessing me with the opportunity of my masters. For you know the plans you have for me - Jeremiah 29:11

To my supervisors, Dr. Romano and Dr. Shenelle Lottering, thank you for your major support, guidance, understanding and patience.

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CHAPTER ONE: GENERAL INTRODUCTION

1. Introduction

1.1 Justification and background of research study

Access to basic water supply and sanitation is a human right recognized by various international and national guidelines. However, more than seven hundred and forty million people do not have access to basic water supply and sanitation, more than two billion people use dilapidated sanitation facilities and live mainly in poor neighborhoods (Jegede and Shikwabane, 2021). This negatively impacts environmental, social, and economic sustainability (Jegede and Shikwabane, 2021). Having access to clean water supply and sanitation is essential to the health of all people. Yet many people worldwide still do not have access to these basic needs (Tempelhoff, 2009). People who need access to improved water and sanitation face limited opportunities to realize their potential (Tempelhoff, 2009). Untreated drinking water and sanitation are the second leading cause of death for children worldwide (Tempelhoff, 2009). About ten thousand people die daily from poor water and sanitation-related diseases, and hundreds more suffer from various diseases (Macharia, 2021). Access to improved water supply and sanitation significantly reduces waterborne diseases (Macharia, 2021).

To deal with inequality in poor access to water. The Sustainable Development Goal (SDG) number 6 seeks to achieve global and equitable access to improved drinking water and sanitation by 2030. (Chitonge,). Tracking inequalities in access to drinking water and sanitation is essential to assess progress (Chitonge, 2020). The SDGs address inequality where Goal 10 aims to reduce disparities between and within countries (Chitonge, 2020). Sub-Saharan Africa (SSA) is one of the regions with little coverage of inequalities in access to drinking water and sanitation to assess progress (Hakimdavar, 2020). Like other developing regions, SSA (SSA) has yet to achieve the Millennium Development Goals (MDGs). However, it has made progress during the MDGs, with 42% of the current population having access to improved drinking water since 1990 (Tooke 1955, 2018). The region has seen a twenty percent increase in the use of improved drinking water sources (Chitonge, 2020). The SSA population doubled during the MDG period (1990-2015).

During apartheid-era in South Africa, no central government department was dedicated to the global supply and control of water, where the mainland government operated the water supply infrastructure (DWAF, 2004). The poorer black rural communities were inefficiently run by uncoordinated mainland government structures that depended almost entirely on the South African government for funding (DWAF, 2004). For example, the two homelands of Chiskai and Transkei were made exclusively for the Xhosa. Boptatswana was made exclusively for the Tswana, KwaZulu-Natal was made exclusively for the Zulu, Lebowa was made for the Pedi tribe, North Ndebele was made for the Venda tribe. Ghazankul was home to Shangaan and Tsonga, and Kwakwa was home to Basotho (DWAF,2004).

As a result, in 1994, it was calculated that a third of the South African population lacked access to enough water services, and half the population lacked adequate sanitation (DWAF, 2004). After apartheid, government investments have improved access to water and sanitation for black households, eliminating extreme inequalities that existed before 1994 (Stats SA, 2018). Despite progress, millions living in rural areas and informal settlements lack access to basic services (Stats SA, 2018). Resource allocation in this sector still reflects the vast inequalities caused during the apartheid era (Stats SA, 2018). Service delivery in South Africa remains divided along the racial groups that dominated the apartheid era (Dubow 1989). People with financial security have ready access to water (Hoogeveen, 2006).

Three themes have shaped water policy post-apartheid (Stats SA, 2018). First, there has been a focus on addressing the high inequalities that dominated the apartheid regime (Stats SA, 2018). This takes the form of government investments to expand infrastructure in poorer areas and policy initiatives to ensure that the poorest are provided with basic services (Stats SA, 2018). Second, the policy is shaped by a neoliberal ethos that emphasizes cost recovery, “user payments,” and “demand management” (Stats SA, 2018). Lack of water supply and funding characterize policy approaches in this sector (Stats SA, 2018). Water prices are designed to reflect economic value and shape resource allocation (Stats SA, 2018). Finally, services are designed to be sustainable and self-financed at the local level (unless poor communities cannot provide basic services, in which case the government subsidizes construction). You can, but you cannot subsidize the operation of the service (Stats SA, 2018).

1.2 Aim and objectives

This study aimed to examine the impacts of water service delivery on rural dwellers in Rookdale.

The objectives for the research were:

- To systematically review existing literature regarding the impacts of water service delivery in rural communities in SSA between 2011-2021.
- To map the sources of rural water supply in Rookdale
- To assess the socio-economic impacts of a lack of water and sanitation service delivery in Rookdale.

1.3 Research questions

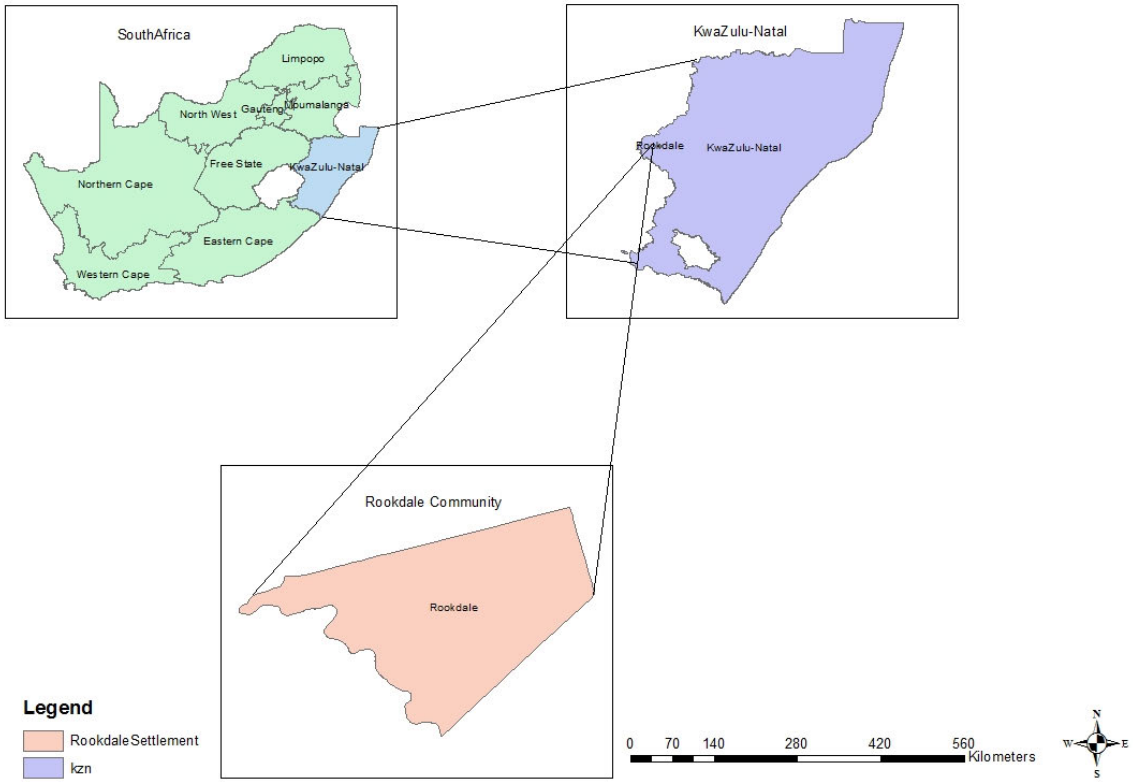
The study investigates water service delivery in Rookdale rural community. The research study will address the following broad questions:

- What are the impacts regarding water service delivery in Rookdale?
- How severe is the lack of water service delivery in the Rookdale rural community?
- What are the socio-economic impacts of water service delivery in Rookdale?
- What are the existing literature findings regarding Rural African communities?

1.4 Description of the study area

Rookdale is a rural community in the town of Bergville in the municipality of uKhahlamba in KwaZulu-Natal, South Africa (Figure 1.1). Rookdale is part of the uThukela County parish (Golding, 1999). uThukela District Municipality is one of ten district municipalities in KwaZulu-Natal (Stats SA, 2017). The uThukela District Municipality is named after the uThukela River, one of KwaZulu-Natal's largest rivers. The river originates in the Drakensberg Mountains and supplies the KZN and much of Gauteng (Stats SA, 2017). uThukela County Diocese has three adjacent parishes within KwaZulu-Natal, namely: Amajuba,

uMgungundlovu and uMzinyathi. (Goulding, 1999). uThukela Borough is responsible for basic water supply and sanitation in the Rookdale rural community (Stats SA, 2017).



<u>Figure 1.1</u> The Study area location of Rookdale rural community in Kwa-Zulu Natal, south Africa.

1.5 Outline of thesis

The research study is a collection of two papers at achieving the objectives stipulated in the introduction. Although each research article is written as standalone papers and can be read separately from the dissertation, each paper is linked to the overall aim and objectives of the research study. The dissertation consists of four chapters:

Chapter one provides a general introduction to research and contextualizes research studies. This chapter also describes the background and motivation of the current research. Furthermore, this chapter presents research objectives, goals, and research questions.

Chapter two provides a systematic review of the relevant literature about the research topic of water service delivery in SSA, the causes of poor water service delivery and sanitation. Lastly, this chapter highlights the research gaps and challenges regarding water service delivery and sanitation in SSA.

Chapter three examines the water service delivery in Rookdale and the socio-economic impacts. It includes the theoretical framework, methods used to gather information in the community, the results and discussion and recommendations of the research findings in Rookdale.

Chapter four provides a synthesis of the study's results, which places the dissertation's findings into perspective.

REFERENCE LIST

Adams, E. A. and S. L. Smiley (2018). Urban-rural water access inequalities in Malawi: implications for monitoring the Sustainable Development Goals. Natural Resources Forum, Wiley Online Library.

Chitonge, H., et al. (2020). Water and sanitation inequality in Africa: challenges for SDG 6. Africa and the sustainable development goals, Springer**:** 207-218.

DWAF (DEPARTMENT OF WATER AFFAIRS AND FORESTRY, SOUTH AFRICA) (2004) A history of first decade of water service delivery in South Africa 1994 to 2004. Department of Water Affairs and Forestry, Pretoria.

Goulding, C. (1999). Consumer research, interpretive paradigms and methodological ambiguities. *European Journal of Marketing*, *33*(9/10), 859-873.

Jegede, A. O. and P. Shikwambane (2021). "Water 'apartheid'and the significance of human rights principles of affirmative action in South Africa." Water **13**(8): 1104.

Macharia, P., et al. (2021). "Examining the relative impact of drivers on energy input for municipal water supply in Africa." Sustainability (Switzerland) **13**(15).

Masindi & Duncker (2016), URL: https://www.researchgate.net/publication/311451788_State_of_Water_and_Sanitation_in_South_Africa

MBEKI T (2004) Address to the First Joint Sitting of the Third Democratic Parliament of South Africa, 21 May 2004. Parliament of the Republic of South Africa, Cape Town.

Stats SA, The state of basic service delivery in South Africa: In-depth analysis of the Community Survey 2016 data, 2017 accessed at http://www.statssa.gov.za/publications/Report%2003-01-22/Report%2003-01-222016.pdf.

Stats SA, 2017, General Household Survey, at p 35-6, accessed at http://www.statssa.gov.za/publications/P0318/P03182017.pdf.

Stats SA, 2018, Non-financial census of municipalities for the year ended 30 June 2017, at p 4, accessed at http://www.statssa.gov.za/publications/P9115/P91152017.pdf.

Tempelhoff, J. W. N. (2009). "Civil society and sanitation hydropolitics: A case study of South Africa's Vaal River Barrage." Physics and Chemistry of the Earth **34**(3): 164-175.

CHAPTER TWO: LITERATURE REVIEW

WATER SUPPLY IN RURAL SUB-SUHARAN AFRICA: A SYSTEMATIC REVIEW

Abstract

Achieving clean water and sanitation has proved challenging in rural Africa. Existing studies suggests an urgent need for clean water service delivery in rural communities in Africa. This study conducted a systematic literature review on rural Africa between 2011 and 2021, the period encompassing the development of the Sustainable Development Goals (SDGs) to progress towards achieving sustainable water and sanitation. The focus was on the potential to improve the availability of water and sanitation. Rural SSA lags far behind, especially in access to water and sanitation. As a result, most of the studies assessing progress towards achieving the SDGs for ensuring water security in rural SSAs focus on water and sanitation, and the available literature is minimal. SSA, therefore, highlights a continent with water shortages and poor sanitation that need improvement. The remaining goals of SDG6 have received little attention, but fragmentary or incomplete evidence has often been used. Our review shows that rural Africa will not achieve water security by 2030, and most SSA developing countries need to conduct more research analysis on water supply for decision makers to have well informed information on how to improve the water distribution in the developing countries and create a positive change that will lead to water security in rural communities. The results of the systematic literature review show a limitation of literature conducted in SSA between 2011 to 2021 for rural water supply and outlines the SSA countries that need of providing literature and analysis on water supply in their countries. The systematic review discusses the literature findings on most of the minimal literature that has been conducted in SSA relating to water supply.

Keywords**:** Clean Water; Water Supply; Water Infrastructure; Sub-Saharan Africa; Rural.

2.1 Introduction

Drinking water supply in most rural areas of SSA are characterized by unreliability, poor water quality, and frequent facility breakdowns and abandonment (Adeniran, 2021). Decades of investment still need to meet their expected goals. Some attribute this to a sector so driven by outsiders and international organizations that it has underdeveloped local and national systems for service delivery (Chen, 2020). Many African countries face additional challenges of high population growth rates, low tax revenues, and weak systems of governance and regulation, all of which hinder progress (Chen, 2020). Investments to improve drinking water supplies in rural Africa are increasingly focused on strengthening national institutions under national leadership (Adeniran, 2021). The SDG agenda set in 2016 includes building national systems through 169 goals towards 2030 (Adeniran, 2021). Building national systems is seen as the foundation of progress, as evidenced by the emphasis on economic and institutional development as the core of social and economic progress (Adeniran, 2021). SDG 6 sets 2030 as the target to achieve safely managed water and sanitation for all (Adeniran, 2021).

The United Nations aims to ensure global and equitable access to safe and affordable drinking water by 2030 (Chen, 2020). Tap water systems are also much more costly for the per capita investment in domestic water supplies. Such systems are rare, especially in rural communities in low-income countries in sub-Saharan Africa. Currently, only eighteen percent of rural households in SSA have access to tap water in 2019 (Adams, 2018). The importance of adequate clean water and sanitation for healthy living and socioeconomic development should be emphasized (Chen, 2020). In rural Africa, piped in-house water systems are rare. The MDG and SDG hope to achieve water security(Adams, 2018). This declaration means universal access to safe drinking water for all (Jagede, 2021). Despite the achievements made so far by these global efforts, SSA in rural areas still lacks clean water tap supply (Jagede, 2021). In Southern Africa, everyone has the right to adequate food and water. This is the law of Southern Africa. The purpose of this law is to ensure the right to basic water supply (Hoogeveen,2006).

This systematic review focuses on water supply in rural areas of SSA. This systematic review identified 83 publications covering water and sanitation issues in rural SSA between 2011 and 2021 and reviewed water service and sanitation delivery in sub-Saharan Africa. It helps identify the countries with poor water security. Clear instructions should be provided. To explore the

water supply and sanitation situation in Sub-Saharan Africa and achieve the water security vision SDG 2030 (Cord, 2022).

More than sixty percent of the African population live in rural communities (Cord, 2022). This is more than half of the total population of African and special attention needs to be paid to water security in rural areas being met. This literature review will clearly identify the countries with no literature on water supply and sanitation. The keywords used to identify the literature were clean water, water supply, water sanitation, water infrastructure, SSA, and rural areas. These keywords were used because they focused directly on the topic/title; therefore, the studies would relate to the topic. This systematic review includes primary and secondary research on water supply in rural Africa within the literature review. It also consists of the results and discussions, pathways to achieve rural water in Africa and policy Implications within Africa. This systematic review will outline the methods used for the systematic review. It will further show the results of the literature available in SSA between 2011 to 2021 and discuss the water in SSA. It will also highlight ways to achieve rural water in SSA. And lastly, discuss the policy implications that SSA are faced with.

2.2. Methods

2.2.1. Literature review

This review was conducted according to the general principles of the PRISMA (Preferred Reporting Items for Systematic Reviews) systematic review process (Figure 2.1). Literature was downloaded from web-based search engines such as: Google Scholar, Web of Science, and Scopus. Search terms were combined with Boolean operators "OR" and "AND" using the following search criteria: “Water Supply” OR “Water Service Delivery” OR “Water Sanitation” AND “Water Infrastructure” AND “Saharan Africa” AND “RURAL” and 2011–2021.

