An Assessment of the Water and Sanitation Problems in New Forest, Bushbuckridge Local Municipality, South Africa

By

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Definitions

Anthropogenic factor - changes which influence the organic world and are introduced into nature by human activity (Farlex, 2011).

Aquifers – an underground layer of permeable rock, sediment (usually sand and gravel), or soil that yield water (Farlex, 2011).

Cistern – is a receptacle for holding liquids, usually water like that collected from a roof or some other catchment area. (Stormwater Management Academy, 2008)

Commodity – a raw material or agriculture product that can be bought and sold; something that is useful or valuable (Oxford, 2005)

Coverage – is the percentage of the population with reasonable access to an adequate amount of drinking water and sanitation facilities from improved sources (Telmo, 2002)

Diagenesis – is the process of chemical and physical change deposited sediment during its conversion to rock (Farlex, 2011).

Pit latrines – is a bored hole into the ground with an appropriate seat or squatting slab, and a superstructure erected over it (Ezane Articles, 2011).

Privatization – is the transfer of a business or industry from public to private ownership (Oxford, 2005)

Rural area – is the area relating to a country rather than the town (Oxford, 2005)

Traditional tribal authority – is the leader of a tribe, or the head of a tribal form of self-government (Book rags, 2006)

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ACRONYMS

ABEMS – Abongi Bemvelo Environmental Management Service
AWARD – Association for Water and Rural Development
BLM – Bushbuckridge Local Municipality
DRWH – Domestic Rainwater Harvesting
DSS – Draft South African Standard
DWA – Department of Water Affairs
ELM – Emfuleni Local Municipality
EU – European Union
GDP – Gross Domestic Product
IDWSSD – International Drinking Water Supply and Sanitation Decade
IFAD – International Fund for Agricultural Development
IRIN – Integrated Regional Information Networks
MDG – Millennium Development Goal
MENA – Middle East and North Africa
NGO – Non Governmental Organization
NWA – National Water Act
OECD – Organization for Economic Co-operation and Development
PRSPs – Poverty Reduction Strategy Papers
RDP – Reconstruction and Development Programme
SA – South Africa
SNV – Netherlands Development Organization
UCLA – University of California Los Angels
UNEP – United Nations Environment Programme
UNICEF – United Nations Children's Fund
US – United State
WSP – Water and Sanitation Program
WUP – Water Utility Partnership

Abstract

The purpose of the study was to assess the problems facing the world, South Africa and in particular New Forest in the provision of water and sanitation. New Forest is a small village found in Mpumalanga province. The issue of improving water and sanitation began over centuries ago, but still there are countless factors hindering water and sanitation services.

The study has progressed through various phases. The first phase of the case study included sampling of the household in New Forest. The second phase included the use questionnaires, literature review, site observation and telephone interview as a data collection tools. In parallel with the literature survey, collection of basic background data was obtained from journals, water reports and approved thesis from internet, for site observation collection of data was done by taking photos and for telephone interviews data was collected through notes writing. The study used the combination of qualitative and quantitative approach. The third phase included combining the findings of several studies and this data was critically analysed using, notes writing, tables and graphs.

Through the distribution of questionnaires to members of the village it was confirmed that there was water and sanitation problem. For most people the desire was to have access to water and sanitation. The community's access to water and sanitation is severely limited due to their socio-economic status, mostly poverty. The villager's access to water and sanitation is caused by lack of employment. Lack of unemployment forces people migrate to urban to look for better opportunities. Most rural people are poor and are highly affected by privatisation. Lack of participation is another socio-economic factor that deprives people from receiving water and sanitation services, people in this village are poorly informed on almost aspect of water and sanitation problems. Water and sanitation coverage is poor in this village due to infrastructure failure.

The literature search showed that there are also other factors contributing to water and sanitation problems, which includes lack of capital and funds by the government to provide access to water and sanitation. Water and sanitation coverage is poor in rural areas because of the scattered nature of settlements. The increasing population was also causing serious depletion in water's availability and this was also causing an impact on the environment and economy. Water availability is also limited by low or irregular rainfalls and again there is too much water available on the world surface, but most of this water is saltwater and only a small amount of freshwater is accessible.

People use indigenous knowledge to survive water and sanitation problem. People in New Forest dig traditional hand dug wells to survive water problems and some access water from the community river. The community borehole also supply water to the villagers, but when water is not available people hire cars to collect water for them in areas where water is available. People in New forest use pit latrine for sanitation. Pit latrines are considered as part of improved sanitation options. These facilities are cheap, easy to operate and no maintenance is required. Majority of the villagers do not own flushing toilets because of water shortage and some villagers do not have toilets at all; they share toilets with their neighbours. In conclusion the assessment of water and sanitation problem led to recommendations of mitigating these problems in the village of New Forest.

Chapter 1

Background to the study

1.1 Introduction

Water is the source of life, the most precious and important of all natural resources, without which the human species cannot survive (DSS, 2010, s.p). Access to safe water is a human right (Corcoran *et al.,* 2010:16). Access to water should be framed as a human right for at least three reasons. First, ensuring access to clean water could substantially reduce the global burden of disease. Millions of people are affected each year by a range of water-borne disease. Second, the privatization of water, which exploits the view that water is a commodity rather than a public good, does not result in equitable access. Third, the world is changing in ways that will both exacerbate water scarcity and threaten the quality of the current water supply (Barbour *et al.,* 2009:s.p). The human right to water entitles everyone to sufficient, safe, physically accessible and affordable water for personal and domestic uses (Bellettin *et al.,* 2005:4).

According to Bushbuckridge water crisis (s.a,s.p) New forest faces severe water crisis. Raab *et al.* (2008:108) mentioned that the challenges in water and sanitation are due to historic underdevelopment of Bushbuckridge local Municipality under apartheid and thus little existing infrastructure, as well as limited capacity in terms of both human and financial resources. The livelihoods of many rural people will be seriously affected if the on-going process of change does not recognize the need to ensure that water is allocated to the productive uses of domestic water. Thus this research has been prepared as a contribution to improve access to reliable water and sanitation services in New Forest.

This chapter provides an overview of the thesis. The objective of this introductory section is to assess water and sanitation problems in the rural community of New Forest. The structure of the chapter firstly presents a limited background analysis of New forest, including demographic, socio-economic and geographic factors. Secondly, it will outline the problem statement, objectives, the hypothesis and significance of the study. Thirdly, it will give a brief outline of the methodology for the study and lastly, it gives conclusion of the study.

1.2 Background of the Study Area

1.2.1 Study Area

New Forest is the community located in Bushbuckridge Local Municipality in Mpumalanga province. New Forest is defined as ward 10. According to Water Services Report Tool (s.a:7) New Forest is a small rural area that has the population of 5913. New Forest is ruled by traditional tribal authority or chief. In terms of language diversity, Shangaan is the main language spoken in this rural area. New Forest consists of households, a few churches, 1 crèche, 2 schools (a primary schools and high school), farms areas and privately owned shops. There are also RDP housing developments in New Forest. The rural community of New Forest has two rivers Mutlumuvi and Mucivoko and the rivers are major sources of water.

1.2.2 Water and Sanitation Resources

The main form of sanitation services is the pit latrine, which community members have constructed themselves in their yards. The community has an electric engine located near Mucivoko River. Water is pumped from Mucivoko River to the electric engine. There is one borehole in this community which is located in the chief household were the community is allowed to collect water. The community members have taps in their yards that they have connected themselves. The community members also access water from the communal standpipes, rivers and hand dug wells. The community members do not pay for water services.

1.2.3 Employment and Livelihoods

New forest has a high rate of unemployment. Many households rely on small scale farming, children grants, pension funds and remittances from relatives in urban areas to survive. New Forest is an area where people have big plots to farm. Because of the schemes they are able to grow crops throughout the year. These are generally small backyard gardens. The main fruits that are produced are mango, guava, papaya and banana. Most of these fruits are planted in the backyard gardens. These fruits are mainly for home consumption and provide shades in hot seasons. According to Agterkamp (2009:33) New Forest has irrigation schemes that provide employment to over 300 full time farmers and between 1000 and 1500 seasonal labourers. These irrigation schemes are cultivated with annual crops. The scheme is traditionally grain and vegetable production areas. Currently a wide variety of grain crops and vegetables are grown. The farmers in the area produce mainly green maize, groundnuts, cabbages, sweet potatoes, onions, tomatoes, leafy vegetables and other vegetables. The dominant summer crop is maize, the dominant winter crop are tomatoes. The crops that are produced are used for home consumption and some are sold for an income. There is no

formal fresh produce market near the scheme and most farmers sell their produce at the roadside. Agterkamp (2009:28) furthermore mentioned that the profit that is made from selling vegetables is low because farmers produce same crops at the same time. According to Soussan *et al.* (2002:6) other water base activities in rural villages of BLM include beer brewing, brick making, hair dressing and homemade ice-blocks (sweet ice-pops).

1.3 Map of the Study Area

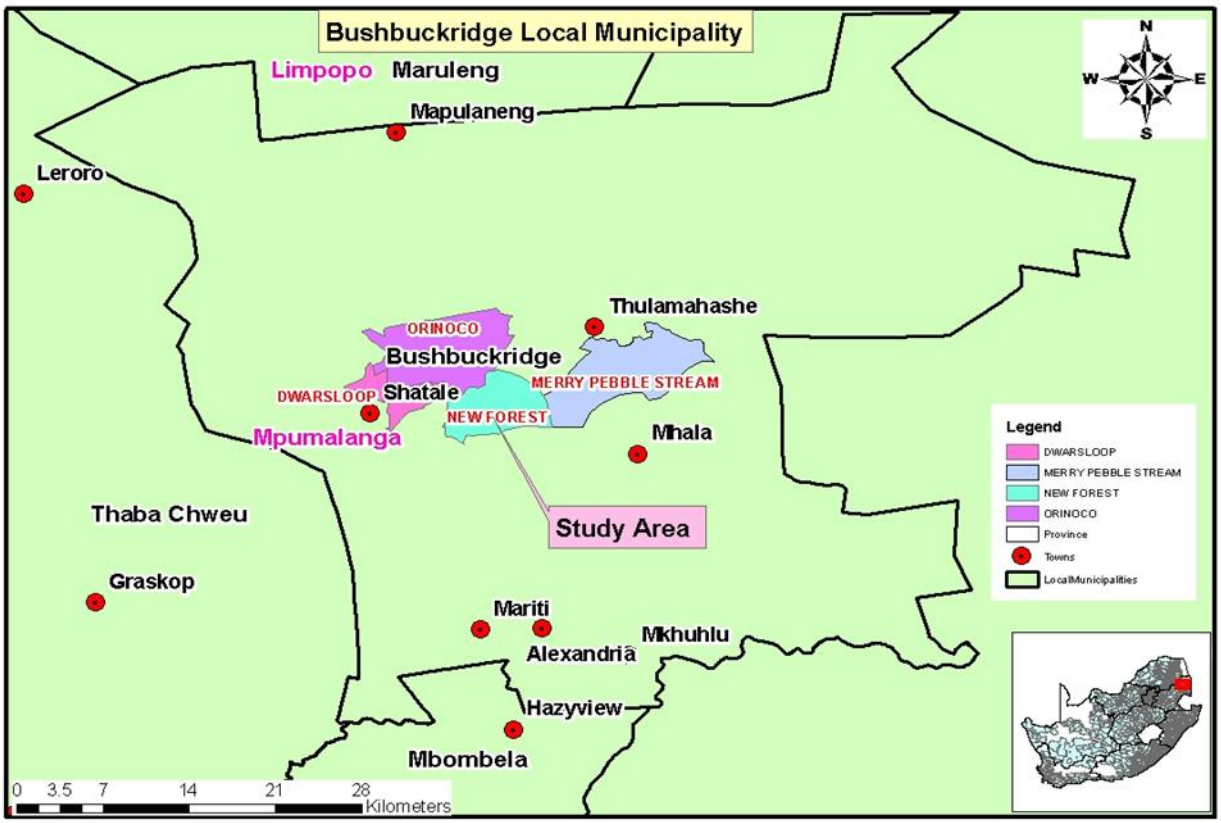

Figure 1: The map illustrates the study area of New Forest (Source: GIS: 2009)

1.4 The Problem Statement

Water supply to New Forest community is not reliable. Linked to water supply is poor sanitation. According to Water service report tool (s.a:7) water and sanitation supply in New Forest is below RDP standard. Most household in New Forest uses pit latrines.

The current water supply system does not have sufficient capacity to cope with the demands. The communal standpipes in the area do not receive water for longer period. There is always a regular breakdown of electric engine that is used to pump water. One of the major challenges in this area is infrastructure failure and the municipality does not have staff capacity or financial resources to implement such systems quickly, hence the majority of residents do not have access to safe water and sanitation services (Raab *et al*., 2008:114). The

failure by the municipality to extend water and sanitation services to villagers put people at risk. The villages are forced to use open sources water from rivers and hand dug wells which often has serious consequences to health and hygiene.

1.5 Objectives of the research

The main objective of the study is to assess the water and sanitation problems in New Forest. Another focus of the study is:

- To determine the causes of water shortage in New Forest.
- To assess water and sanitation infrastructure in New Forest.

1.6 Research Questions (Hypothesis)

The research aimed to answer the following questions:

- What are the current and potential problems with water and sanitation in New Forest?
- How has infrastructure failure influenced water shortages in New Forest?
- Which coping strategies does this community use when there is a water shortage?
- What is the municipality intervention with regard to the water and sanitation problems?
- What are the potential sources of clean water supply in New Forest?

1.7 Significance of the study

It is hoped that the findings of the study will provide ways to improve water and sanitation service delivery to the rural community of New Forest. The findings of the study will improve the existing water management systems and suggesting ways of conducting it. It is also hoped that the findings will become a role model in conducting analogous research in other communities.

1.8 Research design

According to Kombrabail (2009:1) a research design is the specification of methods and procedures for acquiring the information needed. It is the over-all operational pattern or framework of the project that stipulates what information is to be collected from which source by what procedures. A research design involves the consideration of data collection, sampling method and data analysis It is the heart of planning. Kombrabail (2009:1) mentioned that research design involves the following:

- Identifying information requirement
- Identifying information sources
- Preparing detailed plan for execution of research project

The research designed chosen for this study is meta-analysis, where the researcher will combine the findings from several studies, selected from journal article, published thesis and water reports from the internet, concerning water and sanitation problem. The study used the combination of both qualitative and quantitative approach.

1.8.1 Qualitative approach

Qualitative research is collecting, analyzing, and interpreting data by observing what people do or say. Much of the data in this study is qualitative in nature. Qualitative approach includes virtually any information that can be captured that is not numerical in nature. The researcher explained, defined, and interpreted a complex situation through the use of observation, interviews and written documents (or as Telmo (2002:89) put it 'watching, asking and examining') to build up a theory. The study was qualitative in the sense that it used open-ended questionnaires.

The purpose of using open-ended questionnaires in this study was to:

- Understand what is like to be in a particular situation.
- Articulate the views of people
- Gain understanding of underlying reasons and motivation
- Uncover prevalent trends in thought and opinion

1.8.2 Quantitative approach

Quantitative research is about numbers and the counting and measuring of things in other words data is in the form of numbers and statistics. In quantitative approach methods for data collection are developed. The research was quantitative method and employed the use of closed-ended questionnaires.

