Assessing the perceptions of water conservation among informal settlements through a case study of the Mpolweni informal settlement, Reservoir Hills, Durban, South Africa.

By

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Declaration

Submitted in fulfilment of the requirements for the Masters of Social Science degree, in Geography and Environmental Management, School of Agriculture, Earth, Engineering and Environmental Sciences, University of KwaZulu-Natal, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. I confirm that an external editor was not used. This dissertation is being submitted for the degree of Masters in Geography and Environmental Management, in the Faculty of Humanities, Development and Social Science, University of KwaZulu-Natal, South Africa. None of the present work has been submitted previously for any degree or examination in any other University.

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Dedication

This thesis is dedicated to my mother Arina Neerachand.

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"Sure I am that this day we are masters of our fate that the task that has been set before us is not above our strength; that its pangs and toils are not beyond my endurance. As long as we have faith in our own cause and an unconquerable will to win, victory will not be denied us."

\- Robin Sharma

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Abstract

The purpose of this study is to assess the perceptions of water conservation among informal settlements through a case study of the Mpolweni settlement, located in a peri-urban area in Reservoir Hills, Durban, South Africa. The specific objectives that guided this research aimed to examine the factors that give rise to water conservation, the water saving devices that are available for water conservation and the accessibility of such devices to the settlement, the views and practices of the informal settlement dwellers regarding water conservation and water usage and the obstacles that the settlement experience in conserving water. Questionnaires and focus groups were employed in collecting data regarding perceptions of water usage and conservation. Results indicate a general lack of knowledge among residents regarding water saving devices and water conservation practices, highlighting the need for education awareness programs regarding water conservation and water saving devices. However, most residents show positive attitudes toward water conservation and a readiness to adopt water saving practices.

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List of Abbreviations

ANC	African National Congress
CBSM	Community Based Social Marketing
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
GEAR	Growth, Employment and Redistribution
IMF	International Monetary Fund
IWRM	Integrated Water Resource Management
MDG	Millennium Development Goals
NWA	National Water Act
NWRS	National Water Resource Strategy
WC/WDM	Water Conservation, Water Demand Management
SPSS	Statistical Package for Social Sciences

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Chapter One

Introduction

1.1 Preamble

This dissertation has as its central focus, the perceptions of water conservation among informal settlements. Specifically, this research study is based on the Mpolweni informal settlement, which is located in Reservoir Hills, an urban area situated in the city of Durban, KwaZulu-Natal, South Africa. Given that water is a scarce and vital resource, exploring issues surrounding water conservation is essential, especially to those who are being provided with free water (in this case, the Mpolweni settlement).

This study looked at the factors that have led to the need for water conservation. Secondly, it investigated the water conservation devices that are available, as well as the nature of accessibility of these devices to the residents of Mpolweni settlement. The views and practices of the Mpolweni settlement dwellers concerning water usage and water conservation were also unpacked and assessed. This dissertation has also given importance to the limitations that are experienced by the informal settlement dwellers, especially those of the Mpolweni informal settlement, in successfully conserving water resources.

1.2 Background

South Africa's history has been well documented by various authors such as Liebenberg, 2000; Henrard, 2002; Earle *et al.*, 2005; Gumede, 2011; and Glucksmann, n.d. Apartheid, an era which promoted and enforced racial and spatial segregation also entrenched the segregation of basic services. The bulk of South Africa's resources and services (in this case water) was allocated to the white minority, with insufficient or a complete lack thereof to the black majority. The legacy of apartheid has had detrimental impacts on access to basic services to the majority of the country's citizens, leaving the country with a legacy of material and socio-economic inequalities (Albertyn, 2011). Earle *et al*'s (2005) study of Apartheid highlights that between 12 and 14 million people do not have access to a formal water supply and that fifty one percent (51%) had no formal sanitation facilities. Giordano *et al.,* (2002) expand on this, adding that a large percentage of South Africa's population was purposively excluded from

participating in the political and economic and social system in addition to their deprivation of basic services.

South Africa, a country that is acclaimed for having one of the finest constitutions in the world, has to date not been able to redress the critical inequities and conflicts within the water sector. Twenty years into democracy has seen only a modest improvement in the provision of formal access to basic services (water and sanitation) (Maharaj and Khan, n.d). It has been acknowledged by Goebel *et al.,* (2010) that there have been improvements in the access to water and sanitation facilities. Statistics South Africa (2011), illustrates that 8.8 % of the country's population have no access to piped water, and that 14.1 % of these people reside in Kwa-Zulu Natal. *The Status of Sanitation Services in South Africa Report* (2012) highlights that 37% of the population have either no sanitation services at all, or have sub-standard services (Department of Water Affairs, 2012). In addition, 64% of households that are using interim sanitation services are at risk of service failure (Department of Water Affairs, 2012). Goebel *et al.,* (2010) challenge the notion of aggregate data such as national statistics, affirming that it hides the disproportionate spatial improvements and social determinants such as gender, income and education levels that can impede improvements in water provision.

Since entering into the democratic domain, there have been major reforms within the country, with specific focus on redressing the inequalities in terms of the allocation and distribution of water resources (Turton, 1999; Backeberg, 2005; Godden, 2005). The current uneven distribution of the water resources between the urban and rural areas result in a problem of a dual nature. Urban areas are faced with the task of increasing awareness of water conservation, and rural areas have the task of meeting both existing and growing demands. In light of the above, this research has focused on the provision of water in urban areas, specifically to the urban poor. The migration of people from rural to urban areas has resulted in the booming of informal settlements within and around the urban cities. These settlements have added additional pressure on water services authorities to meet the country's Bill of Rights and section 27 of the National Water Act (Act 36 of 1998), which state that *"everyone has a right to access to sufficient water"* (Department of Water Affairs , 2002: 21).

To manage water both efficiently and effectively the South African government has implemented water conservation/ water demand management (WC/WDM). The national water conservation/ water demand management (WC/WDM) strategy is viewed as a strategy that will

ensure compliance with the National Water Act (NWA) (Act 36 of 1998) in terms of effective management of the country's water resources (Department of Water Affairs, 2004). Tate (2000 cited in Mwendera *et al.,* 2003: 762) defines water conservation/ water demand management as *"any socially beneficial action that reduces average or peak water withdrawals or consumption from either surface or ground water, consistent with the protection or enhancement of water quality."*

In light of the above, water scarcity, climate change, international agreements and the demand for water has resulted in the new democratic government being faced with the mammoth task of addressing the inequalities of the apartheid era while simultaneously conserving water resources and ensuring economic growth. Southern Africa is a water stressed region, characterised by low levels of rainfall, high evaporation and extensive arid areas (Department of Water Affairs, 2004). South Africa is a country characterised by a semi-arid climate, with unpredictable and dispersed rainfall patterns and droughts, hindering the country's water supply and needs (Department of Water Affairs, 2004).

The Department of Water Affairs and Forestry (2003: 1) confirmed that South Africa's average annual rainfall is 500 mm compared with the global average of 800 mm per year. The above illustrates that geographically, South Africa receives far less water than most countries which further indicates the need for water to be adequately managed and conserved in the country. The continuous growth of the urban poor population, will add further stress to the region's many challenges with regard to water supplies (Goldblatt *et al.,* 1999).

1.3 Aim of research

The aim of this research has been to assess the perceptions of water conservation among informal settlements through a case study of the Mpolweni informal settlement, Reservoir Hills, Durban, South Africa.

1.4 Research objectives

The objectives of the study are as follows:

- To investigate the factors that give rise to a need for water conservation.
- To explore what water conservation devices are available for water conservation, and the accessibility of such devices to the Mpolweni settlement.
- To unpack the views of informal settlement dwellers on water usage and water conservation.
- To investigate what limitations/obstacles informal settlement dwellers experience in conserving water.
- To provide recommendations that can ensure water conservation is successfully implemented.

The above mentioned objectives have been achieved through the following research questions.

1. What are the factors that result in the need for water conservation?
2. What water conservation devices are available for water conservation? How accessible are such devices to the Mpolweni settlement?
3. What are the views and practices of informal settlement dwellers with regard to water usage and water conservation?
4. What are the limitations/obstacles experienced by the informal settlements in successfully conserving water?
5. What are the recommendations that can be established for the successful implementation of water conservation?

1.5 Theoretical framework

The political economy literature on the topic of water is rapidly developing with most contributions focusing on the issue of the privatisation of water resources. According to Swyngedouw (2009), this branch of literature seeks to understand the concept of the privatisation of water, with more focus on whether the privatisation of water resource will lead to increased conservation of the resource or not as well as the issue of the ownership of water.

The primary goal of privatisation is that society should be controlled by market forces (Narsiah, 2010). According to Narsiah (2008), the private sector is viewed as more efficient than government with regard to service delivery.

Water is a resource that is essential for human existence, but it has become a commodity in capitalist society and is viewed as an opportunity for profit making. Swyngedouw (2009) contributes by arguing that water is increasingly seen as being a commodity and that the access to water is seen and understood through market mechanisms and the influence of money. Taking into consideration that water is essential for life and is seen as a tool in the transformation of society towards social and environmental justice, the researcher is of the view that the inability of the poor to pay for the water resource will not change the current situation of water scarcity. Political economists highlight that the privatisation of water delivery systems have failed to alleviate the water crisis in the south of the world and is one of the obstacles to reaching the Millennium Development Goals (MDG's) (Swyngedouw, 2009).

Mollinga (2000) reiterates that water is a social resource. His example of the Narmada dam illustrates the consequences of canal modernisation as it led to health problems due to the impact of pollution from the construction activities. He emphasises that water problems cannot be separated from the social environment as water should be viewed as a social activity (Mollinga, 2000). He echoes that it is the people that control the technologies that control the movement of water (Mollinga, 2000). His argument is that water is distributed in terms of social inequality, conflict cooperation, exchange and power (Mollinga, 2000).

The 1998 Water Service Act (Act 107 of 1998) was of importance in terms of allowing for the entry of the private sector into water services (Narsiah, 2010). This created an opening for the introduction of market principles such as full cost recovery, block tariff and other tariff structures (Narsiah, 2010). The National Water Act (Act 36 of 1998) states that a pricing strategy is expected to gradually play a significant role with the aim to obtain social equity, ecological sustainability, financial sustainability and economic efficiency (Levite and Sally, 2002). It is for this reason that the political economy of water usage will be used as a theoretical framework.

1.6 Research methodology

Research Design

This research study has followed a case study design which can be referred to as a qualitative approach. This approach has allowed the researcher to investigate case/s through detailed, in-depth data collection (Bryman, 2004). The above-mentioned approach is necessary considering that this research study involves the (people of) Mpolweni settlement as a unit of analysis.

Data Collection

Data was collected using both qualitative and quantitative approaches (mixed methods). The key tools used to obtain data for this study included focus groups, which is a qualitative approach, as well as questionnaires under the quantitative approach. A focus group session was conducted with ten out of fifteen members of the informal settlement committee. Questionnaires were administered to the heads of fifty households out of the one hundred and forty-five households within the settlement.

Sampling

The researcher used two non-probability strategies called purposive sampling and quota sampling. Purposive sampling occurs when a distinction can be made between a known group sample and a quota sample (Plooy, 2009). The reason for the use of this approach is due to the researcher's knowledge and involvement with the informal settlement. Purposive sampling resulted in detailed information from a smaller selective sample size, whereas probability sampling led to wider scope of information from a large sample size selected to be representative of the population (Teddlie and Yu, 2007). Purposive sampling was used for the focus groups (for the informal settlement committee members), as the researcher aimed to determine the perceptions of water conservation amongst the informal settlement, through the committee members who represent the informal settlement management or leadership. Quota sampling is a sample strategy used to obtain a quota of a category being sampled to ensure that diversity among the units is captured (Neuman, 2011). The advantage of this sampling method is that it ensured that the under-representation of the informal settlement dwellers did not occur.

Quota sampling was used for the administration of questionnaires. The total population size of the Mpolweni settlement consists of one hundred and forty-five households, of which fifty households were sampled and administered with questionnaires. The settlement committee was made up of fifteen people in total and ten of them formed part of a focus group session.

1.7 Structure of dissertation

This study is divided into six chapters.

Chapter one: Introduction

The purpose of this chapter is to provide a background of the problem area and surrounding issues, thereby creating a clearer and concise understanding for the reader. Chapter one also provides the reader with an account of what the objectives, research questions, central theoretical argument and research methodology entails.

Chapter two: Theoretical framework

The purpose of this chapter is to unpack the theories and concepts that are relevant to the topic. The theoretical framework used in this study is the political economy framework.

Chapter three: Literature review

Chapter three provides a variety of literature on water and poverty, water conservation, water pollution, economy and water, water demand management, water conflicts, water and the environment, water quality and water equity. This chapter defines water conservation, identifies drivers for water conservation, outlines the benefits of water conservation, and discusses the barriers for water conservation.

Chapter four: Study area and Research methodology

Chapter four discusses the various methods and techniques that have been employed in this study. The chapter substantiates the research study (a case study) and data collection techniques (centred on focus groups and questionnaires). Details on the site (Mpolweni settlement) and

sample are provided, coupled with a framework for analysis of the data. This chapter has been divided into various sub-divisions which include the unit of analysis, research design, data collection, sampling, data analysis. The limitations of the research have also been included in this chapter.

Chapter five: Data analysis and discussion

Chapter five provides the data analysis of the primary data collected in the study area. It links the findings to the literature review which created a platform for the translation of results into a meaningful format. The results from the focus groups are discussed under the relevant themes followed within the focus group schedule. This is done to ensure that a stage is created for thematic analysis. This chapter also focuses on the results from the questionnaire which are discussed in detail within this chapter. The analysis and synthesis of the results then occur within this chapter, in terms of comparing and contrasting findings from both questionnaires and focus groups, but also where the findings are compared and contrasted against the findings in the literature review. Thus this chapter describes, discusses, analyses and synthesises the findings from the research as well as the findings from the literature review.

Chapter Six: Summary and conclusions

Chapter six revisits the overall aim and objectives of the research. The findings are summarised and related to each objective. Conclusions from this research are derived and linked to the research objectives, and based on these conclusions, recommendations are made. The limitations and overall conclusion of the work are highlighted.

1.8 Conclusion

This chapter, has introduced the topic of the assessment of the perceptions of water conservation amongst informal settlements, specifically, the Mpolweni settlement based in Reservoir Hills. It has outlined the background of the study, aim of the study, the research objectives and research questions. The research methodology as well as the structure of the dissertation has also been provided.

Chapter Two
Theoretical Framework

2.1 Introduction

The theoretical framework introduces and describes the theory which explains why the research problem under study (the need for water conservation/ water demand management) exists. The theoretical framework used within this study is the political economy framework. This chapter will describe and discuss the theoretical framework that is used in this study, will justify the use of this approach within this research study as well as the impact of this framework in South Africa, and internationally.

2.2 The political economy framework

The theoretical backdrop of this study is the theory of the political economy. The political economy theory seeks to understand concepts such as the commodification of water, the privatisation of water, its impact on water conservation and the issues around the ownership of water resources and water conflicts (Swyngedouw, 2009; Narsiah, 2010; Page, 2005). The link between the political economy theory and this study is the issue of water conservation. This study aimed at assessing perceptions of water conservation and how, as part of political economy theory, the commodification of water motivates for water conservation. Hosque and Wichelns (2013) illustrate how this commodification of water has resulted in water tariff structures that are commonly referred to as a conservation-orientated rate design structures with the aims of providing a cross subsidy mechanism, whereby the high volume water users pay a higher cost for water to cross subsidise those who stay with the limits of the free basic amount.

With its origin stemming from capitalism, political economy seeks to understand the ways of capturing political, economic, social and cultural worlds and to rationalise, justify and explain the notion of exchange value (Jones, 2008; Hawkes, 1999). Bonilla *et al.,* (2012: 104) defines political economy as, *"an area where economic and politics interact."* The political economy approach believes that society should be controlled by the market forces and places emphasis on the *"market"* to solve problems of (re)distribution (Williams and Taylor, 2000; Page, 2005).

Hawkes (1999) highlights that a "*market*" is dependent upon the individual's capacity to perceive objects (in this case water) as a commodity. He further adds that society must accept the premise that the value of an object (water) is dependent on their exchangeability on the market. Confirmation of society's acceptance of water as a commodity was evident at the World Water Forum in Hague in 2000, where it was agreed that water is a human need and not a human right, and could therefore be sold for a profit (Page, 2005).

The approach asserts that efficiency coupled with equitable distribution and conservation of water resources can only occur if water is treated as a commodity and is able to be sold at the full price of production (Page, 2005). This belief has led to privatisation of the water resource. Narsiah (2010: 381) defines privatisation as the *"decreased state involvement in collective consumption and the transfer of ownership of state assets to the private sector."* The traditional view of privatisation is that it displays a change in ownership from the public sector to the private sector (Narsiah, 2010). The justification for privatisation is based on the premise that the costs of "*state failure*" are greater than that of market failure coupled with the view that the state is a less efficient provider of public services than the market (Bakker, 2001). Further justification for privatisation is that it will benefit the poor by removing the existing subsidy scheme that benefits the rich by providing incentives for private capital to invest in water infrastructure (Page, 2005). Those in favour of privatisation emphasise that private companies have a superior ability and are more efficient in the provision of water and water management than the government (Bakker, 2001; Narsiah, 2008). This notion has been accepted by society as Page (2005) states that the World Summit in Sustainable Development in Johannesburg in September 2002, clarified that the private sector is instrumental in ensuring that the country successfully attains its committed goal of reducing the number of people without access to clean safe water by half.

Sceptics of privatisation believe that water, although scarce, is a common good and should not be treated as an economic good. They inform that the ramifications of corporatising public water providers are negative social and ecological consequences as access to water is then based on the capacity to pay (Page, 2005). Williams and Taylor (2000) support this belief as they argue that the neoliberal political economy comprises the institutional separation of society into an economic and political sphere, thus forming what Karl Polanyi called the 'Economic Fallacy' whereby the division of the economic and political spheres is assumed to be common to all societies, irrespective of their historical context.

2.3 Political economy and its impact internationally

Bauer (1997) presents the benefits of privatisation and free markets in water use and management. The lessons learnt from his case study of Chile, illustrate that it is very difficult to establish markets in water resource. He confirms that in order for the market forces to work, property rights for water need to be legally defined (Bauer, 1997). If the state implements strict laws (which have no loop holes) to exchange water freely then privatisation would attain its desired effect. Bauer (1997) points out that the inefficiencies in this approach are the result of the state failure, and asserts that if the price of water is right, the problems of water scarcity will be resolved. People would conserve water which will result in more supply to meet the growing demand. Haughton's (1998) study of England's water droughts during 1995 confirms the problematic process of adopting and implementing the concept of privatisation. His study identified problems related to economic rationality and short term resource scarcity. Haughton (1998) indicates that in terms of sustainable development, privatisation was arguably the scape goat for the failure to conserve water stocks, in particular the overlooking of water leakages in the existing infrastructure. England's case study proves that it is impracticable to ensure that there is an equilibrium between market mechanisms and the state and that there is no evidence to confirm that neoliberal reform is an essential constituent for a successful regime of accumulation (Haughton, 1998).

2.4 Political economy and its impact on South Africa

To understand the need for WC/WDM in the country, it is of critical importance to understand the geographical, political and social history of South Africa. Geographically, South Africa is a water stressed country, making water a scarce resource. Coupled with the above, apartheid, an era of racial segregation, deliberately distributed the water resources unequally. The apartheid era, was an also an era of basic service segregation, as the government provided adequate services to the white minority and insufficient services to the black majority. As noted by Giordano *et al.,* (2002), a large portion of South Africa's population was deliberately excluded from the political and economic system. In addition, apartheid ensured that black townships and homelands were separated from the government's water supply schemes and that these townships and homelands received water and sanitation services that are of substandard levels in comparison to the white population (Giordano *et al.,* 2002). Narsiah

(2010) sums up the effects that apartheid had on majority of the population as he states that under apartheid, *"black people were forced to live in dehumanising conditions."*

The end of apartheid resulted in the birth of Democracy with many social and economic challenges. The democratic government's priority is to rectify the one of the many challenges that the country is experiencing, the distribution of basic services, in particular the water resource. Swatuk (2002) notes that the new government's main interest is in the provision of basic water services, specifically to rural areas where water is treated as an essential necessity.

Neoliberal political economy became increasingly influential in democracy as evident in the African National Congress (ANC) adoption of the 1996 Growth, Employment and Redistribution (GEAR) programmes (Williams and Taylor, 2000). The 1998 Water Service Act (Act 107 of 1998) was of importance in terms of allowing for the entry of the private sector into water services and thus created an opening for the introduction of market principles like full cost recovery, block tariff and other tariff structures (Narsiah, 2010). Tariff structures are important as it is a method used to ensure the sustainability of water services, as maintaining and developing new infrastructure is costly.

To redress the inequalities of the past and to overcome the backlogs in the provision of water services inherited from the apartheid regime, the democratic government has provided all citizens with a basic supply of water to all households. This is in line with the country's Bill of Rights and section 27 of the NWA (Act 36 of 1998) which state that *'everyone has the right to access to sufficient water'* (Department of Water Affairs, 2000: 21). The free basic water policy allows South African citizens the right to six kilolitres (6000 litres) of water to their household at no cost to its citizens (Narsiah, 2008). The policy aims to make provision for those who cannot afford to pay for this basic service (Narsiah, 2008). Thereafter, full cost recovery is implemented. Once more than six kilolitres of water have been used, the consumer must pay for the first six kilolitres of water that their household has consumed, through the fixed charge mechanism. This problematic rising block tariff approach is in fact regressive to the poor, because of bigger households and thus, higher consumption may in fact be subsiding smaller rich households (Narsiah, 2008). Rising block tariff is a common tariff structure due to its perceived equity benefits, due to its cost recovery scheme, however, the scheme reflect the concept of fairness and not equity, and it is therefore a debatable solution in addressing the racial imbalances (Narsiah, 2008).