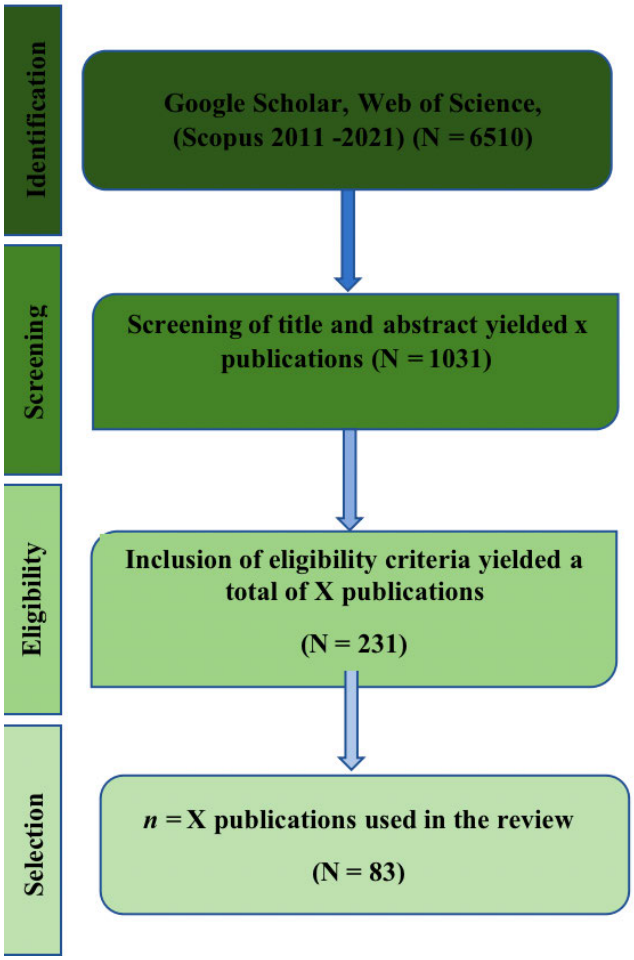


Figure 2.1 The PRISMA flow chart showing the literature search process used for this review

A literature search plan (Figure 2.1) was designed to include three different searches. Strategies including: (a) Google Scholar, (b) Web of Science, (c) Scopus. This strategy was necessary to reduce the risk of exclusion. Related literature and other sources of information. The literature search considered literature, including abstracts and non-abstracts for which the literature was screened. This was necessary because there are other publications without abstracts. Data extraction considered organization, year of publication (2011 to 2021), target group, and document purpose. Initial database searches identified 6510 potential studies. These studies were further refined using inclusion and exclusion criteria by searching titles and abstracts and eliminating duplicate studies. The literature search was limited to articles published in English between 2011 and 2021. After completing the application of the screening procedure, 83 studies were identified as relevant for this systematic review.

Table 2.1. The search topics used in google scholar, Web of Science and Scopus related documents published in Africa.

Table	Search Topic (First Row)	Area restricted (Second Row)
	Water supply - Rural	[AND] Africa
	Water sanitation - Rural	[AND] Africa
	Water infrastructure - Rural	[AND] Africa
	Water service delivery-rural	[AND] Africa

Table 2.2 A summary of the document type used to conduct this literature review between the years 2011 to 2021.

Document Type	No. of Documents
Article	16
Book Chapter	2
Book	5
Review	60

2.3 Results

2.3.1 Rural Water in Africa Research Progression over the Years (2011–2021)

Figure 2.2 shows the countries that dominate the literature on rural water in Africa research and implementation. Nigeria is the leading country with over 20 water related research followed by Zimbabwe, which has between 15 and 20 studies. South Africa, Mali, and Uganda have 6 to 10 water related studies. Zambia, Malawi, Rwanda, Kenya, Ghana and Senegal have one to five water related studies. Research on the water supply and sanitation in Africa remains minimal, with only Nigeria having done the most. Research on water supply remains minimal, with only 10 countries out of 54 in Africa having done the research. The percentage of the countries with water research in Africa is at a minimal 20%.

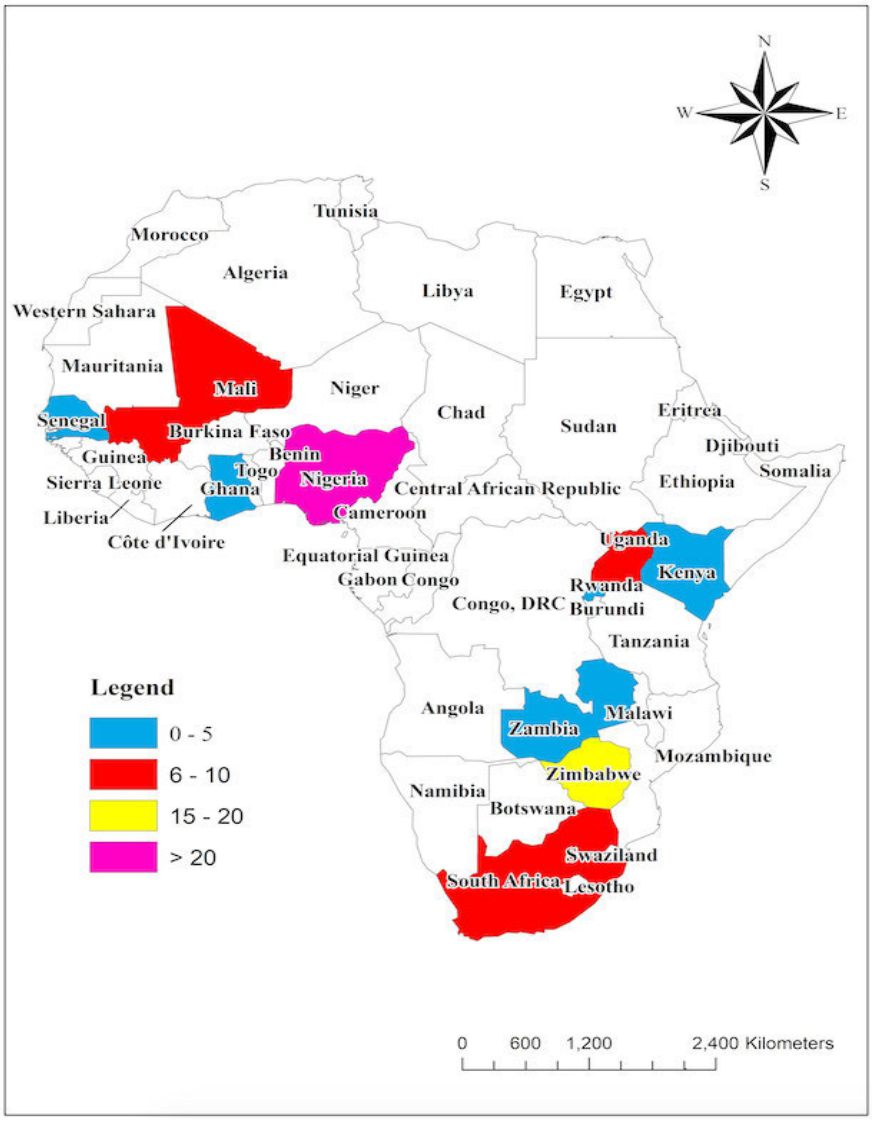


Figure 2.2. Countries where research on water supply in rural Sub-Saharan Africa has gained popularity between 2011 and 2021.

Figure 2.3 shows the percentage contribution of each country in the SSA literature review done in each of the ten countries (10n). Nigeria leads with 33%, followed by Zimbabwe at 22%, Malawi at 10%, South Africa at 9%, Uganda at 7%, and joint with 4% are Ghana, Zambia, Kenya, Senegal and Rwanda.

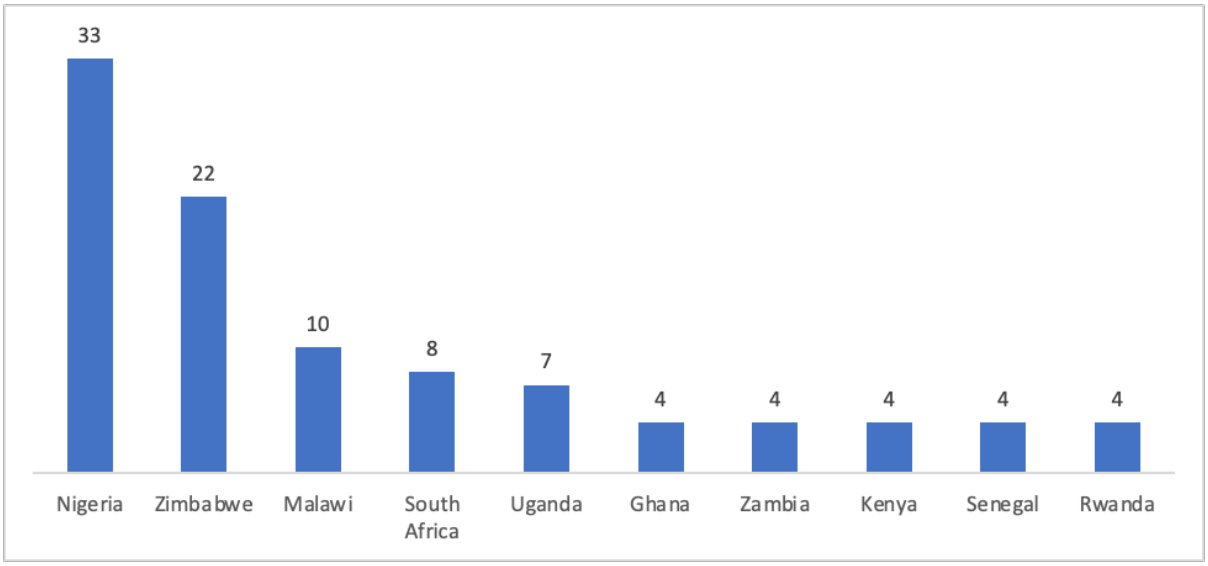


Figure 2.3. Bar graph showing the African countries percentage contribution of literature review done on water supply and sanitation.

Table 2.3 are the remaining 44 countries in SSA do not have water literature between the years 2011 to 2021 in their rural communities should provide literature on water in their respective rural communities so that a clear indication of water supply in Africa can be updated.

Table 2.3 Countries without water and sanitation literature in rural SSA (2011-2021)

Countries without water and sanitation literature in rural SSA (2011-2021)
1. Algeria
2. Angola
3. Benin
4. Botswana
5. Burkina Faso
6. Burundi
7. Cabo Verde
8. Cameroon
9. Central African Republic (CAR)
10. Chad
11. Comoros
12. Congo, Democratic Republic of the
13. Congo, Republic of the
14. Cote d'Ivoire
15. Djibouti
16. Egypt
17. Equatorial Guinea
18. Eritrea
19. Eswatini
20. Ethiopia

21. Gabon
22. Gambia
23. Guinea
24. Guinea-Bissau
25. Lesotho
26. Liberia
27. Libya
28. Madagascar
29. Mali
30. Mauritania
31. Mauritius
32. Morocco
33. Mozambique
34. Namibia
35. Niger
36. Sao Tome and Principe
37. Seychelles
38. Sierra Leone
39. Somalia
40. South Sudan
41. Sudan
42. Tanzania
43. Togo
44. Tunisia

2.4. Discussion

Most of the literature conducted by the 10 countries outlines that there is low coverage of water and sanitation in SSA, some research outlined that urban areas have better water and sanitation services than rural areas. A low water and sanitation literature across SSA are noted by the literature conducted. Majority of the literature highlights inadequate access to water and sanitation services in the rural communities (Cord, 2022). Action is encouraged to be taken to improve water and sanitation access in SSA, it is estimated that not much progress in reducing the lack of water supply and sanitation that leads to mortality of diarrheal diseases due to unsafe water and sanitation services by 2030 (Cord, 2022). In fact, many SSA countries are predicted to show a negative progress in water and sanitation coverage by 2030 (Cord, 2022). Other literature reviewing the relationship between water scarcity, sanitation, and colonization provides additional aspects of the discourse on water and sanitation inequity and the associated challenges to achieving water security in SSA (Cord, 2022). The literature highlights the Importance of colonization for water supply and health in SSA. The literature explains how colonialism and its legacy contributed to and continue to cause this inequality in water and sanitation in the SSA (Jegede, 2021). The role of colonialism in creating imbalances is

therefore important for understanding why such conditions persist and how to overcome them (Jegede, 2021). In many SSA developing countries, lack of financial resources and the low priority of water and sanitation limit the maintenance and expansion of services. Additionally, lack of accountability, corruption, and inefficient management plague all efforts to improve water and sanitation. Lack of sanitation facilities and difficulty in implementing standards also limit opportunities to improve health outcomes (Macharia, 2021).

2.4.1 Pathways to achieve rural water in Africa.

Firstly, to achieve rural water security in Africa there is a need for good governance and public participation: Communities must undertake to manage their public affairs and public resources in a responsible and responsible manner and in accordance with the rule of law for the realization of the interests and human rights of the citizens served by society (Macharia, 2021). Stakeholder consultation should be an ongoing process in rural Africa (Macharia, 2021). Secondly, municipal transformation and organizational development needs to occur: Local governments need to work on building effective systems that enable them to deliver services effectively and efficiently in rural Africa. This must include retaining and attracting competent, experienced, and dedicated employees (Leuenberger, 2021). Third, service provision and infrastructure development: It must be the duty of local governments to provide basic services to all authorized municipalities (Leuenberger, 2021). Communities must commit to serving all communities in rural areas and coordinating services not under their mandate (Leuenberger, 2021). Fourth, regional economic development: Local governments must take responsibility for creating a favorable environment for investment (Rinaldo, 2021). Therefore, local governments, in collaboration with other government agencies and departments, must commit themselves to providing effective services and a state-of-the-art economic infrastructure that facilitates the development of the industrial sector (Rinaldo, 2021). The revitalization of Agri parks and RASET programs will also significantly improve the rural economy and its family of communes (Kaaviya, 2021). Fifth, local government funding and administration: Local governments need to be able to generate sufficient funds to deliver their services and promote development. Above all, municipalities must ensure that public funds are managed and used responsibly (Kibret, 2021). Local governments should continue to ensure that they are properly consulted when preparing their budgets. Local governments must comply with and implement rehabilitation plans (Kibret, 2021).

2.4.2. Policy Implications

It is important to review policies as a core component that is required in water supply in rural Africa (Rinaldo, 2021). Many policies are adopted in Africa from the Colonization era (Rinaldo, 2021). For example, in South Africa the policies were formulated under the National Party government that ruled during the Apartheid era (Tempelhoff, 2009). The causes of poverty in African are historical and systematic. The problems faced by Africa currently can be traced back to the 15th century during the era of rife slave trade whose negative impacts are evident even today. The end of the slave trade was followed in quick succession by European imperialism and the colonization of Africa during which the population was subjected to social injustices, lost a large amount of its natural resources, and was subjected to foreign control that persists in the contemporary context (Willis & Hamon, 2018). There have been documented accusations of the involvement of the west in destabilizing certain African regions for economic and geopolitical gains. In addition to western influence, the low literacy levels in Africa and inefficient economic systems contribute to a perpetual cycle of poverty that has constrained efforts by various countries to foster economic growth. The Apartheid was bias and favored the white population with regards to the supply of basic services (Tempelhoff, 2009). The white population settled in the urban areas in the land planning scheme (Marks, 2013). Therefore, even today in Southern Africa, Urban areas still have basic services such as water infrastructure, health facilities, schools, and roads (Marks, 2013). The policies need to be reviewed and pay particular attention to the key challenges facing Africa's rural water supply and how to supply water to non-whites living in the rural areas (Marks, 2013). Most of the policies are bias and promote water supply and sanitation into urban areas (McGriff, 2020). Good governance and public participation are all key to reaching SDG 6. In addition, African policies need to address the lack of funds and money for water infrastructure to be installed in the rural area (Sutherland, 2015). The policies need to focus on reviewing old water schemes in each African country that have failed to produce water in rural Africa (McGriff, 2020). This is important as every country and rural area is unique with different key challenges faced with, and not only one policy will be able to address rural water supply in Africa (McGriff, 2020). Overall, there is an urgent need to formulate new policy frameworks that promote local

economic growth and development. Water insecurity in the rural areas has highlighted the need to develop new policies (McGriff, 2020).

2.5 Conclusions

The current literature available regarding access to drinking water services in SSA is low. The literature is important since it can be used to distinguish the SSA countries that still need to provide on water and sanitation moving towards 2030 SDG vision. Most households use public recourses in SSA for water supply in rural communities. Only a few have piped water system. due to corruption, lack of funds and colonization in SSA. There is also a large demand for 44 of the SSA countries to conduct literature on water. This can give a more accurate prediction regarding water and sanitation in SSA and explained the severe lack of progress in reaching SDG 6. Furthermore, the responsible authorities need to stop corruption and practice good governance. The fact that so many years have passed without adequate water supply indicates that there have been serious problems affecting the SSA drinking water supply campaign. The world is approaching 2030, the year the SDG should be achieved. Rural Sub-Saharan Africa SSA lags far behind, especially in access to water and sanitation (WSS). As a result, most studies assessing progress towards achieving his SDGs on water security in SSA focus on water and sanitation. The remaining goals of SDG6 have received little attention, but fragmentary or incomplete evidence has often been used. Our review shows that most countries are unlikely to achieve water security by her 2030. The complexity of the challenges outlined here, and the factors hindering the achievement of water security in the SSA.

2.6 Link to the next chapter

The chapter above provided a review of the literature available on water service of Sub-Saharan Africa. Furthermore, it has discussed the gap in SSA literature outlining the countries that need to conduct research on water and sanitation in SSA. The next chapter will examine the socio-economic water service delivery and sanitation in Rookdale rural community.

REFERENCES LIST

Adams, E. A. and S. L. Smiley (2018). Urban-rural water access inequalities in Malawi: implications for monitoring the Sustainable Development Goals. Natural Resources Forum, Wiley Online Library.

Adeniran, A., et al. (2021). "Water infrastructure development in nigeria: Trend, size, and purpose." Water (Switzerland) **13**(17).