The purpose of using closed-ended questionnaires in this study was to:

- Quantify data and generalize results from a sample to the population of interest.
- Measure the incidence of various views and opinions in a chosen sample.
- Collect data from a large population
- Collect numerical data for data representation and analysis.

1.9 Research Methodology

A multi-disciplinary approach was used in this study in order to research objectives, this includes:

- Literature review
- Questionnaires.
- Site Observation
- Telephone Interview

1.10 Sampling method

The researcher selected the community of New Forest, in Bushbuckridge Local Municipality as the area of interest. This was because the researcher was familiar with this area. The area is faced with water and sanitation problem. The target for sampling is only the households. The community of New Forest consist of 430 households with the population of 5913. Among 430 households only 50 households will be surveyed.

Random sampling will be used to select households; this is because random sampling gives each household an equal chance to be selected. The households will be numbered from 0 to 100. The first number is house number 1, then followed house number 3, then 5, 7, 9, 11, 13, 15, 17, 19 until 100. In order words the researcher sampled household 1, but household 2 was not sampled then continued to household 3 and again household 4 was not sampled then continued to household 5 until household 100.

1.11 Data collecting tools

The use of literature review, questionnaires, observation and telephone interview to collect data was employed in this study. Questionnaires, site observation and telephone interview were chosen because they ensure ease of access to the villagers. The literature review was used as a source of collecting secondary data. Primary data was collected through the use of questionnaire, site observation and telephone interview.

1.11.1 Literature Review

A literature review was used to collect qualitative data. The information was obtained from journals, official water reports, approved dissertation and internet. The data was collected from international, continental and local documents. International, continental and local documents were referred to, in order to understand water and sanitation problems throughout the whole world.

1.11.2 Questionnaires

The research employed the use of questionnaires. Questionnaires were used to collect both quantitative data (closed ended questions) and qualitative data (open ended questions). The questionnaires were distributed personally in each household in the community of New Forest. The questionnaire consisted of a set of questions that were presented to the head of the household for answers. Questions were asked in Shangaan language as this was the local language and the answers were ticked or written down. In addition, those who were surveyed were asked a number of questions in indicative of their demographics, employment status, educational status, environmental and water status, the coping strategies, the sources used for water, types of toilet used and municipality intervention.

- **Closed ended questions**

The questionnaire included most closed ended questions, because these types of questions are easy to analyse since they are made of numbers than opinions. The questionnaires that were used were made of multiple or set of answers where the respondents were asked to choose among them. Closed ended questions consisted of a small box next to answer. It was ticked on the appropriate box when a respondent gave an answer.

The main questions of the study include: description of water sources, distance to water sources and the types of toilets used.

- **Open ended questions**

The respondents were given a chance to answer in their own words. Open- ended questions did not contain boxes to tick but instead left a blank section for the researcher to write in an answer provided by the respondent. Open-ended questions were used, because the researcher wanted to find out what people think about water and sanitation service in this community. Fewer questions were asked because there are no standard answers to open-ended questionnaires and data analysis is more complex, as it is options which are sought rather than numbers.

The main questions of the study include: Asking the villagers whether the water supply was working satisfactorily, what were the major causes of water and sanitation problems and what suggestions they have for improving water and sanitation problems.

1.11.3 Site Observation

Another qualitative method used was site observation. Time was spent in the community, observing water sources and sanitation facilities that were currently used by the villagers. The

observation was done through taking pictures of water resources and toilets that are currently used with the camera. Site observation data was recorded with a digital camera. According to Trochim (2006: s.p) technology is a useful part of observation. Extensive notes were written during picture taking in order to assist the researcher not to forget important information when analysing data. The pictures taken by the camera were saved on the computer and pasted on Microsoft word as the results of the current water and sanitation situation, this included boreholes, communal taps, household taps, water irrigation scheme, water engine, traditional hand dug wells and river as well as the types of toilets that (See Appendix A).

1.11.4 Telephone Interview

Telephone interview was also be used to collect qualitative data in this study. Some community members were interviewed telephonically and were selected through purposeful sampling. The respondents were community members. The purpose of telephone interview was to get clarity on some information that might be complicated to draw conclusions. Few questions were prepared for the telephone interview and the answers were recorded immediately through writing notes.

1.12 Data analysis method

1.12.1 Literature review analysis

According to Akindele (2008:10) analysing literature review includes summaries of each work, relationship of each work to the other and highlighting gaps in previous research. In analysing the literature review of this study all the information taken from written or existing documents was summarised. Previous research that were done internationally, continentally and locally was scrutinized. The review was linked to the rationale and purpose of the study in other words the relation of the topic to the existing literature was developed. Same information was grouped together to allow the flow of ideas. The existing documents, relevant information and important facts were personally judged.

1.12.2 Questionnaires analysis

Data analysis was carried out using Microsoft Excel. Excel database was created. Every response item on the questionnaire was carefully entered as a numbered code under the questions header in the Microsoft excel when the entire survey questionnaires was collected. Going through each questionnaire after entering data was done for accuracy as well as referring back to the aims of the study. According to Williams (2003, s.p) when analysing questionnaire it's particularly important to refer back to the original aims of the study and the

hypotheses that you wish to test at this stage to keep the analysis focused. Pivot table and charts on Microsoft excel worksheet was used to draw graphs. The graphs used were bar and pie chart for data presentation. The graphs used contained frequencies and percentages which were important in illustrating the findings.

1.12.3 Observation analysis

According to Telmo (2002:31) observation involves immersing yourself in a culture and learning to remove yourself every day from that immersion so you can intellectualize what you've seen, put into perspective, and write about it. Pictures taken during site observation were closely analysed. From pictures analysis detailed notes were written that described the sources of water and sanitation facilities that were currently used. Notes taken during site observation were critically and summarised and were linked to the pictures taken. Logical conclusion was drawn on how water and sanitation was affecting the community from the photographs.

1.12.4 Telephone Interview analysis

UCLA (2005:7-8) mentioned that after finishing a key informant interview, the interviewer should analyse data by making notes and writing down any additional comments or impressions. All of the interview note and discussion points need to be typed into one word processing documents. In this study notes that were taken during telephone interview were revised and summarised in writing. Same information from the respondents was grouped together. From the summarised notes conclusion was made.

1.13 Reliability and Validity

The questionnaire was constructed which was guided by the research objectives and questions. Once the questionnaire was completed it was tested before it was used to a large scale of population, to see if it was obtaining the result required. This was done by asking the supervisor and the University of the Free State statistics professional to read it through and see if there were any ambiguities which might not have been noticed. They commented on what was needed to be correct, this includes the length, structure and wording of the questionnaire and questions were altered accordingly.

1.14 Limitations and Delimitation

1.14.1 Limitations of the study

Every study has a set of limitations (Leedy & Ormrod, 2005), or "potential weaknesses or problems with the study identified by the researcher" (Creswell, 2005:198).

- Other selected community household members will not be available for this study.
- Due to the limited time the study will not sample the entire households in the area.

1.14.2 Delimitations of the study

Delimitations refer to "what the researcher is not going to do" (Leedy & Ormrod, 2005).

- Participation in the study was only focused to New Forest residents, not to other residents from water scarce communities in the local municipality. Water and sanitation is generally a problem in other communities as well in Bushbuckridge local municipality, therefore the focus is only in New Forest residence.

1.15 Study Framework

This study consists of four chapters focusing on the following:

Chapter 1 – will discuss the introduction and methodological framework of the thesis

Chapter 2 – will focus on the literature review of the study

Chapter 3 – will focus on data analysis

Chapter 4 – will provide major recommendations and conclusion of the thesis

1.16 Conclusion

Chapter 1 provides an overview of the thesis; it introduced the topic to be scrutinized. It also introduced the background of the study area in details. New forest is the areas facing a severe water challenges. The main objective of the study is to assess water and sanitation in this community and also wants to identify the main causes of water and sanitation and to assess the types of water sources that are used in this village. The study provided the research questions which the study will answer. The chapter also provided significance of the study which hopes to improve water and sanitation service delivery to the rural community of New Forest.

The research design was also introduced which is meta-analysis, where the research will combine several studies and analyse them. The study will focus on both qualitative and quantitative approach. The research methodology was also outlined in which it introduced the method that will be used to research the objectives. The study used random sampling technique. The data collection method includes the literature review, questionnaire, site observation and telephone interview. The chapter explained how the data is going to be

analysed and it also provides the limitation and delimitation of the study. The chapter 2 will include literature review.

Chapter 2

Literature Review

2.1 Introduction

Water and sanitation problem is a global major concern. According to Balint (1999:1) there are over one billion people worldwide without water sources and three billion lack minimally acceptable sanitation facilities. A lack of adequate water and sanitation services is particularly apparent in developing countries. Ward (2007:2) estimated that by 2050 some 40% the world population could be experiencing water shortages. Sigenu (2006:1) outlined that South Africa is one of the countries likely to join water shortage ranks by 2025. The problem people experience with water supply and sanitation in developing countries are numerous and complex. There are various explanations to the causes of water and sanitation problems.

The main objective of this review is to assess water and sanitation problems internationally, continentally and nationally. To achieve this research main objective, the review provided some historical background regarding water supply and sanitation development throughout the world in order to understand the emerging of water and sanitation resources. The review critically examines the funds allocation for water and sanitation sector and human access to water and sanitation. The review assessed the underlying causes of water and sanitation problems which include: infrastructure failure, low water availability, poverty, low coverage for water supply and sanitation, population growth, privatization of water services and unplanned rural settlements. Lastly the review examines the coping mechanisms that people use when there was water and sanitation problems and the source that people use to get freshwater, and intervention of local government in the provision of water and sanitation services and the obstacles to improvement to water supply and sanitation and communities participation.

2.2 The history of water and sanitation development

The section discusses the history of water development and efforts done from previous years up to today.

2.2.1 International Studies

According to Annamraju *et al.* (2001:6) water and sanitation shortage is a problem that was there many years ago and even today the problem still remain, for example at the beginning

of the UN water decade in 1981, 1.9 billion of peoples lacked access to safe water and some 2 billion lacked adequate sanitation. Nearly two decades later, in 2000 more than 1.1 billion still lacked access to water and some 2.5 billion lacked adequate sanitation.

Annamraju also mentioned that over the centuries, water was accessed from unreliable sources. The water supply network emerged along with the construction of cities and villages. The Romans developed an organized and centralized system by private water carriers of canals, siphons and collection used for water. In the Middle Ages water was distributed largely by human intervention, partly by private water carriers. After the empirical methods of the 19th century, the first modern societies with regard to water supply were born. From a historical perspective, the current global situation with water is the product of social, economic, and ideological developments attending the advent of industry some two hundred years ago, within the time period 1800-2000.

2.2.2 Continental Study

According to Nwankwoala (2011: 1172) for several years now, many governments have been talking and emphasizing the need for sustained rural water supply and sanitation. Up till today, the effects of all these are far from reality. Since independence in 1960, rural water supply and sanitation development in Nigeria has proceeded inconsistently.

However, serious efforts at addressing rural water supply and sanitation issues began with on-set of the International Drinking Water Supply and Sanitation Decade (IDWSSD) in 1981 to1990, which established target of universal coverage. This was followed immediately by the world summit for children in 1990 which established goal of the universal access to safe water and sanitation. Other external support agencies which played a crucial role from 1981 to 2010 in water and sanitation development include UNICEF and Water Aid (1986-2010). Despite these bold and elegant initiatives, by most conservative estimates, the country is still recording less than 50% access to safe water and sanitary means of excreta disposal. Until recently in 2000 there has been no National Framework which defines policy objectives, guidelines and targets for the entire sector. The rural water supply and sanitation sector and Action Plan, developed in 1992 after a major review by cross-section of stakeholders, did not lead to the planning and implementation of sound rural Water Supply (RWSS).

2.2.3 National Study

According to Water supply and Sanitation Policy (1994:4) the history of water in South Africa cannot be separated from the history of the country as a whole. The history of water is a mirror of the history of housing, migration, land, social engineering and development. The development of South Africa's water resources has been linked more with supporting the progress of the country's wealth sector than with alleviating the position of the poor, particularly in the rural areas.

In the 19th century water problems was caused by that most water in South Africa was for white commercial agriculture. In 1956 a new Water Act (Act 54 of 1956) was passed, which was intended to ensure an equitable distribution of water as well as to authorize strict control over the abstraction, use, supply distribution, pollution of water and treatment. Municipality water schemes were introduced to improve the standards of water supply, although these were subsequently modified to assist only smaller municipalities that would otherwise not have been in the position to carry out work of satisfactory standard. Because of the water shortage and the geographical mismatching of demand and supply, a more recent trend has been construction by the state inter-basin schemes, such as the Orange-Fish or Tugela-Vaal projects. The distribution of water resources has, to a large degree, dictated the establishment of settlements, routes of migration and man's mode of living. The following section discusses water and sanitation sources available to people.

2.3 Human access to water and sanitation

This section discusses human access to water and sanitation.

2.3.1 International studies

Within Eastern Europe different types of water sources are currently used. In a detailed article of OECD (2005:33) it was mentioned that majority of the people in Ukraine use water technologies such as wells, reservoirs and open springs while in Kyrgyzstan people have access to water through in-house water taps, they also access water from natural sources such as canals and rivers as the main source of drinking water supply.

A Study conducted by Kistermann (2008:2-6) showed that in Kyrgyzstan there was no formal infrastructure for sanitation, basic pit latrine or septic tanks with no sanitary refinements were used throughout the rural areas. These are found in the backyard of their houses and they are unhygienic and inconvenient. Sanitation facilities are seldom emptied and have bad odour.

Another study conducted in Panama by Hurtado (2005:2) showed that a thousand of pit latrines have been built around the world, and it is likely that thousand more will be built in future because they solve problems of sanitation.

2.3.2 Continental studies

People develop their own water technologies because of water sanitation shortage, for example an assessment done by Edwards *et al.* (2007:12) showed that in Malawi people use a technology called gravity systems. The gravity system water supply is derived from intakes in streams in the hill then the water flows from the intakes, which are located at approximately elevation 1440 meters, through an open canal to a sedimentation tank. Water is then transported from the sedimentation tank to the village though pipelines. The gravity system can serves approximately 1,600 households and 8000 people. Water in Malawi was also accessed through boreholes, shallow wells and from natural sources such river and streams. A more recent study by Diemand *et al.* (2010:16) showed that the use of boreholes was also common in Tsumkwe where water was pumped from four boreholes into an elevated reservoir and then distributed to community taps and personal storage tanks.

Another research done by Telmo (2002:52) showed that in Gouansolo in Mali the two types of water supplies that exist in the village were hand dug wells and borehole pumps. There were two types of hand dug wells the village: traditional and modern. Traditional hand dug wells were unlined and unprotected holes, generally less than 15 meters deep, that are hand-dug with picks and shovels into the water table. These are very common in rural areas.

Telmo (2002:60) however argued that in Gouansolo in Mali village sanitation facilities were traditional pit latrines. The common pit latrines was usually a hole dug in the ground, with a cover slab made of wood, or (occasionally mortar) overlaying the wood, and some sort of structure built for privacy. It also emerged from the article that traditional pit latrines can easily deteriorate from the eroding action of water, weather, and general use, attack by termites, or rotting of wood and they are also unhygienic.