Bouguerra (2006) reports that the privatisation of the water resources in South Africa is the cause of the country's worst cholera epidemic in its history. This was due to pressure placed on the new democratic government by the World Bank and the International Monetary Fund (IMF) to adopt cost recovery strategies which calls for public services to be self-financing. Failure to pay for services led to disconnection of water services (Narsiah, 2008). The consequence of this adoption resulted in the cost of water being too high for the underprivileged, which forced them to turn to polluted rivers as a water source (Bouguerra, 2006). The above illustrates how complex the issue of privatisation of the water resources is, as well as the complexity of the ramifications of increased water prices.

Against the backdrop, WC/WDM aims to ensure the provision of access to water resources to all the historically disadvantaged households on the premise that water conservation accommodates for meeting water demand. Thus the challenge for government is to provide equitable water provision to all citizens while dealing with pressure of water scarcity, climate change and an increasing demand for water and operation and maintenance cost of the existing and new water infrastructure. The critical challenge that the country faces is to successfully adopt the neoliberal ideologies within a historically disadvantaged country where Karl Polanyi's *"Economic Fallacy"* does not exist. This research will assess the implementation of the neoliberal ideologies, WC/WDM strategies coupled with the provision of free basic water within an informal settlement.

2.5 Conclusion

This chapter has introduced and described the political economy framework which is used to explain why WC/WDM exists. Political economy seeks to understand the ways of capturing political, economic, social and cultural worlds and to rationalise, justify and explain the notion of exchange value. The political economy approach believes that society should be controlled by the market forces and places emphasis on the "market" to solve problems of (re)distribution. The approach asserts that efficiency coupled with equitable distribution and conservation of the water resource can only occur if water is treated as a commodity and is sold at the full price of production. Sceptics of privatisation believe that although water is scarce, is a common good and should not be treated as an economic good. Case studies of Chile and England have revealed that it is very difficult to establish markets in water resources and that it is a problematic process to adopt and implement the concept of privatisation. In South Africa, the

apartheid era resulted in a large portion of South Africa's population being excluded from basic water services. The democratic government is faced with the dual task of meeting the growing demands for basic water while simultaneously conserving water. It also has the difficult task of balancing market mechanisms and state regulation within the neoliberal reform for water services to ensure growing demands are met.

Chapter Three
Literature Review

3.1 Introduction

This literature review will examine the main issues surrounding the factors that give rise to the need for water conservation and the availability and accessibility of the water conservation technologies/devices. The study within this review of literature focuses on Objective 1 and 2 as set out in Subsection 1.4 of the introductory chapter (the third and fourth objective will be met through the empirical data collection and analysis, while the final objective will be derived as a result of the findings from objectives 1, 2, 3 and 4.

By exploring the above areas of literature, a significant contribution will be made to this research. The factors that give rise to the need for water conservation will be evaluated. These factors include water scarcity, climate change, current global water consumption patterns, water service provision and payments for water services. In addition, water conservation devices which are available will be discussed. The barriers to water conservation identified by researchers will be evaluated, these include political, economic, social, technological, environmental and legal barriers. In effect, the value of studying the aforementioned literature areas will provide a meaningful discussion and analysis of water conservation in a structured way to facilitate a critical understanding of the factors that give rise to water conservation and identify what water conservation devices are available.

3.2 Factors resulting in the need for water conservation

3.2.1 Water scarcity

The concept of water scarcity is a highly contested issue. Water scarcity from a human perspective is defined as, *"the extent to which human needs for water, for both domestic and production purposes remain unfulfilled in terms of quantity and quality."* (Schreiner *et al.,* 2002: 128). The concept is best understood through the theoretical framework of political economy as discussed in Chapter Two. Water scarcity can be understood in a physical sense and well as an economic sense. In the physical sense, the volume of water globally is fixed as the earth is a closed system. The question then arise as to how water scarcity occurs in different

parts of the world and the reasons for it. There is no doubt that water scarcity is a man-induced phenomena, especially in South Africa, given the history of the country's water management. Geographically, water scarcity can be understood in the manner in which water is distributed as a result of the global hydrological cycle. The distribution of water also depends on the climatic conditions of the region.

Water is treated as a commodity and is therefore sold for a profit. Understanding water scarcity in an economic sense is best achieved by understanding the link between supply and demand. When the demand for water is high and the supply of water is low, water (the commodity) will be sold at a higher price. Therefore, basic economics illustrates that water scarcity is a human-induced phenomenon and a social relation and a means in which capitalism can function (Bouguerra, 2006). In addition, Anil Agarwal (cited in Bouguerra, 2006) states that water scarcity is fiction, and that it is the mismanagement of the water resource that brings about a "*scarcity.*"

Bouguerra (2006) alludes that twenty-three countries possess two thirds of the global water resources. This provides a clear indication that water is geographically and naturally unevenly distributed in the world. In addition, Rockstrom *et al.,* (2007) asserts that the problem lies not in a lack of water, but in the variability of water, the conservation of water and the lack of reduction in terms of water losses. Falkenmark (1989) emphasises the issues and strategies needed for socio-economic development in Africa. Although written 25 years ago, his strategies and recommendations are still valid today. He documented that most African countries lack the expertise and tools needed to address water scarcity, water conservation and water losses. Sceptical about the pricing of water, Falkenmark (1989) cautions that water pricing will only be successful in countries that do not experience water supply constraints, and will not be effective in developing countries where industries are being created which will consume large volumes of water.

His study focuses on the African continent and establishes that water is a medium term constraint to development in semi-arid areas and is a major concern (Falkenmark, 1989). He believes that a transfer of current techniques to meet water scarcity will not succeed and calls for the urgent need to develop indigenous knowledge regarding water usage and storage (Falkenmark, 1989). Although highlighting the need for action in the African continent with

regard to water scarcity issues, he fails to provide practical solutions that can be implemented to assist the continent. The research in his paper merely highlights that solutions are needed.

Sinha (2009) reiterates that water scarcity is a fact that needs to be accepted by all. In contrast to Falkenmark, however, Sinha (2009) insinuates that the phenomena of water scarcity will result in greater water use co-operation through treaties rather than the more popular belief in water wars. Understanding that water is controlled by economics and politics, she believes that strengthened treaties will be critical to ensure water security rather than water wars for control of water supply (Sinha, 2009). Her idealistic outlook is of the view that water treaties can assist in economic development while simultaneously creating a culture of preservation and conservation (Sinha, 2009).

Rijsberman (2009) sets out to prove that water will be a major constraint in the agricultural sector in the coming decade in the African continent and will require major institutional adjustments. Rijsberman (2009) bases his hypotheses on the evaluation and usage of various water scarcity indicators and believes that the Falkenmark Indicator is the most appropriate indicator for assessing water scarcity. Of critical note, is that Rijsberman's assessment is on a global scale, assessing both developed and developing countries and he identifies that water scarcity is not a domestic water use issue, but rather a food production issue. He concludes that increase in water productivity in agriculture is essential to ensure that food demands are met globally. However, his paper produces critical findings that water scarcity does not affect domestic water use, as his main focus is in global agricultural use. The researcher opposes the view of Rijsberman (2009) that domestic water use will not be affected by water scarcity. His paper overlooks the historical background of different countries that have shaped the current status quo of water provision within each country, rather he provides a global view of water scarcity. Within South Africa, the mismanagement of water has led to a shortage of water that is of acceptable standard for human consumption and use. The ramification of this mismanagement is the resultant competition for the water resource, water scarcity and the need for water conservation within both agricultural and water services sector. This research is focused on domestic water use within a specific community. Although domestic water use is a small fraction of the total water used globally as imbued by Rijsberman (2009), water conservation can accommodate more water demand and increased water productivity within the domestic water uses. An increase in water productivity can also produce benefits within the domestic sector and should also be explored.

3.2.2 Climate change

The most contemporary concern that geographers are focusing on is the concept of climate change. Climate change accompanied by economic development, water pollution, rainfall fluctuations, and global warming have affected the demand and pricing of the water resource (Figueres *et al.,* 2003). Climate change in South Africa has placed further stress on the limited resources as it poses a threat to the water supply in the existing geographically water scarce areas of the country: those that are already characterised by low rainfall and high evaporation rates (Kahinda *et al.*, 2010). The country's history coupled with climate change combine to pose additional challenges to the democratic government in their quest to provide all citizens with safe potable water, as climate change will affect the availability and requirements for water within the country (Kahinda *et al.*, 2010). Climate change will bring about an intensification of the hydrological cycle, with more intense droughts and flooding (Jackson *et al.,* 2001). South Africa is a semi-arid country with highly variable rainfall. Climate change has the potential to make a significant impact on the availability of water in South Africa, due to rising temperatures and increasing variability of rainfall. This will increase drought in some regions and floods in others (Swistock *et al.,* 2010). Climate change is predicted to further alter the amount and distribution of rainfall as well as evaporation rates and is expected to result in an overall decrease in rainfall of 5-10% (Swistock *et al.,* 2010). It is clear that water services and water service authorities need to take into account the potential effects of climate change on water resources and extreme weather events. In addition to the above mentioned impacts, climate change impacts on the sustainability of the freshwater resources, which in turn affects sustainable development, hinders economic growth, nullifies current poverty reduction strategies, food security and ecosystems (Kahinda *et al.*, 2010).

The social implications of climate change are numerous. Clark and Finley (2006) assert that the forces driving water conservation are the acknowledgment and acceptance of climate change and global warming. Their study revealed that household awareness regarding climate change is directly proportional to the implementation of water conservation measures (Clark and Finley, 2006). Randolph and Troy (2008) refute the view of Clarke and Finley (2006) as they claim that climate change has only a minimal impact on the water usage pattern of people, households and communities. Lam (2006) identified that the more a respondent was convinced that there will be a physical shortage of water in cases like a drought, the more likely they were

to be planning to retrofit their household water appliances. Swistock *et al.,* (2010) deduce that community water resource management is essential to safeguard problems associated with water services and water infrastructure and to address water provision for current and future needs.

There are several ramifications that climate change will have on ecosystem functioning as well as societal functioning with regard to water. It is therefore essential that water resource management strategies consider the impacts of climate change on the country's water resource so that solutions to safeguard the resource and to reduce the impacts of climate change on the resource are found.

3.2.3 Current global water consumption patterns

The purpose and uses of the water resources globally are numerous. Given the nature of use by different countries, water is perceived differently by all countries therefore making the benefits from water use very difficult to measure (Wallace *et al.,* 2009). In South Africa, it is quite clear that water is an important resource and there is a need to address the past discrimination of majority of the country's population in their access to it. Wallace *et al.,* (2009) found a trend that the agricultural sector's water needs are given preference over domestic water needs, which results in inadequate amounts of water being provided to for domestic uses. Wallace *et al's* (2009) premise is true in the case of South Africa, leaving the country with a difficult task striking a balance between two sectors, each with increasing demands for the water resource.

Blignaut *et al.,* (2009) conducted a unique study on water consumption within the agricultural sector. Conclusions of their study indicate that initiatives conducted within the agricultural sector will not decrease the demand for water by the sector, but rather increase the current demand. Water is essential for life and economic activities, however, due to the country's geographic location, water supply is limited, unevenly distributed, and negatively impacted by both changes in climate and the prevalence and spread of invasive alien plant species (Cullis *et al.,* 2007; Blignaut *et al.,* 2009). Blignaut *et al's.,* (2009) study echoes that macro-economic planning and economic development strategies need to include natural resource constraints, impact of climate change and alien invasive species.

It is evident that the increasing demand for the water resource and the limited supply is creating an unsustainable scenario and echoes the need for water conservation. This premise is recognised by Department of Water Affairs (2004) who stated that, given the demographic trends, South Africa is likely to experience a water deficit of approximately 1.7% by 2025 (Blignaut *et al.,* 2009). The country cannot sustain a growing water demand given the supply constraints that the country faces, in addition to the impacts on climate change and water provision to all citizens.

Climate change, coupled with invasive alien plants, is likely to reduce the current water supply within the country. It is estimated that alien invasive plants could utilise approximately 16% of the country's water supply if left unattended (Blignaut *et al.,* 2009). Given the above, it is evident that the available amount of water for utilisation is declining rapidly, entrenching water scarcity, globally and especially within South Africa.

Wallace *et al.,* (2009) identifies a trend in the provision of water. They identify that water management strategies/ decisions are based on a term called *"returns of investment."* They highlight that economic and political considerations are often given priority and the distribution of water resources is often skewed towards examining the economic return on the capital invested (Wallace *et al.,* 2009). The problem within domestic water uses (water services) is the variables to consider when measuring the return of investment. Measuring water use within the water services sector needs to consider the value of good health, lower child mortality rates and an improved standard of living, which are all associated with clean domestic water provision and which cannot be quantified economically.

Many authors (including Rijsberman & Molden, 2001; Wallace & Gregory, 2002) have also acknowledged the importance of understanding the linkages between the physical water system, the ecosystems it supports, and the social systems that depend on and manage the water resources. Wallace *et al.,* (2009) assert that there is a complete lack of understanding of the need for an ecological reserve for aquatic systems and suggests that catchment-based Integrated Water Resource Management (IWRM) offers a framework for the holistic management of water. IWRM aims to ensure a better understanding of water needs by all spheres, and focuses on water use efficiency.

In summary water use trends are as follows:

1) Agricultural water use takes preference over that of domestic water use.

2) A new management strategy is required to ensure water security in the face of the effects of climate change and alien invasive species.

3) Awareness of climate change and the need to conserve water is imperative to ensure successful water conservation.

4) Water is managed in a way which concerns itself with a return on investment and is dominated by politics and economics.

5) Domestic water use benefits cannot be quantified economically as there are too many variables to consider.

6) There is a global lack of understanding regarding ecological reserves and care for the environment.

7) There is a need for society to understand that water, the environment and society are interdependent on each other and cannot be viewed in isolation.

8) IWRM is viewed as a new strategy to manage water sustainably.

3.3 Water services in South Africa

The current water resources problems facing South Africa can only be understood through the lens of history. The apartheid years (1948-1994), driven by the motive of racial segregation, has shaped the country's access to and development of the water resources (Naidoo and Constantinides, 2009). Naidoo and Constantinides (2009) provide a descriptive background of water use within South Africa, confirming that policies within the apartheid era were skewed towards the privatisation of water for commercial agriculture, a sector that was dominated by the white South Africans, who owned 83% of the country's arable land and used more than 54% of the country's available water. Stein (2005) supports this view as he adds that during the apartheid era water was allocated on racial grounds: distribution was linked to access to land. In addition, the social engineering of apartheid resulted in expensive inter-basin transfer schemes as major industries were located away from the major rivers (Naidoo and Constantinides, 2009). The most visible and noticeable consequence of apartheid was the differential domestic services based on race system, resulting in reasonable water infrastructure

being implemented in former white suburbs and a complete lack of water infrastructure in black townships (Naidoo and Constantinides, 2009).

This gave the post-1994 democratic government the mammoth task of providing 12 to 14 million people with access to safe water and over 20 million people with access to adequate sanitation (those who were deprived during the apartheid era) (Stein, 2005). The birth of democracy within South Africa resulted in the drafting and implementation of the Water Services Act (Act 107 of 1998) which informs all decision making around treated water and the National Water Act (Act 36 of 1998) (Naidoo and Constantinides, 2009). These Acts have provided the platform for managing water within the country as they state that the Minister of Water Affairs is the custodian of all waters and water resources on behalf of the countries (Stein, 2005). The National Water Act (Act 36 of 1998) has had a significant impact on the way in which water is managed in the country by adoption of a public rights system to water allocation rather than the former private rights system and has resulted in the dismantling of water ownership and water rights (Stein, 2005; Naidoo and Constantinides, 2009). In addition, the laws call for all citizens to embrace the new paradigm of water conservation and water demand management as this concept is viewed as key driver for water use efficiency. Department of Water Affairs and Forestry predicts that South Africa will be classified as a *"water stressed"* country by 2025, making the implementation of water conservation imperative (Stein, 2005; Naidoo and Constantinides, 2009).

To ensure equality to all South African citizens with respect to water provision, the country's demand for water needs to be reviewed with social, economic and environmental factors being taken into consideration. The NWA (Act 36 of 1998) shifts the view of water management from the former supply side management to demand management (Stein, 2005). The democratic government finds itself in the undesirable position of the country becoming increasingly water scarce, with growing water demands exceeding the existing supply levels (Pott *et al.,* 2009). This has resulted in the implementation of WC/WDM, as this paradigm ensures that water resources and the environment are sustainable while simultaneously ensuring the rise of social development within the country (Naidoo and Constantinides, 2009).

3.4 Water conservation and water demand management

The South African National Water Policy (1997) and the NWA (Act 36 of 1998) are instituted on the democratic government's vision of a society in which all citizens have the opportunity to lead a healthy lifestyle and participate in economic activity (Department of Water Affairs, 2004). Provision of water to all citizens is thus a critical factor within this vision to ensure social and economic transformation as well as development. The wounds of apartheid have left the Department of Water Affairs with the task of ensuring that equity, sustainability and efficiency are taken into consideration in the management of the water resources. This has led to the formation of IWRM. IWRM is defined by the Department of Water Affairs (2004: 10) as, *"a process which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."* The purpose of IWRM is therefore to enable DWAF to meet the needs of the people for water, jobs and economic growth in a manner that ensures environmental consideration and protection (Department of Water Affairs, 2004). The National Water Resource Strategy (NWRS) is the blueprint to ensure that DWAF achieves IWRM within the country (Department of Water Affairs, 2004). The NWRS informs the manner in which the water resources will be protected, used, developed, conserved, managed and controlled in accordance with the laws (Department of Water Affairs, 2004).

The NWA (Act 36 of 1998) has implemented radical changes in the management of the water resource within the country and the NWRS emphasises water conservation and measures to promote greater water use efficiency (Department of Water Affairs, 2004). The NWRS comprises five (5) chapters and are listed below:

Chapter 1: Water policy, water law and water resource management
Chapter 2: South Africa's water situation
Chapter 3: Strategies for water resource management
Chapter 4: Complementary strategies
Chapter 5: National planning and co-ordination, and international co-operation in water management.

Chapter 3 of the NWRS focuses on the WC/WDM strategy. WC/WDM relates to the efficient and effective use of water and to the minimisation of loss of water and wastage of water resources (Department of Water Affairs, 2004). The intention of WC/WDM is to shift the focus from the water service authority to the consumer with the purpose of ensuring economic efficiency to meet the task of sustainable and affordable water services (Naidoo and Constantinides, 2009). The WC/WDM strategy comprises three components, the water services strategy, the agricultural sector strategy and the industry, mining and power generation strategy. This research is focussed solely on water services as the research is concerned with water access and provision and conservation within an informal settlement. Pott *et al.,* (2009) highlight the importance of WC/WDM in the context of South Africa. They state that WC/WDM strategies are grounded in three fundamental principles, which include:

1) Water institutions should aim to supply water in an efficient and effective manner by minimizing water losses and promoting WC/WDM to their consumers;
2) Water users should promote the efficient use of water; and
3) WC /WDM should be considered part of the planning processes for water resources, water supply and water services.

Domestic water services have been perceived as less important to agricultural water services/provision in the realm of water management within South Africa as it comprises less than 15% of the total water resources is used by all sectors (Department of Water Affairs, 2004). Although empirically, the sector is perceived as reasonably small, it should be taken into consideration that the country is a developing country and will definitely experience an increase in population which will be directly proportional on the demand of water. In addition, Naidoo and Constantinides (2009) have indicated that negative growth patterns in the agriculture and mining sectors are becoming visible and therefore special attention needs to be given to water services. Coupled with the above, the domestic sector is faced with the mammoth task of addressing the service delivery backlogs inherited from the apartheid years, which will further increase the demand for water.

The Water Services sector allows for the successful implementation of WC/WDM as a result of the increased and projected increase of water demand within the sector. Section 3 of the Water Services Act (Act 107 of 1998), provides for all households to receive a free allocation of 6000 litres (6 kilolitres) of safe reliable water per month (Kidd, 2008). The challenge is that

the majority of the country's population cannot enjoy this right, especially in the rural areas as a result of the country's history. The water services sector can be divided into four components: the former white areas, the former urban black townships, the peri-urban areas (informal settlements) and the rural areas. This research is focused on the peri-urban areas, using the Mpolweni informal settlement as a unit of analysis. Rural-urban migration has resulted in a ballooning of informal settlements in urban areas. The current initiative to replace informal settlements with low cost housing schemes, is an initiative to ensure that the appropriate water services are provided (Department of Water Affairs, 2004). The challenge is to ensure that such services and water infrastructure are of an acceptable standard, to prevent water leaks and other forms of water wastage. A key solution to this problem is consumer awareness education regarding water conservation and water conservation techniques and devices. The WC/WDM strategy has eight (8) objectives to ensure that successful implementation of the strategy. The objectives are tabulated below:

Objectives	Description of objectives
Objective 1	To facilitate and ensure the role of WC/WDM in achieving sustainable, efficient and affordable management of water resources and water services.
Objective 2	To contribute to the protection of the environment, ecology and water resources.
Objective 3	To create a culture of WC/WDM within all water management and water services institutions.
Objective 4	To create a culture of WC/WDM for all consumers and users.
Objective 5	To support water management and water services institutions to implement WC/WDM.
Objective 6	To promote the allocation of adequate capacity and resources by water institutions for WC/WDM.
Objective 7	To enable water management and water services institutions to adopt integrated planning.
Objective 8	To promote international co-operation and participate with other Southern African countries, particularly basin-sharing countries, in developing joint WC/WDM strategies.

Table 3.1: Objectives of the WC/WDM Strategy (adopted from Department of Water Affairs, 2004).

This research is focused on consumer awareness with regard to water conservation and is therefore concerned with objective 4 of the WC/WDM Strategy. This research is specifically focused on water conservation awareness by existing consumers and not by the awareness of new users. To achieve Objective 4, DWAF has created 7 priorities that will ensure that the objective is met, as detailed in Table 3.2 below:

Priority	Activity
1	Develop an appropriate and ongoing marketing, communication and education programme.
2	Implement water tariffs that promote social equity and promote efficient use of water.
3	Ensure the payment of water services by all consumers.
4	Identify, prioritise and implement WC/WDM measures.
5	Reduce unauthorised connections.
6	Assess the departmental water usage by Water Service Authority and establish, achieve and maintain appropriate demand targets.
7	Prohibit and penalise the wasteful use of water by consumers and users.