Bain, R. E., et al. (2014). "Rural: urban inequalities in post 2015 targets and indicators for drinking-water." Science of the Total Environment **490**: 509-513.

Chen, J., et al. (2020). "Augmenting a deep-learning algorithm with canal inspection knowledge for reliable water leak detection from multispectral satellite images." Advanced Engineering Informatics **46**.

Cord, C., et al. (2022). "Pathways to consumer demand and payment for professional rural water infrastructure maintenance across low-income contexts." Science of the Total Environment **815**.

Hoogeveen, J. G. and B. Özler (2006). "2 Poverty and inequality in post-apartheid." Poverty and policy in post-apartheid South Africa: 59.

Jegede, A. O. and P. Shikwambane (2021). "Water 'apartheid' and the significance of human rights principles of affirmative action in South Africa." Water **13**(8): 1104.

Joshua, M. D., et al. (2022). "Water policy and resilience of potable water infrastructure to climate risks in rural Malawi." Physics and Chemistry of the Earth **127**.
Kaaviya, R. and V. Devadas (2021). "Water resilience mapping of Chennai, India using analytical hierarchy process." Ecological Processes **10**(1).

Kibret, S., et al. (2021). "The impact of large and small dams on malaria transmission in four basins in Africa." Scientific reports **11**(1): 13355.

Leuenberger, A., et al. (2021). "Water and health in mining settings in sub-saharan africa: A mixed methods geospatial visualization." Geospatial Health **16**(1)(McGriff and Denny 2020)

Rinaldo, D., et al. (2021). "The economic impact of schistosomiasis." Infectious Diseases of Poverty **10**(1)

Macharia, P., et al. (2021). "Examining the relative impact of drivers on energy input for municipal water supply in Africa." Sustainability (Switzerland) **13**(15).

Marks, S. J., et al. (2013). "Does sense of ownership matter for rural water system sustainability? Evidence from Kenya." Journal of Water Sanitation and Hygiene for Development **3**(2): 122-133.

McGriff, J. A. and L. Denny (2020). "What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities." American Journal of Tropical Medicine and Hygiene **103**(5): 1762-1764.

Rinaldo, D., et al. (2021). "The economic impact of schistosomiasis." Infectious Diseases of Poverty **10**(1).

Sutherland, C., et al. (2015). "Urban water governance for more inclusive development: A reflection on the 'waterscapes' of Durban, South Africa." The European Journal of Development Research **27**(4): 488-504.

Tempelhoff, J. W. N. (2009). "Civil society and sanitation hydropolitics: A case study of South Africa's Vaal River Barrage." Physics and Chemistry of the Earth **34**(3): 164-175.

Zhou, X., et al. (2021). "Toward Improved Comparisons Between Land-Surface-Water-Area Estimates From a Global River Model and Satellite Observations." Water Resources Research **57**(5).

CHAPTER THREE: EXAMINING THE SOCIO-ECONOMIC IMPACTS OF WATER SERVICE DELIVERY IN ROOKDALE COMMUNITY OF KWAZULU-NATAL, SOUTH AFRICA.

Abstract

Apartheid in South African history has left the new, democratic South Africa with a range of challenges, including poverty, inequality, and inadequate access to basic services (Dubow, 1989). These challenges are more prevalent in rural areas and require rural development strategies to alleviate poverty and strengthen rural communities (Dubow, 1989). Limited access to water supplies is a common challenge faced by rural residents in developing countries due to inadequate infrastructure and water systems designed to support rural communities (Dubow, 1989). Poverty is believed to be directly related to isolation, lack of basic services and poor infrastructure development (Hanjra, 2009). The study seeks to examine the perceptions of rural dwellers on water service delivery in Rookdale. This study used a mixed method approach that combined quantitative and qualitative research techniques (Bryman, 2017). The study's findings revealed that the area of Rookdale lacks piped water supply. Most of the people collect water at the designated hand pump boreholes and some rely on water tanks to be delivered by the municipality. A relationship between the water supply method and the number of times water was collected. There was also a relationship between the water supply method and the number of times without water in the household. The research findings revealed that there is inferior water service delivery and sanitation in Rookdale rural community. The uThukela water schemes are designed to supply water to the Bergville and Johannesburg urban areas and rural community of Rookdale has poor infrastructure. The research findings revealed that the collection of water supply for most of the population is at a designated hand pump borehole. This is the most favorable way of water collection in Rookdale for most of the population, and a pit latrine is being used as a toilet. The study findings concluded that Rookdale rural community has a lack of water service supply and poor sanitation due to the water schemes designed in the apartheid era that supported the urban areas with water supply.

Keywords: Apartheid, rural communities, sanitation, water supply

3.1 Introduction

Seventy-four percent of the sub-Saharan Africa (SSA) population lives in rural communities (Mthembu, 2018). Eighty five percent of the SSA rural areas lack piped water supply (Mthembu, 2018). Rural residents in developing countries live simple lives, but the structure and dynamics of daily life are highly complex (West, 2014). Rural communities in

developing countries face challenges such as a lack of basic needs leading to poverty, inequality, vulnerability, and deprivation in SSA (Mthembu, 2018). Rural infrastructure investment in Sub Saharan Africa is increasingly recognized as integral to rural poverty reduction strategies (Hope, 2020). When it comes to infrastructure, the development of functioning water systems for growing rural communities has been considered high on the water supply agenda (Hope, 2020). Despite the importance of water supply as a basic need. Water supply remains a major challenge for rural areas in developing countries (Hanjra, 2009). About 900 million rural residents worldwide have no access to tap water (Van Heerden, 2005). This is more prevalent in his SSA, where water is severely restricted due to the lack of water infrastructure plans to reach rural communities (Malan 2005). Lack of basic water supply and poor sanitation facilities are more common among rural populations who have difficulty accessing economic opportunities (Malan 2005). In many developing countries, such as South Africa, the lack of water infrastructure to support rural communities is a fundamental challenge to basic service delivery (Turton 2005). In South Africa, where service delivery remains a challenge, inadequate rural water infrastructure further limits efficient water service delivery (Turton 2005). Most rural communities in South Africa do not have a basic water supply guaranteed, but adequate and reliable water distribution methods and systems need to be developed to enable rural residents to access services at home (Turton 2005). Socially water scarcity negatively impacts job opportunities, water access impacts food security production and the limitations of subsistence farming, and therefore increases hunger rates (West, 2014). Socially without water for sanitation, it is challenging to provide communities with basic health care at home, in schools and in health care facilities to protect rural communities from avoiding diseases (West, 2014). Economically water scarcity prohibits development and economic growth. Water scarcity impacts job creation resulting in poverty (Mthembu, 2018). Agriculture is a major part of the economy in all African countries. When water scarcity impacts agricultural production, that endangers the livelihood of many people which in turn has a ripple effect on the economy.

Water is a key factor in production, so a reduced water supply slows growth. Economically, water shortages lead to food shortages, higher food prices, more difficult trade with developing countries, and long-term civil unrest (Mthembu, 2018). Businesses may be forced to lay off some of their workforce as slower business activity leads to lower profits, reducing the purchasing power of consumers in vulnerable communities (Mthembu, 2018). Water is key to sustainable growth and poverty reduction as the engine of nearly all production in agriculture, industry, energy, and transport by healthy people in healthy ecosystems (Mthembu, 2018). The

overall aim of the research is to examine socio-economic impacts of water service delivery and sanitation in Rookdale rural community region of KwaZulu-Natal, South Africa. The overall aim will be fulfilled by the main objectives of this study, to examine the water supply in Rookdale rural community. In addition to systematically review existing literature regarding the impacts of water service delivery in rural communities in SSA between 2011-2021. Further to detect the source of water supply in Rookdale rural community. And lastly to examine water supply in Rookdale rural community.

3.2 Theoretical Framework

3.2.1 The Urban Bias Theory and Water

Michael Lipton developed an urban bias theory to explain poverty and inequality in many developing countries today (Sutherland, 2015). This theory states that development plans in developing countries are skewed toward rural areas because most economic resources are allocated to urban rather than rural areas, leaving the poor poorer. Michael Lipton's urban bias theory is not without support (Sutherland, 2015). Robert Chambers describes persistent poverty in developing countries, especially in rural areas (Bain, 2014). He confirms that urban areas receive a greater share of human and financial resources than rural areas (Marks, 2013). In many developing countries Urban areas have water infrastructure for water supply, schools for education, hospitals for good health, roads for transportation and electricity powers supply for electricity. The urban areas have shopping centers for other basic needs such as food, clothes and carry many basic needs and with the urban area receiving the human and financial resources most of the employment is in Urban area and jobs are being created. Therefore, many people daily move into the urban areas for employment. (Marks, 2013). Most interestingly, Chambers identifies an urban bias in policy making, proposing solutions to rural poverty where most people live in urban areas. This Theoretical Framework is the research study's theoretical foundation, which looks at water supply and delivery within rural areas.

Urban-rural water access inequalities are a significant obstacle to achieving universal water coverage. Focusing on sustainable access to clean water and sanitation, Sustainable Development Goal (SDG) 6 promotes the availability and sustainable development of water and sanitation for all (Chitonge, 2020). In sub-Saharan Africa, these inequalities have existed for decades (Adams and Smiley 2018). There are marked differences in access to drinking water and sanitation between rural and urban areas. From the end of World War II until 1970,

development was perceived primarily from an economic perspective (Macharia, 2021). Functional piped water access on premises is a service enjoyed primarily by those living in urban areas because of industrialization and economic growth development (Bain, Wright et al. 2014). Water is a human necessity. But South Africa has a long history of inequality, dating back to the policies and laws of apartheid, which denied access to water to a disadvantaged black population living primarily in rural communities (Shikwambane 2021).

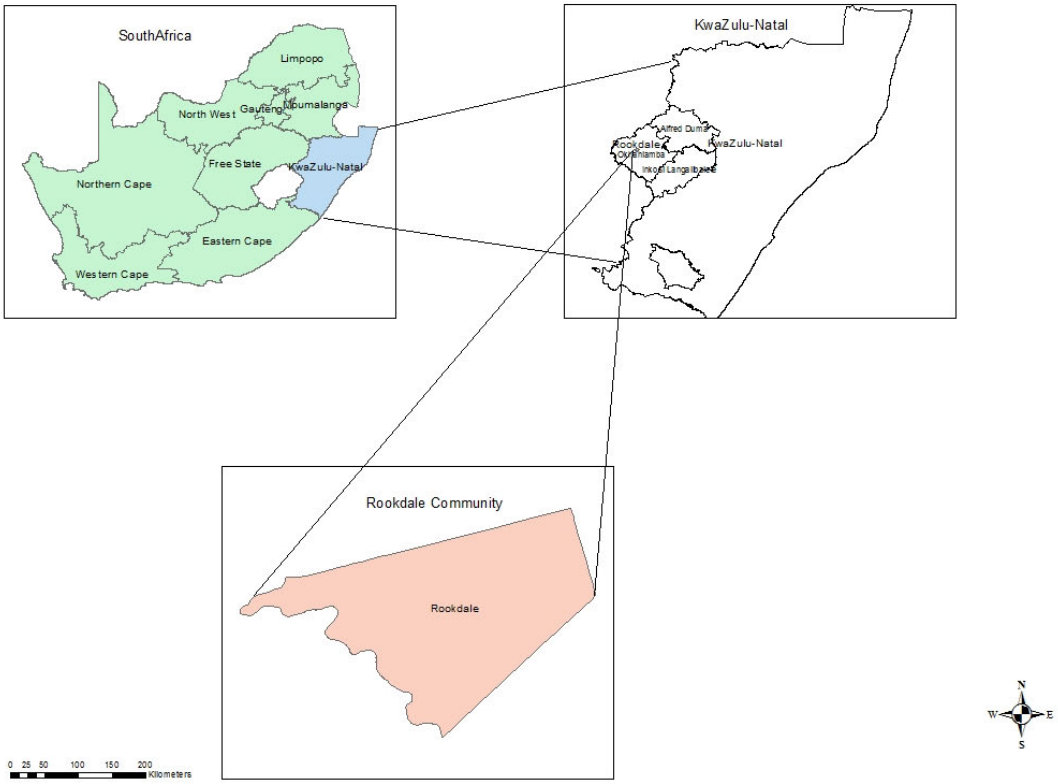
Post-apartheid politics in southern Africa mandated community actors to achieve both social and economic growth. However, they face acute spatial and socio-economic inequalities created by the pressures of apartheid and rapid urbanization (Sutherland, Scott et al. 2015). Access to water and sanitation is a human right recognized in South Africa's Bill of Rights Act (Gleick, 1998). Apartheid in South Africa officially ended with democratically held elections in 1994. Furthermore, through industrialization, the country has inherited inequalities in education, health, and basic infrastructure such as access to clean water, sanitation, and housing (Hoogeveen, 2006). Economic development is uneven across the Okhahlamba municipality, with significant disparities. The urban town of Bergville has basic services whilst the rural community of Rookdale does not. Okhahlamba Municipality is dominated by less developed rural communities with a lack of basic services (Tempelhoff 2009). Historically, spatial planning practices profoundly impacted the spatial structure of the uThukela district. Apartheid policies gave rise to fragmented rural communities such as Rookdale. The end of apartheid was initially perceived as a new chapter for spatial planning. The new spatial planning concepts were recently introduced, encouraging compact and integrated urban environments (Cloney et al. 2005). Such environments are sought by regional planning tools aimed at promoting dignified environments for all members of society to live in (that is, sustainable human settlements).

Although some scholars have proved the urban bias theory, analyzes of rural economic development plans since independence show that this concept is still valid and relevant to understanding the development process of today's developing countries. Understanding the differences that exist between rural and urban areas can further motivate development practitioners and governments to formulate policies and strategies to achieve more equitable development. It will help. These should provide information on how development funds should be allocated within the country. Ignoring these long-standing differences will widen the gap between the two centers, and as a result, rural development will continue to lag.

3.3 Methods

3.3.1 Study Area

The rural community of Rookdale is located within the municipality of OKhahlamba (Mthembu, 2018). Okhahalamba Municipality is one of three (3n) municipalities in the uThukela district, a municipality in KwaZulu-Natal, South Africa (IDP, 2020). Umgeni Water operates and manages raw water abstraction and bulk potable water supply infrastructure in the eThekwini region and many other parts of KwaZulu-Natal. The eThekwini Metropolitan Municipality, through eThekwini Water and Sanitation, supplies water to consumers in the region.Ladysmith is a major administrative center (Mutambara, 2018). Ladysmith is the capital of the uThukela district of KwaZulu-Natal, South Africa. It is located 230 km northwest of Durban in Gauteng and 365 km southeast of Johannesburg. Johannesburg is the economic engine of the country (IDP, 2020). Local communities in OKhahlamba face significant challenges in providing water services. According to the Integrated Development Plan (IDP) (2020), the distribution of services in the city limits of OKhahlamba is very uneven. Some communities have adequate water supplies, while others do not. Water supply in OKhahlamba municipality, especially in rural areas is needed (IDP, 2020). According to IDP (2020), efficient and adequate water and sanitation facilities are in great need. These problems are prevalent in most rural areas of South Africa, mainly due to isolation and lack of access to basic services (IDP, 2020). Rural communities do not have easy access to basic water supplies. Basic services are far from where you live (Gemeinde, 2015). The study area was identified due to the ease of access to the area and the fact that the Rookdale community is a 'forgotten community' in need of attention and support due to extreme poverty and poor living conditions associated with water. Selected as a research study site (Community, 2015). The rural community of Rookdale is far from the Bergville area of the city. Rookdale land is very steep and difficult to drive on dirt roads in very poor condition (Municipality, 2015). The location of the community forces residents to travel for hours to fetch water from hand-pump wells (Municipality, 2015). Lack of access to water and sanitation increases poverty in the region as rural residents lack access to social and economic opportunities.



<u>Figure 3.1</u> The study area of Rookdale rural community in Kwa-Zulu Natal, south Africa.

3.4 Methodological approaches

A quantitative and qualitative research approach was used in this study (Figure 3.2). Quantitative study design uses structured methods to quantify research questions by generating data that can be converted into numerical data or usable statistics (Bryman 2017). Quantitative research focuses on testing philosophical theories by quantifying the collection and analysis of data and examining the relevant days to reach a research field (Bryman 2017). Qualitative research was conducted through individual interviews to understand the community's perception regarding the water supply in Rookdale (Bryman 2017).