2.3.3 National studies

According to Kasrils (2004: 2) in South Africa since from 1994 around 14 million people did not have access to drinking water. These were people, mainly in rural areas, who had to fetch their water from rivers, springs, wells and boreholes and this have been a daily chore for mankind. A research done by Makgoka (2005:9) mentioned that in Sekuruwe village people currently use a diesel borehole pump situated 2 km from the village. Water was then

reticulated to two communal standpipes. Currently, in this village water was sourced from privately owned boreholes.

A research conducted by Makgoka (2006:18) revealed that approximately 70 percent of household in Sekuruwe have corrugated iron structure pit latrines which are poorly constructed, unhygienic and without seat covers and pit ventilation. Another study by Still (2002:1) mentioned that pit latrines in particular are becoming more and more common in South Africa's rural areas. The next section discuses water availability.

2.4 Assessment of water availability

2.4.1 International Studies

According to conducted in London by Lalzad (2007:7) showed that water covers more than 70 percent of the world's surface. The total amount of water on earth is about 1400 million km^3 (326 million miles) about 97.5 percent of this amount is saltwater and only 2.5 percent is freshwater. Only about 0.3 percent of the total amount of freshwater on earth is accessible groundwater or surface water that humans, animals and plants can use.

Lalzad (2007:7-12) also identified that less water was accessible because water was available where it was not wanted and in other cases, there is too much water in the places at the wrong time. Water runs to the oceans in floods or is trapped in icebergs. About three quarters of the annual rainfall occurs in areas containing less than one-third of the world's population. It means that two-thirds of the world's population live in areas receiving only one-quarter of the world's annual rainfall. For instance, about 20% of the global annual rain runoff each year occurs in the Amazon basin. This is a vast region inhabited by somewhat more than 10 million people, only a tiny fraction of the world's population. Water short societies and many countries attempted both to move water from where it occurs in nature to where people wanted it and also to store water for future use. Human efforts to change the water cycle date back to ancient times. Primitive societies tried to bring rain prayer, rain dances, human and animal sacrifices and other rituals.

2.4.2 Continental Study

Malawi has an extensive network of river and lakes, with water bodies covering more than 21 percent of the country. Much of this water was found in lakes. Approximately 30 cubic km of fresh water are renewed every year. There was about 3,000 cubic m per capita per year, but the distribution across the country was irregular and varies by season and year. Ninety

percent of the run off in rivers and streams occurs between December and June, and only 0.1 percent of this is estimated to be captured for later use.

2.4.3 National Studies

Water availability in South Africa is very low; the country is relatively dry and drought prone. The rainfall is general low and irregular with a mean annual precipitation in the order of 500mm compared to that 860mm of the world average. Water availability in SA varies greatly for example in west the rainfall water level is as low as 100mm per year and in the east is as high as 1500mm per year.

According to Local Government Budgets and Expenditure Review (2001:124) ground water resources are also not abundant, as most of South Africa is made up of hard rock formations that do not contain major ground aquifers that can be used on a national scale. It was estimated that only 20 percent of South Africa's groundwater can currently be used. Groundwater resources are extremely used in rural areas. South Africa's water resources are comprised of 77 percent surface water, 9 percent groundwater, and 14 percent re-use of return flows. The following section discusses the treats associated with water and sanitation.

2.5 Threat associated with water infrastructure

2.5.1 International studies

In an article of OECD (2005:28) it was mentioned that most households in Russia were connected to water distribution networks, but water supply has been deteriorating due to some type of threat which is technological failure. A threat according to DSS (2010:6) is defined as anything that may endanger the organization, including its goals and level of service to consumers. Potential threats to drinking water supply systems can be natural or man-made and they are characterised by interruption of essential infrastructure without which the locally agreed level of service cannot be attained.

The study showed that in some areas where water was available, households only receive water for less than 24 hours per day. For example in Azerbaijan and Armenia this was as low as five to seven hours per day. The daily switching on and off the network increased the wear of the infrastructure. Another study conducted by Amnesty International (2009:35) showed that in Shukba, a village in Palestine was served by the piped water network, but shortages were common, even when there was water, it does not reach most of the households on the edge of the village and those on the higher ground. This was because there wasn't enough

pressure to reach the high grounds. A study by Khatri & Vairavamoorthy revealed that the deterioration of infrastructure system was the cause of water problem.

According to Khatri & Vairavamoorthy (2007:11) in United States there has been little or no maintenance of the water infrastructure. A large proportion of this water infrastructure was over 100 years old, placing it at increased risk for leaks, blockages and malfunctions due to deterioration, for example water mains break in hundreds of thousands of locations each year in the US, leaving water customers without supply. Many studies in the following section showed that water problems were due infrastructure failure.

2.5.2 Continental studies

A 2008 water point mapping study undertaken by SNV in ten rural district of Tanzania revealed that 43 percent of water points were no longer operational. Only two thirds of people in the ten districts had access to drinking water. However, the number drops to one third. The study concluded that access was limited by such factors as poor location of the water source and inappropriate technology or deteriorating infrastructure (Wandera & Glotzbach, 2009:10).

Water systems that were not maintained make service delivery less efficient. According to Sanders and Fitts (2011:6) in Pawaga village in Tanzania, the problems with water supply facilities were due to systems which were not repaired and were falling into disuse. Another study done by Kaguru & Kanyagia (2007:9) revealed that a lot infrastructure in Uganda was old fashioned and it was not maintained and therefore makes service delivery less efficient. A similar study conducted by Diemand (2010:30) showed that the problems with water and sanitation systems in Tsumkwe were primarily caused by lack of maintenance. Nearly all the taps were in need of repair or replacement. The next section focuses on an infrastructure assessment in BLM.

2.5.3 National studies

Water supply and Sanitation Policy (1994:4) pointed out that most existing water schemes in rural areas of South Africa were out of order due to technological failure. In addition to technological failure Maluleka *et al.* (2005:9) conducted an infrastructure assessment in Delani village in Bushbuckridge Local Municipality (BLM). The researcher drew a general village map with water infrastructure on it. The aim of drawing this map was to capture the water infrastructure information on it. However Maluleka observed from information

captured that the community was experiencing water problems due to technological failure. From the obtained information it was reported that there were regular breakdown of the engines and their capacities were insufficient to supply the whole village and the village dam ran dry during dry seasons. The reticulation system was problematic regarding the connection setup between the engines and was a cause of regular breakdown. Less than 50 percent of the communal standpipes were effectively providing water. According to Water for Growth and Development Framework (2009:2) in South Africa a major source of water problem was ageing infrastructure exacerbated by poor operations and maintenance at a municipal level. Infrastructure failure is linked to low fund allocated to water and sanitation sector.

2.6 Funding allocation to the water and sanitation sector

The following section focuses on funding allocation to the water and sanitation sector in different parts of the world.

2.6.1 International Review

According to Annamraju (2001:6) the financing gap was the most immediate problem working against the realisation of universal access to water and sanitation. Developing countries, in general the government, do not prioritise spending on water and sanitation sector. There was a declining percentage in funding for water and sanitation sector compared with previous commitments throughout the early 1980's, For example a study done by Satterthwaite (1997:17) showed that in 1982 to 1984 water and sanitation sector received 20 percent of all funding. In the years 1991 to 1993 this sector received less than 10 percent of UNICEF funding. Part of the reason for the low priority during 1991-1993 was the very high demand placed on UNICEF for emergency relief which took more than 20 percent of UNICEF funding in 1993.

Human development Report (2006:156) mentioned that in the United States many of the largest federal investments in history were made to store water, harness it for electricity and curb the potential for floods than for providing water and sanitation. Another study done by Cardone & Fonseca (2006:12) showed that there was lack of evidence that financial flows consistently reach those countries in greatest need, and even where funding does reach the poorest countries, there still appears to be a bias towards larger scale infrastructure solution over basic water and sanitation needs.

An interesting study by Global Water Supply and Sanitation Assessment Report (2000:35) identified that a huge numbers of people were still without services. In contrast, US $11 billion was spent each year in Europe on ice cream; US $17 billion was spent each year in Europe and United States on per food, and US $105 billion was spent each year in Europe alone on alcoholic drinks.

2.6.2 Continental review

Despite the fact that water and sanitation issues were ranked high on people's priority, many studies showed that there was low funding allocated to the water and sanitation sector compared to other sectors. Water and Sanitation Program Report (2003:18) conducted a study in 12 Sub-Saharan countries: Benin, Burkina Faso, Ethiopia, Kenya, Malawi, Mauritania, Mozambique, Rwanda, Senegal, Tanzania, Uganda and Zambia, the study showed that water and sanitation received a lower share of budgetary resources than other sectors such as health and education, for example the share of water and sanitation expenditure in the GDPs of Kenya, Ethiopia and Uganda range from 0.5 to 1 percent, as against 2 to 8 percent for health and education. According to WSP (2005:6) the funding allocated for water and sanitation sector is inadequate to meet actual needs such that service providers consistently failed to cover the cost for operations and maintenance.

Water Aid Report (2009:8) highlighted that the challenge in delivering water and sanitation services in Ghana was that there was no department responsible at assembly level. Service delivery for health and education was done through a decentralized department of the assembly in conjunction with other interested stakeholder such as nongovernmental organization. Other studies have been conducted in South Africa to show that there was inadequate prioritization of water and sanitation.

2.6.3 Nationally review

According to Tremolet *et al.* (2007:9-63) the framework for municipal infrastructure grant has been developed in South Africa with clear policy guiding the use of grant, funding allocations, programme systems, set of structures and procedures from national to local level. Even with these clear procedures the funding allocated to water and sanitation sector is very low, for example the government investment in water and sanitation in SA lies between 1 and 2 percent, innovations in financing happens at municipality level in SA. In Poverty Reduction Strategy papers (PRSPs) developed over the years it was noticed that water and sanitation

appear at a relatively low ranking of priority. Factors leading to such low prioritisation of water and sanitation include a lack of political support for the sector and this affect the poor.

2.7 Poverty

This section focuses on poverty in different parts of the world. According to Telmo (2002:83) efforts to improve water and sanitation are "obviously frustrated by poverty.

2.7.1 International studies

According to IFAD (2002:1) poverty is basically a rural problem in Asia. A study conducted in Eastern Caribbean by Tomas & Wint (2002:2) clearly outlined that poor people are isolated from adequate water and sanitation services because of socio-economic factors. These socio-economic factors include a situation where the poor lack access to political powers and lack of self-confidence. These factors affect access to water and sanitation services and creates conditions of deprivation and serves to retard. Their access to credit, equipment and technology was severely limited. Other constraints, including the lack of market information, business and negotiating experience and collective organization, deprive them of the power to compete on equal terms in the market place. Tomas & Wint (2002:8) define poverty as a condition resulting from social and economic weakness. More studies showed that socio-economic factors hinder people's rights.

2.7.2 Continental studies

Sallah-Phillips (2006:24-26) argued that in Senegal among the poor, socio-economic status denies them individual right. Poverty is a denial of an individual right. Socio-economic factors include silence, unaware of the institutional and legal assistance and processes and lack of training on who to make their voices heard. Bosch *et al.* (2001:373) among the poor lack of political voice may prevent their needs being heard by those who are in charge of allocating the funds earmarked for water supply and sanitation improvements. In terms of accessibility to delivery of water and sanitation facilities, it is usually the poorest that are the least well served. Another study in SA showed that socio-economic factors deny people to water and sanitation services.

2.7.3 National studies

According to Sigenu (2006:20) socio-economic issues such as poverty greatly influence access to water and sanitation. People with the lowest status and wealth in the social hierarchy, often suffer disproportionately when water supplies are limited. The poor

invariably are at greatest risk from weak infrastructure. A study conducted by Gabru (2005:1) argued that beyond racial categorisation, the poor were traditionally especially vulnerable in terms of access to the rights. Poverty is linked with low coverage of water and sanitation in rural areas.

2.8 Water and sanitation coverage

This section provides a brief overview of water and sanitation situation in different parts of the world.

2.8.1 International review

The problem of lack of water and sanitation services hits the rural communities. According to Organization for Economic Co-operation and development (2006:26) in Europe the connection rates in rural areas are much lower than in urban areas. It was estimated that there was only 16% coverage in Kyrgyzstan rural area and there was 100% coverage in large cities for water and sanitation.

2.8.2 Continental review

According to Nnadozie *et al.* (2006:3) water supply and sanitation are inadequate across Africa. About two thirds of the African population lives in rural areas, where water supply and sanitation services coverage is the poorest. A study conducted in Ghana by Water Aid Report (2009:4) estimated that coverage for rural water supply is 52 percent while that of urban areas is 55 percent in 2005. Estimates put coverage for sanitation at 28 percent and 40 percent respectively for rural and urban areas in 2002. The following section discusses water supply and sanitation coverage in South Africa.

2.8.3 National review

According to Raab *et al.* (2008:11-16) the urban areas in BLM generally receive better services than rural areas. UN water (2008:14) revealed that in South Africa water coverage for urban areas is 87% while that of rural areas is 37% and for sanitation the coverage in urban areas is 66% while in rural areas is 46%. A study done in Ngquashwa municipality in the Eastern Cape by Phaswana (2008:8) showed that 98 Percent of the population does not have sanitation coverage, while 14 percent with sanitation are those living in the urban areas of Peddie and Hamburg. Poor water and sanitation is interlinked with privatization.

2.9 Privatization of water services in low income areas

This section focuses on privatization of water services and the impact it has on low income people.

2.9.1 International studies

Pavri *et al.* (2009:4) clearly outlined that after water was fully privatized in the United Kingdom in 1989, water prices significantly increased, 46 percent in the first year alone. Low income families were disproportionately affected. Survey concluded that water dept was growing faster than any other type of dept for low-income families and that three-quarter of household on social support had difficulty paying their water bills. Pavri *et al.* (2009:14-15) furthermore revealed that a consequence of higher water cost is high rates of disconnection from basic water services. Privatization usually leads to an increase in water cost for low income families who are often forces to choose between the basic necessities of life such as food versus water. It was noticed water rates have climbed steadily since privatization. A similar study revealed that privatization has a great impact on the poor.

A study done in Latin America by Hardoy & Schusterman (2000:63) showed that policy of privatizing water supply and sanitation services was first implemented at the beginning of the 1990s. It has had a great impact on the poor, many whom had received these services free of charge before privatization. The study also revealed that the operators or companies failed to adhere to the terms of their contracts with the result that a large proportion of the population is left without access to water and sanitation. Another study conducted by Sampath showed that privatization has an impact on the poor.

A similar research done by Sampath *et al.* (2005:8-9) clearly showed that in India water privatization has led to price hikes in almost all the regions in the world where water has been privatized. This was because there were considerable costs involved in upgrading water harnessing, purification and distribution systems. For such expensive projects, water companies borrow private money, which was subject to high interest rates from financiers and state taxation. The companies recover their costs and expenses by charging the consumers. Not only was the capital cost divided among all the consumers but also the interest, taxes and overheads on the capital. Thus, the consumers were forced to bear the burden of higher payments on company loans. The price hikes following privatization have almost always made water unaffordable to the poor.