Table 3.2: Description of activities for Objective 3 (adopted from Department of Water Affairs, 2004).

(Promote the efficient use of water to consumers and customers)

Although all priorities are interrelated, this research is specifically focused on priorities 1-4 for Objective 4. The researcher is aiming to assess the perceptions of water conservation of the informal settlement dwellers and also to assess their knowledge regarding the need for water conservation, water conservation devices and water availability, which are in line with the researcher objectives. Assessment of the perceptions will indirectly assess if all the priorities are achieved.

3.5 Water conservation devices available for water conservation

Fresh water as a natural resource is vital to ensure the sustenance of life and ecosystems, and therefore there is a growing effort to ensure that the resource is managed sustainably (Gilbertson *et al.,* 2011). Coupled with the above, access to safe water is a fundamental human need and a basic human right (Mathipa and Le Roux, 2009). The main reasoning behind water conservation globally, is that only half a percent of all the water on earth is fresh water that is accessible to humans for water needs (Swistock *et al.,* 2010). Regardless of the source, water availability is limited and is within a continuous state of flux (Swistock *et al.,* 2010).

Water conservation is defined by the Department of Water Affairs (2004: 4), as the *"minimisation of loss of water, the care and protection of water resources and the efficient and effective use of water."* This definition is very broad that allows for many initiates and methods to ensure that water conservation is met. Water conservation is viewed as a mechanism for resolving the global water supply problem (Gilbertson *et al.,* 2011). However, the successful implementation of the concept of water conservation is dependent to a large extent on the support and behavioural change of the public (Gilbertson *et al.,* 2011). Gilbertson *et al.,* (2011) also highlight that the public generally support water conservation measures, however, they highlight the lack of literature regarding the dependence of water conservation attitudes and behaviour on geographical locations and the water situation at specific locations.

This dissertation looks at water conservation within a settlement with specific focus on awareness regarding water conservation devices that are available. It should be noted that there are various devices that are available for water conservation, however, given the case study (informal settlement) not all devices can be applicable as these devices are costly. It is estimated by the Department of Water Affairs (2004) that, by replacing existing plumbing fittings with more efficient fittings (dual flush toilets, user active urinals, low flush shower heads and tap controllers), household water consumption can be reduced by an average of 40%.

Swistock *et al.,* (2010) identifies the growing concern of community-level water conservation programmes that focus on reducing the demand for and wastage of water. Swistock *et al.,* (2010) provides a list of strategies that can be used to ensure that water is conserved and include the following:

• Public education programmes.

• Refit programmes (installing water-saving devices in older buildings).

• Water-rate-structure revisions.

• Distribution-system water loss reduction.

In essence this research study is focussed on the lack of literature regarding water conservation attitudes and behaviours that has been highlighted by Gilbertson *et al.,* (2011). It will look at water conservation attitudes and people's behaviour towards water within an informal settlement that is provided with free water. This research assesses the implementation and success of public education programmes and retro fitting programmes. Water conservation awareness programmes are increasingly implemented around the world with the intention of reducing household water consumption by encouraging the adoption of water saving devices and/or changing the behaviour towards the water resources (Clark and Finley, 2008). Water rate structures will be discussed later on in the chapter within the subsection payments for services. Water saving devices are an inexpensive and long term solution to water conservation and help to eliminate water wastage. These devices are inexpensive, easy to install and are effective in reducing water use (Swistock *et al.,* 2010). The devices that are important to this research are water efficient toilets, showerheads and taps as these form part of the water service infrastructure within the Mpolweni settlement discussed in detail in Chapter 4.

3.5.1 Dual flush toilets

Toilet replacement initiatives comprises the installation of water saving toilet models, the detection and repair of water infrastructure and installation of devices compatible with old toilets to reduce water use. The replacement toilets are designed to have a dual flush, which allows for the disposal of solid or liquid waste separately and/or together (Swistock *et al.,* 2010). Dual flush toilets provide the user with two options, one for disposing of liquid and the other for solid wastes. Reducing the volume of water used to flush a toilet can result in large water savings. Swistock *et al.,* (2010) provide three ways in which the toilet flush water volumes may be reduced, which are dependent on the age and suitability of the existing cistern. The first way is to fit a retrofit device to convert the existing cistern to dual flush, the second is to fit a cistern displacement device in the existing cistern to reduce the volume of water it holds. An alternative to the both options is to replace the toilet and install a new dual flush

toilet. The use of dual flush and low flush volume toilets, has seen a significant decrease in the volume of water used by households and a significant reduction in the use of water and consequently lower water bills (Babooram and Hurst, n.d).

3.5.2 Water efficient showerheads

The type of showerhead used in a household has a major impact on the amount of water consumed in that household. The low flow showerhead is a water saving device that should be used in showers to ensure minimum usage of water during showers. Water efficient showerheads also decrease the volume of water used per minute during a shower. Babooram and Hurst, (n.d) reveal that a standard showerhead uses 17 litres of water per minute, while a low-flow showerhead uses 10 litres of water per minute. Even more efficient than a low flow shower head is an aerated showerhead. The aerated showerhead uses less water, to deliver the same water flow as normal shower. However, the aerated showerheads need a pressure of at least one bar to function correctly (Broas, 2003).

3.5.3 Recycling of waste water and conservative water usage

There are also opportunities to install recycling systems at the household level. Grey water systems collect wastewater from baths, showers, and clothes and reuses the water to provide water for flushing toilets or watering the garden (Tsinde Development Consultants, 2002). This approach will benefit the poor as grey water systems do not require any costly complicated equipment. Household activities such as such as placing a water bottle in the toilet tank so that the toilet uses less water to flush, watering the home garden in the early morning or evening, rather than the middle of the day to reduce water evaporation, closing the tap while washing dishes to reduce water wastage, and using the washing machine only when a full load of laundry has accumulated will assist in conserving water (Middlestadt *et al.,* 2001). Espineira and Valinas (2013) confirm that there has been increasing focus on water conservation in the home, by practicing habits such as turning off the tap when brushing one's teeth or waiting until there is a full load before using a washing machine or dishwasher.

According to Babooram and Hurst (n.d), society has adapted to the existing water resource constraints by implementing water conservation, through the use of water efficient

technologies which enable society to maintain the standard of living they currently experience while reducing the environmental impact (Babooram and Hurst, n.d). Babooram and Hurst's, (n.d) study highlights the following trends with regard to water usage and perceptions:

1) Home owners are more likely than renters (tenants) to use water saving devices in their homes.
2) Households with a high income are more likely to adopt water conservation technologies.
3) There is a direct proportional link between education and water conservation adoption by households.
4) Households that are well established are more likely to conserve water.
5) The higher the education levels in a household, the lower the chance of that household adopting rainwater harvesting.
6) Metered households have a higher chance of conserving water by using water conservation devices.
7) Where municipal water costs are not based on the volume of water used, there may be less incentive to conserve water.

3.5.4 Rainwater harvesting

Climate change has a significant impact on the hydrological cycle as well as the existing limited water resources (Kahinda *et al.*, 2010). The effects of climate change coupled with the semi-arid climate conditions of South Africa means that adaption measures need to be explored and implemented to ensure the supply of water (Kahinda *et al.*, 2010). One specific measure to minimise the effects of climate change is the concept of rain water harvesting. This method is not very common in urban areas. However, if adopted, this practice will save large amounts of money and, more importantly, save water. This technique involves the collection of rainwater from many buildings that have large roof areas (Broas, 2003). Kahinda *et al.*, (2010) describes rainwater harvesting as the collection of run off that is stored in a variety of ways to prevent evaporation and increase water supply. Ngigi (2003) adds to this description, adding that rainwater harvesting involves the collection and concentration of runoff for productive purposes and domestic water supply and incorporates diverting, collecting, concentration, storing and managing run off. Water is normally channelled and stored in a water tank,

commonly referred to as a JoJo® tank. Buckle *et al.,* (2002) asserts that rainwater harvesting provides many benefits such as providing a source of water in areas where alternative sources may not be available, reducing municipal water consumption, reducing energy and chemical costs, and reducing storm water runoff. Kahinda *et al.,* (2010) supports this view by confirming that this concept is viewed as an additional water source and serves as a cushion against the impacts of drought in rural areas located in unfavourable geographical and topographical conditions. Kahinda *et al.,* (2010) provides a concise summary of the advantages and disadvantages of rain water harvesting as tabulated below:

Advantages	Disadvantages
Water provision for small scale productive activities.	Implementation costs.
Saves time as provides additional water source.	Training for construction.
Lessens effect of water related diseases.	Operation and maintenance.
Improved sanitation.	Loss of revenue for the water service provider.
Increased food security.	
Improved health.	

Table 3.3: Advantages and disadvantages of rain water harvesting (adopted from Kahinda *et al.,* 2010).

Rainwater harvesting is seen as the solution to provide water to rural and peri-urban communities where conventional technologies cannot (Kahinda *et al.,* 2007). Ngigi (2003) suggests that rainwater harvesting can address spatial and temporal water scarcity in semi-arid environments. According to Kahinda *et al.,* (2007) South Africa is using rainwater harvesting as a tool, in the quest to attain the 7th Millennium Development Goal, by providing financial assistance (storage tanks and related costs) to poor households. The 7th Millennium Development Goal (MDG) target is, by 2015, to halve the proportion of people without sustainable access to safe drinking water and basic sanitation (MDG 7, Target 1), and to provide the first six kilolitres of water consumed monthly free to poor households (Kahinda *et al.,* 2007). Kahinda *et al.,* (2010) mentions that there are limitations to rainwater harvesting with the major limitations being the physical limits (climate conditions of the region) and financial constraints to implement and install a rainwater harvesting system.

3.5.5 Water efficient taps

Taps are the most commonly used water devices in both the urban and rural areas. If taps are designed to prevent wastage of water than there will be huge volumes of water saved. Broas (2003) informs that taps are probably the most commonly used water fitting device but are generally chosen on cost or aesthetic preference. Aerator controlled taps like the aerator shower are designed to use less water and this is a successful water saving device (Broas, 2003). The effect of the aerator/flow controller is to mix air with the water to increase its bulk, whilst reducing the flow to a level which normally would probably be unacceptable to most users (Broas, 2003). However, the wetting effect is increased by the aeration to the extent that it may be even better than when using a standard tap (Broas, 2003).

3.6 Payment for water services

Given the water scarcity problems experienced globally and the paradigm of political economy of water, payment for water services is a critical component in the pursuit of water conservation. The sustainability of water services is directly proportional to revenue generation as maintaining and developing new water infrastructure are very expensive. Continuous payment for water services is essential for maintaining and functioning of a water supply system. What is interesting, however, is that South Africa's history has resulted in the implementation of the free basic water policy, and has therefore made the topic (payment for water services) highly contested. Tariff structures are used as an urban resource management tool to provide efficient, effective and sustainable management of water services (Renwick and Green, 1999).

The aim of water tariffs are to recover the costs that are associated with the provision of water, the operation and maintenance of and investment in water infrastructure (Hosque and Wichelns, 2013). The concept of payment for services (stemming from the political economy framework) has been discussed within Chapter 2 of this thesis, the theoretical framework. As part of the customer demand management measure within WC/WDM, a rising block tariff structure has been implemented by Umgeni Water, the water service authority within eThekwini Municipality.

As the name suggests, the rising block-rate tariff is a structure in which there is an increase in the rate of payment for consumption above a certain level. The rising block-rate tariff is the most commonly adopted tariff globally. This tariff provides a free basic amount of water for all citizens. Thereafter the charges are directly proportional to the volume of water used (Hosque and Wichelns, 2013). Narsiah (2010) provides a detailed illustration of the rising block tariff that eThekwini municipality has implemented. The first block of water is given free and charges increase in each consequent block on an incremental scale. The first block is known as a *"lifeline tariff"* consists of the free basic water amount of six kilolitres (6000 litres) (Narsiah, 2010). Though the lifeline tariff seems to be the opposite of the WC/WDM measures, its introduction has witnessed a decrease in water demand in a number of communities as the poor now have a reason to manage their water usage to ensure that it remains below the free 6 kilolitres per month (Naidoo and Constantinides, 2009; Swistock *et al.,*2010).

A user that uses between six to twelve kilolitres fall within the second block, with a fixed charge, and usage of water greater than twelve kilolitres fall within the third block with a higher fixed charge (Narsiah, 2010). The downfall noted with this structure is that when a user consumes more than six kilolitres of water, a fixed charge equivalent to the six kilolitres of free water is charged in the second block, acting as a cross subsidisation mechanism (Narsiah, 2010). However, this means that consumers who use more than six kilolitres of water, do not in fact receive their free basic water which is a right in South Africa as they pay for it in the second tariff block which is charged at a higher price. This raises issues of equity, as consumers who use more water than the allocated amount have to pay for the total amount of water that they have used which goes against the free basic water policy in South African legislation. Sceptics of this tariff structure indicate that the increasing block-rate tariff is not an equitable structure as households with more than four people are at a disadvantage regardless of their social standing (Hosque and Wichelns, 2013).

3.7 Barriers to water conservation

Ward *et al.,* (2007) examines the barriers to water conservation in the Rio Grande basin, in America. He identifies the challenges and opportunities in promoting water conservation and emphasised the importance of water trading for beneficial water use to remove the barriers of water conservation (Ward *et al.,* 2007). Although focussed on the agricultural sector, his work

advances the understanding of the barriers to water conservation by providing a concise summary of them. Although his study is within a developed country and is context specific, valuable information can be extracted from his study and can assist in preventing the same or similar barriers within South Africa for both domestic and agricultural sectors. Clark and Finley, (2008) supplements Ward *et al.,* (2007) findings through their examination of the obstacles and opportunities for household water conservation in Blagoevgrad, Bulgaria. Their results indicate a general lack of understanding and knowledge regarding water saving devices and practices among residents as a major barrier, despite most residents having a positive attitude towards water conservation and the adoption of water saving practices.

The table below shows in a summarized form, the barriers to water conservation into the following categories: political, economic, social, technological, environmental and law. It is important to understand that all barriers are interrelated and cannot be seen in isolation. The section below will briefly explain each type of barrier.

Type of barrier	Description
Political	• Interstate treaties • Land tenure
Economic	• Price of water
Social	• Conservation attitudes • Water rights • Water conservation awareness
Technological	• Illusory water savings
Environmental	• Ecological reserve
Law	• Water transfer restrictions • Insecure rights to conserve water

Table 3.4: Barriers to water conservation (adopted from Ward *et al.,* 2007)

3.7.1 Political barriers

The rapid growth in population coupled with the increase in demand by all sectors for water will further exaggerate the competition for the water resources (Ward *et al.,* 2007). The increased demand for water has resulted in a change in the management of water resources through the development and implementation of legislation and the encouragement of private investment into the water sector with the intention of promoting water conservation (Ward *et al.,* 2007). De Loe *et al.,* (2001) revealed that financial constraints, lack of political will and lack of buy-in by the public all have a negative effect on municipal conservation programmes. Ward *et al.,* (2007) also identified that policy that allows irrigators to carry over the volume of water that they have not used in one year to the next year encourages water conservation. In South Africa, the Bill of Rights guarantees every South African the right of access to sufficient water (Stein, 2005). As a result of the country's history, as discussed previously, those with political power face the mammoth task of ensuring that equality is achieved for all South African citizens with respect to water provision, while ensuring economic growth and environmental protection. The National Water Act shifts the view of water management from the former supply side management style to one of demand management (Stein, 2005).

3.7.2 Economic barriers

Economic factors are twofold. The first is the cost of water and the second is the cost of water saving devices. Ward *et al.,* (2007) identify that the price of water is directly proportional to water conservation. If the price is high then water conservation is high, and if the price is low, then water conservation is low. Mulwafu *et al.,* (2003) supplement this view with their case study in Malawi which identifies the same trend. Economic factors play a crucial role in water provision and water scarcity as water is treated as a commodity (as discussed in Chapter 2). The "*right*" price for water is the price that ensures that there is no wastage or over usage of the water resource. Graymore and Wallis's (2010) analysis of water pricing indicates that where water prices are high, water usage is low, while they found that pricing structures that include a free allowance can lead to water wastage.

Moore and Negri (1992) discovered that a reduction in water supply and/or the increase in water prices in the agricultural sector will increase the food prices. Jenkins and Lund (2000)

suggested that the cost associated with water shortages can be reduced by expanding water infrastructure. Yang *et al.,* (2003) found that the increase in water prices was unsuccessful in generating a drive for water conservation and that water pricing reform in isolation would not be successful in the promotion of water conservation. Exponential growth in domestic and agricultural demands of water is applying pressure on governments to provide cost effective measures for the promotion of water conservation and increased water use efficiency in both agriculture and the domestic sectors (Ward *et al.,* 2007).

With regard to water saving devices, Clark and Finley (2008) highlight that barriers to adopting water conservation include a lack of finance as people perceive water conservation devices as a luxury and not a necessity. In addition, they found that water conservation is viewed passively rather than actively as a result of inadequate water conservation education programmes, as most households in their study had a lack of understanding of how and why they should be conserving water in their homes. Roseth's (2006) finding was that that many people viewed water-saving devices as too expensive. The cost hinders people's ability to conserve water overall, despite a willingness to conserve. Swistock (*et al.,* 2010*)* indicate that these devices are inexpensive, easy to install and are effective in reducing water use.

3.7.3 Social barriers

The social buy-in to water conservation is a critical component when measuring the success of water conservation. Negative attitudes toward reduced water use can represent a major barrier to water conservation (Ward *et al.,* 2007). Antwood *et al.,* (2007) acknowledge that there has been little research on residents' perceptions of water conservation measures and their satisfaction with them. Clark and Finley's (2008) study reveal that there is a general lack of research on public attitudes and perceptions of water resource management, as the majority of the water literature focuses on water supply issues with a focus on engineering, infrastructure, and economic aspects.

Assessing the social buy-in is within the scope of Objective 3 of this research, although focused on the domestic sector and not the agricultural sector's attitudes towards water conservation, is of critical importance. Transforming negative water conservation attitudes and behaviours into positive ones can reduce the shortage of water availability to a growing demand. In

essence, the social barrier is the main barrier to the successful implantation of water conservation. Gilbertson *et al.,* (2011) expose that gaps in current knowledge of water conservation attitudes and behaviours, specifically with regard to the impact that different geographical locations have on community attitudes and behaviours. A large volume of research has been conducted on public attitudes and behaviours relating to water conservation and water restrictions, however, there has been a lack of research that specifically focuses on identifying the differences in water conservation behaviours and attitudes between geographical locations (Gilbertson *et al.,* 2011). This research aims to fill the gap that exists, which is to identify the informal settlement residents' attitude and behaviour towards water conservation.

Middlestadt *et al.,* (2001) admits that behavioural change is possible over a short period of time provided the correct training is given to the public and is essential to ensure conservation of natural resources (in this case water). Graymore and Wallis, (2010) highlight that many approaches, such as water restrictions, information campaigns, pricing structures and retrofitting, have been adopted globally to reduce water consumption. All of these have had mixed successes. Espineira and Valinas, (2013) found that water scarcity can be better understood through household adoption and adaption of water-saving devices. Their research asserts that educational awareness programmes regarding water conservation has a positive influence in improving the adoption of water saving devices (Espineira and Valinas, 2013). Wright *et al.,* (2012) suggest that communication about water quality and quantity is crucial to promote water services in the country. He adds that access to newspapers, radio, and television is important and should be used as a means to ensure that information and knowledge is distributed with regard to water conservation (Wright *et al.,* 2012). Graymore and Wallis, (2010) reveal that the adoption of water conservation devices is influenced and constrained by many situational and personal factors such as the lack of knowledge, resistance to learning new knowledge, environmental values and attitudes, lack of incentives, economic factors.

The implementation of information campaigns is a highly debated topic. Espineira and Valinas, (2013) mention that existing literature is equivocal regarding education. In order for water conservation education to be fully understood and implemented, society needs to understand the nature of water shortages, the water saving technologies that are available and the social buy-in that all households can conserve water (Espineira and Valinas, 2013). With the above mentioned statement, the premise is that better-educated households will be more likely to

conserve water. However, Lam's (2006) study reveals that education levels have no impact on the behavioural intention to conserve water and that other socio-economic factors need to be considered. Graymore and Wallis, (2010) highlight the need for research on people's water usage patterns, adoption of water saving devices and barriers to the usage of water saving devices in rural and regional areas. They assert that an effective water demand management strategy takes into consideration the situational factors, personal factors, perceptions of water abundance, source of water supply and the trust in the water service authority as influences on a person's need to save water (Graymore and Wallis, 2010).

They have been many water conservation programmes that have been conducted globally, all with their specific purpose, but overall the general focus is to reduce domestic water consumption by promoting the adoption of water saving devices and introducing behavioural change towards the water resource. Mathipa and Le Roux (2009) highlight that one of the main limitations in managing water demand is the absence of well-structured water conservation education and training programmes. Graymore and Wallis, (2010) assert that information campaigns have short term results and impacts on water saving (impacts tend to last as long as the publicity). However, Clark and Finley (2008) state that a water conservation programme is dependent on successfully educating water users to minimise the amount of water they use.

Graymore and Wallis, (2010) suggest that community-based social marketing (CBSM) is a method that can be used to develop behaviour change strategies based on behaviour theory. They add that for the use of CBSM to reduce water demand, the understanding of the community's water use practices and perceptions is essential in determining the drivers and barriers of water saving behaviour (Graymore and Wallis, 2010). Clark and Finley, (2008) stress the importance of ongoing water conservation programmes to ensure that sustainable water conservation habits are created and to reinforce a positive attitude towards water conservation.

Graymore and Wallis (2010) make an interesting analysis that for information campaigns to be successful, people need to believe that behavioural change is necessary and that their change will have an impact. Graymore and Wallis, (2010) confirms that the barriers preventing water conservation are the availability of water resources, the attitude of the water service authority, the public trust in water authorities, knowledge of ways to save water, cost of devices and retrofitting, water usage practices. Espineira and Valinas, (2013) add that the main barriers to

the adoption of water conservation behaviours are the perception of the inconvenience, impracticality and the costs associated with purchasing water-saving equipment.