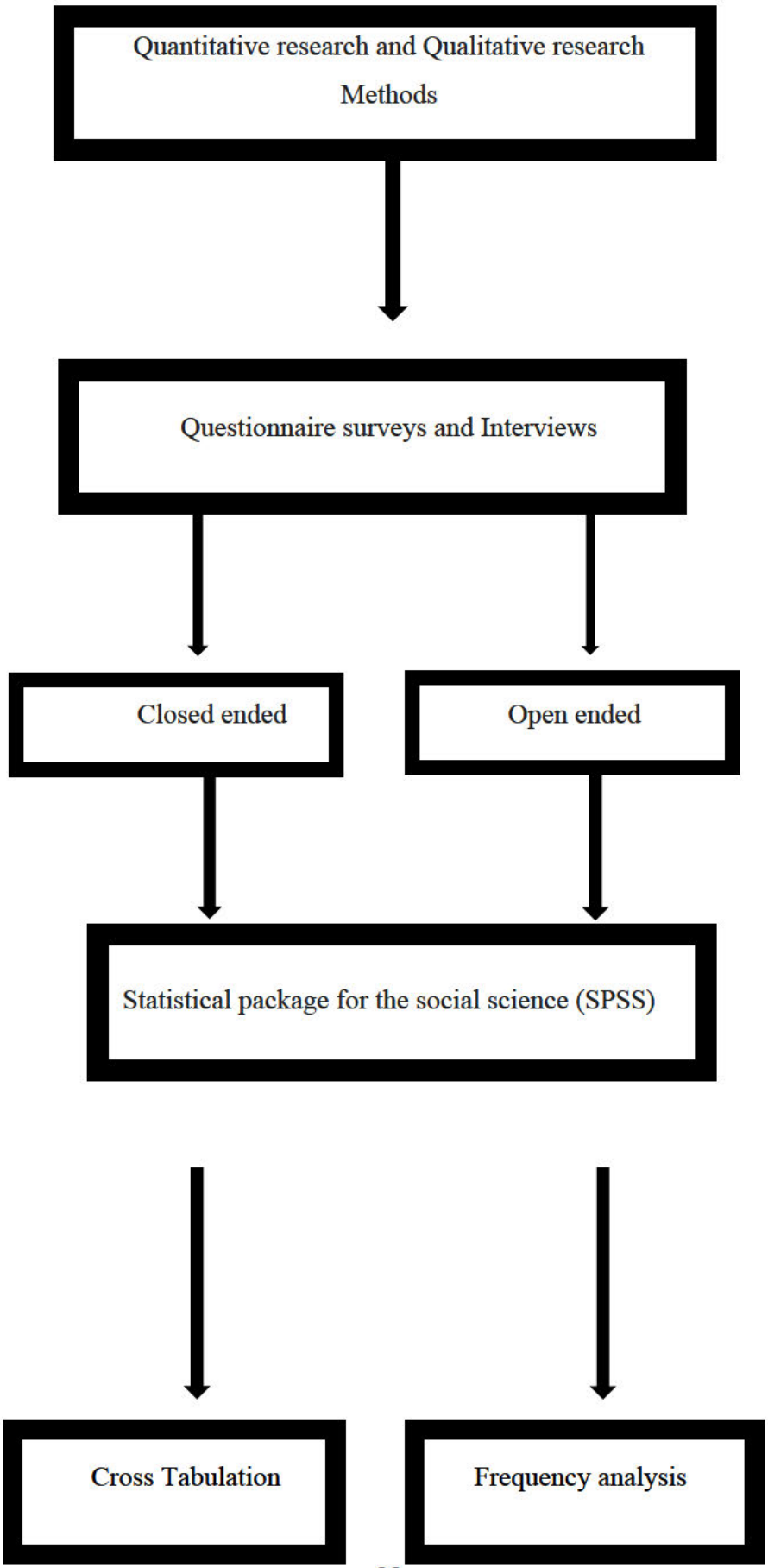

Quantitative research and Qualitative research Methods
Questionnaire surveys and Interviews
Closed ended
Open ended
Statistical package for the social science (SPSS)
Cross Tabulation
Frequency analysis

Figure 3.2 Sequenced methodology used for the research study.

3.4.1. Questionnaire design and Interviews

Surveys and questionnaires are an essential tool for gathering information. In the social sciences, questionnaires are well-established tools for gathering information about social traits, beliefs, behaviors, and challenges respondents face in their daily lives (Siniscalco, 2005). Questionnaires use a formally designed survey to collect information from respondents (Siniscalco, 2005). Questionnaire design is critical when used as a research tool to ensure that the data generated serve the purpose of the study (Siniscalco, 2005). When conducting questionnaire research, researchers need to ensure that the questionnaire format is arranged in a logical order to allow flow from one topic to the next. This is to ensure that respondents understand the purpose of the research study (Siniscalco, 2005). Interviews were conducted with the competent authority, uThukela district. The district is responsible for water supply in Rookdale. The interviews allowed for greater understanding of the water supply background in the rural community (Siniscalco, 2005). The Interviews were goal driven to provide answers to the questionnaires questions that needed more than a yes or no answer and are vital to gain a better understanding of the districts experience regarding water supply in Rookdale (Siniscalco, 2005).

3.4.2 Procedure

A structured questionnaire and interviews were conducted in the Rookdale community to meet the research objectives. A systematic sampling technique was used to select samples from the target population. Every fifth house was selected by the researcher. In this technique, researchers start from any point within the parameters of the study population once the starting point is marked. A consistent frequency is then maintained throughout the data collection process (Bellhouse 2005). The survey included a total of 120 respondents. A total of 5 employees of the uThukela District were interviewed. A preliminary site visit was conducted in the study area to brief the City Council and the Rookdale Community Committee on the study and to seek permission to conduct the study in the area. The oKhahlamba Municipality and the Rookdale Rural Council granted the researchers permission to conduct the study. Researchers and field assistants then traveled daily from Pietermaritzburg to Bergville for five

days to reach the study area. Most respondents in the Rookdale survey area were proficient with isiZulu. Therefore, understanding of English was limited in this study. In addition, since the native language of the researcher and assistant is Isizulu, the researcher had a good understanding of the translations and questions in their mother tongue Isizulu. The data collection was conducted in the Rookdale community. The researcher conducted questionnaire surveys with the local community members including the community counsellor. Interviews were conducted with the uThukela District where authorization had to be gained first before the interview. All respondents said they thought the questionnaire was appropriate, and felt overseen by government officials, and wanted people and relevant authorities to see where they lived. All the participants in the questionnaires survey and interviews were willing to participate. The houses were widely situated in the study area, where community members lived, and the researcher and assistants walked to the homes in the area conducting the questionnaires research techniques during this time. The questionnaires were very beneficial and provided the researchers with a broader understanding of the various issues facing the community. The questionnaire provided detailed and helpful questions and reasons related to providing services in the area and helped draft the interviews for the uThukela district. The second stage of data collection was directed to the competent authority (uThukela District), the government official responsible for the provision of water services in Rookdale. Researchers conducted an interview with the u Thukela district officials. In this research study, no community or government officials refused to respond to the questionnaire because they wanted change, and their basic needs were being met. Researchers were able to obtain detailed and useful information to address their research goals.

3.4.3 Data analysis

Data from the research study was processed and statistically analyzed using the Social Sciences V28 (SPSS) statistical package. Simple descriptive statistics were performed to obtain demographic information on the respondents (Levesque 2007). Cross tabulation was used to determine relationships between various variables within the dataset. Crosstabulation has become a useful analytical tool in the social sciences, primarily used for analyzing categorical data (Ronna et al. 2016). The chi-square is the outcome of the crosstabulation. In the chi-square the outcome is the p-value (Ronna et al. 2016). A p-value measures the probability of obtaining the observed results, assuming that the null hypothesis is true. The lower the p-value, the greater the statistical significance of the observed difference (Ronna et al. 2016). A null hypothesis is a type of statistical hypothesis that proposes that no statistical significance exists in a set of

given observations. If the p-value of the crosstab is less than 0.05, the null hypothesis is rejected which will mean there is a significant difference between the variables being tested (Ronna et al. 2016). The chi-square was used to analyze any relationship between two or more variables (Ronna et al. 2016). Combining cross-tabulation with statistical measures such as chi-square allows researchers to measure the degree of association between variables (Ronna et al. 2016). The chi-square test is a statistical test performed by cross-tabulation to determine the actual observed and expected frequencies. In this study, researchers used the chi-square to determine relationships between two or more variables. In addition, chi-square was used to obtain the score and the p-value was used to indicate the significance of this score (Ronna et al. 2016).

Table 3.1 Cross tabulation of conditions of water supply in Rookdale

			Percentage (%)	**Chi-square**	**p-value**
Water supply method	Water collection time	2 Hours	60	35.848[a]	***
		3 Hours	14		
		4 Hours	26		
	Number of times without tap water	Weeks	20	18.081[a]	***
		Months	80		
Number of times water is collected a day	Water collection time	2 Hours	60	15.452[a]	***
		3 Hours	40		
		4 Hours	26		
	Person responsible for collecting water	Adult	9%	17.739[a]	***
		Child	57%		
		Student	34%		

* Portray significant difference p-value <0.05

**Portray significant difference p-value <0.01

***Portrays significant difference p-value <0.001

3.5 Results and discussion

Table 3.1 illustrates the cross-tabulation used to analyze the relationship between two or more variables (Ronna et al. 2016). The Chi-square results shows a relationship between the water supply method in Rookdale which is supplied through hand pump boreholes and the time it takes for the community to collect water daily. The chi-square is 35.848[a] and the p-value is <0.001 which portrays significant difference. The hand pump boreholes are situated at various distances than the households in Rookdale. Secondly there is a relationship between the water supply method and the amount of time the rural community don't have tap/piped water. The chi-square is 18.081[a] and the p-value is <0.001 which portrays significant difference. The main method of water supply in Rookdale are hand pump boreholes that run out of water daily because of the over growing population. There is a lack of piped tap water in Rookdale as the water supply is not sufficient for the overpopulated area. There is also a relationship between the number of times water is collected and the time taken by the community to collect water from the hand pump boreholes. The chi-square is 15.452[a] and the p-value is <0.001 which portrays significant difference. This is because the hand pump boreholes are at different distances to each household. Also, some of the hand pump boreholes run out of water and need to recharge as there is a large community that is supplied by the hand pump boreholes. Lastly there is a relationship with the number of times water is collected and the person who is responsible for collecting the water daily at the households. The chi-square is 17.739[a] and the p-value is <0.001. This is because in most households the child is responsible for water collection and is only able to carry one or two buckets of water and may not be enough water for the families. Most of the families are big and often more than one member collects water, and it varies in the different households. All the variables of the chi-square resulted in the p-value of 0.001 that portrays a significant difference. In the Rookdale community, 60% of the people take an average of 2 hours to collect water at the closest designated hand pump borehole, 14% take an average of 3 hours, and 26% take 4 hours to collect water daily. The Bergville individual development plan (IDP) states that the community is overpopulated and has restricted handpump boreholes that function properly. Most of the hand pump boreholes water

recharge demand is too low and the boreholes run out of water before all the members of the community have collected water (IDP, 2020). This further delays the community as more time is spent waiting further for the hand pump borehole to recharge with more water before they can collect further (IDP, 2020). In addition, there are also long lines at the hand pump boreholes to collect the water and a large community that uses the water supply casing damage to the hand pump boreholes and a regular need to maintain and repair the primary water source in the area (IDP, 2020).

Water is collected in the form of buckets at the nearest hand pump borehole. 80% of the Rookdale community have no water in the households for months, while the remaining 20% have no water in the household taps for weeks. This is a 5% improvement from Mthembu findings that 85% of SSA rural areas lacking piped water (2018). In 57% of the households, the children that do not go to school or are too young to go to school are responsible for collecting the water at the nearest handpump borehole. According to Adams research that he conducted in Malawi where his mentioned that children mostly collected water over long distances in rural communities and is one of the most common forms of child labor (2018). In 34% of the households, it is a student that collects the water and often makes the students late for school and often battle with being tired leading to poor concentration levels during classes and needing to leave school early to collect water after. Adam goes on to mention that this effects the student's health at school. The adults the households make up the remaining 9% that collect the water. Most of the households in Rookdale collected water from the distributed hand pump boreholes in Rookdale. Evidence has shown that the more geographically isolated an area is, the higher the chances that basic services will be below average and below rural averages (Hanjra, 2009).

The supply of water in rural areas is important in reducing poverty in rural areas as a basic need (Hanjra, 2009). The research findings confirm that there is a lack of water supply in Rookdale rural community and no socio-economic development and supports Adeniran findings in Nigeria that according to his research there is a need for water infrastructure investment in rural communities to provide basic services and create socio-development that is currently lacking in SSA (2021). The urban bias theory developed by Michael Lipton is evident (Sutherland, Scott et al. 2015). As a result, more and more people according to Asongu are moving into urban area (2014). The uThukela district municipality authoroties after being interviewed by the researcher and after reviewing the Integrated Development Plan (IDP) of Bergville that

further supported this theory mentioned the below challenges in Rookdale rural community regarding water supply:

- No water scheme in rural areas
- Inconsistency of water supply
- Extend water supply to nearest source or divert potential source
- Rehabilitation of deliberately destroyed sewage pumping stations
- Inadequate sanitation infrastructure
- New projects to eliminate waterlogging and intermediate wells.
- Hand pump needs repair due to unstable water supply.
- Fund inadequate sanitation infrastructure
- Massive water loss due to illegal connections to risers
- non-functioning reservoir
- Maintenance of existing sources

The main challenges highlighted by the uThukela district municipality is the water schemes that are designed to supply the urban areas of Bergville with water supply and transport water to urban Johannesburg which is seen to be the economic hub of the country and promote Socio-economic development. The district municipality that is responsible for the water supply in Rookdale further added that the water schemes policies in Bergville were designed in the Apartheid era and are still active today. The urban bias water schemes have caused inconsistent water to supply due to the ever-growing population in the rural community. The lack of water supply has caused insufficient sanitation infrastructure and practices. Since the district municipality is facing water schemes policies from the apartheid era, they have opted new project to address water backlog and in the interim drill boreholes. The district municipality is also having financial challenges and requires funding to repair the hand pump boreholes that are the main water supply method in Rookdale.

There is no social and economic development benefit in Rookdale. This is evident with the high unemployment rate and high food expenses. There are no agricultural practices in Rookdale, and this can be linked directly to the lack of water supply in the area. Poor water sanitation can also be directly linked to water scarcity that is vital for reducing diseases and improving the health, welfare, and productivity of the community. The research findings

support the systematic literature review that labels SSA as a water scarcity continent. And mentions that drinking water supply in most rural communities in sub-Saharan Africa are labeled by low water reliability, poor water quality and sanitation, and the frequent breakdown and abandonment of facilities. The findings support much scholar's research that many African nations face the additional challenges of a high rate of population growth in rural area and the perspective that the SDG 6 will not be reached by 2030.

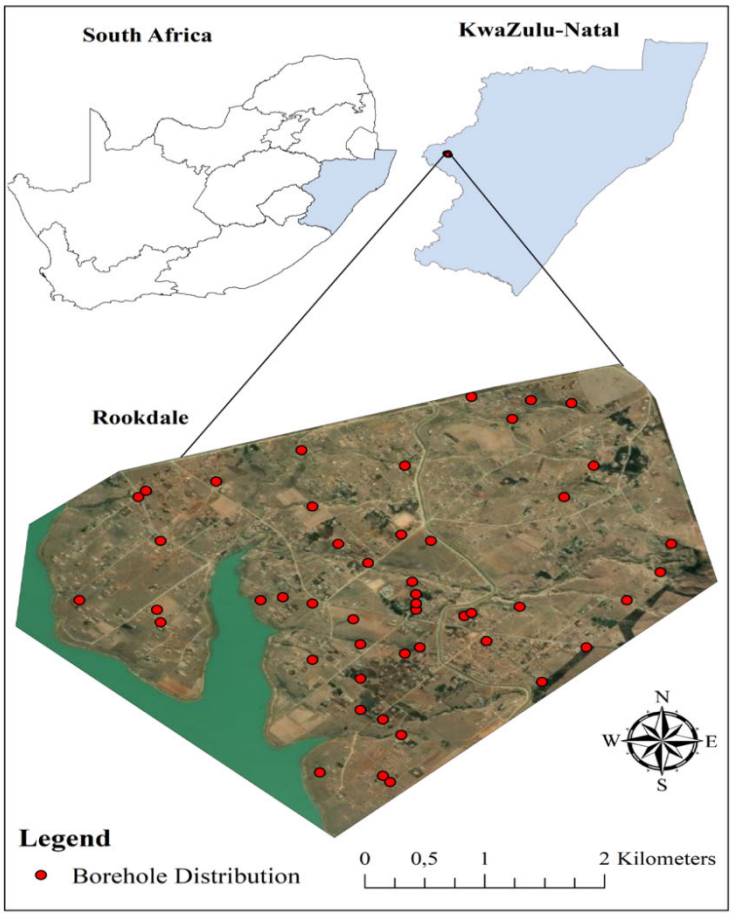


Figure 3.3 Distribution of the hand pump boreholes in Rookdale community.

Figure 3.3. shows the total amount of hand pump boreholes in Rookdale. The total number of boreholes is 47. The distribution of the boreholes varies from 0.5km to 2km. Most of the handpump boreholes shown in figure 3.3 in Rookdale are not functional and need to be replaced. This results in longer distances in some households to collect water. The average distance above supports Adams finding that long distances need to be covered for water collection in rural areas (2018). This results in fatigue for the children at schools as most of the

water is collected by the children and this affects the children education and health (Adams, 2018).

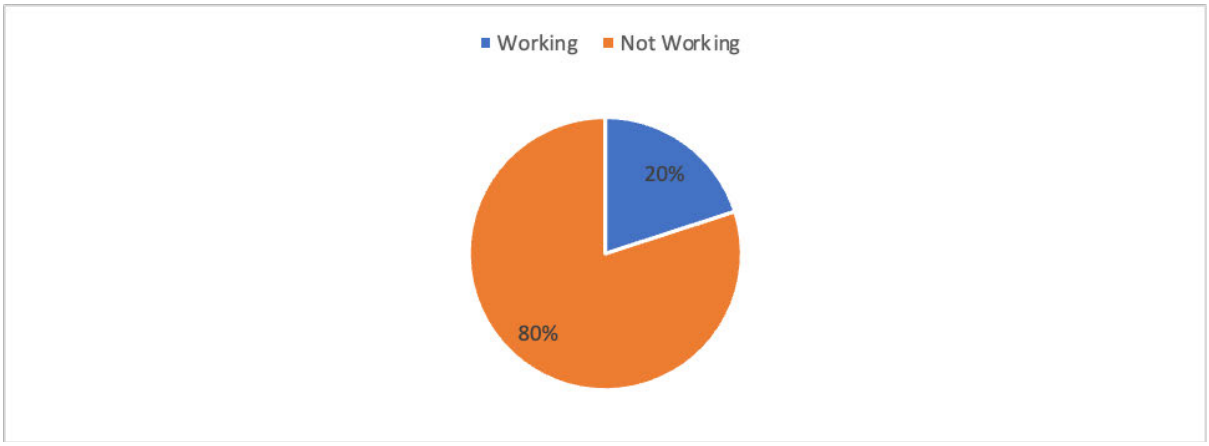


Figure 3.4 Employment status in Rookdale.