According to Moe and Rheingans (2006:51) the global burden of poor access to water supply and sanitation falls primarily on the poorest of the poor this access arises from income shortages. Moe and Rheingans conducted a research that clearly explored that households earning less than United State (US) 1 dollar (R8.15 – South African Rand) per day are almost nine times more likely to lack improved water and sanitation, in comparison to those earning more than US 2 dollars (R16.30 – South African Rand). Martin (2002:9) explored that it has been estimated that in Latin America, a 1 percent growth in per capita income reduces the share of people living in poverty by half a percentage point. Moe and Rheingans revealed that household in the lowest wealth quintiles were 5.5 times more likely to lack improved water access and 3.3 times more likely to lack adequate sanitation, compared with household in the highest wealth quintile in the same country. A similar study conducted in Nepal by the National Living Standard (2004:s.p) reported that the richest quintiles are eight times more likely to have improved sanitation (79 versus 10) than the poor. The following section discusses privatization in Nigeria.

2.9.2 Continental studies

According to Mahmoud (2004:1-2) Nigeria has seen the success of economic reforms in central and Eastern Europe, therefore like many other developing countries; Nigeria adopted the policy of privatization. The best practice of privatization re-emerged in the sub-Saharan Africa during 1990s. The study argued that in Nigeria privatization will not help the poor because they cannot pay, privatization would lead to tariffs the poor cannot afford to pay. According to Bosch *et al.* (2001:384-395) people have inadequate water and sanitation because the cost are simply too high in relation to local private provision. The poor lack the income to purchase the services they want. According to Ward (2007:11) many cultures treat water as a free resource.

Mahmound (2004:2) furthermore mentioned that when closely examined, most arguments against privatization in Nigeria like in many developing countries revealed that not to privatize was the worse option. The reason was that the governments had difficulties in regulating these enterprises were probably even less apt at operating them. A South African study showed that privatization has an impact on the poor.

2.9.3 National Studies

A study conducted by Greenberg (2003:5-21) mentioned that a new system of privatization was introduced by government and it was seen as a way of improving the efficiency of water

service delivery. According to Steele (2005:1) the system of privatization of water services was becoming increasingly common, especially in underdeveloped countries, and it is leaving poor people without water because they cannot afford to pay for it. The problem with this system was that, it catered only the elite or the privileged people who could afford the services and therefore they were left without water and sanitation services. Steele (2005:1) furthermore describes privatization as a *"mockery of human right"* because everyone should have the right to water regardless of income. Greenberg (2003: 5-21) furthermore mentioned that in South Africa thousands of people have had their water cut off because they couldn't pay. Between 1999 and 2000, some 75 400 water disconnections occurred in Cape Town, and in 1999, 20 000 houses had their power supply cut off in Soweto. Privatization of water was leading to social unrest and jeopardized the health of people in rural areas, who were forced to use unsafe water because they cannot pay for piped water. According to O'Hanlon (2007:1) water problems have more to do with population movement.

2.10 Population growth

This section focuses on population growth and the impact it has on water availability. It also focuses on the impact of population growth on the economic development.

2.10.1 International studies

A study done by Gleick (1998:574) mentioned that water availability was affected by anthropogenic factor which was the population growth. For example a research done by Katri & Vairavamoorthy (2007:2-9) showed that the availability water sources throughout the world were becoming depleted and this was aggravated by the rate at which populations were increasing, especially in developing countries.

According to Gleick (1998:574) increasing population leads directly to decreasing per capita water availability. For example, Fletcher (2002:6) clearly outlined that India's population was less than 400 million and per capita water availability over 5.000 cubic meters per year. Fifty years later, population has grown to over a billion and per capita water availability has fallen to hardly more than 2.000 cubic meters per year. According to Singh (2001:s.p) it was estimated that by the year 2050, half of India's population will be living in urban areas and will face acute water problems. A number of studies have calculated the effect of population growth on water resources, holding water resources constant.

2.10.2 Continental studies

A study conducted by Moe and Rheingas (2006:44) mentioned that water scarce areas in Africa have some of the highest population growth. According to a study done in Africa by Human Development Report (2006:136) projected that in most water-stressed countries experiencing very high population growth rates, per capita availability was shrinking fast. For example analysis showed that with 1950 as a benchmark, the distribution of global population growth has dramatically reshaped the per capita availability of water. While availability stabilized in rich countries in the 1970s the decline continued in developing countries, especially in arid developing countries. By 2050 more than 3 billion people could be living in water-stressed countries.

Another example by Roudi-Fahimi *et al.* (2002:2) showed that MENA's population has doubled between 1970 and 2001, rising from 173 million people to 386 million people and reducing the average amount of fresh water available per capita by more than half, to 1640 cubic meters per person per year. MENA include countries like Algeria and Libya.

2.10.3 National studies

According to a research done by Sigenu (2006:17-32) mentioned that some causes of water shortages were human induced, meaning that water shortages were aggravated by human responses. Population growth can modify the physical environment in a way that makes useful water scarcer. The rapid population growth, particularly during the 1960s, 1970s and 1980s, has caused (and still causes) serious depletion and degradation of water resources in South Africa, and yet demand is constantly increasing.

Otieno & Ochieng (2004:120) showed that South Africa is currently categorized as water stressed country because of population growth and it was forecasted to experience physical water scarcity by the year 2050 with an annual water availability of less than 1000 m3 per capita. With the trends in population there will be increased pressure on the available water leading to water shortages. According to ABEMS (2011:78) it was evident that settlement growth has occurred throughout the municipal area of Bushbuckridge. A study done by Maluleke *et al.* (2005:13) revealed that in Hlalakahle in BLM, between 1986 and 1995 villagers access to water was reasonably. But with growth population there were challenges in water supply. Population growth has an impact on economic development discussed in the following section.

- **Population growth and Economic impact**

Economists showed that population growth has a great impact in economic development. A study conducted by Panayotou (2000:4-9) showed there were serious concerns as to the effect of population growth on local resources such as water. Unlimited population growth will ultimately outstrip the ability of the economy to meet the demand for water resource availability. As land resources such as water, becomes increasingly scarce, land prices rise and incentive will thus, increase for people to substitute more abundant resources such as labour.

According to a study done by Khan (2008:2) in Pakistan population factors were seen, sometimes, as inhibitors of sustainable economic development: "demographic factors, combined with lack of access to resources in some areas, and excessive consumption and wasteful production patterns in others, cause or exacerbate problems of environmental degradation and resource depletion and thus inhibit sustainable development.

According to Madulu (2004:95) in Tanzania, an increased in the number of people causes increased demand for water and other essential materials from the natural pool. High population growth produces a depressing effect on the gross national product (GNP) and the per capita income, in order words, high population growth generates an economic burden to the government by channelling the meagre resources towards provision of services rather than investing development sector. The study concluded that it was important to match the rates of population and economic growth with the provision of social services, because the higher the population growth the higher the demand for socio-economic and environmental resources. According to National Population Unit (2000:27) population growth is interlinked with the environment.

- **Population growth and environmental concerns**

According Fien (s.a:20) studies showed that there was a direct link between the environment and population. The population growth affects the amount of water available in the environment or hydrological cycle in other words population growth has a direct impact on environment. This was explained by the I=PAT equation. It is, thus interaction of population with consumption and technology that determines environmental change. In this construction, the environment remains unchanged if population growth is offset by a corresponding reduction in consumption per capita or improvement in technology that reduce waste per unit of consumption.

A research conducted by Madulu (2004:98) in Tanzania explained I=PAT model better. The researcher argued that the environmental impact (I) is a joint function of population (P), affluence (A), and technology (T). The Model sees population size (P) as integrating in a multiplicative fashion with affluence (A) and technology (T) to create impact (I) on the environment. This implies that population determines how many persons are there to consume available water resources and producing more impact on the environment. In order words, the more people there are, the greater is the impact on the environment's water.

National Population Unit (2000:27) a South African study showed that human life depends for its need on the environment, it is clear that population and the environment are closely interlinked. The country's population holds implications for the environment. The impact of population growth on the environment is dependent on the specific lifestyle of the population. The main element of lifestyle relevant to environmental impact is the particular production and consumption patterns employed to fulfil human needs and desires. Population growth is linked to unplanned rural settlements

2.11 Unplanned rural settlements

2.11.1 International studies

According to Shaar *et al.* (2003:21) water shortages and poor sanitation services affect the poorest that live in isolated rural areas, in other words their geographical locality makes them to be socially excluded from water and sanitation resources. A similar study was conducted in Africa.

2.11.2 Continental studies

The scattered nature of rural settlements presents major challenges for providing water and sanitation services. In a recent study by UNESCO (2010:248) it was outlined that in Tanzania the Scattered settlements in rural areas make costly investments for water supply services. Providing water to the majority of the Tanzanians was a big challenge particularly in the rural areas due to scattered settlement.

2.11.3 National studies

A South African study by Pelser & Redelinghuys (2009:44) clearly mentioned that service delivery in rural areas has always lagged behind that of urban areas due to a number of reasons. Supplying services to remote and geographical spread out population makes infrastructure development and maintenance, as well as ensuring supply of services such as water provision, costly and difficult to maintain. Some of the poorest municipalities are

situated in densely populated, deep rural areas that are characterized by backlogs in service delivery. In a detailed article of water for growth and development framework (2009:17) it was mentioned that many of the larger villages in South Africa are located on hillsides and generally have unplanned layouts and in these circumstances, to provide even a basic water supply to each household is complicated and costly. A study done by Arenas (2003:24) revealed that the South African settlement structure is considered as one of the most inefficient and distorted of the world. The following section discusses the coping strategy used by people when there is water shortage.

2.12 Coping Strategy

The following section discusses the coping strategies that people use when there are water shortages. In trying to cope with water insecurity, different countries employ different strategies depending on their resources.

2.12.1 International Coping Strategy

A study conducted by Amnesty International (2009:17) mentioned that Palestinian families who do not have enough water to meet their needs often have no choice but to resort to coping strategies. These include, buying water from unsafe sources such as agricultural wells, which were not monitored for quality. They also reuse the same water for several tasks: water used to boiled vegetables was reused to wash dishes, then reuse again to wash floors and then finally reuse to flush toilet. Toilets were flushed less frequently. Washing less regularly and fully, using a bucket or jug to limit the water used instead of showering. Washing clothes and floors as infrequently as possible and using a small quantity of water to hand-wash clothes in a bucket rather than using a washing machine. Only growing rain-fed crops in their home gardens or not keeping a home garden at all in dryer areas. They keep fewer animals or none at all.

Amnesty International (2009:35-39) furthermore mentioned that in Shukba village they built a water cistern in their garden with the help of Spanish NGO in order to store water that they receive from the network, together with the rainwater they collect, and additional water that they buy from water tankers. In Tuwani village they depend on rainwater harvesting and water delivered by tankers for their washing and other need, and for their animals. The following section discusses the coping strategies that are used in Africa.

2.12.2 Continental Coping Strategy

According to Manyatsi *et al.* (2010:166) the livelihood strategies to cope with water problems used in Swaziland include selling of livestock to buy water from those with boreholes. They also get water from boreholes in schools. Another coping strategy that was used was harvesting water from roofs and water recycling. Similarly Lockwood *et al.* (2006:24-25) stated that in Chizinya in Malawi people collect rainwater off of roof tops to compensate for lack of wells or boreholes. However, other strategies include boiling shallow well water in order to treat. People furthermore filter water through a cloth to remove visible debris during the rainy season. For sanitation people use the bush, maize field, or areas close to lakes as a toilet.

A study conducted by Gyampoh *et al.* (2008:416) mentioned that in Ghana people have to wake up very early in the morning so as to get water that has not been muddied already by early fetchers. Some people also have to resort to buying water from sachet water producers at a higher cost. The next section discusses the coping strategy that is used in South Africa when there is water shortage.

2.12.3 National Coping Strategy

In a comprehensive article of AWARD (s.a:11-27) it was mentioned that in Acornhoek in Bushbuckridge local Municipality frequently people have to travel some long distance to other villages, which create conflict, as this increased the demand that villages cannot easily meet. People sometimes resort to using water from sources that are not of good quality for drinking. Rainwater is harvested and stored in tanks. Having drums and tanks at homesteads which were filled when water was available enable the household to meet its water needs when the system fails. For example, in instances where there pump in a village break down and this create water shortages for several days.

AWARD furthermore, reported that some households engages in beer brewing for sale and have invested in water drums. They use some of the cash income to hire a vehicle to collect water for them in another village and fill the drums. Some households have a donkey cart and have 25 litre drums, which they use to collect their own water. The following section focuses on potential source of freshwater supply that is used by communities.

2.13 Potential sources of freshwater supply

The section discusses the potential sources of water supply in different parts of the world.

2.13.1 International review

State of the environment and policy retrospective (2002:153) about 2 billion people, approximately one-third of the world's population, depend on groundwater supplies. Many rural dwellers depend entirely on groundwater. The issues of groundwater use and quality have until recently received far less attention than surface water, particularly in developing countries. However, in Europe, much attention has been paid to groundwater quality because many settlements depend on such resources for water supply. Most people think groundwater provides freshwater but generally, groundwater resources are vulnerable to a variety of threats, including overuse and contamination.

A research conducted by Ragheb (2011:5) revealed aquifers are important freshwater resources large metropolitan areas cities in the world such as Jakarta, Indonesia, Dhaka, India, Peru and Mexico depend on their underlying aquifers for their freshwater supplies. Recently the rate at which they are exploited has more than doubled from 126 to 283 cubic kilometres per year in the last few decades. The underground aquifers sustain streams, wetlands, and ecosystems and they resist land subsidence and salt water intrusion into fresh water supplies. In aquifers, the freshwater is held in the pores of the medium. Water infiltrates into the soil through the pores and cracks until it reaches the saturation zone, which occurs because water infiltration the soil reaches an impermeable layer of rocks it cannot soak through. The water table is located at the top of the saturation zone. The following showed that in Tanzania groundwater was considered as a source of freshwater supply.

2.13.2 Continental review

According to Bogaard *et al.* (2008:7) in Tanzania groundwater was the largest storage of freshwater supply and widely used by human. People in the arid and semi-arid region use groundwater exclusively for all their needs but the disadvantage of groundwater is that, it is not always within easy reach. The withdrawal of groundwater becomes difficult and expensive when it is confined over 800 depths. The surface water bodies, as lakes and rivers hold a very small amount of freshwater. Unlike groundwater it is easily accessible. A similar study in SA also considers groundwater as freshwater.

2.13.3 National review

Bredenhann *et al.* (2000:1) mentioned that groundwater was a key component of the water resources of South Africa. As such it provides water required for basic needs, since the country's surface water resources are unevenly distributed and cannot cope with the growing

demand for water. Almost two-thirds of South Africa' population depends on groundwater for domestic water needs and also provides the only means of satisfying basic human needs. According to Knuppe (2011:68) groundwater was considered safe because much geological and ecological function such as the transport of dissolved matter below ground, rock weathering and diagenesis, the formation of mineral deposits, supporting water purification and nutrients transportation process. Studies showed that only one percent is freshwater flowing through rivers and lakes, much of that has been polluted by humans. The following section discusses the government intervention to water and sanitation problem.

2.14 Government intervention

The following section focuses on government's intervention and the challenges that obstruct service delivery by the government.

2.14.1 Global government intervention

According to Pahl-Wostl (2002:394) in Germany, the water sector was currently undergoing major processes of transformation at local, regional and global scales. A study done by Frone (2008:293) clearly outlined that in Romania one of the specific objectives by the government was to provide water supply in line with European Union (EU) practices and policies in most countries by 2015 and by developing efficient regionalized water management structures. The following section discusses the government's intervention in Africa.