3.7.4 Technological barriers

Although technological devices are available, Roma *et al.,* (2010) highlight that user's feedback to water saving technologies have received scarce attention. Their study investigates the use of water saving sanitation technologies and users' experience thereof, and indicates that user training is of critical importance to ensure the maintenance, functionality and satisfaction (Roma *et al.,* 2010). Peterson and Ding (2005) found that the availability of water-saving irrigation systems does not guarantee the promotion of water conservation in irrigated agriculture because the price of water is a variable that determines the promotion of water conservation. Ward *et al.,* (2007) mentions that agricultural producers view water efficient technology as a push factor towards adopting more technically efficient irrigation which will yield higher net incomes through increased crop yields. It is evident that a clear understanding of water saving technologies is essential to ensure the success of the water saving devices.

3.7.5 Environmental barriers

The Rio Grande study illustrates the barriers faced by arid regions in which the water resource is currently over-allocated and is experiencing a growing demand coupled with the effects of climate change (Ward *et al.,* 2007). Graymore and Wallis, (2010) add that drought is one of the major factors resulting in the reduction of water consumption and the need to conserve the water resource. These factors, along with the need for water policies that are sustainable, have resulted in water managers focusing on water management alternatives that encourage, promote, and reward water conservation. The impacts of climate change have been discussed in Section 3.2 above. Clark and Finley, (2008) suggest the development of new water sources or the reduction in water demand by all communities in order to address water shortages. They confirm that the first option is difficult as a result of political, economic and environmental barriers making conservation the option to reduce water demand (Clark and Finley, 2008).

3.7.6 Legal barriers

Ward *et al.,* (2007) outline the legal barriers to water conservation. These include the lack of clear titles to water rights, barriers to water transfers, on-farm water savings that fail to save water for the basin, and barriers to securing rights to conserved water (Ward *et al.,* 2007). Other barriers include the ease with which greater ground water use can be substituted for reduced surface water, water's uncertain duty, the common property nature of carry-over storage, interstate compact constraints, and water's low price, all of which can effectively lock water into low-valued agriculture(Ward *et al.,* 2007).

3.8 Conclusion

The study of relevant literature related to water resources is a complex and continuously changing landscape. To begin with, water cannot be viewed in isolation. Although there are many drivers for water conservation, including increasing water scarcity, the impacts of climate change, and the current global water consumption patterns that affect water availability, there are also political, economic, social, technological, environmental and legal barriers to the successful implementation of water conservation. The main barrier is the social barrier as there is a clear lack of understanding by society at large about the need for water conservation, and the manner in which they conserve water (the how and why of water conservation). The historical use of water within the country has been discussed as well as the current water use trends. Water resource literature places emphasis on the agricultural sector as they are the country's main water users. Alien invasive species and impacts on climate change will present further problems in the management of the water recourse. The literature confirms that awareness and education on climate change and water conservation is imperative to ensure the successful implementation of water conservation. The review of literature has stressed the need for water conservation to be implemented with the emphasis on the need for water consumers/users to become independent and responsible in the water conservation practices and water usage.

To accommodate this new paradigm the Department of Water Affairs has provided objectives as well as priorities to achieve these objectives which provide a bench mark for measuring the success of water conservation. The main support mechanism for this research is Objective 4 of

the WC/WDM strategy. Within Objective 4 the research is focused on the priorities 1-4 that are developed to promote the efficient use of the water resource by consumers. The literature review has identified that educational campaigns provided mixed success and confirms the need for more focus to be placed on educating society, not only on the need for water conservation, but also on how to practically conserve water. With regard to tariff structure, the literature has highlighted that this priority is a highly contested topic and that government's free basic water policy aims to achieve social equity and promote efficient water use. Although the informal settlement does not pay for water, the literature review highlights that cost recovery is the manner in which the municipality collects revenue for the provision of water to the informal settlements. With regard to Objective 4, the literature review identifies the WC/WDM measures that can be implemented by the informal settlement, namely duel flush toilets, water efficient showerheads, recycling of waste water and conservative water usage, rainwater harvesting and water efficient taps.

Chapter Four
Study Area and Research Methodology

4.1 Introduction

This research methodology chapter will provide details of all research methodologies, techniques and approaches that have informed this study. This chapter consists of information based on the research strategy that was adopted, the means of collecting data for analysis, including site and sample selection, and the approach that was used for analysis. Specifically, the sub-sections of this chapter include the aim of the research; the objectives of the research; the unit of analysis; the research design; data collection; sampling techniques; and data analysis. In addition, the reader will be directed towards the thorny issue of potential limitations and problems with the chosen research strategy and its implementation. An informative background on the relevant research concepts, methods and techniques is provided in every section.

4.2 Aim of the research

To assess the perceptions of water conservation among informal settlement dwellers within the Mpolweni settlement, Reservoir Hills, Durban.

4.3 Unit of analysis (Case study area)

Located within the eThekwini metropolitan municipality, The Mpolweni informal settlement is located at the end of Pemary Road, Reservoir Hills, Durban, South Africa. With the geographic co-ordinates of 29°47' 30.07" South and 30°56' 38.27" East, the settlement comprises approximately one hundred and forty-five (145) households, and is home to approximately four hundred (400) people. There are many important aspects that make this settlement a unique unit of analysis. Firstly, the Mpolweni settlement is located within an urban area and receives free unmetered water from Umgeni Water, the water service authority within eThekwini Metropolitan municipality. Secondly, the level of service surrounding the Mpolweni settlement consists of tapped water at household level which is approximately 6m away from the settlement. It is important to question whether or not residents of an informal

settlement that is located within an urban area are aware that water is a scarce resource and are aware of the need for water conservation. The existing water infrastructure within the settlement are:

1) 2x communal standpipes
2) 1x ablution block

At the time of this research (the year 2014) the following infrastructure is currently being constructed and is still work in progress:

1) 1 x ablution block
2) 2 x communal standpipes

Figure 4.1 illustrates the case study area (Mpolweni settlement) as well as the existing water reticulation network for the area.

4.4 Research design

A research design is a general orientation to conduct social research. It is the strategy and framework by which the collection and analysis of empirical data is conducted (Bryman, 2004; Coldwell and Herbst, 2004). There are five commonly used qualitative research designs, namely, ethnography, phenomenological study, grounded theory, content analysis and case study (Leedy and Ormrod, 2010). For the purposes of this study, a case study design has been used.

Ethnography as a research design is not appropriate for this research work as it is associated with the investigation of the everyday behaviours of the people in the group with the purpose of identifying the cultural norms, beliefs, social structures, and other cultural patterns (Bryman, 2004; Leedy and Ormrod, 2010; McNeill and Chapman, 2005). A phenomenological study has some appeal as it attempts to understand people's perceptions, perspectives, and understandings of a particular situation, making generalisations of what a phenomenon is like from an insider's perspective (King and Horrocks, 2010; Leedy and Ormrod, 2010). However, this research is not solely focused on insider's (informal dwellers) perspectives of a phenomenon, but also includes focus group discussions with the informal settlement's committee members.

Grounded theory is focused on a process related to a particular topic, with the ultimate goal of developing a theory about that process (Leedy and Ormrod, 2010; Neuman, 2011). Since the aim of this research is not to develop a theory, but rather to identify the informal settlement dwellers' perceptions of WC/WDM and to identify possible solutions/problems that are experienced within the settlement with regards to the successful implementation of WC/WDM, this theory is inappropriate for this research.

As a research design, content analysis is inappropriate as the strategy serves the purpose of identifying specific characteristics of a body of material through forms of human communication (Leedy and Ormrod, 2010). The case study design allows the researcher to gather widespread data on an individual(s), programme(s), or event(s) on which the research is focused (Leedy and Ormrod, 2010). The researcher includes the details about the context surrounding the case, and or the physical environment and historical, economic, and social

factors that have an influence on the situation/ phenomena (Leedy and Ormrod, 2010; Coldwell and Herbst, 2004; Saunders *et al.,* 2003). The case study design is most appropriate for this study.

Given the nature of this research (an in-depth study of a contemporary phenomenon (water conservation) in a complex environment (Mpolweni informal settlement), where a variety of stakeholder perspectives are sought (committee members and informal dwellers) and where the underlying research philosophy is based on an interpretative understanding of the world) a strategy that meets the needs of the research is a case study. Coupled with the number of inter-related objectives within this study, the case study approach is best suited to facilitate an in-depth study of contemporary issues that promotes focus, and supports the idea of obtaining different stakeholders' perspectives to gain a deeper understanding of water conservation within a complex setting. Coldwell and Herbst (2004) argue that the case study approach emphasises the full contextual analysis of events or conditions and their inter-relations. A case study approach facilitates the researcher's drive to probe deeply into the informal settlement dwellers' understanding of and attitude towards water and water conservation by devoting time to and concentrating on specific aspects of water usage and conservation within one informal settlement. As mentioned above, a case study is a strategy for doing research which involves the investigation of a specific contemporary phenomenon within its real life setting using multiple sources of evidence (Saunders *et al.,* 2003). The case study provides the focus that is required and is based on a contemporary phenomenon within a real life context that can only be understood through social construction and interactions.

This research will compare the literature review findings with the empirical data of the case study. Saunders *et al.,* (2003) believe that the case study approach meets that objective because a case study approach allows the researcher to gain a rich understanding of the context of the research and is therefore the most suitable method of exploring existing theory and also provide a source of a new hypothesis. Although the output of this research is not to set a new hypotheses, it is nevertheless worthwhile in that existing theory (from the literature review) will be compared against the behaviour of the informal settlement dwellers within the Mpolweni settlement and, as a result, an improved understanding and not a new hypothesis will be developed to assist the government in their quest to address the water backlogs through the implementation of WC/WDM in South Africa.

A case study is not without its critics and limitations. The researcher is aware that the research design's major weakness is that, especially when only a single case is involved, findings cannot be generalised to other situations (Leedy and Ormrod, 2010) and is hence context-specific. The researcher is aware that there are many informal settlements within Kwa-Zulu Natal, however, by attempting to reveal what is happening in one particular setting, the aim is to contribute to the knowledge of WC/WDM. The findings of a case study of WC/WDM, regardless of the informal settlement, can be of use and interest to those who will be implementing WC/WDM nationwide. The contribution of this research work to the discourse on WC/WDM will be developed from a synthesis of the case study analysis and the findings of the literature review.

4.5 Data collection

Data collection methods are an integral part of a research design (Sekaran and Bougie, 2009). There are several data collection methods, each with its own advantages and disadvantage. Both qualitative and quantitative methods were used to obtain data. The qualitative tool used in this research was focus groups. The quantitative tool was the administration of questionnaires. Ethical issues were taken into consideration during the data collection process. Consent was given by the committee members prior to the administration of the questionnaires and focus group discussions to perform research within the settlement. In addition, consent was provided by all the individual to whom questionnaires were administered to as well as those individuals who were involved in the focus group discussion. To ensure that participants fully understood the content within the consent form, the consent form was translated into IsiZulu, the home language for the informal settlement dwellers (Appendix1). To ensure confidentiality, names have been omitted from all documents and field notes. The study has received ethical clearance from the Higher Degrees Committee of the University of Kwa-Zulu Natal (Appendix 4).

4.5.1 Sources of data

There are two types of data sources that exist, namely primary sources and secondary sources (Sekaran and Bougie, 2009). Primary data refers to information obtained first hand by the researcher for the specific purpose of the study (Sekaran and Bougie, 2009). For purposes of this research primary data were obtained from focus groups and questionnaires. Secondary data

refers to information gathered from sources that already exist (literature review). The primary sources was obtained via the data collection instruments used in this research, namely focus groups and questionnaires. Secondary data (from sources such as academic journals, papers and reports) has been presented in Chapter 3, the literature review.

4.5.2 Data collection instruments

4.5.2.1 Questionnaires

A questionnaire is a data collection instrument that comprises a pre-determined set of questions to which respondents (informal settlement dwellers) record their answers, within a set of defined alternatives (Sekaran and Bougie, 2009). Questionnaires are viewed as efficient in terms of data collection, especially when the researcher knows exactly what is required and how to measure the variables of interest (Sekaran and Bougie, 2009). In this research, questionnaires (Appendix 3) were administered personally to the heads of fifty (50) out of the one hundred and forty-five (145) households within the Mpolweni settlement. The questionnaires aimed to assess their awareness levels and thoughts regarding water saving technologies. The distribution of the questionnaires was done through the use of non-probability quota sampling. The questionnaires consisted of open- and closed-ended questions and were concerned with information regarding household profile, the affordability of water and water saving technology and awareness.

Open-ended questions allow the respondent to answer a question in any way they desire to (Sekaran and Bougie, 2009; Neuman, 2011). In contrast, a closed-ended question asks the respondents to choose an answer from several alternatives presented to them (Sekaran and Bougie, 2009; Neuman, 2011). Both types of questions have their advantages and disadvantages. The majority of the questions within the questionnaire are closed-ended questions, as it allowed the respondent to make a quick choice among the several alternatives before them, hence saving time. Given the setting (in this case the Mpolweni informal settlement) literacy levels were expected to be low, and therefore closed-ended questions would mean that the respondents would not be disadvantaged in anyway, as the responses can assist in clarifying the question's meaning (Neuman, 2011). In addition, closed-ended questions also help the researcher to code the information easily for subsequent analysis (Sekaran and Bougie,

2009). Open-ended questions have been included as these questions can help the researcher discover unanticipated findings and reveal the respondent's logic, thinking process and frame of reference (Neuman, 2011).

4.5.2.2 Focus groups

The focus group technique allows the researcher to develop an understanding of why people feel the way they do and allows people to probe each other's reasons for their particular view. These possibilities mean that focus groups may be very helpful in obtaining a wide variety of different views in relation to a particular issue (informal settlement committee members' views regarding WC/WDM (Bryman, 2004). Focus groups consist typically of eight to ten members (informal settlement committee members with a moderator (the researcher) leading the discussions for about two hours on a particular concept (WC/WDM awareness) (Sekaran and Bougie, 2009). Members are generally chosen on the basis of their expertise on the topic in which information is sought (Sekaran and Bougie, 2009). It is for this reason that ten out of the fifteen informal settlement's committee members were chosen, as they represented a *"management/leadership function."* King and Horrocks (2010) mention that one-to-one interviews have certain advantages but emphasise the advantages of group interviews, adding that they can open up an opportunity to obtain in-depth opinions or attitudes and that the data from these discussions can reveal the social and cultural contexts of people's understandings and beliefs. A dictaphone was used to record all responses in the focus groups to ensure that no data is omitted by the researcher.

The use of focus group discussion is appropriate for in depth discussion with a variety of important stakeholders within a focused framework (committee members' perceptions of WC/WDM, including barriers for WC/WDM). To help focus the participant discussions in terms of reflecting the main objectives of this research and to ease the analysis of the qualitative data, the focus group discussions will be structured according to themes through the use of a focus group schedule (Appendix 2). These themes reflect the overall aims and objectives of this research and echo the main areas arising from the review of literature. Within focus group discussion members were encouraged to talk and respond to each other rather than to the facilitator, thus allowing people to explore their own attitudes and experiences in their own words (McNeill and Chapman, 2005). The advantages of this is that the members are

comfortable in a natural setting, thus allowing themselves to express their opinions or ideas freely (Neuman, 2009). Morgan (1997, cited in King and Horrocks, 2010) maintains that focus groups are useful when investigating what participants think, and are important in identifying why participants think as they do. A moderator may unknowingly limit open, free expression of group members. The recordings of the focus group discussion will be stored on the premises of the University of Kwa-Zulu Natal, as per arrangements with the researcher's supervisor.

4.6 Sampling techniques

A sample is a subset of the population that a researcher selects from a large pool and generalises to the entire population (Wagner *et al.,* 2012; Neuman, 2011). The type of research that a researcher is conducting influences the type of sampling that is used. Quantitative research commonly uses probability sampling. Probability sampling aims to ensure that a sample representative is created. Within a probability sampling strategy, the researcher attempts to create an accurate representative sample that has mathematically predictable errors and includes a random process in which everyone in the population has an equal and independent chance of being included in the sample (Neuman, 2011; Laher and Botha, 2012). In contrast, qualitative research commonly uses non-probability sampling. Non probability sampling is a non-random sampling process, where people are included in the sample because they are available and willing to participate in the study (Laher and Botha, 2012). The difference in sampling approaches is determined by the intent of the research study. Quantitative studies focus more on creating samples that can be a generalisation of the entire population, whereas, qualitative studies focus on selecting cases and treating them as carriers of aspects/features of the social world and to provide insight and understanding about larger process, relationships and social scene (Neuman, 2011). This research is qualitative in nature (perceptions of informal dwellers of WC/WDM), although it has elements of quantitative research, and therefore makes use of non-probability sampling.

Non-probability sampling consists of four sampling strategies that can be used. These are namely, convenience sampling, quota sampling, snowball sampling and purposive sampling (Neuman, 2011; Laher and Botha 2012). This research will make use of two out of the four sampling strategies, namely, quota sampling and purposive sampling.

Quota sampling was used for questionnaires, whereas purpose sampling was used for the focus group. As mentioned above, the Mpolweni settlement population consists of one hundred and forty-five households of which, fifty households were administered with questionnaires. The settlement's committee comprises a total of fifteen members of whom ten were involved in the focus group. As its name suggests, quota sampling is a sample strategy used to obtain a quota of a category that one is sampling to ensure that one captures diversity among the units (Neuman, 2011). One first determines how many cases one needs to get for each category and this provides the quota. Wagner *et al.,* (2013) summarises the necessity of this type of sampling by stating that it becomes essential when a subset of the population is underrepresented within an organisation. This type of sampling also has its flaws in that this approach only captures a few aspects of all population diversity, the fixed number of cases is not an accurate reflection of the total population and that convenience sampling is used for the selection of each quota category (Neuman, 2011).

Believed by many to be one of the most useful type of non-probability sampling, purposive sampling allows the researcher to rely on his/her own experience to find the participants in such a manner that they can be considered to be a representative of the population (Laher and Botha, 2012). Purposive sampling is defined as "*a non-random sample in which the researcher uses a wide range of methods to locate all possible cases of a highly specific and difficult to reach population.*" (Neuman, 2011: 267). This sampling method selects cases with a specific purpose in mind (WC/WDM awareness within informal settlements) and is an appropriate sampling method to select unique cases that are especially informative.

For the qualitative aspects of the research non-probability purposive sampling was used for the focus groups, as mentioned earlier. The specific purpose of the focus groups is to obtain information from the informal committee members regarding WC/WDM and future plans of the settlement in terms of water and water provision. For the quantitative aspect of the research, non-probability quota sampling was used for the administration of questionnaires. Quota sampling was used because the research will be analysing information from the committee members' as well as the informal dwellers' perspective. Quota sampling ensured that under representation of the informal settlement dwellers did not occur, and will therefore provide a well-represented set of data as the data sources will be committee members and informal settlement dwellers, providing a holistic view/response from the Mpolweni settlement.

4.7 Data analysis

4.7.1 Quantitative data analysis

Data analysis for the quantitative aspects of this research was executed through the use of Statistical Package for Social Science (SPSS). SPSS is a data management and analysis program designed to perform statistical data analysis, including descriptive statistics such as plots, frequencies, charts and lists (Sekaran and Bougie, 2009). SPSS was used as a data analysis tool to analyse data obtained by the questionnaire.

4.7.2 Qualitative data analysis

Thematic analysis is a general approach to analysing qualitative data that involves identifying themes or patterns in the data (Wagner *et al.,* 2003). The approach involves the identification of themes and patterns of the data. With this respect, the data gathered from the focus groups were coded into themes and patterns. These patterns and themes were recognised and interpreted from the data, and this forms the basis for analysis (Wagner *et al.,* 2003). Themes where chosen according to their relevance to the research questions of this study. Some of the themes that were identified during thematic analysis included: water scarcity, water conservation, water usage, water saving devices, water conservation awareness. The results from SPSS and thematic analysis were compared and integrated with each other as well as the information gathered from the literature review.

4.8 Limitations

The results of this research cannot be generalised to the wider research community as there are numerous variables that differ between individual informal settlements within South Africa and globally. As a result of the researcher's use of a non-probability sampling design, the findings from the study of the sample cannot be confidently generalised to the whole population, as also reiterated by Wagner *et al.,* (2003). The manner in which the questions are formulated can also result in inaccurate responses as majority of the people within the informal settlement are illiterate. A Focus group was conducted with a group of ten people at the informal settlement. This may have affected the openness of responses due to other committee

members being part of the focus group. The focus group was conducted after working hours. This may have influenced the quality, the length and even the interest that participants may have had in responding as they might have been answering as quickly and briefly as possible due to time constraints.