Figure 3.4 shows the majority 80% of the people in Rookdale are unemployed and rely on social grants and are dependent on the minority 20% that are working. No development or job opportunities are adequate to handle the large population of Rookdale in the community or Bergville. Water is necessary to create jobs. Accordioning to Charnley the unemployment rate in rural SSA is 77%. Rookdale in Bergville is close to the unemployment rate as it is 3% higher than the SSA unemployment rate. In addition, according to Marks, most employment opportunities are in the urban areas so there is no surprise that there is a high unemployment rate within the rural community (2013). The results show that there is a need for economic development in the rural areas to create jobs for the rural community (Charnley, 2013).

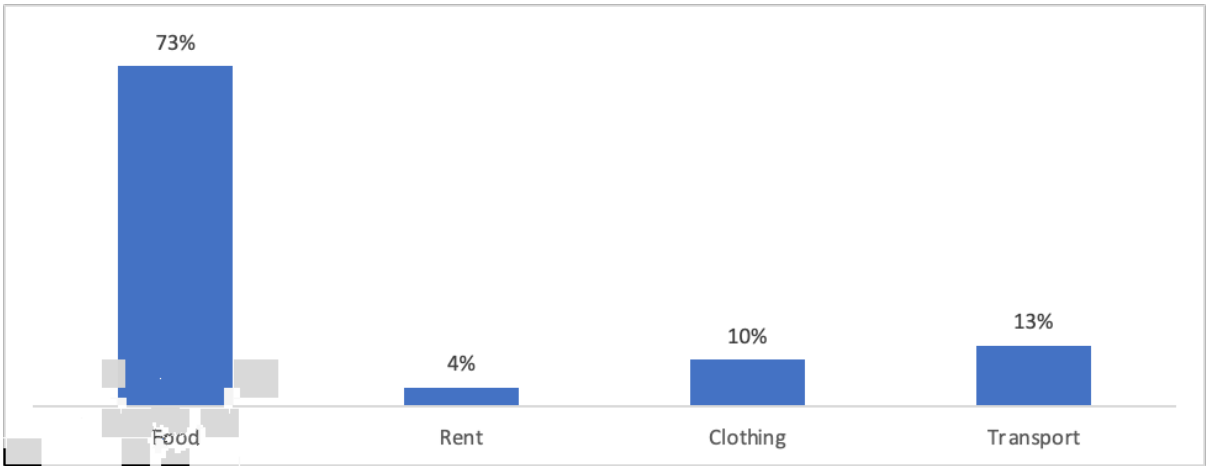


Figure 3.5 Monthly expenses of residents in Rookdale.

Figure 3.5 shows that 73% of the residents in Rookdale spend most of their money on food. Thirteen percent of the monthly expenses is towards transport In Rookdale. This is understandable as Rookdale in the outskirts of the nearest town in Bergville. Ten percent of the money is spent on clothing, and four percent is spent on rent. Most of the residents in the Rookdale lived with family member and the house belonged to a relative in the family and did not have to pay for rent. There is no surprise that food in the rural areas is the most expense in the households every month followed by Transport into the Urban areas to seek the basic services that are unavailable in the rural community. Most people travel long distances into the Urban areas to buy food and to seek health care according to Hanjra and this costing a lot of taxi fees as the rural areas are far away from urban areas (2009).

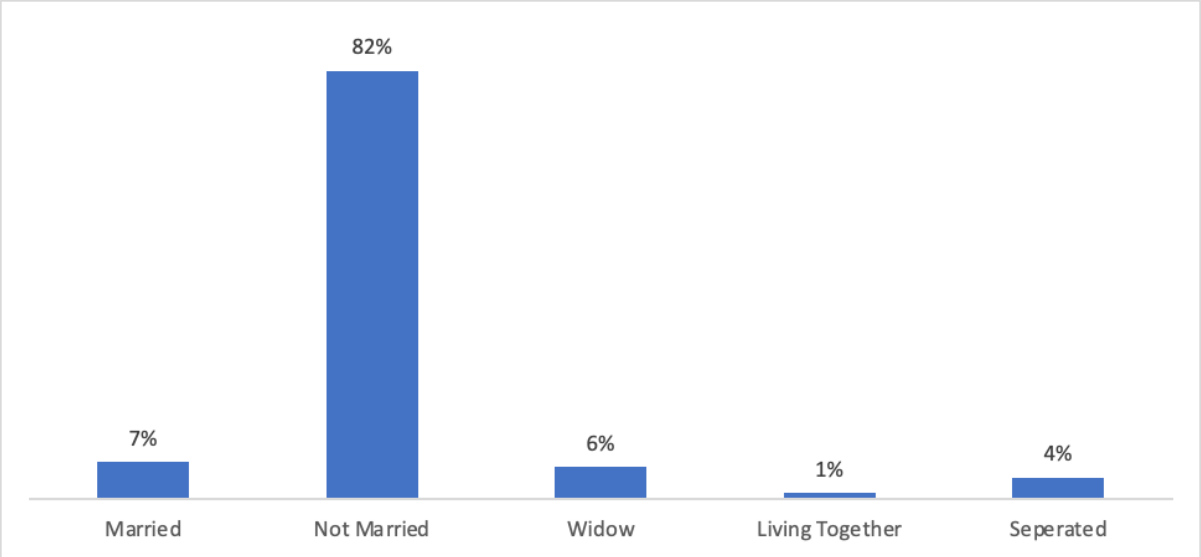


Figure 3.6. Marital Status in Rookdale.

Figure 3.6. shows that 82% of the people living in Rookdale are not married, 7% are married, 6% are widows, 4% are separated, and 1% live together. This shows that marriage is not common in the Rookdale community. According to Hoogeveen marital statuses in the rural areas are low In SSA and believes there is a connection between poverty and marital statuses. The scholar's findings are supported in figure 3.6. Rookdale is a are that is associated with poverty and the number of people that were not married are very high (2006). Illnesses such as HIV are associated to be at a staggering high in rural communities Hogeveen states. This effects the populations health and social being (Hoogeveen, 2006).

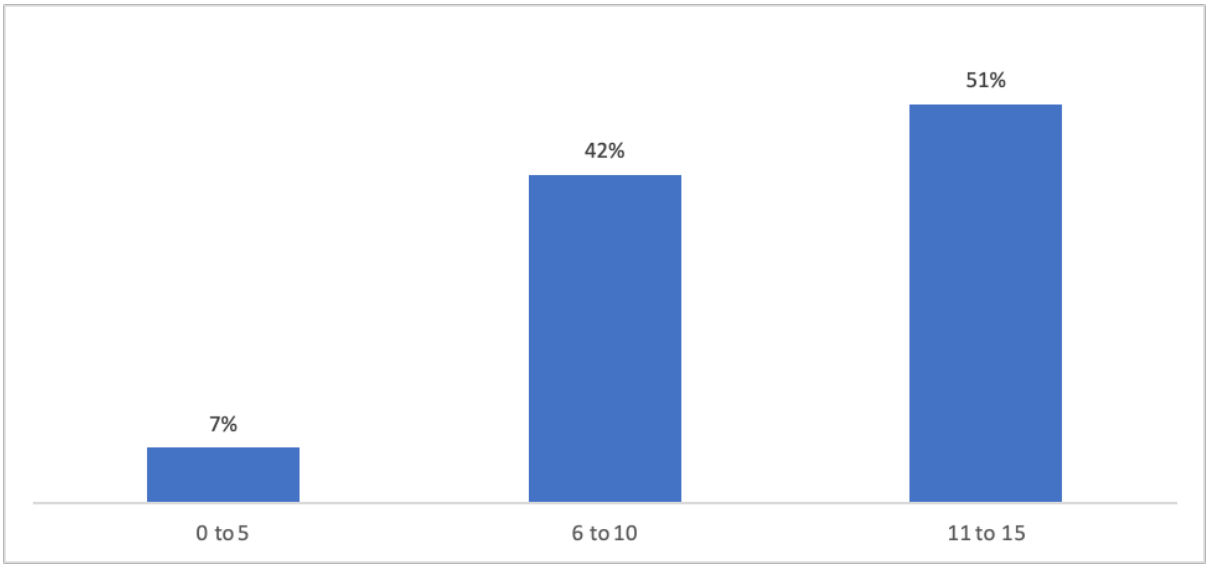


Figure 3.7 Average number of people in household.

Figure 3.7 shows the average household size in Rookdale. 51% of the Households have 11 to 15 people living in one house. 42% have 6 to 10 people living in the house and 7% of the houses have 1 to 5 people living in the house. This shows that most households and families in the Rookdale community are large. The average family in a study conducted by the oKhahlamba municipality was 13 and the research supports the finding (2015). The large family households are a challenge for the municipality as recourses are restricted because of the overgrowing population out grows the availability of the basic services that are available (IDP, 2020)

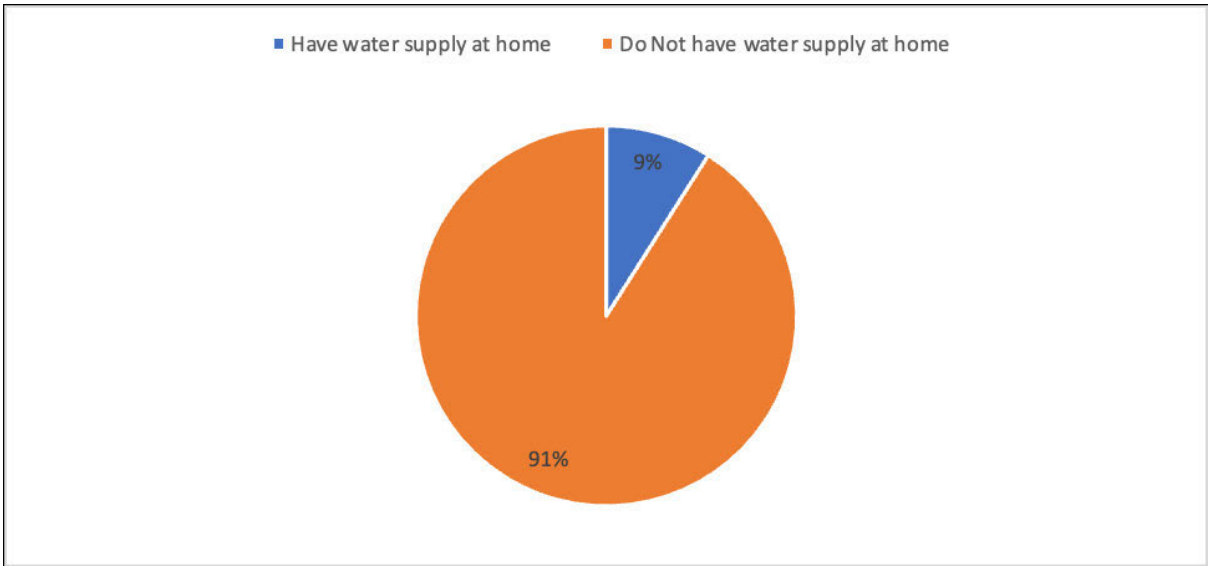


Figure 3.8 Water supply at home.

Figure 3.8 shows that 91% of the Rookdale community does not have consistent piped water at home and 9% do. Some of the people in the community have their own private boreholes in their houses that they received water from and did not need to collect water with the rest of the community at the public hand pump boreholes. This is 6% higher than Mthembu findings that 85% of SSA rural areas lack piped water (2018). This is a challenge that affects the daily livelihoods of the community in Rookdale and causes several challenges such as cooking and bathing and prohibits the community to practice subsistent farming for food security. If subsistent farming were possible, the amount of money the community spends on food and travel cost would be less. The water insecurity leads poverty and causes an inconvenience to the daily livelihoods of the rural community (Mthembu, 2018).

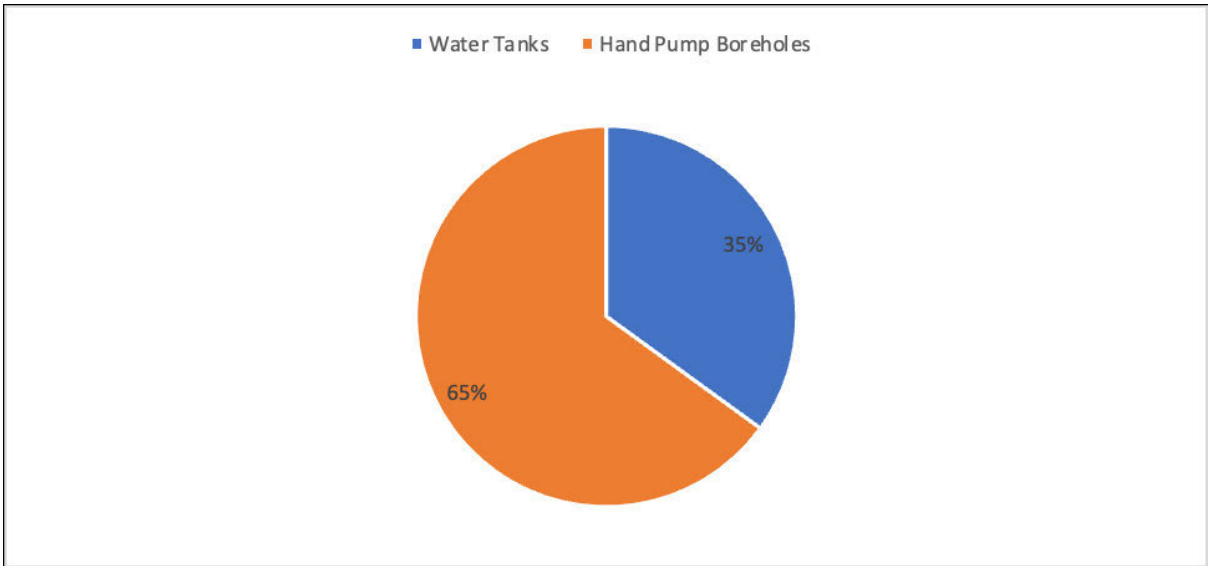


Figure 3.9 Water supply method in Rookdale community.

Figure 3.9 shows the two main water supply methods in the study area. 65% of the community collect their water from the hand pump boreholes and 35% receive water from the municipality. Both these methods should be free and are supplied by the municipality but the driver that distributes the water in the form of tanks are corrupt and the driver sells the water to the community for R500 a tank.

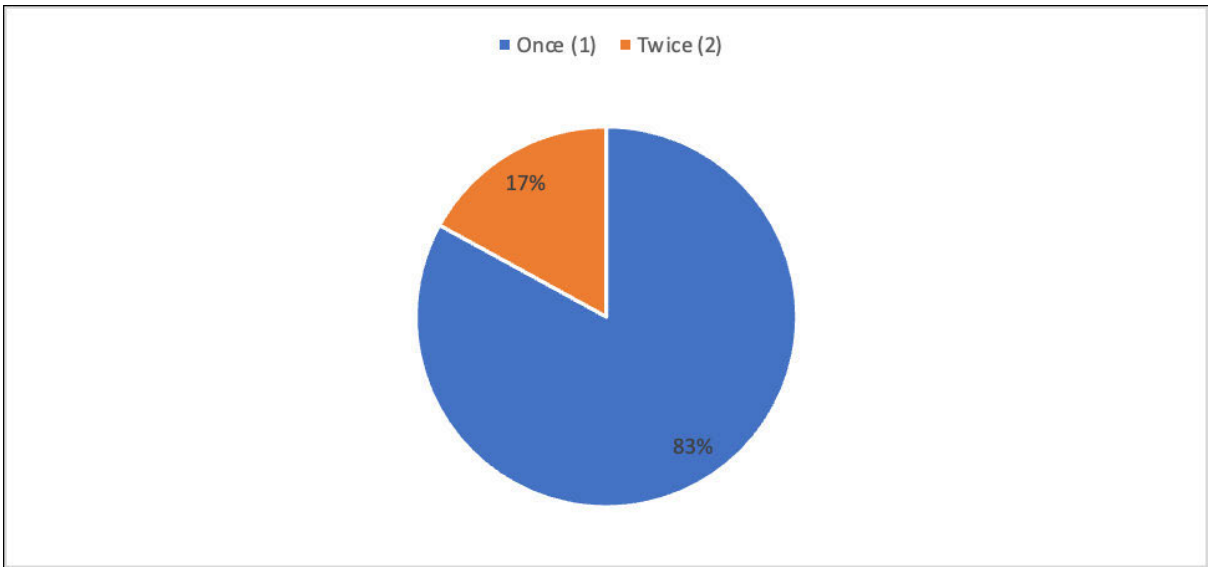


Figure 3.10 The amount of times water is collected per day.