2.14.2 Continental government intervention

According to USAID (2007:1) Benin has made slow, but steady, progress in developing its water supply and sanitation sector. The government have succeeds in significantly expanding coverage under a clear development framework particularly in rural areas. Benin was currently revising its national water policy, to include a strategy for sanitation and to promote integrated water resource management and create a regulatory agency with oversight over water and sanitation service provider delivery standards. According to Diemand *et al.* (2010:2) the Namibian government has attempted to mitigate problems in the water sector by devising various water policies that outline everything from the proper testing of water supplies to the investigation into new government structure to improve water management. The next section discusses the government's intervention in South Africa.

2.14.3 National government intervention

According to Guerquin *et al.* (2003:80) South African government has been putting in place a comprehensive water policy framework since 1994, defining priorities for water management and developing local and national financing solution. National government was committed to eliminating the backlog in basic water service; the first step up the water ladder was the provision of at least basic water and sanitation service to all people living South Africa.

According to Kahinda *et al.* (2007:1051-1055) providing water and sanitation to people without access by South Africa government was one of Millennium Development Goal (MDG). As part of the effort to achieving MDG, the South African government has committed itself to provide financial assistant to poor household and also wanted to implement Domestic Rainwater Harvesting (DRWH), which has an advantage of proving water directly to household. Arenas (2003:32) the government in Port Elizabeth undertook a major water storage and supply project in building Hendrik Verwoed Dam in the Orange River. Government has made a progress in providing water and sanitation but there are still some obstacles hindering services discussed in the following section.

2.15 Obstacles to Improvement of Water Supply and Sanitation

The following section discusses the obstacles to improvement of water supply and sanitation.

2.15.1 International review

A study conducted globally by Montgomery and Elimelech (2007:22) discussed that in many developing countries, lack of accountability, corruption, inefficient management, lack of personnel and difficulty in enforcing standard creates a situation where water and sanitation does not receive due attention. A study in Romania showed that the government lack experienced staff, inappropriate institutional framework, unclear role and responsibilities, inefficient management. Another study conducted in Buenos Aires by Hardoy and Schusterman (2000:67) mentioned that the failure to extend services was due to the lack of appropriate social policies and the lack of proven models.

2.15.2 Continental review

According to Parker (2009:8) in Naivasha in Kenya, the government does not have a plan for water and sanitation, and developing one is unlikely to become a priority in the foreseeable future and in Lusaka the government has limited capacity to facilitate water and on-site sanitation. Another study done by Telmo (2002:95) mentioned that in Mali the lack of

financial means by government was identified to be the main obstacle to the improvement of water supply and sanitation. A research conducted by Mehta & Mehta (2008:45) revealed that in many African countries it was a common practice for NGOs to fund investments directly, bypassing local government budgets. These practices affect local government control and combined with the lack of reliable and transparent information, make it difficult for local government to plan and budget efficiently.

2.15.3 National review

A study conducted by Makgoka (2005:12) discussed that even though the South African government has delivered water supply to rural communities, but many challenges remains. The service provision has suffered due to financial and human resource shortages, leading to the insufficient service delivery water and sanitation. A study done by Peters (2010, s.p) mentioned that the problem of service provision by local government is that, it was hampered by low capacity of local government, corruption, political influence, the lack of political accountability and transparency.

A similar study conducted by Dlamini & Cousins (2009:23) showed that in BLM there was poor performance by water service authorities because of poor capacity, due to lack of sufficient human, lack of strategic management due to lack of leadership and strategic management skills. Planning was not practical and the tendency was to focus on legislation compliance rather than on performance. A study conducted by Raab (2009:114-116) states that BLM does not have financial resources to develop water infrastructure and was also a lack of transparency. According to Dlamini (2007:1) in Bushbuckridge the lack service provision was due to institutional confusion that has arisen as a result of changing mandates for water services. Peters (2010:s.p) mentioned that the problem of service provision by government was the lack of people's participation. The following section discusses participation by communities.

2.16 Communities Participation

This section discusses participation of communities as a factor that weakens improved water and sanitation services.

2.16.1 International studies

A study done by Barat (2007:17) discovered that a factor that undermines the sustainability of improved services includes communication participation. Studies showed that many water

projects by government in Afghanistan did not sufficiently involve the community, who therefore did not feel that the project was theirs. As a result, demand for the improved services suffered, and services become unsustainable. The following section discusses community participation in Uganda.

2.16.2 Continental review

A research done by Barungi *et al.* (2003:22-23) mentioned that in Uganda there was a failure of community participation in decision making. Communities didn't know they were entitled to water projects, and because they were not clear about this, they were in no position to articulate demand. Often site-selection for projects was done with no community involvement. Communities were generally not involved in the section of the appropriate technology. The engineers have the final say on where wells and pumps can be located, based on water availability. For example the community preferred springs than hand-pumps, because hand-pumps break frequently and old people and children could not use them, but the contractors installed hand-pumps, without consulting them. The community participation in decision making was often seen as a non-essential component of implementing projects, it was something that the governments do in performing their facilitation roles. The community was clearly not the customer from which the private sector takes orders. The government places the orders and awards the contracts to the private sector: the communities are mere recipient, passive beneficiaries who are detached from and not parties to the actual contract making. The next section discusses community's participation in Cape Town and Ilembe.

2.16.3 National review

A study conducted by Goldberg *et al.* (2009:50) showed in Cape Town a common thread for all communities serviced by private contractors was that community members themselves have not been properly consulted regarding water and sanitation choices and service delivery options. Instead, the decisions either appear to have been made by the government, or were jointly discussed between the government and community leaders of the area, at best, communities were informed of decisions already made at committee meeting, and at worst were given the sanitation options without any prior communication at all. Overall, it appears that community members are very poorly informed on almost all aspects of water and sanitation service delivery. According to Robbins *et al.* (2009:45) in Ilembe studies showed that there is no known, clear and accepted system of involving the community in any of the issues and decision making process with regards to water and sanitation supply. Communities

claim that their voice is not heard on even valued because there is no community's participation.

2.17 Conclusion

This chapter covers literature review of the study. This study provided an assessment of water and sanitation problems in different part of the world. This chapter discussed the water sources used by people around the world and for sanitation people are still using pit latrines. The chapter discovered water problems were due to deterioration of infrastructure systems that were not maintained. It was also mentioned in this chapter that water and sanitation problems were due to inadequate prioritization, other sector receive priority than others. People living in rural areas are deprived services because of their socio-economic status. Most people living in the rural areas are very poor. In most cases privatization affects most people who leave in the rural areas because they are not able to pay for services. Water and sanitation situation in rural areas is poor compared to urban areas. Another factor explained in this chapter causing water and sanitation problems was population growth. Population growth directly affects the amount of water removed from water systems. Unplanned rural settlement makes it difficult for water and sanitation services because they are scattered. Even though water is a problem in the rural areas people have coping strategies. They use groundwater from borehole as a source of freshwater supply. The government is doing much in supplying water and sanitation but still a lot need to be done in terms of human resource, finances and efficient management. Another obstacle to providing water and sanitation is lack of community participation. Chapter 3 discusses data presentation and analysis.

Chapter 3

Data Presentation and Analysis

3.1 Introduction

This chapter presents an overview of the main findings of water and sanitation situation that was conducted in the village of New Forest. The findings briefly discussed the current environmental and water status, the coping strategies that are used when there was water shortage, the sanitation situation, the current water service, the water sources that are used and municipality intervention to water and sanitation problem.

The results of the survey are presented and were compared to the information provided in the literature review. Graphs and tables were used for data presentation to give the overall view of the findings and to establish relationship between parts of the findings. The types of graphs used in this chapter for data presentation are histograms and pie charts.

3.2 Demographics

Figure 2 shows that majority of respondents in this village were females (70%) and male respondents had a cumulative total of 30%. Majority of the respondents were female and were aged between 50 to 59 years, which had a cumulative total of 22% while male had the cumulative total of 6%. Other respondents which were aged 60 years were drawn from women with the cumulative total of 18% while that of male had the cumulative total of 4%. Female had the highest response for ages between 40 to 49 years and 25 to 39 years which had cumulative total of 12% for both years while male had 8% and 6% respectively. Only 2% of the female were aged below 18 years.

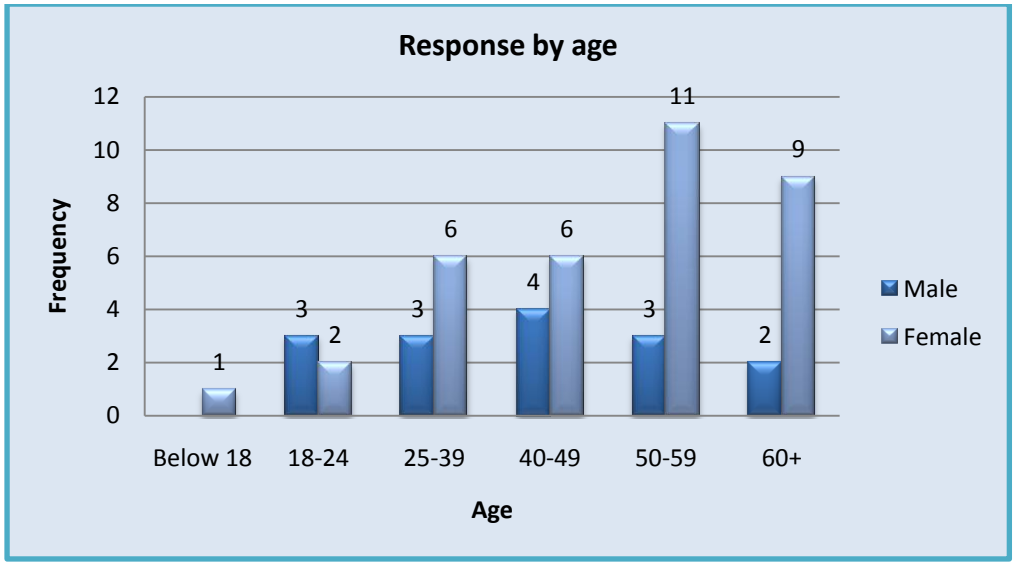

Figure 2: Distribution of respondents by age in New Forest

Figure 3 shows that majority of females did not go to school. According to data presented females had the cumulative total of 30% and male had 8%. For primary education females had 16% and males had 8% and for secondary education females had 22% and males had 14%, only 2% females had tertiary education.

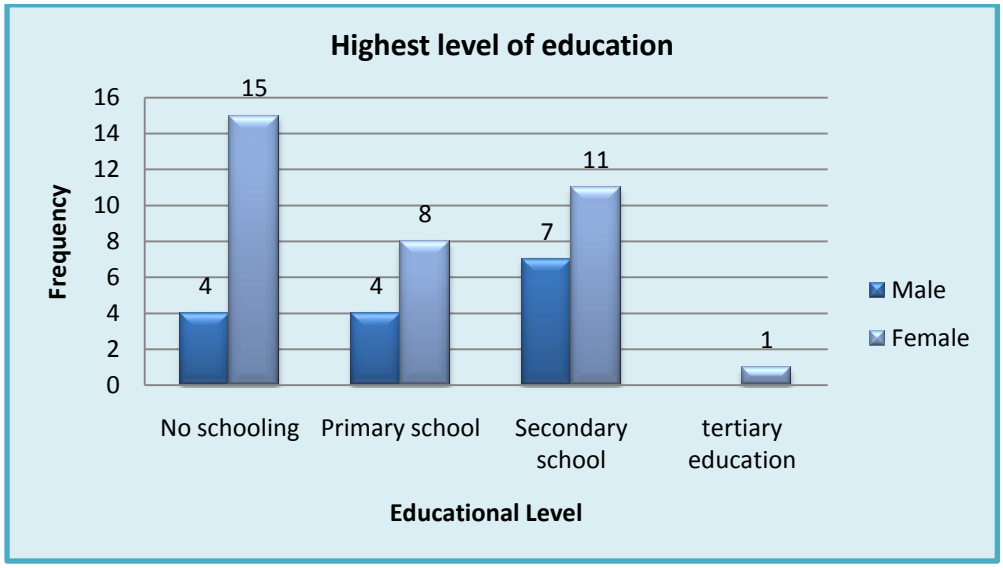

Figure 3: Distribution of respondents by educational level in New Forest

3.2.1 Head of the households

Majority of the households in the community of New Forest were headed by women; this was because most of the men in this community were working in the urban areas and others were working in the farms in the nearby locations to provide for their families. Women in this

village have the responsibility to take care of the household chores and their children. Most women in this rural area do unpaid jobs, such as household chores, while their husbands were working in urban areas. Domestic chores such as collecting water are seen as responsibilities of women. Most men in rural areas migrate to the urban areas for better opportunities and better services. This was supported by Mohammad *et al.* (2011:160-167) in the literature review that migration was because of people who were looking for better conditions and to enhance their quality of life in the urban areas. This can be traced back to apartheid era where men forced to migrate to the cities to look for jobs.

The findings showed that there was high rate of older female than older males in this community. Older women in this community take care of households as well as their grandchildren, while other family members were away to look for better opportunities. Most of the older females were widowed, but some were taking care of their husbands who are very old and sick. The older women support their families with pension funds paid by government. The few male respondents in this village were the one who have retired from their work and can no longer work anymore.

3.2.2 Current village education level

Majority of people in this community were not educated. Older women in this community did not go to school. There were fewer males, who had no schooling compared to females, but at least young women in this community went to primary and secondary school and even to tertiary compared to man. Most people drop their studies in secondary schools and some have passed grade but are sitting at home because of lack of financial resources.

Older people in this community were the ones who do not have primary education; this was because in olden days education did not receive priority. However up until recent times, enrolment, as well as government spending on the education sector, has received attention to assist the older people with basic education. Government has introduced Adult Basic Education and Training (ABET). Government is now spending millions on education than in water and sanitation sector, which is why there are water and sanitation problems. This was supported by Satterthwaite (1997:17) that education received more priority than water and sanitation. Government is now offering free education for all.

3.3 Socio-Economic Variable

Figure 4 shows that 64% of female respondents were unemployed while 14% of male respondents were unemployed, 2% of male and female were doing contract work and the

other 2% for both male and female were doing part time employment. The male respondents with full time employment and formal employment had a cumulative total of 2% and 4% respectively. The other male respondents 6% and female respondent 2% had their own business.