4.9 Conclusion
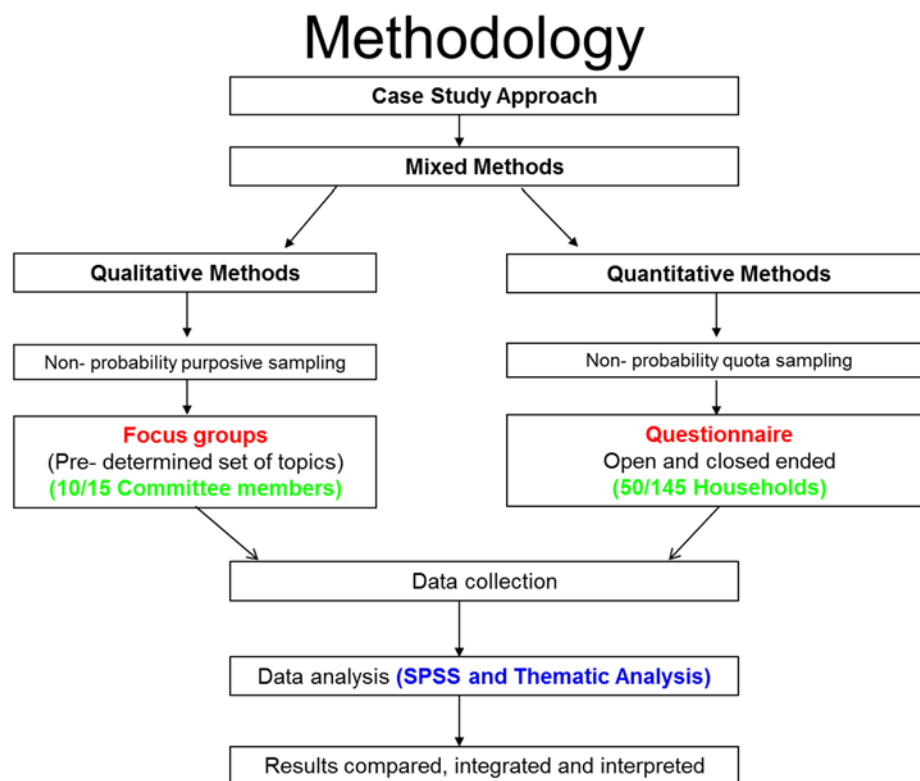
Figure 4.2: Summary of research methodology

Since this research study involved the settlement as a unit of analysis, a case study approach had been used to conduct this research study. Mixed methods have been used to obtain data. Mixed methods involve the collection and analysis of both qualitative and quantitative data on a single study. For the qualitative methods, non-probability purposive sampling was used and the data collection instrument was a focus group. A focus group schedule, with a predetermined set of topics was used during the focus group discussion with ten out of the fifteen committee members. Data analysis was carried out via thematic analysis and the data was compared, integrated and interpreted. For the quantitative methods, non-probability quota sampling was used for the administration of fifty questionnaires to fifty out of the one hundred and forty-five

households. The questionnaire consisted of both open and closed-ended questions. Since the population is large, this instrument will allow for quick data retrieval. Data analysis was done via the use of SPSS and the data was compared, integrated and interpreted.

Chapter Five

Data Analysis and Discussion

5.1 Introduction

This chapter reveals the results of the case study described in Chapter Four, the research methodology. The chapter concentrates on two groups of stakeholders: the informal settlement dwellers of the Mpolweni settlement and the committee members of the Mpolweni settlements who are the custodians of the water resource infrastructure within the settlement and who are influential with regard to the implementation and practice of water conservation and its awareness within the settlement. This case study is approached in a structured way. First, a description of the results is provided about the households that are within the informal settlement, followed by water usage and water conservation awareness. Prior to the description and analysis of the findings, aspects resulting in the need for water conservation will be made to set the study in context. It should be appreciated that municipalities are very complex organisations and that this research is not an attempt to explain water services and water conservation, nor to describe fully its operations and culture, but merely to place the study into context.

The South African history has been discussed in detail prior to this chapter. As documented, the legacy of apartheid has had detrimental impacts on access to basic services for the majority of the country's citizens, resulting in material and socio-economic inequalities and leaving approximately 12-14 million people with a lack of access to formal water supply (Albertyn, 2011; Earle *et al.*, 2005). The change in government from an authoritarian state to a democratic state has seen an increase in rural to urban migration as many people from previously disadvantaged areas, have migrated to urban cities in search of economic gains and a better standard of living. The volume of people that are participating in the rural-urban migration has resulted in the development of informal settlements around the urban areas. These informal settlements place additional stress on the water services authorities in the provision of safe potable water to these settlements as part of abiding to the country's Bill of Rights.

5.2 Case study results; Quantitative: Description, Analysis and Synthesis

The quantitative results will be discussed and analysed in two sub sections, the household profile as well as water usage and water conservation awareness. It is of critical importance that one understands the household profiles of the settlement as this will provide an in-depth understanding of the water patterns that have been discovered. Household profile is directly linked to the water usage patterns and demands and discovering this profile will enhance the understanding of the settlements water needs and usage.

5.2.1 Household profile

5.2.1.1 Access to safe drinking water

Figure 5.1 Access to safe potable water
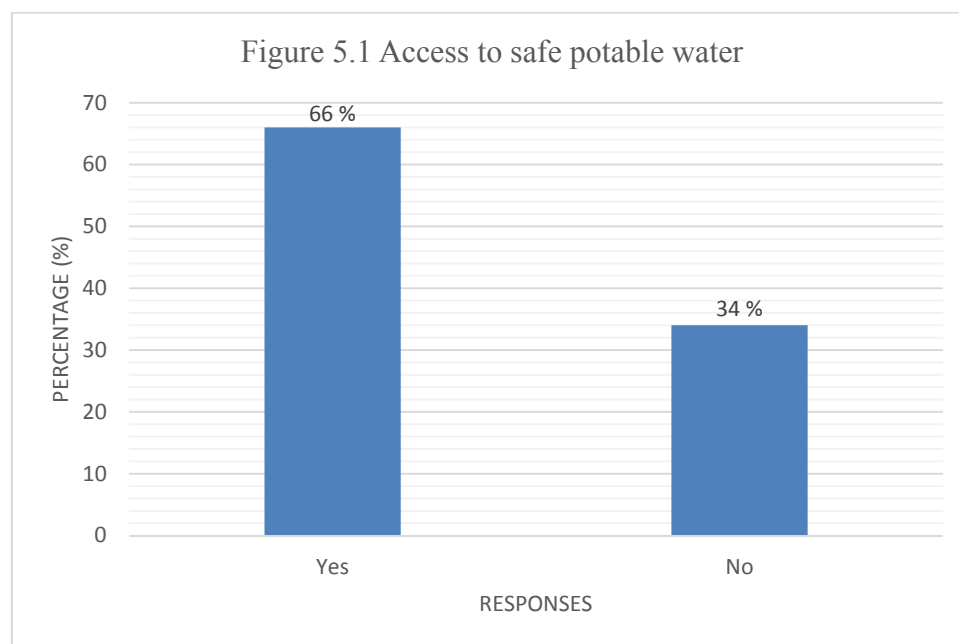
The Mpolweni settlement has two communal standpipes as indicated in Chapter 4 and depicted in Figure 4.1. Surprisingly, when the settlement dwellers were asked if they have access to safe potable water, 66% of the dwellers confirmed that they have access to safe drinking water, while 34% of the dwellers informed that they do not have access to clean safe drinking water, as illustrated by Figure 5.1. The reason for one third of the population suggesting that they do not have access to safe potable water could be a result of the interpretation of the question, as the question was asked under the heading household profile. A possible reason could be that the settlement dwellers could have interpreted the question as meaning they have access to safe

potable water within each household and not generally which was the purpose of the question as the researcher was fully aware that the entire settlement is serviced by the two standpipes mentioned above. The settlement receives water from two communal standpipes, which illustrates that the government is in line with the country's Bill of Rights and section 27 of the NWA which state that '*everyone has the right to access to sufficient water*' (Department of Water Affairs, 2000: 21). As a result of the social standing by the inhabitants of the settlement, the householders do not pay for water services.

5.2.1.2 Level of service

When questioned about the level of service that the dwellers are exposed to, 66% of the dwellers informed that they obtain water from a communal standpipe, 26% mentioned that they obtain rain water from a roof tank and 8% mentioned that they receive water from a full pressure system as illustrated by Figure 5.2.

Figure 5.2 Level of service
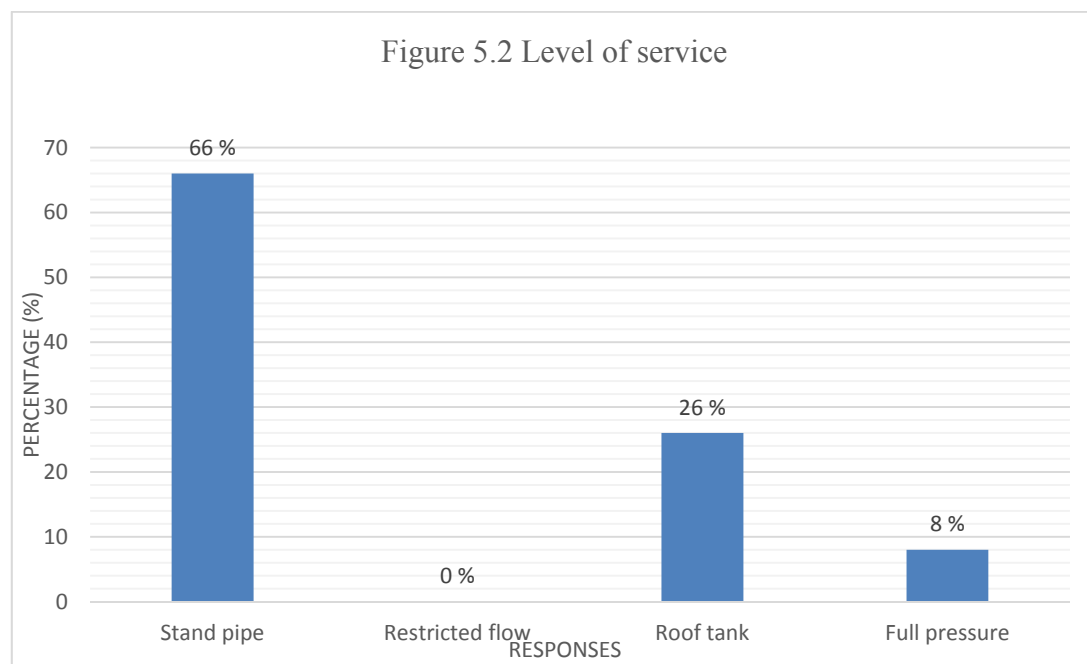
The empirical findings suggest that not all the householders rely on the two standpipes for their water supply. Just over a quarter of the population use roof tanks as a water source or as a secondary water source. This clearly illustrates that water conservation is occurring within the settlement. This finding supports the views of Buckle *et al.,* (2002) and Kahinda *et al.,* (2010) which state that rainwater harvesting provides benefits to households and can be regarded as

an additional water source. The settlement is not serviced by a full pressure water reticulation system. The fact that 8% of the population informed that the level of service with regard to water provision is through a full pressure water reticulation system indicates that there is a lack of understanding regarding the difference between a communal standpipe and a full pressure system. This illustrates the lack of awareness regarding the infrastructure type within the settlement. The findings are supported by Mathipa and Le Roux, (2009) who state that one of the major constraints in managing water demand is the lack of a well-structured education and training programmes.

5.2.1.3 Household size and use of water

Question 3 of the questionnaire was *"What does you daily usage of water comprise?"*
All respondents mentioned domestic water usages such as water for drinking, cooking, washing clothes and dishes, bathing and sanitation purposes. In addition, to domestic water uses, 24 % of the population mentioned they use water for irrigation purposes. As stated above, household water usage is directly proportional to the number of residents per household. Figure 5.3 illustrates the number of residents per household within the Mpolweni settlement.

Figure 5.3 Household size
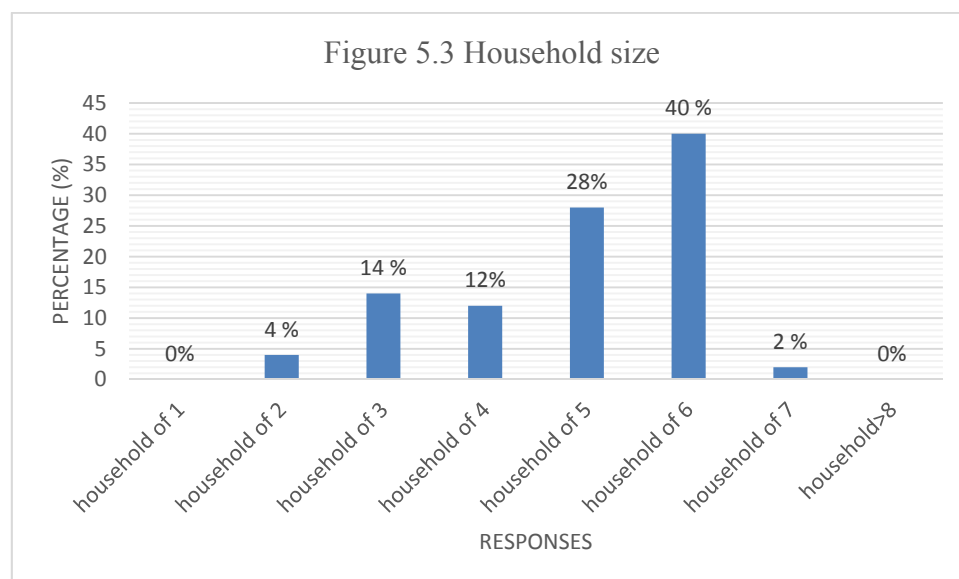
The graph illustrates that 40% of the settlement consists of households that contain a family of six people, 28% contain a family of five people, 14% contain a family of three people, 12% contain a family of four people, 4% contain a family of two people and 2% contain a family of seven people. From the empirical data one can deduce that 70% of households within the

settlement comprise of more than four people per household. This clearly illustrates that the basic free water amount of 25 litres per person per day is not adequate for this settlement, as this amount is based on an average of 4 people per household (Kidd, 2008).

5.2.1.4 Education levels

The adoption and implementation of water conservation is dependent to a large extent on people's awareness regarding the current status of the water resource. Although there are many mediums in which society can be made aware of water conservation, education level is a major variable that need to be considered for ensuring the understanding, awareness and successful implementation of water conservation.

Figure 5.4 Education Levels within the settlement

A bar chart titled "Figure 5.4 Education Levels within the settlement" with y-axis labelled PERCENTAGE (%) ranging from 0 to 40, and x-axis labelled RESPONSES. Values: no schooling 0%, some primary schooling 14%, complete primary schooling 32%, some secondary schooling 34%, complete secondary schooling 2%, higher than secondary schooling 18%.
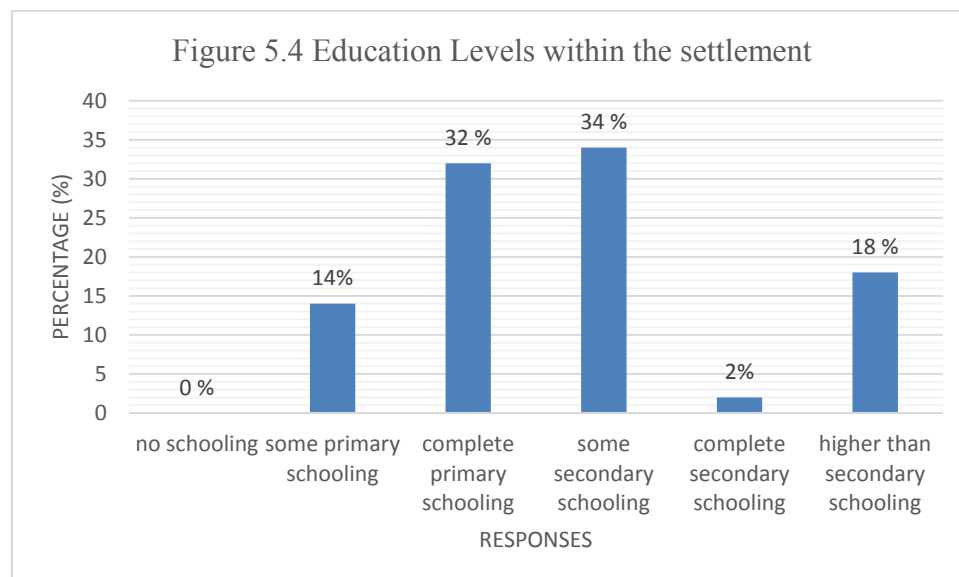
Figure 5.4 illustrates that only one fifth (20%) of the population has completed secondary school. Of these only 18% have studied further than secondary school. Only 34% of the population has done some secondary schooling. A total of 32% have completed primary school and 14% of the population have begun but not completed primary school. The empirical findings indicate that 80% of the population has not completed secondary schooling. This has major ramifications on the successful implementation of water conservation. Without basic education, it will be difficult to fully understand the concept of water conservation, the importance of the water resource and the need for its conservation. It is essential that schools focus on teaching learners about water conservation and the importance of the water resources so that the message of water conservation is taken home, resulting in the settlement population

gaining an understanding of the concept and ensuring that water conservation is successfully implemented. Espineira and Valinas (2013), assert that educational awareness programmes regarding water conservation have a positive influence on improving the adoption of water saving devices. Wright *et al.,* (2012) suggest that communication is crucial to promote water conservation in the country. He adds that access to newspapers, radio, and television is important as a means to ensure that information and knowledge is distributed with regard to water conservation (Wright *et al.,* 2012). With the above mentioned statement, the premise is that, better educated households will be more likely to conserve water. However, Lam's (2006) study reveals that education level has no impact on behavioural intention to conserve water and other socio- economic factors need to be considered.

5.2.1.5 Household income per month

Figure 5.5 Combined household income per month
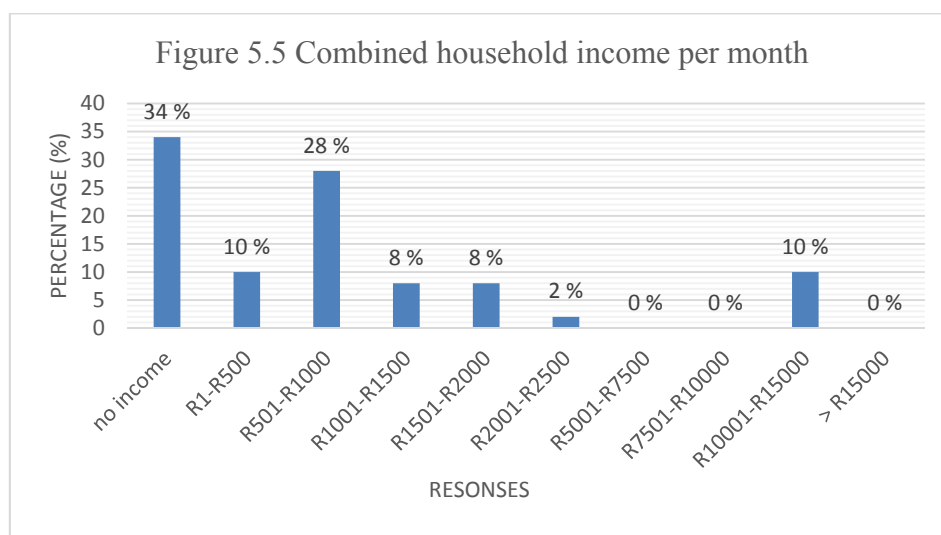
The financial bracket of households also influences the perceptions of the water resource at a similar rate to that of education levels. Figure 5.5 highlights that 34% of the households within the Mpolweni settlement receive no income and that 90% of the households earn less than R2500 per month. Graymore and Wallis's (2010) analysis of water pricing indicates that where water prices are high, water usage is low, while they indicate that pricing structures that include a free allowance can lead to water wastage. It should be noted that although the income levels of the settlement are low, the settlement does not pay for water and water infrastructure maintenance, making this case study is unique.

5.2.1.6 Satisfaction with water services

When questioned about water service satisfaction, 84% of the population are satisfied with the current water services by the water service authority as depicted in Figure 5.6. The graph indicates that 16% of the population are not satisfied with the current level of service.

Figure 5.6 Satisfaction with water services
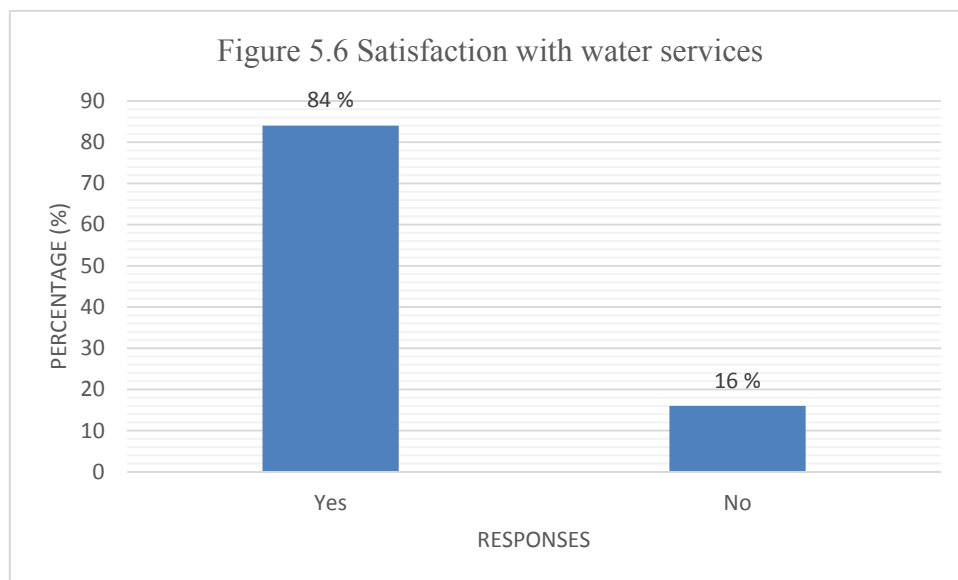
Those who were satisfied added that they are satisfied with the water services they receive because it is free and they can fulfil all their requirements with the amount of water they are given. Coupled with the above, they mention that the water is clean and safe for human consumption. Those that who were not satisfied added that the standpipes are far from their houses and they therefore have to walk a distance to get to the standpipe. The reasons for dissatisfaction is not in any way related to the provision of water, but rather easier access in terms of distance to standpipes. This further suggests that the results for Figure 5.1 can be a result of the respondents misunderstanding the question as data illustrates that they have access to water.

From the household profile the following can be deduced:

1) Thirty four percent of the households perceive that the communal standpipes do not provide the settlement with safe potable water. The researcher is of the firm belief that the question was misinterpreted in terms of context (could have been perceived as water availability *within* the household and not the settlement).

2) Roof tank (rain water harvesting) is an important source of water to 26% of the households.

3) The main water uses within the settlement for domestic use and comprise of drinking, cooking, washing, bathing and sanitation purposes.

4) Seventy percent of the households have more than four people residing in them. This makes the limit of 6 kilolitres per month per household invalid as this figure is based on a household of 4 people (Kidd, 2008).