Figure 3.10 show that 83% of the Rookdale community collect water once a day. This is because they are aware of how much water they use on average and carry enough buckets for one load a day whilst 17% collect water twice daily.

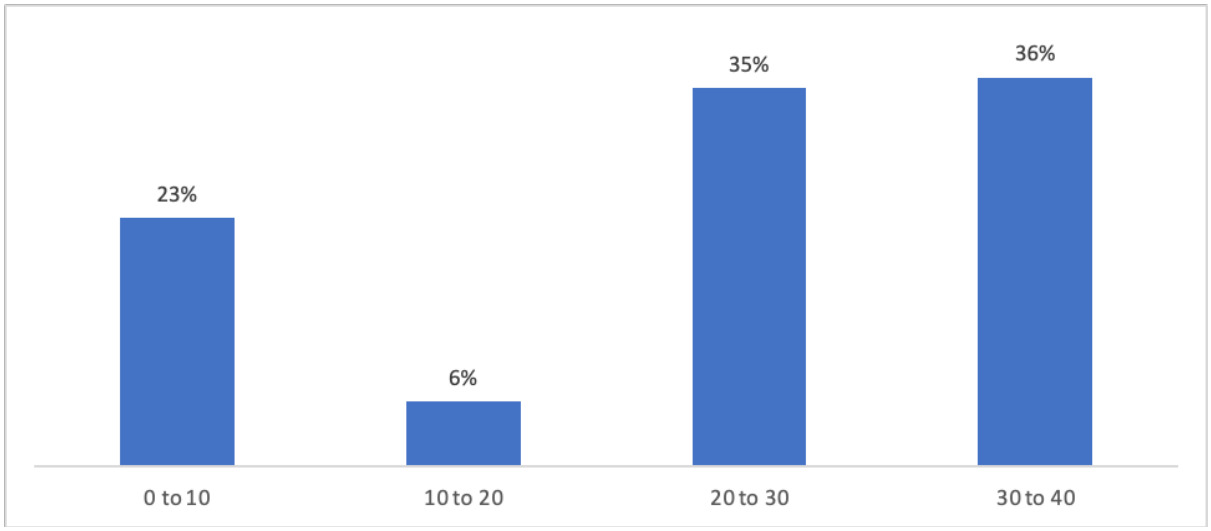


Figure 3.11 The average number of years living in Rookdale.

Figure 3.11 shows the average number of years that participants have lived in the Rookdale community. Thirty six percent of the community have been living in Rookdale between 30 to 40 years, 35% have been living in Rookdale for 20 to 30 years, 23% are new between 0 to 10 years and 6 & between 10 to 20 years. Most of the people of Rookdale have lived in this community since the Apartheid era and mention that there has been little change regarding water supply.

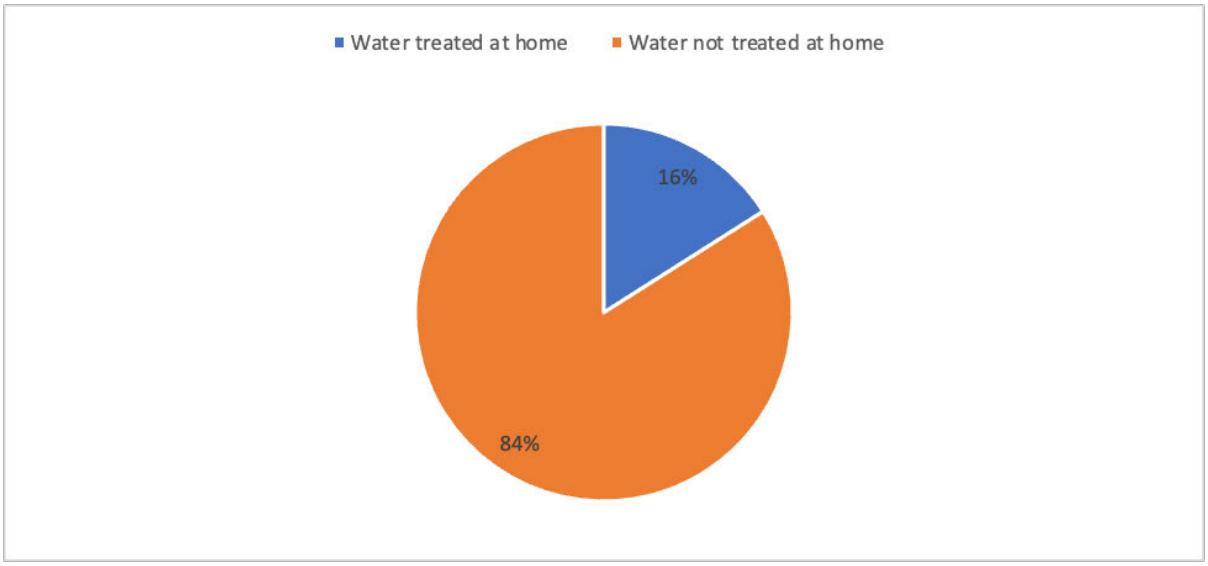


Figure 3.12 Water sanitation after collecting water.

Figure 3.12 shows that 84% of the community do not treat the water after it is collected from the boreholes and only 16% do. This shows poor sanitation practices in the community.

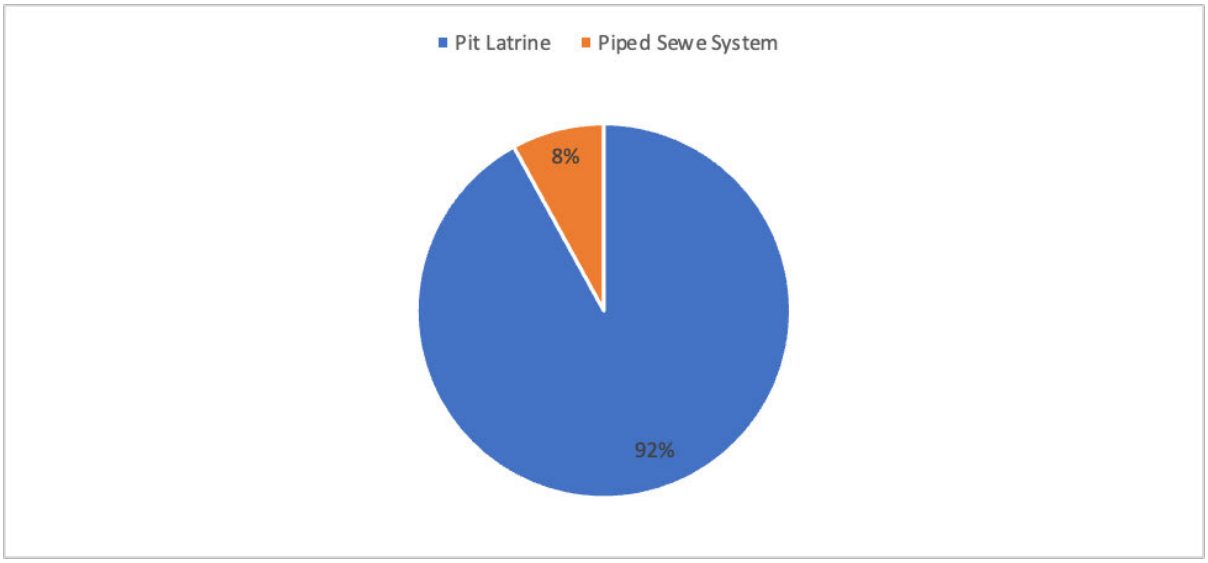


Figure 3.13 Toilet facility in Rookdale households.

Figure 3.13 shows that 92% of the community in Rookdale uses a Pit Latrine as a toilet facility. Whilst 9% have a piped sewer system. Again figure 3.13 shows poor sanitation practices within the community. Pit latrines are commonly used in rural areas because they are not expensive to operate. The challenge that are faces pit latrines is poor hygiene (brain, 2014).

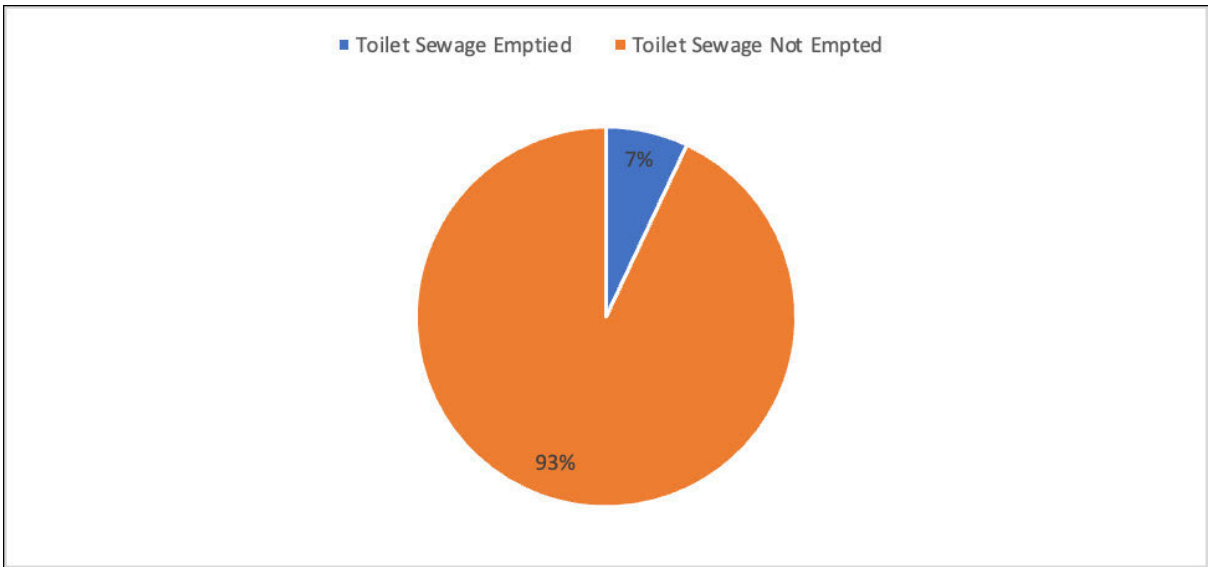


Figure 3.14 Toilet systems used that are emptied and not emptied.

Figure 3.14 above shows that 93% of the toilet facility used is not emptied, and 7% is. Again, this shows that the Rookdale community has poor sanitation. With most of the community using pit latrines as the toilet facility. The pits are not emptied and expensive for the community. Most of the community is unemployed and cannot afford to empty the pit latrine. Pit latrines are low-cost toilets but once they are not emptied often, pit latrines cause flies and odor that effects the community's health negatively (Brain, 2014). The few that can empty out their toilet facility use piped toilet facilities and have a private borehole present at the household.

3.8.1 Administrative challenges

The following are administrative challenges that the competent authority identified when interviewed by the researcher. The competent authority uThukela District municipality mentioned that Bergville has 4 pump stations and treatment works, namely: Bergville water treatment works, Langkloof water treatment works, Zwelihla-moyeni water treatment works, and Winterton water treatment works.

- The main issue is that the water scheme for the treatment works named above were designed back in the apartheid era, and the water from the treatment works supplies

water in the town of Bergville, and the rest goes to urban Johannesburg as it is seen to be the economic hub of the country said the uThukela officials.

- Water schemes were not designed to support the overpopulated community of Rookdale and other rural communities in Bergville.
- The manager mentioned that the hand pump boreholes in Rookdale are not up to standards, and some are not functioning.
- Corruption within the water supply truck tanks: The municipality have made an alternative method to deliver water in tanks to the population, but the driver of the water tanks sells the water when he gets into the community for an average amount of R500.
- Furthermore, the district does not have money to upgrade the hand pump boreholes that are not functioning, and the water schemes need to be changed at a national level to supply Rookdale with water as most of the water is being transported to Johannesburg as they only currently support urban areas.
- The uThukela officials further mentioned that there is presently 0% chance for piped tap water supply In Rookdale because of overgrowing illegal water connections from the residents of Rookdale that are overgrowing.

3.9 Recommendations

3.9.1 The involvement all government.

South Africa is a public authority authorized to manage and govern certain regional affairs. The results of the study showed a lack of effective intervention by national governments in local communities. Local government involvement and the integration of different sectors of government are key to efficiently providing water services to the rural poor. Responsibility for water supply lies primarily with the uThukela district and Umgeni Water was established under the Water Services Act 1997 to provide water and sanitation services primarily in rural areas of KwaZulu-Natal and service areas including the eThekwini metropolitan area. was established to area (Rimayi, 2018). The Water Works Association supplies water to approximately 6 million consumers. In addition, the Co-operative Governance and Traditional Affairs Department needs financial support to support and oversee the uThukela District. However, a common challenge faced by most government agencies in South Africa is the lack of integration and communication between different departments and departments of government. A department or municipality can find resources for water supply within the

municipality, but no proper infrastructure has been developed. This leads to areas with no water supply.

3.9.2 Prioritization of rural water infrastructure and review apartheid water scheme policies.

There is a need to build the infrastructure that supports the Rookdale community. The uThukela district should focus on appointing employees based on their ability to meet job description requirements rather than on political affiliation. There is an urgent need to re-evaluate ways to eradicate corruption (Asongu 2013). uThukela needs to improve its financial management requirements by hiring competent and capable officers. Furthermore, there must be accountability by ensuring that oversight is carried out by senior officials and various departments of government. This ensures that corruption, fraud, and mismanagement of funds are eliminated or reduced (Asongu 2014). The water scheme policies that were drafted during the apartheid era need to be visited and review as they are bias towards supplying urban areas with water.

3.9.3 Maintenance initiatives.

Projects need to be monitored to ensure that water infrastructure is regularly maintained and has a longer life cycle (Charnley, 2006). Water monitoring projects are highly effective in reducing poverty and strengthening local communities through partnerships with governments, the private sector, community-based programs, non-governmental organizations, and local rural people (Kielmann, 1986). Such partnerships are critical to empowering the poor, as they are part of the solution in meeting the challenges of making a living. This type of partnership is critical to community empowerment, skills development, and economic development in the Rookdale community.

3.9.4 Infrastructure development and Job creation.

Rural communities lack the basic infrastructure facilities (Charnley, 2006). As a result, the community travels to the nearest town situated in urban areas. Investments from private and the public sector needs to occur within the rural community. Shopping centers need to be built to create jobs and reduce the amount of people traveling into the urban areas and to reduce the unemployment rate by creating economic development (Charnley, 2006). Clinics and hospitals need to be built in the rural areas for better health care for social development. The rural

community needs to be upgraded in terms of infrastructure and basic services need to be provided to help eradicate poverty (Charnley, 2006).

3.10 Conclusion

In conclusion in this study, three objectives were set to achieve our aim. In this section, we examine the extent to which this study achieved these objectives. To Achieve the first objective: To systematically review existing literature regarding the impacts of water service delivery in rural communities in SSA between 2011-2021. The Priority Reporting Items for Systematic Reviews (PRISMA) method was used to achieve the first objective. A systematic literature review was conducted according to the general principles of the (PRISMA) systematic review process. Literature was downloaded from web-based search engines such as Google Scholar, Web of Science, and Scopus. The search terms were combined with Boolean operators "OR" and "AND" using the following search criteria: “Water Supply” OR “Water Service Delivery” OR “Water Sanitation” AND “Water Infrastructure” AND “Remote Sensing” OR “Saharan Africa” AND “RURAL” and 2011–2021. The second Objective was to to show the main source of water supply in the Rookdale rural community. The second objective: was to show the main source of water supply in the Rookdale rural community. By identifying the main source of water supply in Rookdale from the community and then gathering the geographical co-ordinates of each hand pump boreholes from the uThukela district municipality within Rookdale and mapping each hand pump borehole co-ordinate in the area map of Rookdale rural community using ArcGIS. The last objective: to examine water supply in Rookdale rural community. This objective achieved through a structured questionnaire and participatory exercises conducted in the rural community of Rookdale. A total of 120 respondents were included in the survey. Most of the participants questionaries outlined that Rookdale rural community have poor water supply and sanitation resulting in no socio-economic development. This resulting in high unemployment leading to poverty in the Rookdale area.

REFERENCES LIST:

Adams, E. A. and S. L. Smiley (2018). Urban-rural water access inequalities in Malawi: implications for monitoring the Sustainable Development Goals. Natural Resources Forum, Wiley Online Library.

Adeniran, A., et al. (2021). "Water infrastructure development in nigeria: Trend, size, and purpose." Water (Switzerland) **13**(17).

Asongu, S. (2014). "Globalization (fighting), corruption and development: How are these phenomena linearly and nonlinearly related in wealth effects?" Journal of Economic Studies.

Asongu, S. A. (2013). "Fighting corruption in Africa: do existing corruption-control levels matter?" International Journal of Development Issues **12**(1): 36-52.

Bain, R. E., et al. (2014). "Rural: urban inequalities in post 2015 targets and indicators for drinking-water." Science of the Total Environment **490**: 509-513.

Bellhouse, D. (2005). "Systematic sampling methods." Encyclopedia of Biostatistics **8**.

Bryman, A. (2017). Quantitative and qualitative research: further reflections on their integration. Mixing methods: Qualitative and quantitative research, Routledge**:** 57-78.

Charnley, S., et al. (2006). "Socioeconomic Monitoring Results Volume III: Rural Communities and Economies." UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE GENERAL TECHNICAL REPORT PNW **649**(3).

Chitonge, H., et al. (2020). Water and sanitation inequality in Africa: challenges for SDG 6. Africa and the sustainable development goals, Springer**:** 207-218.