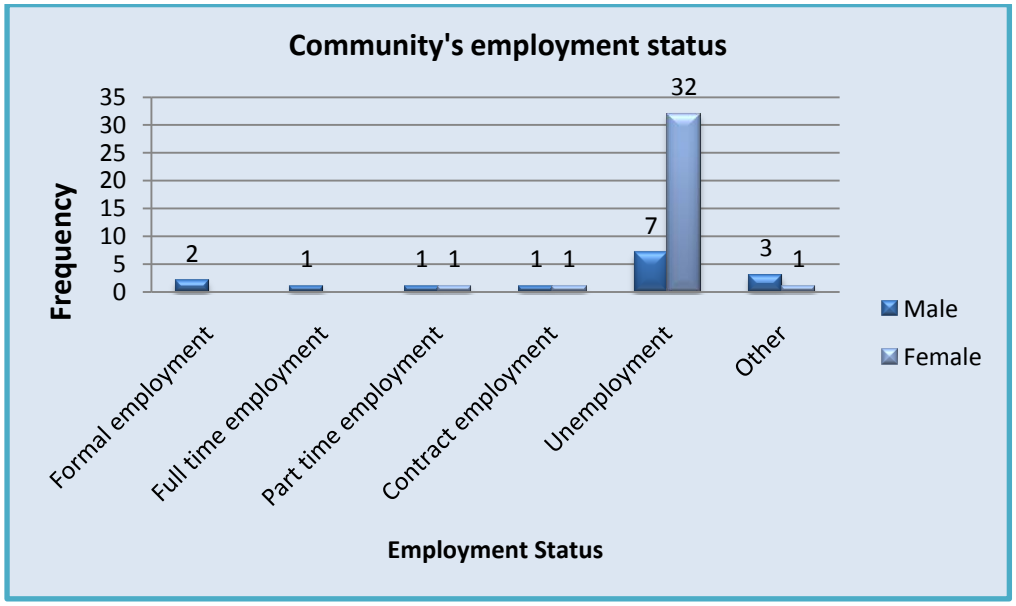

Figure 4: Distribution by employment status

Figure 5 shows that 48% of people in this village were not getting income and 14% of respondents were getting salary over R5000, while 8% of respondents were earning R3001 to R5000. People earning R1001 to R3000 were 12%; those earning R501 to R1000 were also 12% and only 6% of respondents were earning R100 to R500.

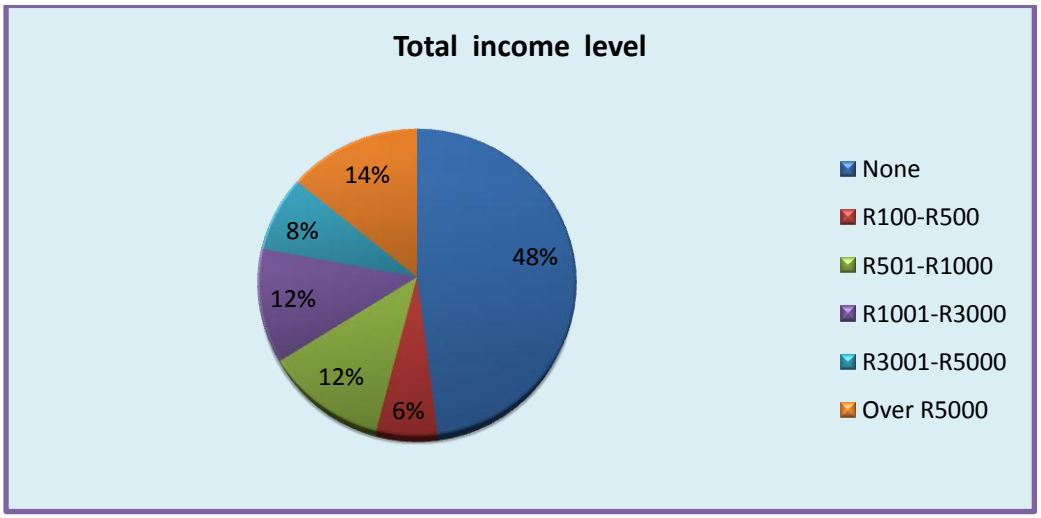

Figure 5: Distribution of respondents by income level

3.3.1 Current village employment status

There was high rate of unemployment in the community of New Forest. Majority of people in this community who were not working were women. There was high rate of unemployment for women than men. The unemployed women were involved in primary economic activities such as farming. They engage themselves in subsistence farming so that they produce enough food to feed themselves and their families. Other women who are not employed have their own sewing businesses and there were few women who were contracts workers and were working in nearby areas.

Men in this community work as security guards, some work as taxi drivers and some seasonal migrate to farm areas for work. Majority of men in this village do jobs that pay little salary. Other men in this community were self-employed; they do activities such as building houses and tiling of houses. People with formal employment were the teachers in this community. There were only government opportunities in this rural area, which were careers in teaching.

Because of high unemployment rate many families survive in with pension meant for elderly and it ends up being insufficient for their needs and other people who were not employed support their children with government's grant.

3.3.2 Poverty

The findings showed that people were still living in poverty line, because of high rate of unemployment. The study showed that the poor in this village have weak infrastructure, and most people facing the greatest problems of weak infrastructure on a day-to-day basis are the many rural poor. People living in rural areas face the consequences of weak delivery of services in water and sanitation. According to Sigenu (2006:20) people with the lowest status and wealth in the social hierarchy, often suffer disproportionately when water supplies are limited. Poor people are the ones who cannot afford to pay for water services and they are mostly affected by privatization. Privatization comes with paying for maintenance of water facilities of which the poor can't afford to pay. This was motivated by Moe and Rheingans (2006:51) that the global burden of poor access to water supply and sanitation falls primarily on the poorest of the poor this access arises from income shortages.

3.4 Environment and water status

Table 1 indicates that 50 households have experienced water shortages and there was no household which haven't experienced water shortage.

Table 1: Illustrates the number of people who have experienced water shortages

Response	Number of Respondents	% of the Respondents
Yes	50	100%
No	0	0%

Table 2 presents that 70% of the residences have experienced water shortages for many years, 26% of the respondents indicated that they have experienced water shortages for months and 4% of the respondents have experienced water shortage for days.

Table 2: Illustrates the period that people have experienced water shortages

Period	Number of Respondents	% of the Respondents
Days	2	4%
Months	13	26%
Years	35	70%

Table 3 indicates that 74% of the residences think the cause of water shortages was due to municipality pipes, 12% of respondents think that water shortages were caused by lack of rain and 8% of the respondents mentioned that there were other causes except lack of rain and municipality pipes, that make water shortage a problem, which was shortage of dams. Only 6% of respondents were not sure what the cause of water shortages was.

Table 3: Illustrates the causes of water shortages

Cause of water shortage	Number of Respondents	% of the Respondents
Lack of rain	6	12%
Municipality Pipes	37	74%
Not Sure	3	6%
Other	4	8%

Table 4 shows that 38 (76%) of people mentioned that water shortage was affecting their domestic use, two (4%) people mentioned that water shortages was affecting their livestock and three people (6%) mentioned that water shortages was affecting their businesses while the other three (6%) mentioned that water shortages was affecting their gardening.

Table 4: Illustrates the impact of water shortages on people's economic activities

Impact of water shortages	Number of Respondents	% of the Respondents
Domestic use	38	76%
Livestock	2	4%
Business	3	6%
Gardening	3	6%
Other	4	8%

3.4.1 Village water coverage

According to research findings New Forest is currently experiencing water shortages. This is of great concern considering that this problem is expected to become worse by 2050 (Ward, 2007:2). The findings have proven that there was poor water coverage in rural areas than urban areas. New Forest which is rural local municipality is worse off in terms of accessibility to water compared to its urban counterparts. This was supported by Raab *et al.* (2008:4) that the urban areas generally receive better services than rural areas. In the case of this research 100% of people in this village were experiencing water problems, this indicate that the coverage was very poor. According to the findings of the research people in this community receive water for few days; water is then cut off for days, months and even years.

3.4.2 Causes of water problems

- **Deterioration of water systems**

According to the research's findings there was deterioration of water infrastructure systems in the community of New forest. There were water infrastructure systems that were no longer used because they were no longer repaired or maintained and they were too old because of lack of maintenance. People in this community used to get water from the municipality pipes. Most of the municipality standpipes are now dysfunctional. Water systems that were not maintained fall into disuse. This water motivated by Sanders and Fitts (2011:6) in the literature review that problem with water supply facilities were due to systems which were not maintained and therefore falls into disuse.

- **Insufficient capacity**

The research's findings showed that a typical problem with regard to the causes of water shortage in New Forest was that the community electric water engine had insufficient capacity to supply the whole community because it was too small. Maluleke *et al.* (2005:9) in

the literature review mentioned that insufficient capacity was the cause of water problems. Initial this community was using diesel engine which had regular breakdown, then this engine was changed to electric engine, but it is small as mentioned above that it cannot carter the whole community. According to the research's findings this community also has insufficient capacity because its water is diverted to other neighbouring community; this was the reason for water shortages.

3.4.3 Impact of water shortages

The findings of the research showed that lack of water supply has a negative impact on the villager's economic activities. Water shortages in this village have a great impact especially on domestic use. Smaller business such as building houses, tiling of houses requires water and were affected by water shortages, as their production relies on water. People in this community have backyard gardens and community gardens which cannot be irrigated due to water shortages, irrigating garden from communal stand pipe is practically non feasible for other community members who do not stay closer to water sources.

3.4.4 The coping strategies

Table 5 shows that 19 (38%) of people get their water from traditional hand dug wells, while 13 (26%) of people get water from community's borehole and the other 13 (26%) of people get their water from the river and only 5 (10%) access water from neighbouring communities.

Table 5: Illustrates the sources that people use when there is no water supply.

Water sources	Number of respondents	% of respondents
Tap	5	10%
River	13	26%
Groundwater	13	26%
Other	19	38%

Table 6 present that 43 (86%) of people travel distance when collecting water and 7 (14%) of people does not travel distance when collecting water.

Table 6: Illustrates the distance for fetching water.

Response	Number of respondents	% of the respondents
Yes	43	86%
No	7	14%

Table 7 shows that 18 People who travels distance access water from hand dug wells, 12 people access water from community borehole, 10 people access water from the river and 3 people access water from neighbouring community taps. People who do not travel distance access water from hand dug well (1), community borehole (1), river (3) and neighbouring community taps (2)

Table 7: Illustrates the water source that people use when accessing water for both people who (travelling and not travelling)

Water sources	Travelling distance	Do not travel distance
Hand dug well	18	1
Community borehole	12	1
River	10	3
Neighbouring community taps	3	2

Table 8 shows that 22 people travel 1 Km when collecting water, 9 people travels a distance of 2 Km's when collecting water, 10 people travels a distance of 3Km's when collecting water and 2 people travels 4 Km's when collecting water, while 7 people travels a distance of less than a kilometre when collecting water.

Table 8: Illustrates the distance in km's travelled when collecting water

Kilometres	Travelling distance	Not travelling distance
Less than kilometre	0	7
1 Km	22	0
2 Km	9	0
3 Km	10	0
4 Km & Over	2	0

Table 9 shows that most people collecting water were women in each household, followed by boy child (16%) and girl child (16%), and Man (14%), while other 10% of respondents mentioned that they hire cars to collect water for them.

Table 9: Illustrates the people who collect water in the each household

People collecting water	Number of respondents	% of respondents
Man	7	14%
Women	22	44%
Boy child	8	16%
Girl child	8	16%
Other	5	10%

3.5.1 The coping strategies

The research findings showed that water is provided to the community of New Forest to mitigate water shortages, but still the supply is insufficient and irregular. Villagers in this community resort to coping strategies when there are water shortages. This was supported by Amnesty International (2009:17) that families who do not have enough water to meet their needs often have no choice but to resort to coping strategies. Most of the respondents from New Forest access their water from traditional hand dug wells and from natural resources as their coping strategy when there is no water supply. Villagers are forced to dig traditional hand dug wells themselves, but they also dry up when there is no rain. Those who can afford drill borehole in their yards. Boreholes are very expensive majority of the villagers do not afford this water equipment. Some villagers hire cars to collect water for them in their neighbouring communities.

3.5.2 Distance to water sources

The findings showed that most people in the community of New Forest travel distance when collecting water. The villagers complained about the distance they travel to access water. They travel distance of one to four kilometres to access water. They access water from hand dug wells, boreholes, river and taps from neighbouring communities which are not nearer to their homes. They carry water with their heads and some use wheelbarrows. Most of the villagers who stay in distance area from water resources travel distance when collecting water. People who do not travel a distance when collecting are the ones who live near the

water sources, for example there are those who live very close to the river, they do not travel when collecting water.

3.5.3 People collecting water

According to the research's findings women in New Forest like many other rural women in the world are the ones responsible for collecting water. Generally, women carry out most of the work in rural areas of collecting water. Fetching water according to African culture is considered as women's work. When water is available women gather in the communal tap to collect water. They wait for one another. Most people have wheelbarrows which assist them to carry water to their houses, but some who do not have wheelbarrows they carry water with their heads. Almost everyone in this village have buckets and drums to collect and store water. Girls and boys in this village assist their mother with collecting water. Other families who afford hire cars for water collection.

3.6 Sanitation infrastructure

Figure 6 shows that 68% of People from this community were still using pit latrines and 32 % of people do not have toilets; they share toilets with their neighbours.

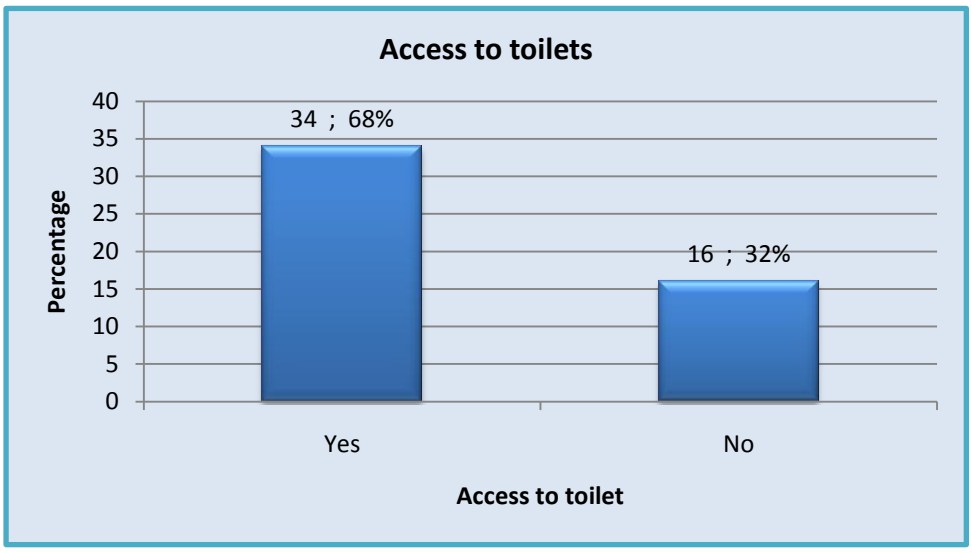

Figure 6: Illustrates the people with access to toilets

Figure 7 Illustrate that 33 (65%) households in this village have pit latrine toilets and only 1 (2%) household has flushing toilet, while there other community members did not own toilets 16 (32%).

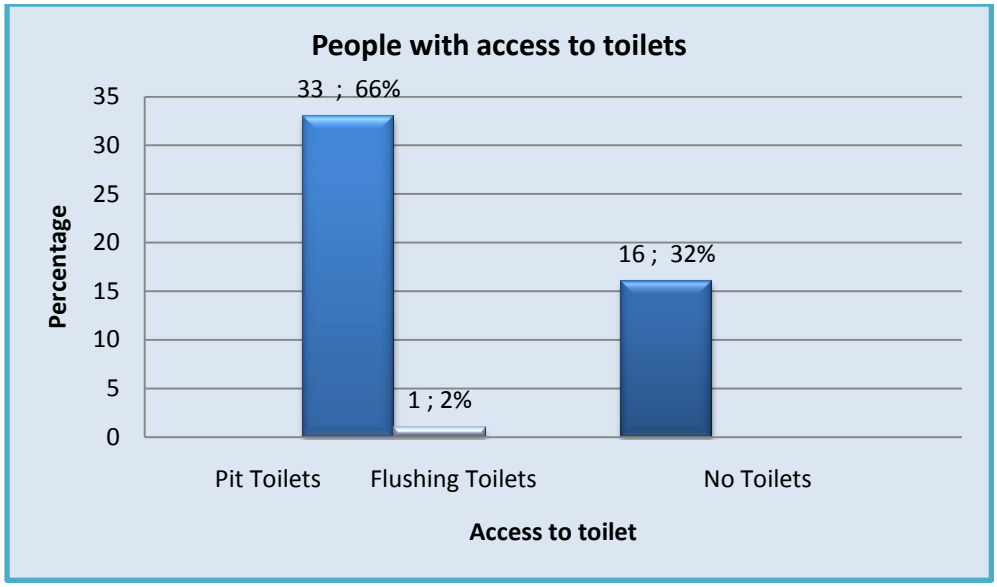

Figure 7: Illustrates the number of household with access to pit and flushing toilet.