5) Education levels within the settlement are very low with 80% of the population not having completed secondary school.

6) Ninety percent of the households within the settlement earn less than R2500 per month.

7) Eighty four percent of the settlement is satisfied with the water services.

5.2.2 Water usage and water conservation awareness

The platform created by the empirical data, regarding household profiles of the Mpolweni settlement, will provide clarity and understanding with regard to water usage and water conservation awareness within the settlement. An open-ended question was included in the questionnaire which is as follows:

What is your understanding of water conservation?

The general response was "*to save water.*" Eighteen percent mentioned that water conservation refers to the preservation, control and development of water resources, both surface and ground water and the prevention of water pollution. Forty-two percent of the population did not answer the question, indicating that the respondents did not understand the question. Forty percent mentioned that water conservation means saving water. The results support the view of Lam (2006) who mentions that education level has no impact on behavioural intention to conserve water and other socio- economic factors need to be considered. The empirical findings indicate

low education levels (80 % of the population not completing secondary school), however the questionnaire yielded results that are similar to that of Lam (2006) as 60 % of the population have a general understanding of water conservation. Water conservation is defined by the Department of Water Affairs (2004: 4), as the *"minimisation of loss of water, the care and protection of water resources and the efficient and effective use of water."*

5.2.2.1 Awareness regarding free basic water amount

Figure 5.7 Awareness regarding free basic water amount
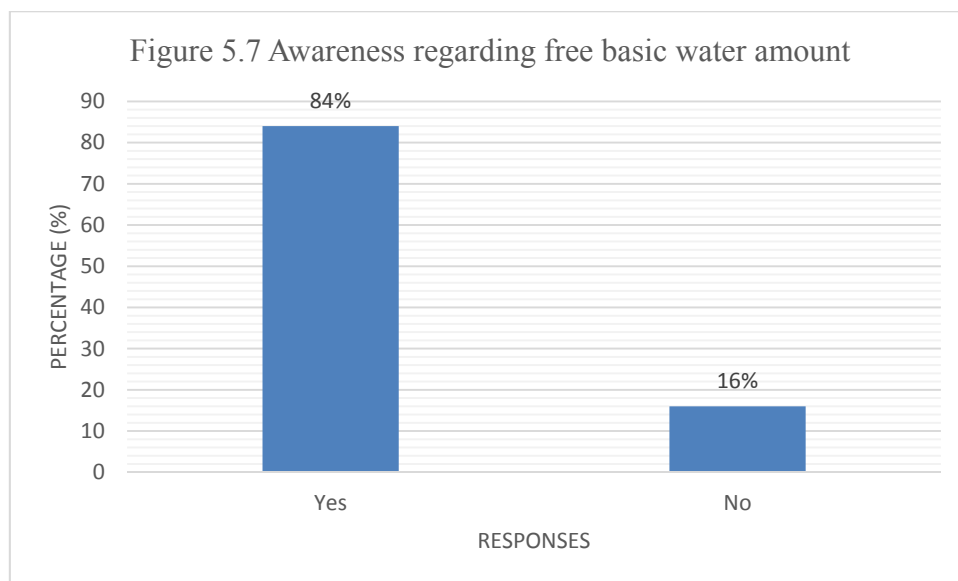
When questioned about awareness regarding government's policy of free basic water, 84% of the settlement were aware of this policy while 16% of the population were not aware. Since the settlement receives free water, a possible reason for lack of awareness regarding free basic water policy by the minority, could be attributed to the non-payment for water services, and therefore the perception that water is free resource.

5.2.2.2 Cost of water

Although the informal settlement receives free water, the dwellers where questioned regarding the cost of water. The researcher has questioned whether dwellers are aware that the provision of water and its infrastructure that has been provided to them by the municipality incur operation and maintenance costs.

Figure 5.8 Awareness regarding cost for water provision
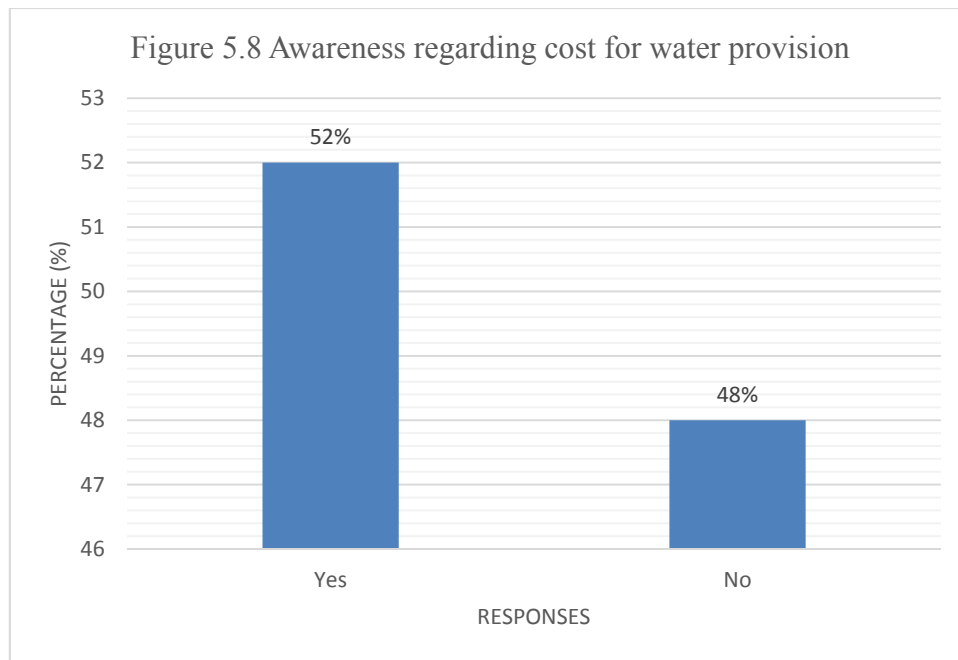
Empirical data indicated that only 52% of the informal settlement are aware that it costs the municipality money to provide the settlement with water as depicted in Figure 5.8. Predictably, the same percentage of 52% of the dwellers were aware that the more water they use, the higher the cost, and 48% of the dwellers where not aware that the more water they use, the higher the cost of the provision of the water to the informal settlement.

5.2.2.3 Willingness to pay for water services

Figure 5.9 Willingness to pay
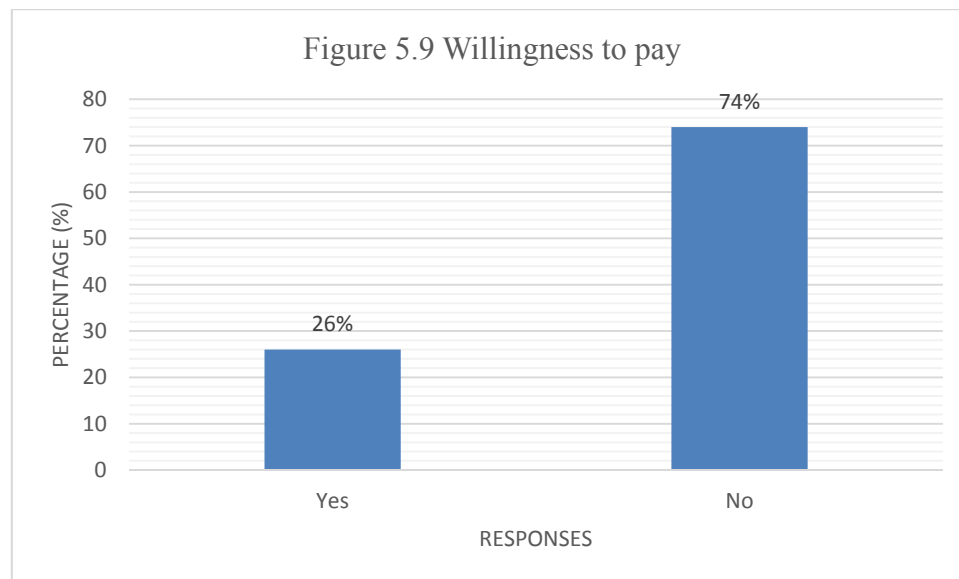
Although the empirical data suggests that more than half of the population (52%) are aware that there is a cost implication to provide the settlement with water, 74% of the population are not willing to pay for water. This can be attributed to the fact that 90% of the settlement earn less than R2500 as discovered in the household profile section of the empirical data discussed above.

5.2.2.4 Awareness regarding water as a limited resource

Although majority of the population are not willing to pay for water, 52% of the population regard water as a scarce resource as depicted in Figure 5.10. When questioned about water being an important resource, 98% of the population perceived water to be an important resource.

Figure 5.10 Awareness regarding water as a scarce resource
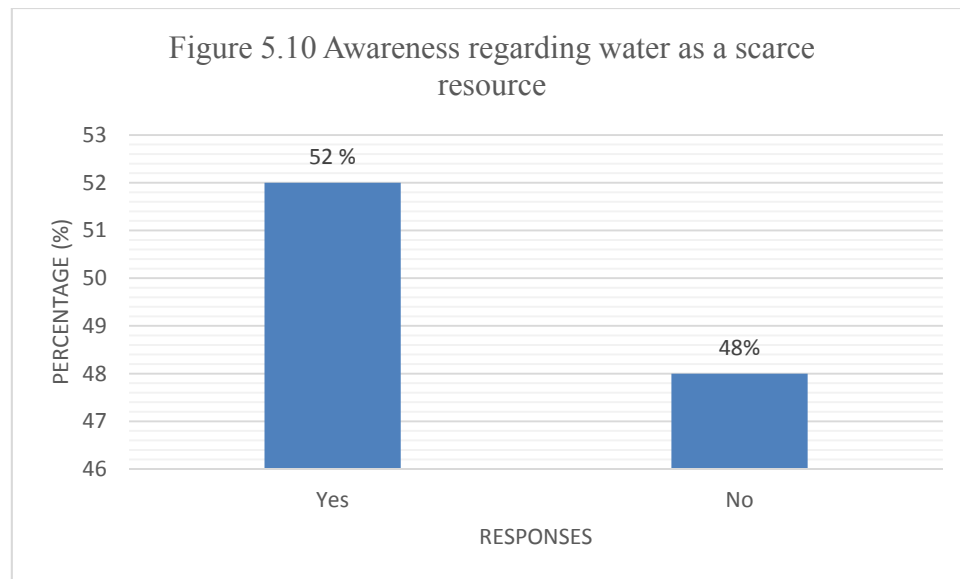
Given that majority of the population regard water as an important resource, the questionnaire then shifted focus to identify the perceptions of water supply globally, within South Africa as well as within Mpolweni settlement.

5.2.2.5 Perceptions of adequate water supply globally, in South Africa and within the Mpolweni settlement.

Figure 5.11 Perceptions of adequate water supply
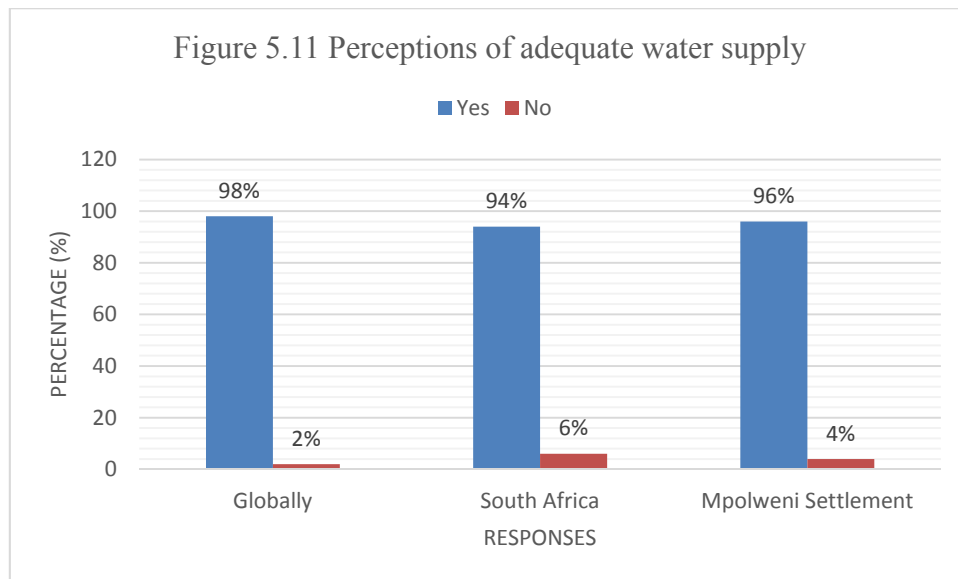
Ninety eight percent of the population is of the view that there is adequate supply of water globally, whereas 2% believe that there is not an adequate supply of water globally. With regard to water supply in South Africa, 94 % believe that there is adequate supply of water within the country whereas 6% believe that water is not in adequate supply. Within the Mpolweni settlement 96% of the population believe that the settlement has adequate water supply, whereas 4% believe that there is not adequate supply of water. The results clearly illustrate that awareness education regarding the water resource and water conservation is lacking. Literature provides evidence that is in complete contrast to the empirical data obtained. Bouguerra (2006) alludes that twenty-three countries possess two thirds of the global water resources. This provides a clear indication that water is geographically and naturally unevenly distributed in the world. The main reasoning behind global water conservation is that only half a percent of all the water on earth is fresh water that is accessible to humans for their water needs (Swistock *et al.,* 2010).

With regard to South Africa, the social engineering of apartheid resulted in water being allocated on racial grounds as distribution was linked to access to land (Stein, 2005). This mis-management of the country's water resources has resulted in approximately 12 to 14 million people without access to safe water and over 20 million people without access to adequate sanitation (all those who were deprived during the apartheid era) (Stein, 2005). In addition,

geographically, South Africa receives far less rain than most countries which further indicates the need for water to be adequately managed and conserved in the country. The Department of Water Affairs and Forestry predicts that South Africa will be classified as a "*water stressed*" country by 2025 (Stein, 2005; Naidoo and Constantinides, 2009). With regard to the Mpolweni settlement, the results again indicate that there is a lack of awareness regarding the water resource. A possible explanation for this can be that the settlement does not pay for water resources and low education levels.

Although 96% of the population believe that there is adequate water supply within the Mpolweni settlement, 70% of the population perceive that water will become a scarce resource in the future as depicted in Figure 5.12. This illustrates a high level of reasoning by majority of the settlement although education levels are minimal. Factors that can contribute to this include the historical scarcity of water that these settlement dwellers were faced with.

5.2.2.6 Perceptions of water resource becoming a scare resource in the future

Figure 5.12 Perceptions of water becoming a scarce resource
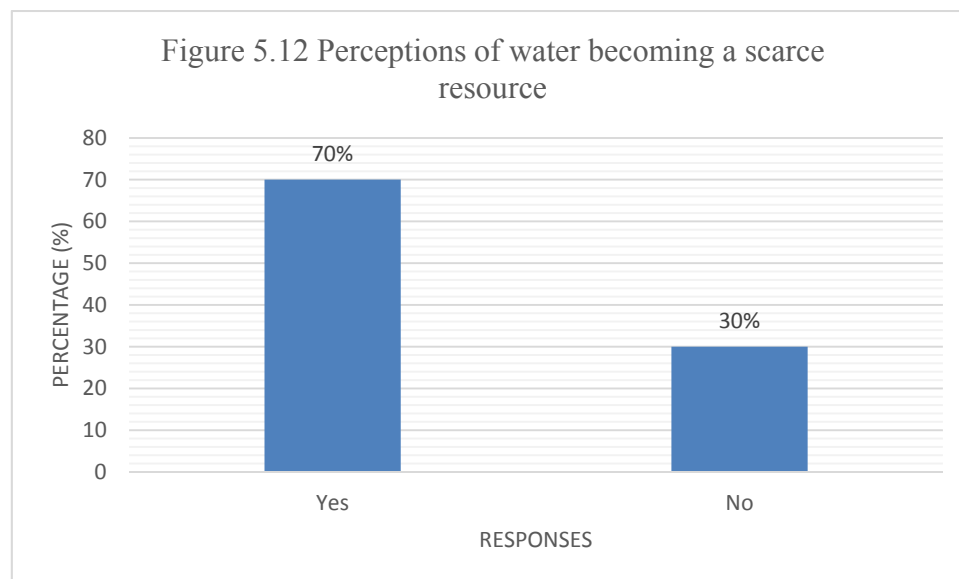
Surprisingly, the entire settlement (100%) views the need to save water as a priority. This is a good indication that water conservation is a necessity. However, when questioned about South Africa in quest to save water, Figure 5.13 illustrates that 46 % of the population are aware that the country is trying to conserve water, 26 % are unaware and 28% are not sure. From the results a generalisation can be made that 56% of the population are unaware that South Africa is trying to conserve water.

5.2.2.7 Awareness regarding South Africa in quest to conserve water

Figure 5.13 Awareness regarding South Africa trying to conserve water
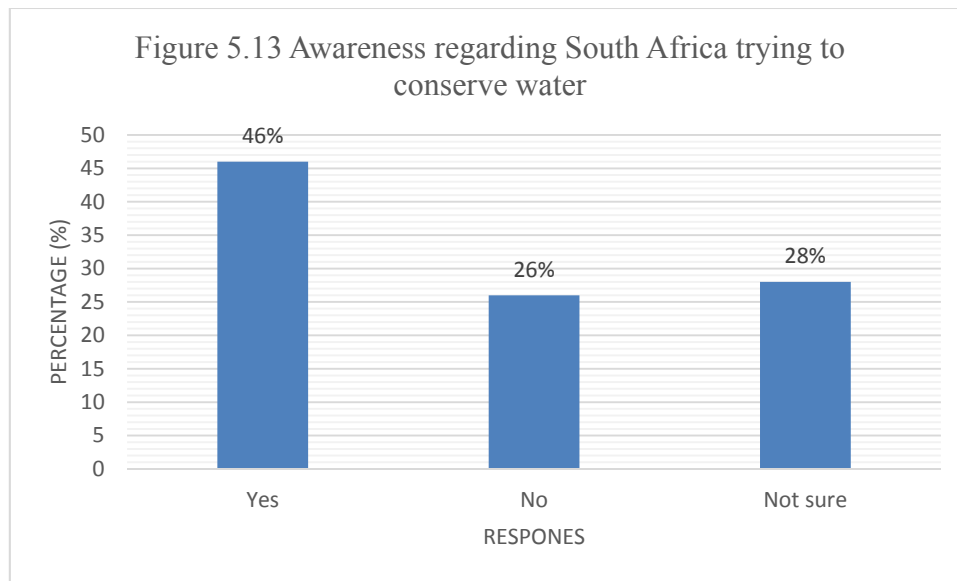
It is interesting to note that although 46% of the population where aware that the country is trying to save water as depicted in figure 5.13, 76% of the population provided a source in which they were informed about water conservation. The reason for this could be a lack of understanding about the concept of water conservation. As simple mathematics will identify, 46% of the population that is aware of water conservation and the 28% of the population that are not sure is totalled to 74%. So the empirical data can illustrate that those who are not sure have heard about water conservation, however they are not fully aware of the scarcity of the resource and the country's quest to save water. When questioned why they feel South Africa is trying to save water, 58% mentioned that the country is trying to save water to cater for expansion (population growth), to save money, for the future generation, so that there is enough water in our country for the people who do not have water. Surprisingly, the perceptions of the importance of saving water is supported by Goldblatt *et al.,* (1999) who mention that the continuous growth of the urban poor population, will add further stress to the regions many challenges with regard to water supplies. In addition, to population growth the need to address inequalities as a result of apartheid has also placed pressure on South Africa to conserve water. Forty two percent of the population did not answer the question, indicating that they are unaware of the country's reasons for saving water. The graph below depicts the medium in which the dwellers have been informed about water conservation.

5.2.2.8 Medium in which you are informed about water conservation

Figure 5.14 Medium in which dwellers were informed about water conservation
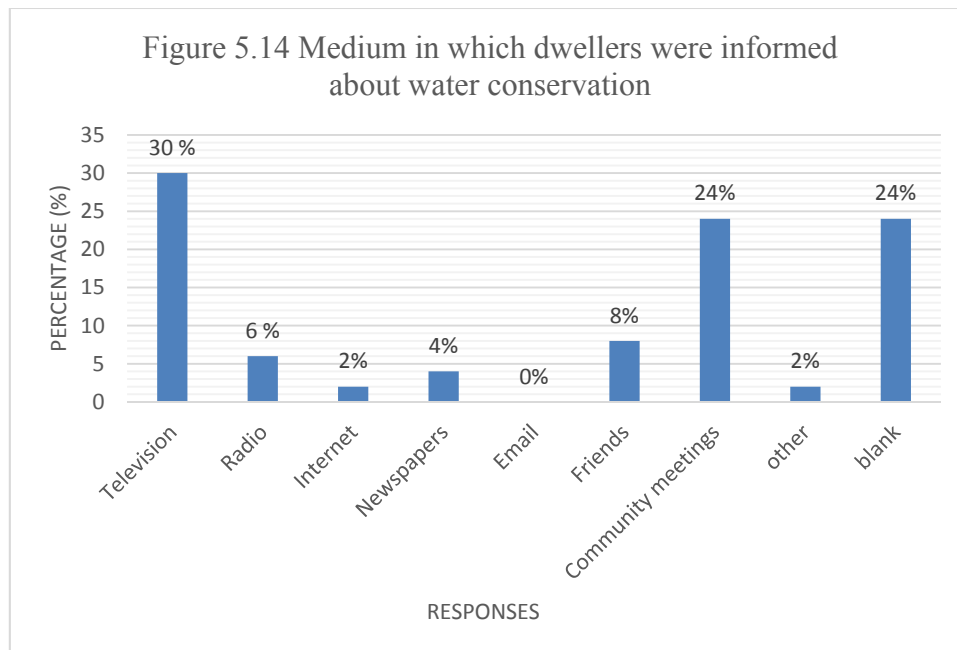
It is evident form the empirical data that households are being educated about water conservation through various mediums. Thirty percent of the population have heard about South Africa trying to conserve water from watching television, followed by 24% being made aware by community meetings. Six percent have heard from the radio, 2% from the internet, 4% from the newspapers, 8% have heard from friends, and 2% have heard via other mediums that were not specified. Twenty-four percent of the population did not answer this question as they were not aware that the country was trying to save water. This illustrates that they were unaware that the country is trying to save water. The results support the view of Wright *et al.,* (2012) who mention that access to newspapers, radio, and television is important as a means to ensure information and knowledge is distributed with regard to water conservation.