Dubow, S. (1989). Racial segregation and the origins of apartheid in South Africa, 1919–36, Springer.

Gleick, P. H. (1998). "The human right to water." Water policy **1**(5): 487-503.

Hakimdavar, R., et al. (2020). "Monitoring water-related ecosystems with earth observation data in support of Sustainable Development Goal (SDG) 6 reporting." Remote Sensing **12**(10): 1634.

Hanjra, M. A., et al. (2009). "Reducing poverty in sub-Saharan Africa through investments in water and other priorities." Agricultural Water Management **96**(7): 1062-1070.

Hoogeveen, J. G. and B. Özler (2006). "2 Poverty and inequality in post-apartheid." Poverty and policy in post-apartheid South Africa: 59.

Hope, R., et al. (2020). "Rethinking the economics of rural water in Africa." Oxford Review of Economic Policy **36**(1): 171-190.

Jegede, A. O. and P. Shikwambane (2021). "Water 'apartheid'and the significance of human rights principles of affirmative action in South Africa." Water **13**(8): 1104.

Kielmann, A., et al. (1986). "Control of deaths from diarrheal disease in rural communities: II. Motivating and monitoring the community." Tropical Medicine and Parasitology: Official Organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) **37**(1): 15-21.

Leckie, D. G., et al. (2005). "Automated detection and mapping of crown discolouration caused by jack pine budworm with 2.5 m resolution multispectral imagery." International Journal of Applied Earth Observation and Geoinformation **7**(1): 61-77.

Levesque, R. (2007). "SPSS programming and data management." A guide for SPSS and SAS Users.

Macharia, P., et al. (2021). "Examining the relative impact of drivers on energy input for municipal water supply in Africa." Sustainability (Switzerland) **13**(15).

Malan, L. (2005). "Intergovernmental relations and co-operative government in South Africa: The ten-year review." Politeia **24**(2): 226-243.

Marks, S. J., et al. (2013). "Does sense of ownership matter for rural water system sustainability? Evidence from Kenya." Journal of Water Sanitation and Hygiene for Development **3**(2): 122-133.

McGriff, J. A. and L. Denny (2020). "What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities." American Journal of Tropical Medicine and Hygiene **103**(5): 1762-1764.

Mthembu, B. and E. Mutambara (2018). "Rural tourism as a mechanism for poverty alleviation in Kwa-Zulu-Natal Province of South Africa: Case of Bergville." Journal of Hospitality, Tourism and Leisure **7**(4): 1-22.

Municipality, O. L. (2015). "Okhahlamba Municipality IDP Review-2015/2016." Bergville, South Africa.

Mutambara, E. and B. Mthembu (2018). "Critical resources for the development of rural tourism within the greater Bergville area of Kwa-Zulu Natal South Africa." African Journal of Hospitality, Tourism and Leisure **7**(5): 1-25.

Rimayi, C., et al. (2018). "Contaminants of emerging concern in the Hartbeespoort Dam catchment and the uMngeni River estuary 2016 pollution incident, South Africa." Science of the Total Environment **627**: 1008-1017.

Rinaldo, D., et al. (2021). "The economic impact of schistosomiasis." Infectious Diseases of Poverty **10**(1).

Siniscalco, M. T. and N. Auriat (2005). "Questionnaire design." Quantitative research methods in educational planning **8**.

Sutherland, C., et al. (2015). "Urban water governance for more inclusive development: A reflection on the 'waterscapes' of Durban, South Africa." The European Journal of Development Research **27**(4): 488-504.

Tempelhoff, J. W. N. (2009). "Civil society and sanitation hydropolitics: A case study of South Africa's Vaal River Barrage." Physics and Chemistry of the Earth **34**(3): 164-175.

Thiese, M. S., et al. (2016). "P value interpretations and considerations." Journal of thoracic disease **8**(9): E928.

Tooke, F. G. C. (1955). The Eucalyptus Snout-beetle, Gonipterus Scutellatus Gyll: A Study of Its Ecology and Control by Biological Means, The Government Printer.

Turton, A. R. (2005). The political aspects of institutional developments in the water sector: South Africa and its international river basins, University of Pretoria.

Van Heerden, J., et al. (2005). "Prevalence, quantification and typing of adenoviruses detected in river and treated drinking water in South Africa." Journal of applied microbiology **99**(2): 234-242.

West, A., et al. (2014). "Spatial analysis of hydrogen and oxygen stable isotopes ("isoscapes") in ground water and tap water across South Africa." Journal of Geochemical Exploration **145**: 213-222.

Zhou, X., et al. (2021). "Toward Improved Comparisons Between Land-Surface-Water-Area Estimates From a Global River Model and Satellite Observations." Water Resources Research **57**(5).

CHAPTER FOUR: EXAMANING THE SOCIO-ECONOMIC IMPACTS OF WATER SERVICE DELIVERY IN ROOKDALE RURAL COMMUNITY OF KWAZULU-NATAL, SOUTH AFRICA: A SYNTHESIS

4.1 Introduction

The focus of this thesis was to examine the water service delivery in Rookdale rural community. Water service delivery are basic needs that affect individuals daily. Water service delivery and sanitation results are more common in urban areas where development has occurred. Without the basic needs of water and sanitation, daily livelihoods are interrupted, and areas that lack water service delivery are seen as poor areas and are commonly rural communities. Post-apartheid water service delivery in the rural community was a priority in Southern Africa and a basic need in the Bill of rights for every citizen in the country. Even though it has been 28 years since apartheid ended, the goal of providing water service delivery and sanitation in the rural community has not been achieved. Most research focuses on the global and African studies of water and sanitation rather than a more local focus. At the same time, factors such as poverty, political marginalisation and social exclusion that intensify the impacts of water service delivery and sanitation are ignored. Research to improve the understanding of water service delivery and sanitation in rural areas regarding the nature and impacts of water service in Rookdale is essential for the development of rural communities. The significance of this study is its contribution by bridging the gap between continental knowledge regarding the impacts of water service delivery at a local scale.

4.2.1 Aim and objectives reviewed

The aim of this study was to examine the impacts of water service delivery on rural dwellers in Rookdale.

In this study, three objectives were set to achieve our aim. In this section, we examine the extent to which this study achieved these objectives.

- **To systematically review existing literature regarding the impacts of water service delivery in rural communities in SSA between 2011-2021**

The following method was used to achieve the first objective. A systematic literature review was conducted according to the general principles of the Priority Reporting Items for Systematic Reviews (PRISMA) systematic review process. Literature was downloaded from web-based search engines such as Google Scholar, Web of Science, and Scopus. The search terms were combined with Boolean operators "OR" and "AND" using the following search

criteria: “Water Supply” OR “Water Service Delivery” OR “Water Sanitation” AND “Water Infrastructure” AND “Remote Sensing” OR “Saharan Africa” AND “RURAL” and 2011–2021. Many studies had reported similar findings across SSA with a large number of studies stating that rural communities in SSA are water scare with poor sanitation.

- **To map the source of rural water supply in the Rookdale.**

The second objective was met by gathering the geographical co-ordinates of each hand pump boreholes from the uThukela district municipality within Rookdale and mapping each hand pump borehole co-ordinate in the area map of Rookdale rural community using ArcGIS. This objective was meet with figure 4.1.

- **To to assess the socio-economic impacts of a lack of water and sanitation service delivery in Rookdale.**

  A third objective was achieved through a structured questionnaire and participatory exercises conducted in the rural community of Rookdale. A systematic sampling technique was used to select samples from the target population. In this technique, researchers start from any point within the parameters of the study population once the starting point is marked. A consistent frequency is then maintained throughout the data collection process (Bellhouse 2005). A total of 120 respondents were included in the survey. Many of the participants questionaries outlined that Rookdale rural community has poor water supply and sanitation resulting in no socio-economic development. This resulting in high unemployment leading to poverty in the Rookdale area.

4.2.2 An overview of literature relating to the impacts of water supply in rural SSA.

Chapter two provided an overview of the nature and extent of water service delivery and sanitation in SSA. The chapter also highlighted the various socio-economic impacts of water service delivery and this effects the livelihoods of the most vulnerable in SSA. Furthermore, the chapter highlighted the dominant countries leading with information on water service delivery in SSA. And the chapter discussed the Pathways to achieve rural water in Africa with policy implications included.

4.2.3 To show the main source of water supply in the Rookdale rural community.

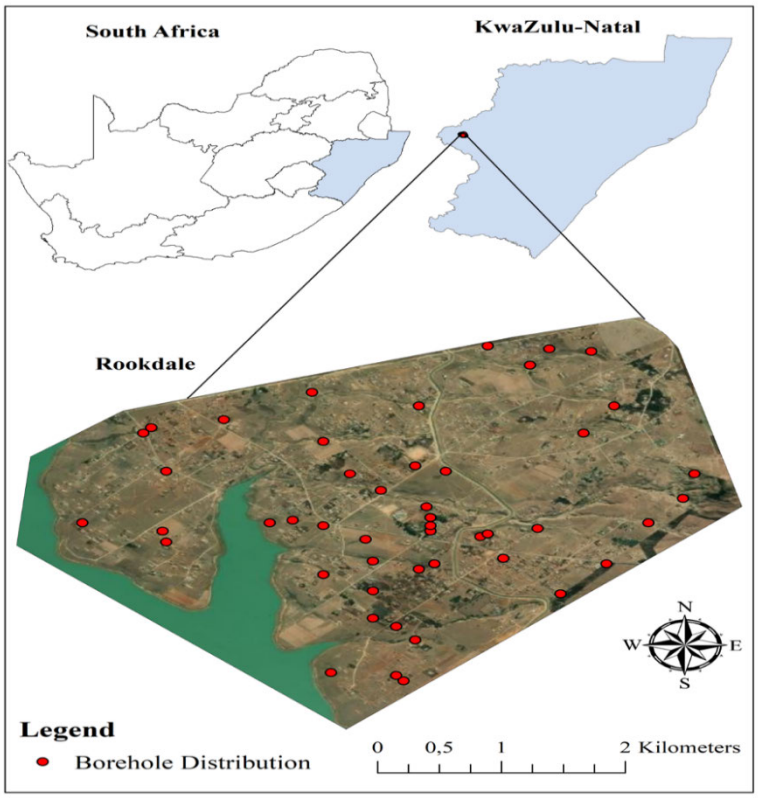


Figure 4.1 The distribution of the hand pump boreholes in Rookdale rural community.

Remote sensing technology plays a significant role in detecting and mapping the impacts and severity of handpump boreholes over large spatial scales. In addition, co-ordinates were obtained from the uThukela district municipality of the hand pump boreholes as the main source of water supply in Rookdale. Figure 4.1 above shows the distribution of the hand pump boreholes in Rookdale rural community.

4.2.4 To examine water supply in Rookdale rural community.

4.1 Conditions of water

			Percentage (%)	**Chi-square**	**p-value**
	Water collection time	2 Hours	60	35.848[a]	***

Water supply method		3 Hours 4 Hours	14 26		
	Number of times without tap water	Weeks Months	20 80	18.081[a]	***
Number of times water is collected a day	Water collection time	2 Hours 3 Hours 4 Hours	60 40 26	15.452[a]	***
	Person responsible for collecting water	Adult Child Student	9% 57% 34%	17.739[a]	***
* Represents significant difference p-value <0.05 **Represents significant difference p-value <0.01 ***Represents significant difference p-value <0.001					

This objective aimed to assess rural communities impacts regarding the water service delivery and sanitation in Rookdale, as well as the various adaptive strategies used to get water. This was an important objective to understand how individuals who are directly affected by poor water service delivery cope and how severe the lack of water and service delivery in Rookdale. The key findings relating to this objective revealed that the frequency and intensity of poor water service delivery has been severe in the area over the past 28 years, which is a direct cause of apartheid. This has resulted in a decrease in sanitation and poor basic need not being met in the rural community. Results further revealed socio-economic impacts of poor water service delivery such as high unemployment, increased poverty levels and low marital rates. The

impacts of water service delivery in Rookdale are poor and the residents in the rural community take up to two hour per day to collect water from a designated hand pump borehole near where they live. A significant finding in the chapter, revealed the administrative challenges that are faced by the uThukela district municipality factors that influence the poor water service delivery and sanitation. Factors such as water schemes that support the urban areas rather than rural that were drafted in the apartheid era. These findings highlighted the major limitations rural communities and face with regards to water service delivery, which are important for policy makers to understand and be aware of. The chapter shed light on the minimal role that government institutions played towards assisting rural communities. The results revealed a significant association between the water supply method, water collection time and amount of times without tap water and the person tin the household that collects the water (**Table 4.1**).

These findings highlighted the importance of the basic service of water and sanitation in homes and government involvement in providing water, in rural communities. The findings of this study were underpinned by the theory of urban bias theory, which provided a theoretical foundation in understanding the perceptions of respondents as well as how they respond to the impacts of water service delivery. The cross-tabulation, chi-square was used to analyze the relationship between two or more variables (Ronna et al. 2016). The Chi-square above showed a relationship between the water supply method in Rookdale which is the distributed hand pump boreholes and the time it takes for the community to collect the water daily. Secondly there was a relationship between the water supply method and the amount of time the rural community does not have tap/piped water. There was also a relationship between the number of times water was collected and the time taken by the community to collect water from the hand pump boreholes. Lastly there is a relationship with the number of times water was collected and the person who is responsible for collecting the water daily in the household. All the above-mentioned variables chi square resulted in the p-value of 0.001 that portrays a significant difference. In the Rookdale community, 60% of the people took an average of 2 hours to collect water at the closest designated hand pump borehole, 14% took an average of 3 hours, and 26% took 4 hours to collect water daily. The Bergville individual development plan (IDP) states that the community is overpopulated and has restricted handpump boreholes that function properly (2020). Most of the hand pump boreholes water recharge demand is too low and the boreholes run out of water before all the members of the community have collected water (IDP, 2020). This further delays the community as more time is spent waiting further for the hand pump borehole to recharge with more water before they can collect further (IDP,

2020). In addition, there are also long lines at the hand pump boreholes to collect the water and a large community that uses the water supply casing damage to the hand pump boreholes and a regular need to maintain and repair the primary water source in the area (IDP, 2020). Water is collected in the form of buckets at the nearest hand pump borehole. 80% of the Rookdale community had no water in the households for months, while the remaining 20% have no water in the household taps for weeks. This is a 5% improvement from Mthembu findings that 85% of SSA rural areas lack piped water (2018). In 57% of the households, the children were responsible for collecting the water at the nearest handpump borehole. According to Adams research that he conducted in Malawi where his mentioned that children mostly collected water over long distances in rural communities and is one of the most common forms of child labor (2018). In thirty four percent of the households, it is a student that collects the water and often makes the students late for school and often battle with being tired leading to poor concentration levels during classes and needing to leave school early to collect water after. Adam goes on to mention that this effects the student's health at school. The adults the households make up the remaining 9% that collect the water. Most of the households in Rookdale collected water from the distributed hand pump boreholes in Rookdale.

Evidence has shown that the more geographically isolated an area is, the higher the chances that basic services will be below average and below rural averages (Hanjra, 2009). The supply of water in rural areas is important in reducing poverty in rural areas as a basic need (Hanjra, 2009). The research findings confirm that there is a lack of water supply in Rookdale rural community and no socio-economic development and support Adeniran findings in Nigeria that according to his research there is a need for water infrastructure investment in rural communities to provide basic services and create socio-development that is currently lacking in SSA (2021). The urban bias theory developed by Michael Lipton is evident which proposed that development planning in less developed countries is biased against rural areas in that most of the economic resources are allocated to the urban areas rather than the rural ones, making the poor poorer (Sutherland, Scott et al. 2015). As a result, more and more people according to Asongu are moving into urban area (2014). The uThukela district municipality manager after being interviewed by the researcher and after reviewing the Integrated Development Plan (IDP) of Bergville further supported this theory as the below challenges were highlighted in Rookdale rural community regarding water supply:

- No water scheme in rural areas

- Inconsistency of water supply
- Extend water supply to nearest source or divert potential source
- Rehabilitation of deliberately destroyed sewage pumping stations
- Inadequate sanitation infrastructure
- New projects to eliminate waterlogging and intermediate wells.
- Hand pump needs repair due to unstable water supply.
- Fund inadequate sanitation infrastructure
- Massive water loss due to illegal connections to risers
- non-functioning reservoir
- Maintenance of existing sources

4.2.5 Scope and limitations and recommendations

The scope of the research study involved assessing perceptions regarding the various socio-economic of water service delivery and sanitation in Rookdale, KwaZulu-Natal, South Africa. The nature of the study required the use of a mixed method approach, incorporating both quantitative and qualitative research methods. The researcher utilised a structured questionnaire for the quantitative aspect of the study and focus groups, interviews and participatory techniques formed part of the qualitative aspect of the research study. The data obtained from the structured questionnaire was captured and analysed using The Statistical Package for Social Sciences (SPSS) version 28. The sample size for the research study was 120 respondents. The sampling strategy utilised was purposive sampling as it suited the objectives of the research study. The limitations for the research study included the time constraints associated with conducting questionnaire surveys, interviews, focus group discussions and participatory research techniques. It was also quite difficult to get into contact and arrange meetings with formal stakeholders, although I did interview my target number, getting interviews with a broader range of stakeholders would improve the research study.

This section focuses on providing future recommendation for reaching water security in Rookdale rural community.

The involvement all government.