Figure 8 presents that 33 pit toilets were located outside the house and 1 flushing toilet was located inside the house and 16 household do not own toilets.

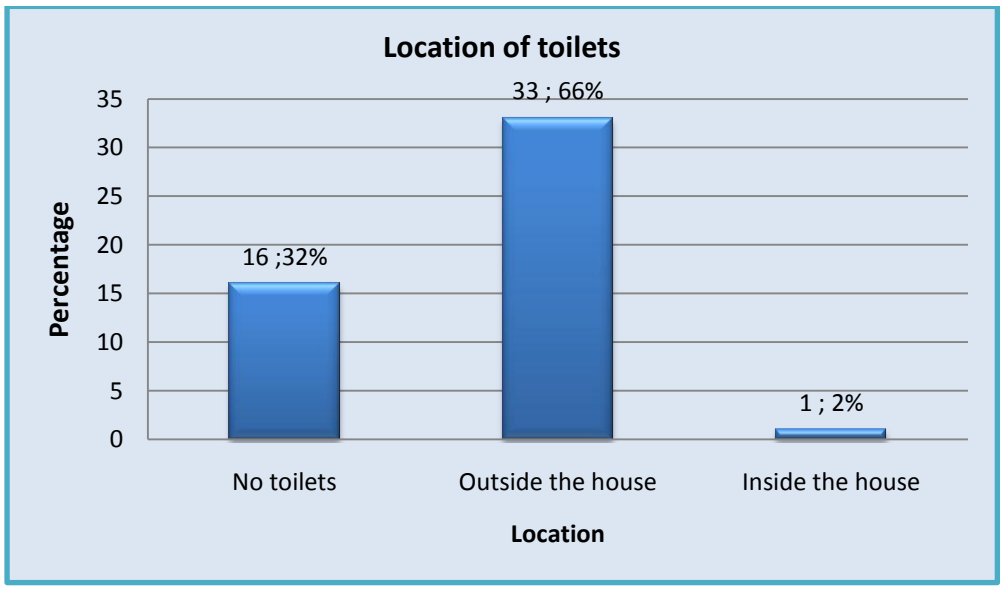

Figure 8: Illustrate the location of toilets

3.6.1 Access to flushing toilets

The findings showed that almost everyone in the community of New Forest does not have access to flushing toilets. The pit latrines are one of the most widely used sanitation technologies in this area. They are part of improved sanitation options. The pit latrines need no water to function; this was the big advantage in water scarce area like New Forest.

According to the research finding pit latrines are easy to operate and there is no maintenance required, they are very cheap and there is no treatment included. Research findings also showed that people who do not have toilets share toilets with their neighbours. There was only one household in this community which have a flushing toilet; this was because this family had a private borehole which supplies water to the in-house taps and the toilet. People who do not afford to install private boreholes have no choice but to use pit toilets.

3.6.2 Problems related to pit latrines

- **Bad odour**

Pit latrines according to the research finding are built in the backyard of most households and at least a distance away from houses; this was because of their bad odour and they are seldom emptied. This was supported by Kistermann (2008:2-6) that pit latrines are found in the backyard of houses and they are unhygienic. They cause too much house flies because of their bad odour. Pit latrines have a small hole on the seat that allows human waste to pass through to the ground. Most of these toilets do not have sit covers and they produce a bad odour through the small hole especially when the weather is hot and when they are full.

- **Accessibility of pit latrines**

Respondents mentioned that these pit latrines were not easily accessible at night especially for children because they are built outside the houses. This was supported by Kistermann (2008:2-6) that pit latrines are inconvenient. Some of the pit latrines in this area does not have roofs and cannot be easily accessible when there are heavy rains. Most people use buckets at night that they dispose the following day. The household with flushing toilet mentioned that they could not find it easy to access these pit latrines at night because they were scared of being bitten by snakes.

- **Deteriorate from the eroding action of weather**

According to the research findings some toilets in this area were poorly constructed, they were susceptible to hazards because they are designed and built with simple local available materials.According to Telmo (2002:60) traditional pit latrines can easily deteriorate from the eroding action of water, weather and attack by termites, or rotting of wood. In the case of the research findings most pit latrine toilets in this village are made of bricks and cement, they cannot easily rot or attacked by termites.

3.7 Potential Sources of freshwater supply

Table 10 shows that 41% of people in the community of New Forest access freshwater from the community borehole and 39% access water from hand dug wells. 18% of people access water from the river while 2% use bottle water.

Table 10: Illustrates the sources of freshwater supply

Freshwater supply	Frequency	Percentage
River Water	9	18%
Well	19	39%
Bottle	1	2%
Other	20	41%

Table 11 shows that water collected from the above sources is mostly used for domestic purpose, 90% of the respondents mentioned that they use water collected from different sources for domestic purpose, livestock (6%), gardening (2%) and business (2%).

Table 11: Shows the water uses

Water use	Frequency	Percentage
Domestic	45	90%
Livestock	3	6%
Gardening	1	2%
Business	1	2%

Figure 9 show that 72% of households do not treat their water before use while 28 % of the households treat their water before consumption.

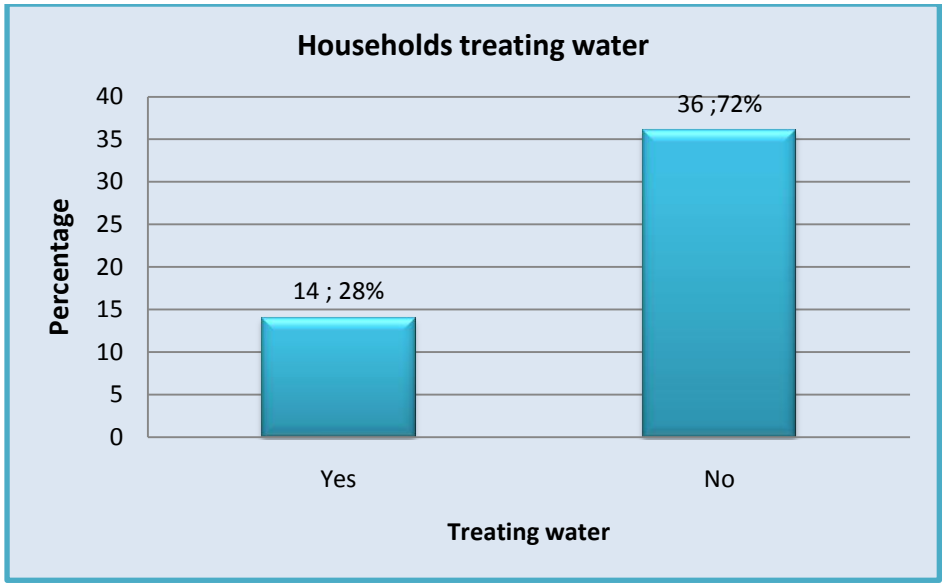

Figure 9: Illustrates the sources of freshwater supply

Figure 10 shows that 50% of children were affected by water diseases were, while 24 % men were also affected by water disease, 8% of women affected by water shortages and 18% of respondents mention that water shortages affects everyone in their households.

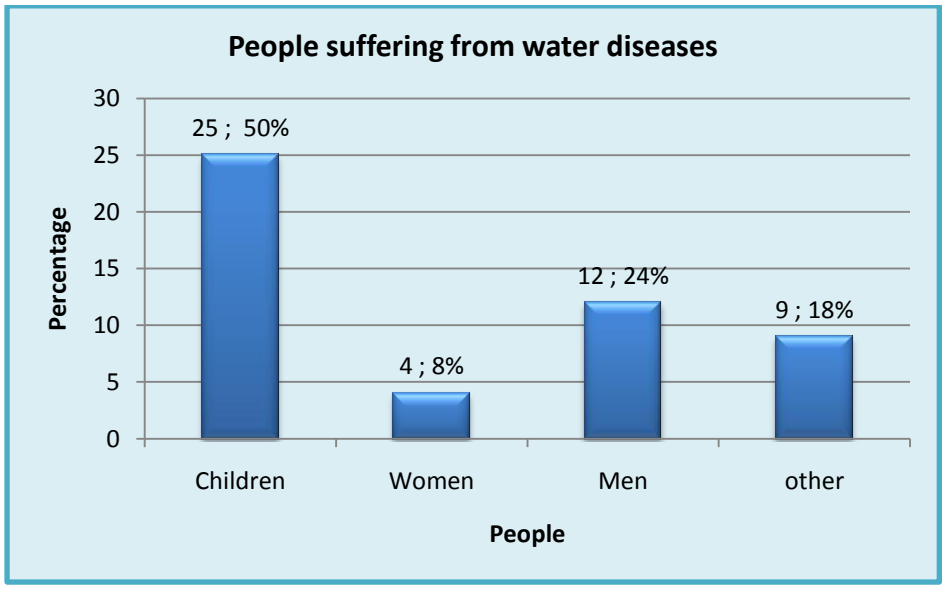

Figure 10: Shows most people suffering from water disease.

3.7.1 Sources of freshwater supply

Majority of people in New Forest community uses water from the borehole; this water was considered as freshwater from the ground. This was supported by Bogaard *et al.* (2008:9) that groundwater was the largest storage of freshwater. People from this village also consider

water from the river and wells as a source of freshwater, but according to Bogaard *et al.* (2008:9) surface water bodies like river hold a very small amount of freshwater.

3.7.2 Contamination of existing water supplies

The research finding shows that water availability for human use is shrinking because of pollution from human activities. These activities were degrading water quality in the community's river, irrigation scheme and wells. Pollution of normal water supplies effectively destroys part of the water resources. Water pollution in this community is the result of the casual disposal of human excreta. According to a research done by Sigenu (2006:17-32) mentioned that some causes of water shortages were human induced, meaning that water shortages were aggravated by human activities.

3.7.3 Treating water before use

Most people in this community do not treat water before use. Although people were not treating water before use, there has never been an outbreak of cholera in this village. This was because people use water from unprotected sources for other domestic use, such as cleaning and washing except for drinking or cooking. There were those who had suffered from diarrhoea because they do not treat their water from unreliable sources. Most of those people were children followed by men and this was because these people residing near the community river.

3.8 Municipality intervention

Figure 12 shows that 64% of people strongly disagree that their water and sanitation infrastructure is maintained regularly, 6% disagree that water and sanitation infrastructure is maintained and only 4% of people were not taking sides to the situation, 24% of people mentioned that water and sanitation infrastructure were maintained and only 2% of people strongly agree that water and sanitation infrastructure was maintained.

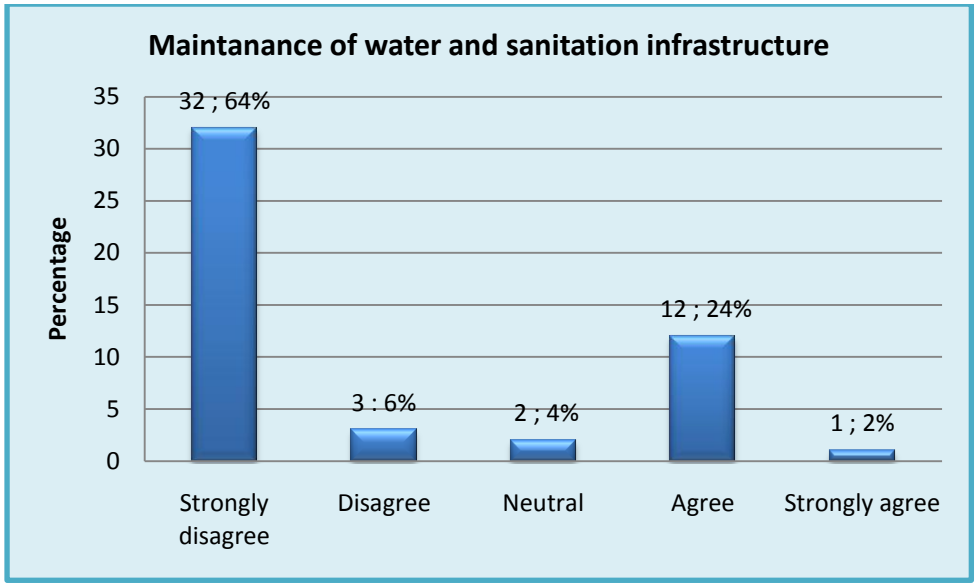

Figure 11: illustrates the maintenance of water and sanitation infrastructure by municipality.

3.8.1 Community's participation

The community was not involved in any water project and decision making. Not involving the community in decision making have weakens water and sanitation service delivery for example they have no choice in selecting the appropriate technology for their community, such as boreholes or hand pump. This was motivated by Barat (2007:17) that a factor that undermines the sustainability of improved services includes community's participation. Most respondents mentioned that they want the government to intervene to water and sanitation problems.

The current water supply service is poor. Water is cut off without informing the community. This is supported by Goldeberg *et al.* (2009:50) that in most cases community members are very poorly informed on almost all aspects of water and sanitation service delivery. Lack of access to information prevents many rural people from keeping in touch with a changing world.

3.8.2 Maintenance of water systems

The research also showed that water and sanitation system are not maintained, systems that are not maintained causes infrastructure failure. According to OECD (2005:28) water supply deteriorates due to technological failure.

3.9 Conclusion

This chapter covers the data analysis and findings of the research. Findings of the study established that the community is facing water and sanitation problems due to lack of employment, poverty, lack of water infrastructure, deterioration of water system, poor water supply, contaminating the existing water supply systems and lack of community participation.

People are accessing water from traditional hand dug wells, borehole, river and water from neighbouring community. The findings of the study also showed that there was high rate of women in this community. The study also established that most people collecting water from these sources were women and children. Most of people walk distance to access water from these sources.

The study has demonstrated that the villagers have developed strategies to cope with water and sanitation problems. The strategies include accessing water from unreliable sources and storing water to sustain them for longer period when there are water shortages. People have constructed pit latrines to cope with sanitation problems. People in this village are denied access to water and sanitation because their socio-economic status. Water shortages have a great impact on community's economic activities. The recommendation and conclusion of the study will be discussed in chapter 4.

Chapter 4

Recommendations and Conclusion

4.1 Introduction

This chapter provides the recommendation and conclusion of the study. From the findings of the study the researcher point out recommendations that can be implemented to mitigate water and sanitation problems in New Forest Village. The chapter provided standards and guidelines for basic services delivery. The conclusion provides the overall findings of the study.