5.2.2.9 Awareness regarding water conservation strategies

Figure 5.15 Awareness regarding water conservation strategies
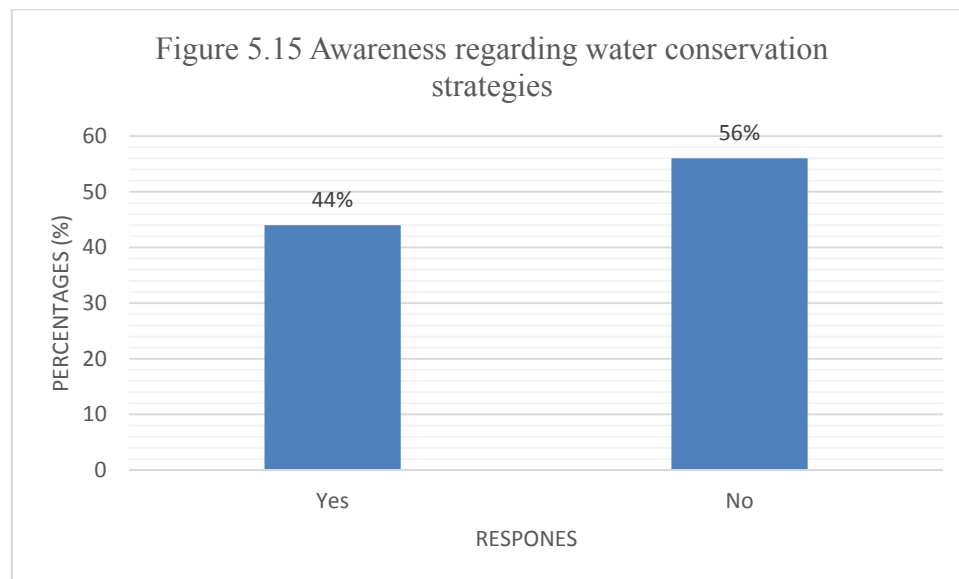
In assessing the awareness regarding the concept of the country saving water, the questionnaire focused on assessing the awareness of any water conservation strategies. The empirical data informs that 44% of the population are aware of water conservation strategies, whereas 56% of the population are unaware of the strategies. In addition, the same portion of the population (44%) are aware of water saving devices that have been/ are currently being used within the settlement while 56 % of the population are not aware of any water saving devices that are used to conserve water within the settlement. The results reiterated the need for awareness education with regard to water conservation. Espineira and Valinas (2013) confirm that water conservation education can be fully understood and implemented when society understands the nature of water shortages and is aware of the water saving technologies that are available to ensure water conservation practices are implemented.

5.2.2.10 Accessibility of water saving devices

The questionnaire then shifted its focus to the accessibility of water saving devices to the community. In this area of questioning 48% of the population believe that the devices such as water efficient showerheads and Jojo® tanks are easily assessable whereas the majority of the population (52%) believe that these devices are not easily accessible.

Figure 5.16 Accessibility of water saving devices
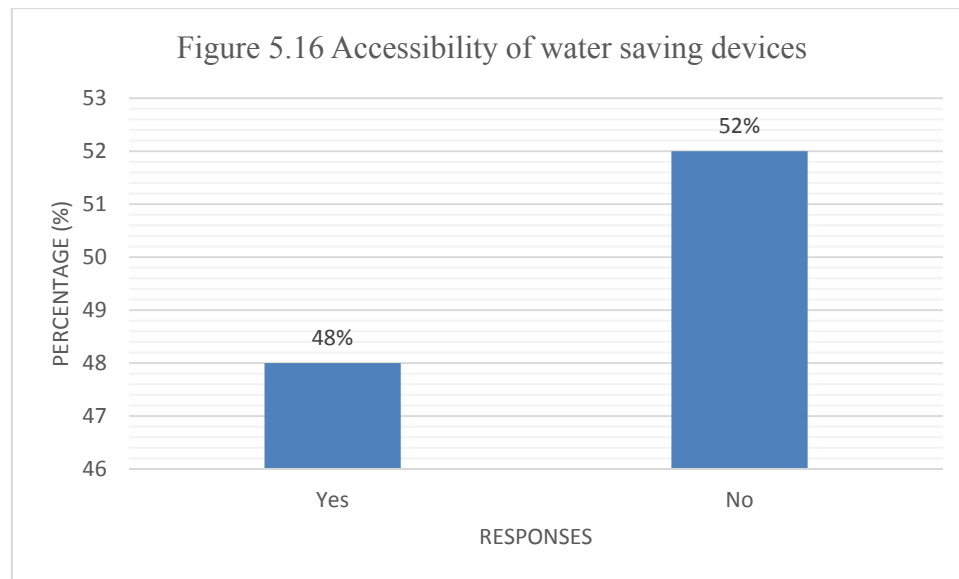
Again the results indicate that a large portion of the settlement are unaware of where they can obtain water saving devices. This reinforces the need for awareness campaigns. Although the questionnaire did not ask the respondents why these devices where not accessible to the community, Espineira and Valinas, (2013) indicate that the main barrier to the adoption of water conservation behaviours are the perception of the inconvenience, impracticality and the costs associated with purchasing water-saving equipment.

5.2.2.11 Education programmes regarding water conservation

Figure 5.17 Education programmes regarding water conservation
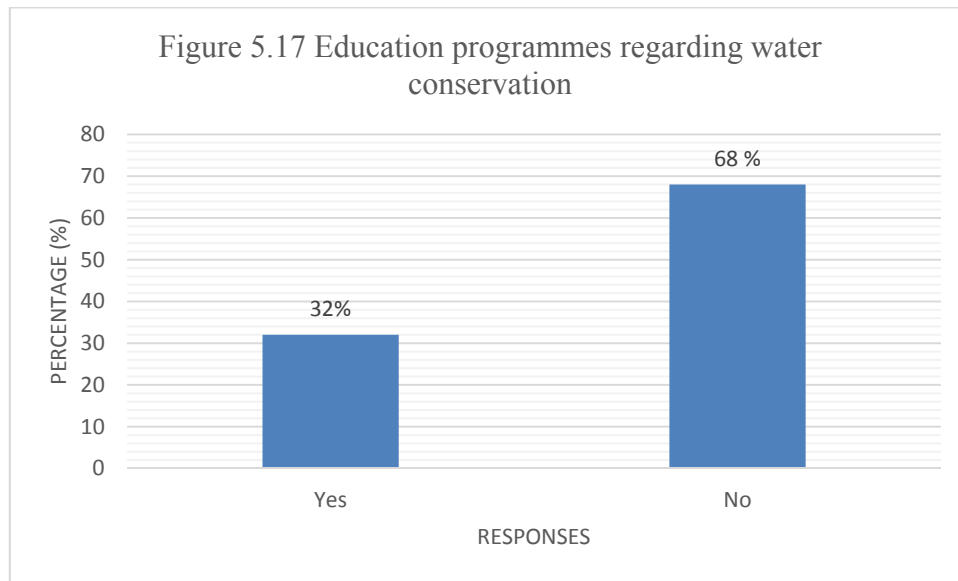
The questionnaire then paid attention to education programmes with regard to water conservation, question 24 of the questionnaire stated:

Was there any introductory programme/procedure implemented to educate the Mpolweni settlement of any water saving methods or devices?

From the empirical data it is evident that 68% of the population did not receive any introductory programme/procedures educating the dwellers about water saving methods and devices. However, when questioned if they would like to be informed about water saving devices and strategies, 98% of the population said they would like to embrace water conservation and learn more about water saving. The findings are in agreement to Clark and Finley's (2008) results that society (in this case, the Mpolweni settlement) does not fully understand the factors that contribute to water conservation. In addition, they have limited knowledge of water saving devices and practices.

5.2.2.12 Perceptions of water wastage effecting the environment

Figure 5.18 Perceptions of the link between water wastage and the impact on the environment
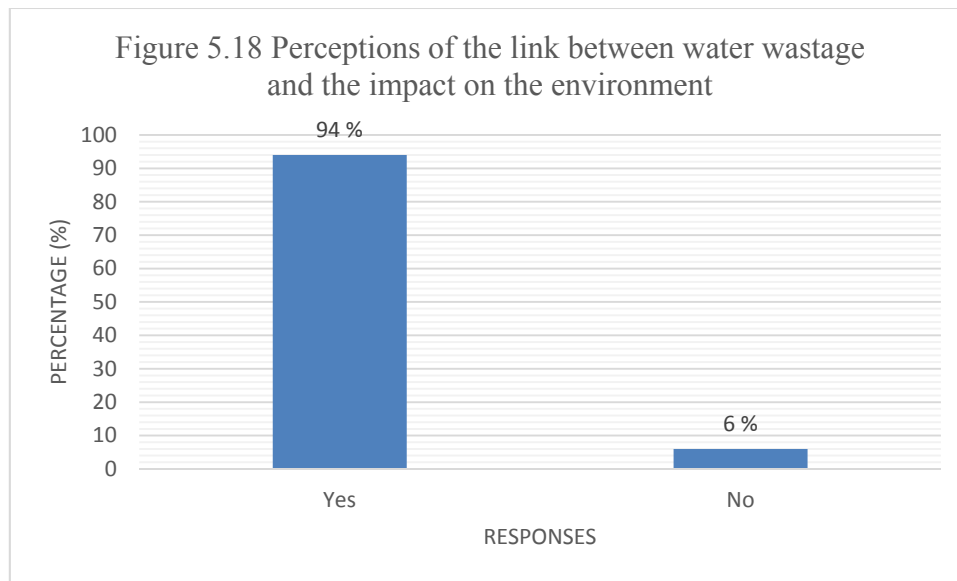
Shifting focus from water saving devices to water provision and its impact on the environment, the questionnaire identified perceptions of the link between water wastage and whether it has a negative impact on the environment. The empirical data depicts that 94 % of the population believe that the wastage of water has a negative impact on the environment and 6% of the population believe that wastage of water has no impact on the environment

5.2.2.13 Current engagement in water saving activities

Figure 5.19 Dwellers currently engaging in water saving activities
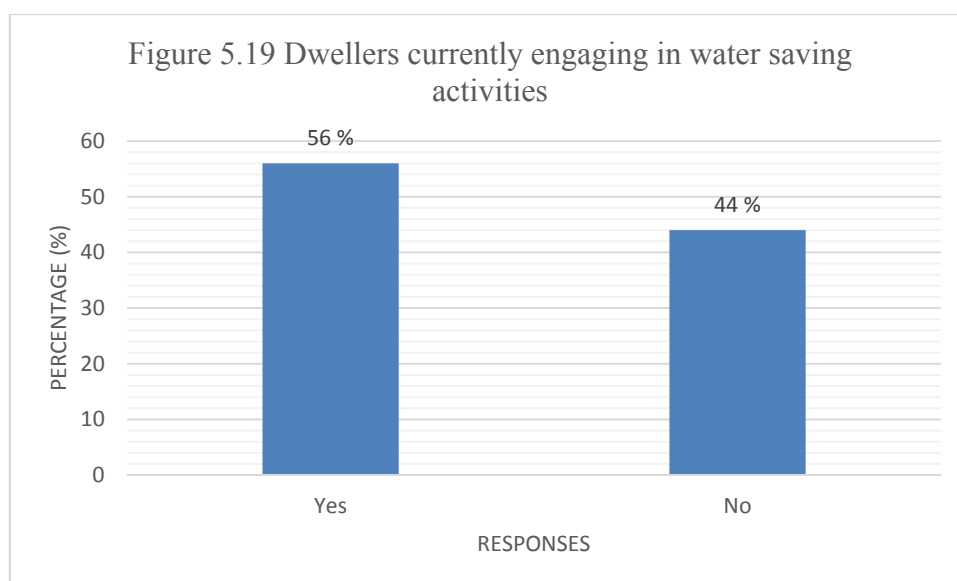
The questionnaire shifted to identifying whether informal dwellers currently engage in water saving activities. Fifty six percent of the population currently engage in water saving activities. The questionnaire then further probed the type of water saving activities that is occurring within the settlement. Table 5.1 illustrates the types of water saving activities/ initiatives engaged by the settlement.

Type of water saving devices	Percentage (%)
Rainwater Harvesting	44%
Recycling of waste water	26%
Water efficient showerheads	16%
Use of flow restrictor taps	14 %

Table 5.1: Water saving activities/initiatives engaged by the Mpolweni Settlement

The empirical findings are again supported by literature that states that rainwater harvesting provides an additional water source and acts as a buffer to water shortages (Kahinda *et al.,* 2010).

5.2.2.14 Engagement of any activities that prevent wastage of water

Figure 5.20 Dwellers activities that engage in activities that prevent wastage of water
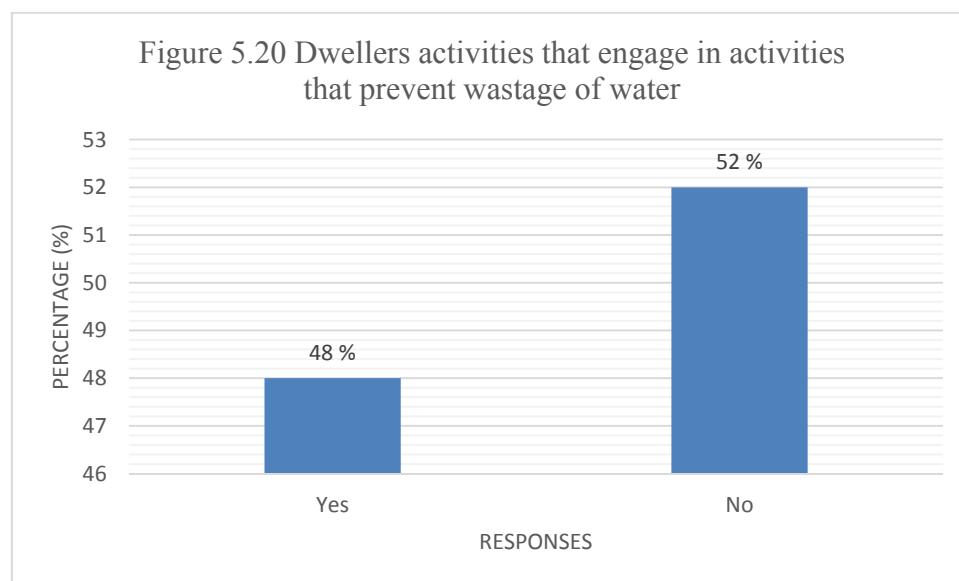
When questioned about activities that prevent water wastage 52 % of the population mentioned that they do not engage in activities that prevent water wastage. The firm belief of the researcher is that the question has been misinterpreted and the word "*prevent*" was misunderstood by many of the respondents.

5.2.2.15 Perceptions if more could be done to implement water conservation within Mpolweni

Figure 5.21 Dwellers perception if more can be done to implement water conservation
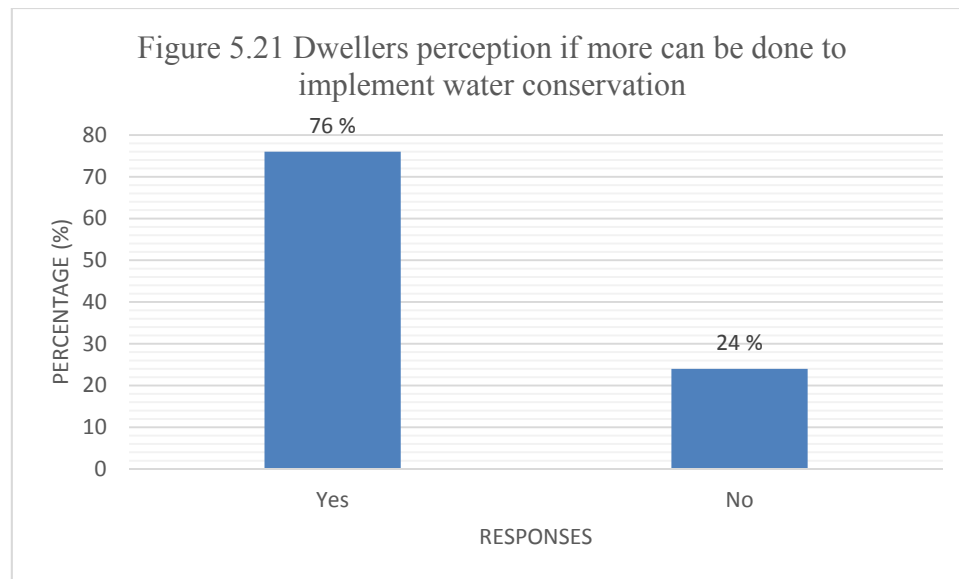
Focusing on the implementation of water conservation, respondents were asked if more can be done with regard to the implementation of water conservation. Seventy six percent of the population believe that more can be done while 24% believe that nothing more can be done to implement water conservation.

5.2.2.16 Perceptions regarding obstacles that are preventing water conservation from being implemented

Figure 5.22 Obstacles preventing water conservation
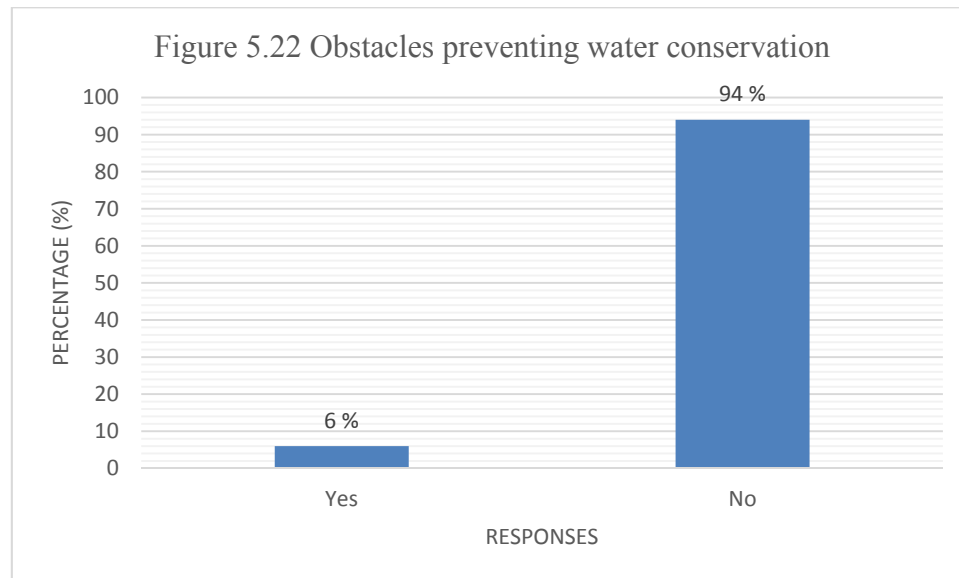
Lastly the questionnaire focused on identifying any obstacles with regard to implementing water conservation. Ninety four percent of the population believe that there is no obstacle in ensuring water conservation is being implemented. Six percent believe that there are obstacles. The 6% that believe the obstacles are the cost of water tanks (JoJo® tanks). Respondents mention that they use buckets to contain water but they are not very effective as they believe that they can save more water if they had the right storage tanks. The empirical data reveals that education levels are a barrier/obstacles in preventing water conservation. Due to the lack of education, informal settlement dwellers do not fully understand the concept of water conservation and the importance of the water resource. This view is supported by Mathipa and Le Roux (2009) as they indicate that one of the major constraints in managing water demand is the absence of well-structured education and training programmes. Graymore and Wallis (2010) confirms that the barriers preventing water conservation are, the availability of water resources, the attitude of the water service authority, the public trust in water authorities, knowledge of ways to save water, cost of devices and retrofitting and water usage practices. Espineira and Valinas (2013) adds that the main barriers to the adoption of water conservation behaviours are the perception of the inconvenience, impracticality and the costs associated with purchasing water-saving equipment. Graymore and Wallis (2010) assert that an effective water demand management strategy takes into consideration the situational factors, personal factors,

perceptions of water abundance, source of water supply and the trust in the water service authority influences a persons need to save water.

5.3   Case study results-Qualitative: Description, Analysis and Synthesis

The sections that follow are an analysis of the focus group discussion held with the committee members of the Mpolweni settlement. The Mpolweni informal settlement is located within the eThekwini metropolitan municipality, and comprises approximately one hundred and forty-five households (145) and is home to four hundred people (400). As discussed in the previous chapter (Research methodology), this case study has distinct qualities that make it a unique study of analysis, namely that the settlement receives free metered water and that this settlement is located within an urban suburb that has water infrastructure that consists of household taps. The focus group was concentrated on two main areas, the community profile and the water usage and conservation. The focus group was held with the Mpolweni settlement committee members who are the custodians of the water resource infrastructure in the community. The aim of the focus group was to reveal the status of water management within the settlement, the awareness of water conservation by the custodians of the water resources and to identify the common water uses within the settlement.

5.3.1 Community profile

Respondents were questioned about the settlement's water infrastructure system, its adequacy and the effectiveness of the water infrastructure in servicing the settlements need. All of the participating committee members are well aware of the water infrastructure system that is currently servicing the Mpolweni settlement as they confirm that the existing water infrastructure consists of two (2) communal standpipe and one (1) ablution block. It was the general consensus that the settlement's first standpipe was installed in 2001. The second standpipe was installed in 2007, although, three (3) out of the ten (10) respondents were of the view that the second standpipe was installed in 2009. When probed into the adequacy and the effectiveness of the water infrastructure system, all the respondents where grateful for the water infrastructure that has been provided by the municipality although they highlight that the existing system is not enough to service the settlement one respondent mentioned:

> *"We had our first stand pipe in 2001 and the second one later in 2007. The first ablution block was built as well as a second pipe to provide us with more access to water. We are grateful for the infrastructure that has been provided, however it is difficult for our kids and wives to carry buckets of water daily as the standpipes are at the road and not within the settlement. However, this year (2014) more ablution blocks are being built with extra taps and showers as well as washing basins which will make it easier on the women and children within the settlement to obtain water."*

The discussion illustrates that historical knowledge is present within the settlement with regards to water service delivery to the community. Generally, there is gratitude shown by the committee members. However, they have described the difficulty experienced by family members (specifically women and children) in collecting/drawing water. It can therefore be deduced that within the community, there has been a shift in focus in water provision. The shift involves a change from the provision of safe potable water, to easier access to safe potable water (i.e. from standpipes to household connections). This shift can consequently raise future concerns in terms of customer satisfaction with water resources. Therefore, it is essential to debate the free basic water policy. The question that needs to be asked is, how does one measure the free basic water policy and what are the indicators that can be used? The data indicates that the perceptions of water services are evidently evolving from societal needs to societal wants.