South Africa is a public authority authorized to manage and govern certain regional affairs. The results of the study showed a lack of effective intervention by national governments in

local communities. Local government involvement and the integration of different sectors of government are key to efficiently providing water services to the rural poor. Responsibility for water supply lies primarily with the uThukela district and Umgeni Water.The Water Works Association supplies water to approximately 6 million consumers. In addition, the Co-operative Governance and Traditional Affairs Department needs financial support to support and oversee the uThukela District. A department or municipality can find resources for water supply within the municipality, but no proper infrastructure has been developed. This leads to areas with no water supply.

Prioritization of rural water infrastructure and review apartheid water scheme policies.

There is a need to build the infrastructure that supports the Rookdale community. The uThukela district should focus on appointing employees based on their ability to meet job description requirements rather than on political affiliation. The water scheme policies that were drafted during the apartheid era need to be visited and review as they are bias towards supplying urban areas with water.

Maintenance initiatives.

Projects need to be monitored to ensure that water infrastructure is regularly maintained and has a longer life cycle (Charnley, 2006). Water monitoring projects are highly effective in reducing poverty.

Infrastructure development and Job creation.

Rural communities lack the basic infrastructure facilities (Charnley, 2006). As a result, the community travels to the nearest town situated in urban areas. Investments from private and the public sector needs to occur within the rural community. Shopping centers need to be built to create jobs and reduce the amount of people traveling into the urban areas and to reduce the unemployment rate by creating economic development (Charnley, 2006). Clinics and hospitals need to be built in the rural areas for better health care for social development. The rural community needs to be upgraded in terms of infrastructure and basic services need to be provided to help eradicate poverty (Charnley, 2006).

4.2.6 Conclusion

This study aimed to examine the socio-economic impacts of water service delivery in Rookdale, KwaZulu-Natal, South Africa. The study's findings revealed that the frequency and duration of lack of water service delivery have been ongoing for over the past 28 years since apartheid ended. Furthermore, the impacts of water service delivery have disproportionately impacted the most vulnerable rural communities. The conclusions reached in this thesis contribute to a broad body of scientific knowledge and highlight important issues and challenges regarding the impacts of water service delivery in rural communities. The main conclusion is consolidated based on the observations throughout this thesis and answers the key questions posed in chapter one:

What are the perceptions of various stakeholders regarding water service delivery in Rookdale?

- The perceptions of the community and people of Rookdale see the municipality and government to blame for the lack of water supply in the community. They feel neglected by the government and believe that the government has not fully committed themselves in supplying water for the community as they have had over 28 years since democracy and being in power to change and improve the water insecurity situation in Rookdale. On the other hand the uThukela district that is responsible for water security for Rookdale give the following administrative challenges below for water insecurity in the area:

- The main issue is that the water scheme for the treatment works named above were designed back in the apartheid era, and the water from the treatment works supplies water in the town of Bergville, and the rest goes to urban Johannesburg as it is seen to be the economic hub of the country said the manager at uThukela.
- Water schemes were not designed to support the overpopulated community of Rookdale and other rural communities in Bergville.
- The manager mentioned that the hand pump boreholes in Rookdale are not up to standards, and some are not functioning.
- Corruption within the water supply truck tanks: The municipality have made an alternative method to deliver water in tanks to the population, but the driver of the water tanks sells the water when he gets to the community for an average amount of R500.

- Furthermore, the manager mentioned that the uThukela district does not have money to upgrade the hand pump boreholes that are not working, and the water schemes need to be changed at a national level to supply Rookdale with water as most of the water is being transported to Johannesburg as they only currently support urban areas.
- The uThukela manager further mentioned that there is presently 0% chance or water supply In Rookdale because of overgrowing illegal water connections from the residents of Rookdale that are overgrowing.

How severe is the lack of water service delivery in the Rookdale rural community?

- The water service is very poor and highly severe in Rookdale. Ninety one percent of the Rookdale community do not have consistent piped water at home and 9% do. The community of Rookdale spend months without any tap water and for some weeks. Some of the people had their own borehole in their houses that they received water from and did not need to collect water with the rest of the community at the public hand pump boreholes. The lack of water security is a challenge that affects the daily livelihoods of the community in Rookdale and causes several challenges such as cooking and bathing and prohibits the community to practice subsistent farming for food security. If subsistent farming were possible amount of money the community spend on food and travel cost would be less. The water insecurity leads to poor health and causes an inconvenience to the daily livelihoods of the rural community (Mthembu, 2018).

What are the socio-economic impacts of water service delivery in Rookdale?

- Socially water scarcity negatively impacts job opportunities, cooking, washing, water access impacts food security production and the limitations of subsistence farming, and therefore increases hunger rates (West, 2014). Socially without water for sanitation, it is challenging to provide communities with basic health care at home, in schools and in health care facilities to protect rural communities from avoiding diseases (West, 2014). Economically water scarcity prohibits development and economic growth. Water

scarcity impacts job creation resulting in poverty (Mthembu, 2018). Water is a key factor in production, so a reduced water supply slows growth. Economically, water shortages lead to food shortages, higher food prices, more difficult trade with developing countries, and long-term civil unrest (Mthembu, 2018). Businesses may be forced to lay off some of their workforce as slower business activity leads to lower profits, reducing the purchasing power of consumers in vulnerable communities (Mthembu, 2018). Water is key to sustainable growth and poverty reduction as the engine of nearly all production in agriculture, industry, energy, and transport by healthy people in healthy ecosystems (Mthembu, 2018).

Overall, this study concludes that rural communities in SSA are particularly vulnerable to the impacts of water service deliver, due to their high growing population and water scheme that do not support and reach the rural communities. Hand pump boreholes is the main source for water service delivery in Rookdale as there is no tap water for weeks and months inside the households. These hand pump boreholes are distributed over Rookdale and consume on average two hours daily of residents lives collecting water. Socio-economic impacts associated with no basic water service delivery caused poverty, high unemployment, low marital status and poor sanitation practices as pit latrine are the most common toilet. Results further revealed that there are administrative challenges in the uThukela district that need an integrated approach to be tackled and assistance from all government. The urban bias theory framework was utilised as the basis for understanding the various determinants of lack of water service in Rookdale rural community. The study is very important for planning future basic needs being meet in rural communities. More importantly, assessing these impacts from multiple perspectives is essential in understanding not only the diverse challenges that the residents are faced with, but also the various challenges the uThukela District and government are faced with.

REFERENCES LIST

Adams, E. A. and S. L. Smiley (2018). Urban-rural water access inequalities in Malawi: implications for monitoring the Sustainable Development Goals. Natural Resources Forum, Wiley Online Library.

Adeniran, A., et al. (2021). "Water infrastructure development in nigeria: Trend, size, and purpose." Water (Switzerland) **13**(17).

Asongu, S. (2014). "Globalization (fighting), corruption and development: How are these phenomena linearly and nonlinearly related in wealth effects?" Journal of Economic Studies.

Asongu, S. A. (2013). "Fighting corruption in Africa: do existing corruption-control levels matter?" International Journal of Development Issues **12**(1): 36-52.

Bain, R. E., et al. (2014). "Rural: urban inequalities in post 2015 targets and indicators for drinking-water." Science of the Total Environment **490**: 509-513.

Bellhouse, D. (2005). "Systematic sampling methods." Encyclopedia of Biostatistics **8**.

Bryman, A. (2017). Quantitative and qualitative research: further reflections on their integration. Mixing methods: Qualitative and quantitative research, Routledge**:** 57-78.

Charnley, S., et al. (2006). "Socioeconomic Monitoring Results Volume III: Rural Communities and Economies." UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE GENERAL TECHNICAL REPORT PNW **649**(3).

Chen, J., et al. (2020). "Augmenting a deep-learning algorithm with canal inspection knowledge for reliable water leak detection from multispectral satellite images." Advanced Engineering Informatics **46**.

Chitonge, H., et al. (2020). Water and sanitation inequality in Africa: challenges for SDG 6. Africa and the sustainable development goals, Springer**:** 207-218.

Cord, C., et al. (2022). "Pathways to consumer demand and payment for professional rural water infrastructure maintenance across low-income contexts." Science of the Total Environment **815**.

Dubow, S. (1989). Racial segregation and the origins of apartheid in South Africa, 1919–36, Springer.

Gleick, P. H. (1998). "The human right to water." Water policy **1**(5): 487-503.

Hakimdavar, R., et al. (2020). "Monitoring water-related ecosystems with earth observation data in support of Sustainable Development Goal (SDG) 6 reporting." Remote Sensing **12**(10): 1634.

Hanjra, M. A., et al. (2009). "Reducing poverty in sub-Saharan Africa through investments in water and other priorities." Agricultural Water Management **96**(7): 1062-1070.

Hoogeveen, J. G. and B. Özler (2006). "2 Poverty and inequality in post-apartheid." Poverty and policy in post-apartheid South Africa: 59.

Hope, R., et al. (2020). "Rethinking the economics of rural water in Africa." Oxford Review of Economic Policy **36**(1): 171-190.

Jegede, A. O. and P. Shikwambane (2021). "Water 'apartheid'and the significance of human rights principles of affirmative action in South Africa." Water **13**(8): 1104.

Joshua, M. D., et al. (2022). "Water policy and resilience of potable water infrastructure to climate risks in rural Malawi." Physics and Chemistry of the Earth **127**.

Kaaviya, R. and V. Devadas (2021). "Water resilience mapping of Chennai, India using analytical hierarchy process." Ecological Processes **10**(1).

Kibret, S., et al. (2021). "The impact of large and small dams on malaria transmission in four basins in Africa." Scientific reports **11**(1): 13355.

Kielmann, A., et al. (1986). "Control of deaths from diarrheal disease in rural communities: II. Motivating and monitoring the community." Tropical Medicine and Parasitology: Official Organ of Deutsche Tropenmedizinische Gesellschaft and of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) **37**(1): 15-21.

Leckie, D. G., et al. (2005). "Automated detection and mapping of crown discolouration caused by jack pine budworm with 2.5 m resolution multispectral imagery." International Journal of Applied Earth Observation and Geoinformation **7**(1): 61-77.

Leuenberger, A., et al. (2021). "Water and health in mining settings in sub-saharan africa: A mixed methods geospatial visualization." Geospatial Health **16**(1)(McGriff and Denny 2020)

Levesque, R. (2007). "SPSS programming and data management." A guide for SPSS and SAS Users.

Macharia, P., et al. (2021). "Examining the relative impact of drivers on energy input for municipal water supply in Africa." Sustainability (Switzerland) **13**(15).

Malan, L. (2005). "Intergovernmental relations and co-operative government in South Africa: The ten-year review." Politeia **24**(2): 226-243.

Marks, S. J., et al. (2013). "Does sense of ownership matter for rural water system sustainability? Evidence from Kenya." Journal of Water Sanitation and Hygiene for Development **3**(2): 122-133.

McGriff, J. A. and L. Denny (2020). "What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities." American Journal of Tropical Medicine and Hygiene **103**(5): 1762-1764.

Mthembu, B. and E. Mutambara (2018). "Rural tourism as a mechanism for poverty alleviation in Kwa-Zulu-Natal Province of South Africa: Case of Bergville." Journal of Hospitality, Tourism and Leisure **7**(4): 1-22.

Municipality, O. L. (2015). "Okhahlamba Municipality IDP Review-2015/2016." Bergville, South Africa.

Mutambara, E. and B. Mthembu (2018). "Critical resources for the development of rural tourism within the greater Bergville area of Kwa-Zulu Natal South Africa." African Journal of Hospitality, Tourism and Leisure **7**(5): 1-25.

Rimayi, C., et al. (2018). "Contaminants of emerging concern in the Hartbeespoort Dam catchment and the uMngeni River estuary 2016 pollution incident, South Africa." Science of the Total Environment **627**: 1008-1017.

Rinaldo, D., et al. (2021). "The economic impact of schistosomiasis." Infectious Diseases of Poverty **10**(1).

Siniscalco, M. T. and N. Auriat (2005). "Questionnaire design." Quantitative research methods in educational planning **8**.

Sutherland, C., et al. (2015). "Urban water governance for more inclusive development: A reflection on the 'waterscapes' of Durban, South Africa." The European Journal of Development Research **27**(4): 488-504.

Tempelhoff, J. W. N. (2009). "Civil society and sanitation hydropolitics: A case study of South Africa's Vaal River Barrage." Physics and Chemistry of the Earth **34**(3): 164-175.

Thiese, M. S., et al. (2016). "P value interpretations and considerations." Journal of thoracic disease **8**(9): E928.

Tooke, F. G. C. (1955). The Eucalyptus Snout-beetle, Gonipterus Scutellatus Gyll: A Study of Its Ecology and Control by Biological Means, The Government Printer.

Turton, A. R. (2005). The political aspects of institutional developments in the water sector: South Africa and its international river basins, University of Pretoria.

Van Heerden, J., et al. (2005). "Prevalence, quantification and typing of adenoviruses detected in river and treated drinking water in South Africa." Journal of applied microbiology **99**(2): 234-242.

West, A., et al. (2014). "Spatial analysis of hydrogen and oxygen stable isotopes ("isoscapes") in ground water and tap water across South Africa." Journal of Geochemical Exploration **145**: 213-222.

Zhou, X., et al. (2021). "Toward Improved Comparisons Between Land-Surface-Water-Area Estimates From a Global River Model and Satellite Observations." Water Resources Research **57**(5).

APPENDECES

APPENDIX 1

Ethical Clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

28 September 2022

Mthokozisi Njabulo Zwane (213523471)
School Of Agri Earth & Env Sc
Pietermaritzburg Campus

Dear MN Zwane,

Protocol reference number: HSSREC/00004778/2022
Project title: Examining the socio-economic impacts of water service delivery in Olivershoek and Rookdale, Bergville and compare the source of water supper to the distribution of water in homes through Satellite Imagery.
Degree: MSc

Approval Notification – Expedited Application

This letter serves to notify you that your applicationreceived on 15 September 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 28 September 2023.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

APPENDIX 2

Research Questionnaire

UNIVERSITY OF KWAZULU-NATAL

Discipline of Geography

School of Agricultural, Earth and Environmental Sciences

Imibono nemibuzo mayelana ngamanzi nomtelelo enawo endaweni

(Views and questions regarding water supply and the effect it has in the area)

Ulimi lasendlini

(Home Language)

1. English

2 isiZulu

3 Xhosa

4 Afrikaans

5 Other (specify)

Iminyaka

(Age)

Uyasebenza

Are you employed?

YEBO/YES

CHA/NO

Isimo sakho somshado

(Current marriage status)

1Njengamanje oshadile

2 Ongashadile

3 Umfelokazi

Ihlukaniswe

5 Ukuhlala nomlingani

6 Bahlukanisile

Isimo somsebenzi

(Employment status)

1. Waqashwa

2 Ongasebenzi

3 Ozisebenzayo

4 Uthathe Umhlalaphansi

5 Kugibele izinyanga

6 Umfundi

7Ngokunye (chaza)

(Bangaki labantu abahlala ekhaya lakho)
(How many people do you stay with at home?)
0 1 2 3 4 5 6 7 8 9 10 >10

Yini into ebiza kakulu kwinyanga
(What are your main monthly expenses?)

1 Food/groceries
2 Rent
3 Medication
4 Clothing
5 School fees
6 Transport
7 Farming equipment
8 Other (specify)

Usuhlale Isikathi esingaka nani la?
(How long have you been living in this area?)
1. Between 1-5 years

2. Between 6-10 years
3. Between 11-15 years
4. Between 16-25 years old
5. Between 26-30 years old
6. over 30 years

Do you have water at home
Do you have access to water?
1 cup
2. Yes/No

how do you get water?
(How do you get water?)

What are the impacts if there is/no water in the area? (What does having/no water in the area do?)

What is your family's main source of drinking water?
tap water in the apartment
Water pipe to yard/property
public faucets/standpipes
casing/borehole
well protected
dug an unprotected well
protected spring
unprotected spring
collection of rainwater
bottled water
Wagon with small tank/drum
tank truck

Surface water (rivers, dams, lakes, ponds, streams, canals, canals) >>Q2
Other (please specify)

How long does it take to go there, fetch water and come back?
members do not collect
fraction
I do not know

During the past month, has your home not had enough drinking water available when you needed it?
yes at least once
no, always enough
I do not know

Who always goes to this spring to draw water for your house?
Is this person under the age of 15? which gender?

Are you treating your water to make it safer to drink?

What do you usually do with water to make it safer?
one more?
Take note of all points mentioned
cooking
Add bleach/chlorine
strain with a cloth
Use a water filter (ceramic, sand, composite, etc.)
solar disinfection
put it down and calm down
Other (please specify)

What type of toilet facilities do members of your household typically use? Where are you going?

sewage system
septic tank
pit toilet
other place
unknown location/unknown/unknown location
Enhanced ventilation pit toilet (VIP)
Pit toilet with plate
Pit toilet without slab/open pit
Composting toilet
bucket
Hanging toilet/hanging toilet
No facilities, no bushes, no fields
Other (please specify)

Where is this toilet facility?
In your own apartment in your own garden/property
other place

Have you ever emptied your (pit toilet or septic tank)?
yes it is empty
do not empty
I do not know.

Where was the content emptied the last time it was emptied? Carried to a sewage treatment plant by a service provider
buried in a covered hole
i don't know where
empty out of home
buried in a covered hole
Open pits, open ground, bodies of water or other locations
Other (please specify)

Do you share this property with other households?

How many households use this toilet facility?

How often do you fetch water in a day?