4.2 Recommendations

4.2.1 Investing in rainwater harvesting technology

Most of the villagers in New Forest have back yard gardens, domestic animals and businesses that require water for functioning. Investing in rainwater harvesting technologies will help in mitigating water problems. The government should introduce and promote simple and cost-effective technologies for rainwater harvesting. The government should also commit itself to providing financial assistance to poor household for the capital cost of rainwater underground tanks. Rainwater harvesting underground tanks can be alternative, much cheaper than yard taps. Rainwater harvesting tanks can provide water for domestic use, livestock and gardening. Their advantage is that they can provide water when water is not available.

4.2.2 Investing in community water infrastructure

The government should construct more water infrastructure that will supply the whole community with water; these include installing extra boreholes, improving water wells, taps and dams. More water sources will reduce the burden of having to walk long distances to fetch water. In this community there was only one borehole that supplies a large population of people. People from different parts of the community walk a distance to access water from this borehole.

4.2.3 Community's participation

Public participation action is needed to remedy water and sanitation problem, but it must be action based on clear policy which is premised on the rights of all people to determine their own future. The villagers should be in the forefront in all phases of the water projects in the village. The villagers should be given the opportunity to identify, implement, monitor and evaluate community water projects. The villagers should also be given the opportunity to

select the appropriated water technologies they want and the location of water sources. The villagers should be given the opportunity to participate in community meetings, water projects and income generating project such as planting vegetables. Community members should have the customers care helpline numbers in order to know who to contact when water is cut off. Women should also participate in water project. Women knowledge and experience of water management should therefore be acknowledged as a worldwide resource to be developed, encouraged and used. A platform must be created that will encourage villagers to voice their opinion and share their knowledge. Information is a fundamental aspect of development.

4.2.4 Maintaining of water distribution infrastructure

The water supply infrastructure in New Forest requires further technical investigation around the causes of water shortage. Existing water infrastructure, such as community diesel, communal pipes, borehole and irrigation schemes should be checked regularly, maintained and refurbish if necessary. There is a need to replace old, small and simple waterworks with new waterworks and to extend the water networks from surrounding location where water is always available to central village and to residential points. Government should accelerate the process of supplying potable water to all water distribution infrastructures. This process will help decrease the workload of local women.

4.2.5 Protecting drinking water sources

Open water sources should be protected from the debris falling into water wells to reduce health hazards. There is a need to enhance environmental protection around wells in regions not reached by water pipe networks. Water sources such as water irrigation schemes need to be regularly cleaned with appropriate chemicals. There should be awareness programmes in the community that educate people about protecting water sources. Community awareness programmes should teach the villagers about the dangers of contaminated water, and should encourage training on how to protect drinking water sources. Villagers should be involved in nature conservation activities; these include protecting natural water sources that exist in the community, such as rivers.

4.2.6 Improving village sanitation coverage

Overcoming the obstacles to improving sanitation will require policies and funding initiatives. With enough funds the government would be able to construct improved pit latrines with air ventilation systems for poor households. Improving village sanitation

coverage means providing sanitation for all. Water should be accessed every day by the villagers since improved sanitation requires water for proper functioning and this will improve village sanitation coverage. Lack of water poses public health risk that can lead to increased mortality if there is no intervention.

4.2.7 Strong institutional performance

There should be adequate human resources capacity for planning and management of water and sanitation activities. There should also be strong coordination and clear roles and responsibilities among government institution and other sectors. Unclear roles and responsibilities creates situation where water and sanitation does not receive attention, therefore proper training will develop institutional performance.

4.2.8 Contingency plan

The water utility should prepare contingency plans and make all the necessary preparations for the distribution of water. The contingency plan must include all the procedures which are service measures, allocation of resources, and level of preparedness, prevention and mitigation. One of the solutions is to make the water consumers aware of the possibility of disruption and to explain to them the need to store water in their homes, in large water tanks to sustain them for longer period in case of an emergency.

4.2.9 Sustainable financing strategy

A sustainable financing strategy is needed. A good financing strategy will increase resource allocations to water and sanitation sector. It will improve the efficiency and effectiveness of existing resources wherever they are found, and tap the potential of alternative financing mechanisms. Efforts directed to the government to increase government allocation and to facilitate the investments being made for communities are needed.

4.3 Conclusion

The objective of the study was to assess water and sanitation problems in New Forest community. The assessment of water and sanitation problems in this community established that people faces a severe water crisis. Studies showed that by 2025 the world population could be facing severe water shortage.

The study highlighted significant problems in equity and sustainability of rural water and sanitation service delivery. The causes of water and sanitation problem according to review of the literature were due to infrastructure failure, poverty, low coverage, low allocation of

funds for water supply and sanitation, lack of water availability (rainfall), population growth, privatization of water services and unplanned settlements. The obstacles to improving water supply include lack of human resources, lack of financial resources, unclear roles and responsibilities.

The analysis of the study has been done based upon responses to the different questions by the villagers. The analysis gave a picture of what was causing water and sanitation problems. The analysis of the study threw up a very common response from the villagers "we want water''. This study presents a synthesis of findings from a research project. The findings of the research showed that water shortages were due to weak infrastructure, systems that were not repaired and maintained which makes systems to fall into disuse. Water shortages were also due to insufficient water capacity, contaminating existing water sources and lack of communication by government officials to the villagers. The villagers collect water from unreliable sources and were still using pit latrines as their coping strategy. Water shortages have a great impact on community's activities.

In conclusion public action is needed to remedy this unacceptable situation in New Forest, it must be action based on clear policy which is premised on the rights of all people to determine their own future. The government must ensure that all South Africans have access to basic water and sanitation services at a cost which is affordable to the rural households and to the country as whole.

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Appendix A

Types of water sources and toilets that are used in the community of New Forest

1. Traditional hand dug well

Illustration 1: Traditional hand dug well

2. Water Irrigation Scheme

Illustration 2: Community's water irrigation scheme

3. The River in New Forest

Illustration 3: Mutlumuvi River in New Forest

4. Community Tap

Illustration 4: A communal village water tap in New Forest

5. Old Community Tap

Illustration 5: An old village water tap that was no longer maintained

6. Household Tap

Illustration 6: Household tap and a blue plastic water container.

7. Jojo Water Tanks

Illustration 7: Household with Jojo water tank in New Forest

8. The Communal Engine

Illustration 8: The newly constructed community electric engine

9. Description of village Sanitation

9.1 Improved Toilet

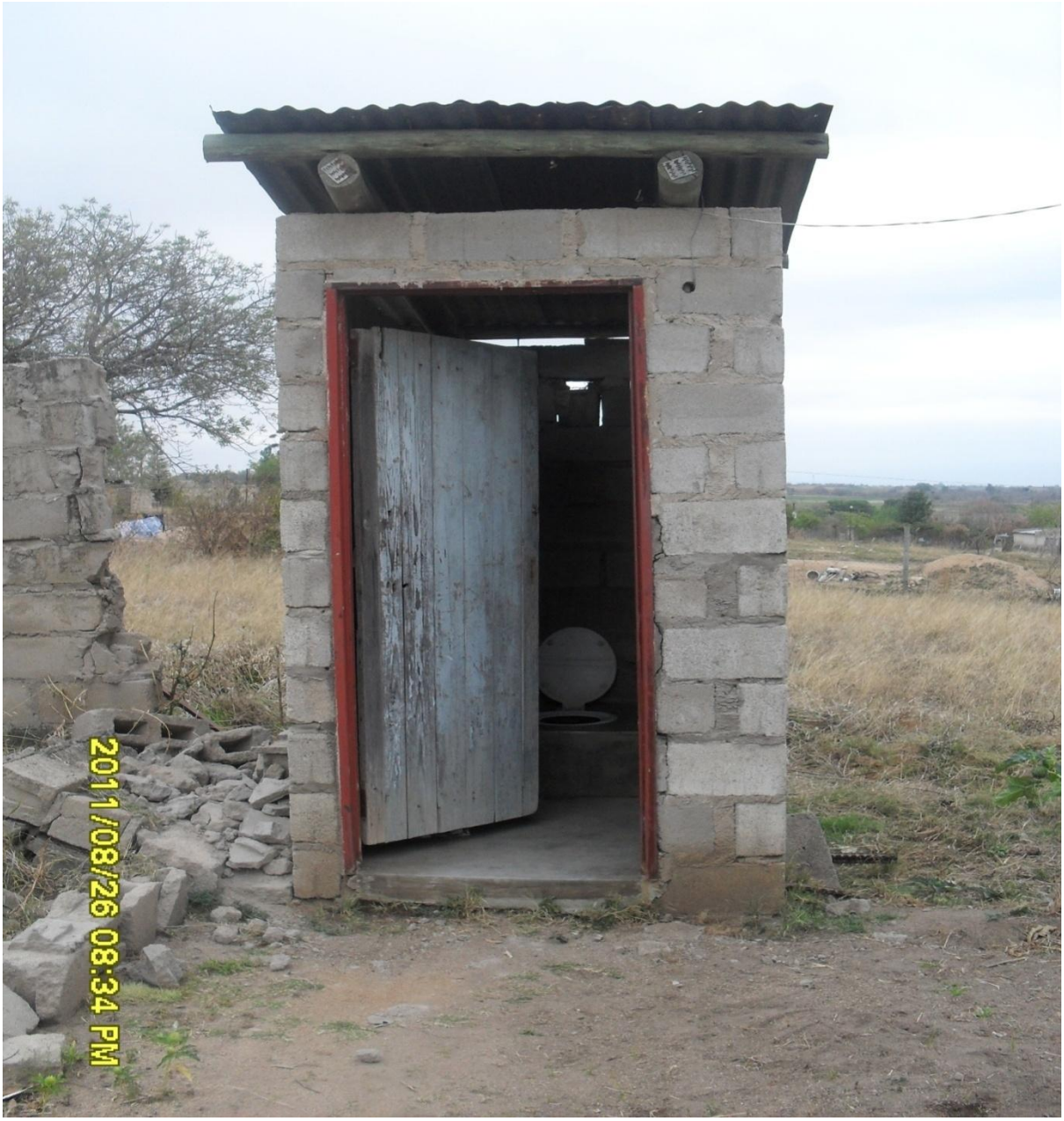

Illustration 9: Improved pit latrine.

9.2 Unimproved pit latrine

Illustration 10: the picture shows the poorly constructed pit latrine.

9.3 Old pit latrines

Illustration 11: Old double pit latrine

10. Pit latrines seats

Illustration 12: Pit toilet with seat covers Illustration 13: Pit toilet without seat covers

11. Local Vegetable Market

Illustration 13: A market selling sweet potatoes located in New Forest main road

Appendix B
Questionnaire

1. DEMOGRAPHICS

1. Gender

1) Male	
2) Female	

2. Age

1) Below 18	
2)18-24	
3)25-39	
4)40-49	
5)50-59	
6)60+	

3. Current marital status

1) Married	
2) Divorced	
3) Separated	
4) Single	
5) Widowed	
6) Rather not say	

2. EMPLOYMENT STATUS

4. Kindly state your employment status

1) Formal employment	
2) Full time employment	
3) Part time employment	
4) Contract employment	
5) Unemployment	
6) Other	

Specify_____

3. EDUCATIONAL STATUS

5. Highest level of education

1) No Schooling
2) Crèche/Pre-school
3) Primary school
4) Secondary school
5) Tertiary education

4. SOCIO-ECONOMIC VARIABLE

6. How many people are working in this household?

1) None
2) 1-3
3) 4-6
4) 7 & above

7. Total Income level

1) None
2) R100-R500
3) R501-R1000
4) R1001-R3000
5) R3001-R5000
6) Over R5000

8. Current Source of income for the household head

1) No Source
2) Child support income (Grant)
3) Allowance from relatives
4) Salary (formal)
5) Wage (contract)
6) Pension
7) Disability benefit income
8) Other

Specify_____

9. Household size

1) 1-3 ☐
2) 4-6 ☐
3) 7 & above ☐

10. How long have you lived in this area?

1) Less than a year ☐
2) 1-5 years ☐
3) 6-15 years ☐
4) Over 15 years ☐

5. ENVIRONMENTAL AND WATER STATUS

11. Have you experienced water shortage in this area?

1) Yes ☐
2) No ☐

12. If yes, for how long?

1) Hours ☐
2) Days ☐
3) Months ☐
4) Years ☐

13. What do you think are the major causes of water shortage in this area?

1) Lack of rain ☐
2) Municipality ☐
3) Not sure ☐
4) Other ☐

Specify_____

14. How have you been affected by water shortages?

1) No water for domestic use ☐
2) No water for livestock ☐
3) No water for business ☐
4) No water for gardening ☐
5) Other ☐

15. What solution can you identify? _____

16. Who needs to be part of improving water shortage in this community? _____

6. THE COPING STRATEGIES

17. Where do you get water when there is no supply?

1) Tap ☐
2) River ☐
3) Borehole ☐
4) Dam ☐
5) Other ☐

Specify_____

18. Do you walk a distance when fetching water?

1) Yes ☐
2) No ☐

19. If yeas, how long do you think is the distance?

1) Less than 1km ☐
2) 1km ☐
3) 2km ☐
4) 3km ☐
5) 4km & Over ☐

20. Who collect water in this household?

1) Man
2) Women
3) Girl child
4) Boy child
5) Household
6) Other

21. What container do you fetch water in? _____

22. What do you use to carry the water? _____

23. Where do you store water? _____

24. Do you buy water when there is no supply?

1) Yes
2) No

7. ADEQUACY OF SANITATION INFRASTRUCTURE

25. Do you have a toilet?

1) Yes
2) No

26. If yes, what type of toilet do you use?

1) Chemical toilet
2) Bucket System toilet
3) Pit latrine toilet
4) Flushing toilet
5) Other

27. Where is it located?

1) Inside the house
2) Outside the house
3) Other

Specify_____

28. Do you share your toilet with neighbours?

1) Yes ☐
2) No. ☐

8. POTENTIAL SOURCES OF FRESHWATER SUPPLY

29. What do you use as a source of freshwater supply?

1) River water ☐
2) Well water ☐
3) Bottle water ☐
4) Other ☐

Specify_____

30. What do you use this water for?

1) Domestic ☐
2) Livestock ☐
3) Gardening ☐
4) Business ☐

31. Do you treat your water before use?

1) Yes ☐
2) No ☐

32. If yes, what do use to treat water? _____

33. Have you or anyone in this community suffered from any of these disease?

1) Cholera ☐
2) Diarrhoea ☐
3) Malaria ☐
4) Other ☐

Specify_____

34. Which class of people suffers from these diseases?

1) Children ☐
2) Women ☐
3) Men ☐
4) Other ☐

Specify_____

9. MUNICIPALITY INTERVENTION

35. How is the current water supply service?

1) Excellent ☐
2) Good ☐
3) Poor ☐

What is your feeling with regard to municipality intervention?

36. **Notification:** It is always announced before water is cut off

1) Strongly disagree ☐
2) Disagree ☐
3) Neutral ☐
4) Agree ☐
5) Strongly Agree ☐

37. **Maintenance**: Water and sanitation infrastructure are well maintained

1) Strongly disagree ☐
2) Disagree ☐
3) Neutral ☐
4) Agree ☐
5) Strongly Agree ☐

38. **Service Delivery:** Municipality always provides water, sewage, sanitation and water management

1) Strongly disagree	
2) Disagree	
3) Neutral	
4) Agree	
5) Strongly Agree	

39. **Contact Information**: I always know who to contact when

1) Strongly disagree	
2) Disagree	
3) Neutral	
4) Agree	
5) Strongly Agree	

40. **Other Comments:**

_____

_____

_____