Regarding the responsibility of the water infrastructure, all the participants agreed that the settlement as a whole is responsible for protecting the water resources as any damage or misuse of the water infrastructure has an impact on the entire settlement. One respondent added:

> *"We all are responsible for the water infrastructure as well as our water use. Government has provided us with water, we must look after it and use it wisely. We must not forget the difficult days of collecting water from the rivers and must therefore protect the taps that give us clean water to drink."*

Generally we can see a sense of gratification present in the committee members with regard to water infrastructure provision. Although all respondents agreed that they do not have a water management plan for the settlement, they all were adamant that they do use water sparingly and they do practice water conservation. As one respondent indicated:

> *"We do not have a water management plan, but we do practise water conservation and we tell our families that they must not waste water."*

It is essential that we understand the reasons for the defensiveness regarding conservative water use that was portrayed by the committee members. Being previously disadvantaged, the members appreciate the water infrastructure and services. From the perspective of the committee members, they would want to depict the image of successful water conservation adoption within the settlement. The reasons for this can vary from fear or the stigma that is attached to informal settlements and their negative water use patterns. The data indicates that the committee members need more education intervention regarding the planning and management of water resources at a community level.

The focus group discussion then shifted focus onto the sensitive topic of payment for water services. The settlement does not pay for water services as confirmed by one of the respondents:

> *"No, we don't pay for the water that is provided to us for free, but the municipality pays for the whole service for us."*

As anticipated by the researcher, many respondents were defensive regarding the payment of services, which could be attributed to the affordability of the water resource, historical disadvantages and new laws making provision to the right to access to water. From the empirical data in Section 5.2, 84% of the population are aware of the free basic water policy, which serves as a reason behind non-payment for water resources. One respondent commented:

> *"We do not pay for water, many of our people do not have jobs and therefore cannot pay for water services. We use water sparingly as we understand that it costs money even though we do not pay for it."*

It was revealed that the standpipes are metered and that municipality sends their officials or service providers to check the meter reading every second month as noted by the respondents:

> *"We do not have any monitoring system to monitor water use as the municipality gets people to check the meter every second month. We don't monitor the meter, we only tell our families not to waste water. Most of the*

water uses are to wash our clothes, cook our food and water our vegetable
gardens."

Focusing on identifying awareness with regard to water conservation devices, the focus group discussion shifted focus to accessibility of water saving devices. Again, it was generally agreed by the settlement that they do not have any water saving devices, as one respondents added:

"We do not have any saving devices but we make sure that every member of
the community keeps an eye to saving water. If there is any misuse of water
they must let us know. Hardware shops are three kilometres away from the
settlement if we need anything I can go there."

However, an interesting discussion occurred between all respondents in identifying what water saving devices are available. One committee member mentioned:

"I have attended a water conservation water demand management course by
the municipality. I used to work there on a voluntary basis and they offered
me to do the course. I learnt a lot about water conservation and how to save
water. The municipality provides us with water saving showerheads in our
ablution block. Most of the people are not aware of what infrastructure are
water saving devices as we do not buy these devices. They are provided to us
by the municipality. They (the municipality) come and do the maintenance on
the taps and the ablution block every three (3) months. They also attend to
any call outs that they receive."

The researcher picked up that, although the one respondent seems to be well aware of water conservation, he did not share his knowledge about what he had learnt in the course by the municipality with the committee members. This could be deduced from the facial expressions and deep interest shown in the faces of all the committee members when the respondent was discussing what he learnt from the course. It is evident that this was the first time the residents of the settlement was aware of this knowledge. In addition, prior to the question, the committee members were of the view that there are no water saving devices used by the municipality.

The focus group discovered that the settlement has no measures put in place to protect the water infrastructure from vandalism as one respondent mentions:

> *"No, there are no measures put in place to protect from vandalism in water but again it goes back in the eye of the community, when something happens we are told and then we tell the municipality. They (municipality) will come and fix the taps. They (municipality) come and fix the taps once they are called, it can vary from same day to the next day, depending how busy they are. Most of the time if they are informed in the morning it takes about 4 to 6 hours. This happened in 2010 when our pipes got stolen."*

When questioned about the detecting water leaks collectively the group answered

> *"We will know that we have a water leak when the pressure in our taps drop and if we notice any area is damp. Leakages and vandalism are reported to the councillor's office and or directly to the municipality, depending on the type of incident. If a leak or vandalism occurs we try to guide and coordinate the water distribution from the water tankers that come to the settlement. This is done to ensure that water is made available to each household. We also inform the people to use water sparingly as the supply is short. Once the standpipes are working again we inform the settlement."*

Surprisingly, early on in the discussion the committee members were not aware of any water saving devices. However when members were questioned about water efficient technologies and the use of water efficient showerheads, the committee members mentioned that

> *"Water efficient showerheads as the people who installed them explained to us how and why the showers work in the way that they do."*

This illustrates that the committee are not aware of the terminology regarding the concept water conservation and water saving technologies but they are aware of the water infrastructure that they have and whether it saves water or not. When questioned if an introductory programme was done, the committee members all agreed that an introductory programme had been done.

"Yes a programme was done, however few people attended the programme,

so overall I would say that the programme was not effective. The programme

was not done in the settlement people were chosen to attend the programme

in town."

There is a common trend that can be highlighted from the data with regards to the management of water by the Mpolweni committee members. The data reveals that committee members rely fully on the municipality to attend to issues regarding water services/ infrastructure needs and maintenance. This trend leads one to question the sustainability of the free basic water policy and the water services within the municipality. The reason for questioning the sustainability arises when one considers that the municipality is providing the operations and maintenance of the water resource to the settlement at no cost. A common municipal trend is to outsource infrastructure repair work to small medium and micro enterprises (SMME's), who require payment for their services. The cost recovery tariff can only assist to a certain extent, which raises the sustainability concern. What the data is highlighting is that a dependency relationship is being created where the informal settlements are not being self-sufficient in the maintenance of the infrastructure. It is evident that there is no accountability by the settlement for the management of the water infrastructure.

5.3.2 Water conservation and usage

The second section of the focus group concentrated on water usage and water conservation. Overall the committee members regard water as an important resource as they believe that water is life.

"Water is a very important resource for us, we use it to cook, clean and grow

our vegetables. Without water we will not be able to survive."

Discussing the topic of water scarcity was difficult as the committee members did not seem to grasp the concept of water scarcity. When given examples such as droughts or lack of supply of water, the committee members could relate to this. As one respondent mentioned:

"We need to save every drop of water since every drop counts and we are not ready to face drought. Water is an important resource for the settlement as it enables us to survive. Most of the households do not work and we use water to grow our own food. If we have water scarcity it will be bad for the people of Mpolweni as we all will not survive. Therefore it is essential that we save water to ensure that the community does not experience a water scarcity. We need to think of our tomorrow our future needs for water and cannot just look at today."

The focus group has revealed that the committee members are not confident that the people of the Mpolweni settlement understand water conservation. One respondent mentioned:

"Not to say everybody understands water conservation, but we as a community try our best to undertake or control water to ensure that the community is aware of water usage and how they should practice saving water. To be honest it is really hard to say if everyone understands water conservation as water usage is different because of the number and size of families in the community. Everyone uses water for different uses and they all use different amounts, so we don't know how to assess if the people understand water conservation. Main water uses are for cooking cleaning, washing clothes and farming, the amount of water depends on the number of people in the family so it is hard to tell. We do keep reminding the settlement to use water sparingly though."

The committee members illustrated through their discussions that they are unaware of water reuse techniques. In order to minimise water usage the settlement uses buckets to collect drinking water and water for washing dishes, however, they could not make the connection that they should recycle the water that they have used for rinsing the dishes for any other purpose that incorporated the use of grey water. This clearly illustrates that there is a lack of awareness regarding how people can reuse water. One committee member mentioned:

"When one is doing their washing, they ensure that they use buckets or basin dishes to fill in their water for washing and everybody collect drinking water with buckets. We try to get as much done with the one bucket of water."

The committee members did mention that they are aware of water conservation strategies and that they would like to be made aware going forward of all the possible ways to conserve water.

> *"Yes we are aware and practice water conservation. We would like to know more about water conservation and how we can further conserve the water resource. Currently we don't just use water whenever we feel like, sometimes we use our water twice depending on what the first use was for, and we also try and collect rainwater when it rains with buckets as we do not have JoJo® tanks."*

The committee members are of the view that more can be done to conserve water in the settlement.

> *"Yes, more programmes can be introduced to the community ensuring water conservation is practiced daily and bring up different ideas on how one should save water. Currently we do create awareness of the importance of water conservation by ensuring that we call community meetings and teach one another about water conservation and how we should take part in saving water."*

With regard to the settlement's action plan to manage water and to reduce poverty within the settlement, collectively the respondents mentioned:

> *"As the area community we engage with different stakeholders to help us lift the community and ensure that one practices self-improvement to fight poverty. Life coaching skills are introduced and water awareness programmes are introduced were we discuss difficulties that we have when it comes to water and sanitation. We also teach farming skills so that people can grow their own vegetables."*

The committee members are of the view that there are no obstacles that are preventing them from conserving water. One respondent mentions:

> *"There are no obstacles that prevent anyone from the municipality conserving water, one should appreciate the amount of water supplied daily and acknowledge*

the privilege of having safe water and ensure that we practice to save water today

for tomorrow since water is precious to our daily lives."

5.4 Conclusion

This chapter has set out to encapsulate and present the findings of the study. In addition, the chapter has described and analysed the findings of this research, as well and synthesised the data with the theory found within the literature review (chapter 2). The data reveals that the case study (Mpolweni Settlement) is of a settlement that is in transition and that there is a shift in water provision, involving a change from the settlements' rights to the access of safe potable water, to that of easier access to safe potable water (i.e. from standpipes to household connections). In addition, the data reveals that education and household income in the informal settlement is low and that water conservation is being practiced to a degree. However, to ensure the successful implementation of water conservation, more education is required regarding water saving devices and awareness training. Subsequently, the focus groups revealed that the roles and responsibilities of the settlement committee members need to be defined as the settlement relies fully on the municipality for all aspects related to water (operations and maintenance). The data highlights is that a dependency relationship is created where the informal settlements are not self-sufficient in the maintenance of the infrastructure. The assessment of this case study has given rise to new contradictions and provides recommendations for future research. Chapter Six presents a set of conclusions and recommendations.

Chapter Six
Summary and Conclusions

6.1 Introduction

This section will re-examine the objectives of this research, summarise the findings of the research and offer conclusions based on the findings. The previous chapter which dealt with the case study results, was large and requires a summary, hence the summary in this chapter. The chapter concludes with recommendations to ensure efficiency in terms of water conservation/ water demand management (WC/WDM). These recommendations will assist in ensuring that the water demand management targets are met.

6.2 Summary

With regard to Objective One:

- To investigate the factors that give rise to a need for water conservation.

This study has revealed that the factors such as water scarcity, climate change, current global water consumption patterns, the provision and payment for water services are the factors that drive water conservation. In South Africa, water scarcity is a result of two factors, the first is that country's history of water mismanagement. The second reason is a result of the geographic location of the country globally, resulting in a physical shortage of water supply as the country is a semi-arid country. Climate change has and will continue to entrench the physical water shortages as the phenomena results in the intensification of the hydrological cycle, giving rise to the intensification and frequency of droughts and flooding. Global water consumption patterns indicate that the agricultural sector dominates water usage and the impacts of climate change and alien invasive plants are changing the current water use practices. The provision of water has increased the awareness about water conservation as the water resource is viewed as a commodity and sold for a profit. Within South Africa, as a result of the country's history and the aim of the new government to provide water to all citizens, water conservation is encouraged as water conservation accommodates for increased water demand. Empirical

findings suggest that the population are aware to some extent of the importance of water and that current water demand is outstripping supply.

In conclusion, the main factors giving rise to the need for water conservation are water scarcity, climate change, current global water consumption patterns, the provision and payment for water services. In South Africa, the mismanagement of water by the apartheid government coupled with the above mentioned factor has given rise to the need for water conservation.

With regards to Objective Two:

- To explore what water conservation devices are available for water conservation, and how accessible such devices are to the Mpolweni settlement.

The study has confirmed the water conservation devices that are available for water conservation. For purposes of this study, given the case study area (informal settlements) only water conservation devices that are applicable to the case study's water infrastructure have been included in this study. These devices include, dual flush toilets, water efficient showerheads, water reuse, rainwater harvesting and water efficient taps. The study has revealed that these devices are readily accessible to the settlement as they are provided by and maintained by the eThekwini metropolitan municipality. Although, the provision and maintenance of the devices are paid for by the municipality, the study highlighted that not all the informal settlement dwellers know where they can obtain water saving devices from.

In conclusion, water saving devices are available for water conservation and are easily accessible to the informal settlement, although not all the informal settlement dwellers are aware of these devices and where they can obtain these devices

With regard to Objective Three:

- To unpack the views of informal settlement dwellers on water usage and water conservation.

This study has identified the perceptions of the informal settlement dwellers with regard to water usage and water conservation. Empirical findings indicate that water is viewed as an important resource to the informal settlement. Many individuals within the settlement have some understanding of water conservation. The settlement does engage in water conservation techniques such as rain water harvesting. The main use for water in the settlement is for domestic uses such as human consumption, cooking, washing clothes and sanitation purposes. Education levels in the settlement are low with 80% of the population not having completed secondary school, therefore formal awareness and training with regard to water conservation is lacking in the settlement. However, the dwellers are keen to learn more about water conservation.

In conclusion, water conservation is somewhat understood and practiced by the settlement, although there is the need for formal water awareness and conservation training. The empirical findings reiterate the need for consumer education and general water awareness to informal settlements. The low education levels of the settlement support this need.

With regard to Objective Four:

- To investigate what limitations/obstacles informal settlement dwellers experience in conserving water.

Literature highlights political, economic, social, technological, environmental and legal barriers to the conservation of water resources. The empirical findings indicate that the settlement does not have any obstacles that prevent the residents from conserving water. However, they explain that cost of water saving devices such as JoJo® tanks hinders the settlement from maximising the conservation of water. The empirical findings the researcher has deduced that education levels are also a barrier to water conservation as a result of lack of knowledge and awareness.

In conclusion, the Mpolweni settlement does not experience any obstacles from conserving water. Rain water harvesting is the most common water conservation practice that is undertaken by the settlement. The informal settlement dwellers use buckets to store the rain water. The settlement did mention that the cost of water saving devices serves somewhat as a barrier in terms of allowing for maximum conservation of the water resource.

With regard to Objective Five:

- To provide recommendations that can ensure water conservation is successfully implemented.

Literature provides many options that can be adopted by households to reduce water usage. These include replacing plumbing devices with water efficient plumbing devices. Literature suggests that household activities such as placing a water bottle in the toilet tank can use less water to flush, watering crops during the early morning and late evenings can reduce evaporation, closing the tap when brushing teeth and/or washing dishes and clothes, and many more. Empirical findings suggest that more awareness is required and will be welcomed by the informal settlement regarding water conservation.

6.3 Recommendations

The recommendations of this study are based on the conclusions of the research objectives. The recommendation for Objective One is to ensure that more awareness is provided to society regarding the factors that give rise to water conservation. A thorough understanding of the factors given rise to water conservation will enable society to successful implement and practice water conservation as they will understand the importance of the phenomena.

The recommendation for Objective Two is to ensure that more water conservation awareness regarding water conservation devices are conducted. The informal settlement should be educated by the municipal staff regarding the devices that they are using, the benefits of the devices and the accessibility of the devices in the event that the residents are required to purchase the device.

The recommendation for Objective Three, Four and Five is to ensure that consumer awareness education and best practice training are given to the informal settlement. Empirical findings indicate that the settlement is conserving water and would like to maximise conservation of the water resources. Findings also indicate that the settlement will welcome more training and awareness with regard to water conservation and water conservation devices. Future research needs to pay attention to the sustainability of the free basic water policy given the scarcity of

the water resource. Future research should provide attention assessing the successfulness of the communication channels between the municipality and the informal settlement dwellers, identifying and addressing the barriers in communication between the two parties can ensure the greater success in the conservation of water within the settlement and society as a whole. Research should also focus on the dependency relationship that informal settlements have on the municipality and the effect of this relationship on the successfulness of water conservation.

6.4 Conclusion

This chapter has concluded the research study. It has re-examined the objectives of this research, summarised the findings of the research and offered conclusions based on the findings. It has also provided recommendations that can ensure the successful implementation of water conservation. The study has indicated that the success of water conservation is to a large extent dependent on education levels and water conservation awareness. Recommendations for future research was discussed. It is hoped that the recommendations will assist in ensuring that the water demand management targets are met.

References

Antwood, C., Kreutwiser, R. and Deloe, R. (2007). Residents' assessment of an urban outdoor water conservation program in Guelph, Ontario, *Journal of American Water Resources Association*, 43(2): 427-439.

Albertyn, C. (2011). Law, gender and inequality in South Africa, *Oxford Development Studies,* 39(2): 139-162.

Babooram, A. and Hurst, M. (2010). Uptake of water and energy conservation devices in the home, *Statistics Canada Catalogue* 11-008: 10-19.

Backeberg, G. (2005). Water institutional reform in South Africa, *Water Policy*, 7: 107-123.

Bakker, K. (2001). Paying for water: water pricing and equity in England and Wales, *Transactions of the Institute of British Geographers*, 26: 143–164.

Bauer, C.J. (1997). Bringing water markets down to earth: the political economy of water rights in Chile, 1976-95. *World Development*, 25 (5): 639-656.

Blignaut, J. and Van Heerden, J. (2009). The impact of water scarcity on economic development initiatives, *Water South Africa*, 35(4): 415-420.

Bonilla, A., Couyoumdjian, J.P. and Gatica, L.A. (2012). Political economy and its application in Latin America: A Review, *Asian Journal of Latin American Studies,* 25 (4): 103-129.

Bouguerra, M. (2006). *Water under threat*, London: Zed Books.

Broas, C. (2003). *Guidelines for water conservation and demand management: implementation of water conservation and water demand management measures within the water services sector*, Volume 3 of 3.

Bryman, A. (2004). *Social research methods*, New York: Oxford University Press Inc.

Buckle, H., McKenzie, R. S., Meyer, N. and Wegelin, W. A. (2002). *Water demand management cookbook*, United Nations Centre for Human Settlements and Rand Water, South Africa.

Clark, W.A. and Finley, J.C. (2008). Household water conservation challenges in Blagoevgrad, Bulgaria: a descriptive study, *Water International*, (33)2: 175-188.

Coldwell, D. And Herbst, F. (2004). *Business research*, Cape Town, Juta and Company.

Cullis, J.G. and Marais C. (2007). A strategic study of the impact of invasive alien vegetation to the mountain catchment areas and riparian zones of South Africa in total surface water yields, *Water South Africa*, 33(1): 35-42.

De Loe, R., Moraru, L., Kreutzwiser, R., Schaefer, K. and Mills, B. (2001). Demand side management of water in Ontario municipalities: Status, progress, and opportunities, *Journal of the American Water Resources Association*, 37(1): 57-72.

Department of Water Affairs and Forestry. (2000). *Model water services bylaws*, Pretoria: Government Printer.

Department of Water Affairs and Forestry. (2000). *Water conservation and demand management strategy for the forest sector in South Africa*, Pretoria: Government Printer.

Department of Water Affairs and Forestry. (2002). *Guidelines for compulsory national standards and norms and standards for water service tariffs and water service provider contract regulations*, Pretoria: Government Printer.

Department of Water Affairs and Forestry. (2003). *National water conservation and water demand management strategy*, Final draft, Pretoria: Government Printer.

Department of Water Affairs and Forestry. (2004). *National water conservation and water demand management strategy*, Pretoria: Government Printer.

Department of Water Affairs and Forestry. (2012). Report on the status of sanitation services in South Africa, http://www.sahrc.org.za/home/21/files/Quality%20of%20sanitation%20-%20Exec%20Summary%20Mar12%20(Fin).pdf; accessed [15:04:2013].

Earle, A., Gokdin, J. and Kgomotso, P. (2005). *Domestic water provision in the democratic South Africa – changes and challenges, compiled for the Nordic Africa Institute's conflicting forms of citizenship programme*. University of Pretoria.

Falkenmark, M. (1989). The massive water scarcity now threatening Africa: why isn't it being addressed? *Ambio*, 18 (2): 112-118.

Figueres, C. and Ivanova, M. (2002). Climate change: national interests or a global regime? In, Esty, D. and Ivanova, M. (eds), *Global environmental governance, options and opportunities*. Yale. Yale School of Forestry and Environmental Studies.

Gilbertson, H.A. and Dolnicar, S. (2011). Does water context influence behaviour and attitudes to water conservation? *Australasian Journal of Environmental Management*, 18(1): 47-60.

Giordano, M., Giordano, M. and Wolf, A. (2002). The geography of water conflict and cooperation: internal pressures and international manifestations, *The Geographical Journal*, 168(4): 293-312.

Glucksmann, R. (n.d.). *Apartheid legislation in South Africa.* http://ra.smixx.de/Apartheid_Legislation_in_South_Africa_2010-2.pdf; accessed [29:01:2014].

Godden, L. (2005). Water law reform in Australia and South Africa: Sustainability, efficiency and social justice, *Journal of Environmental Law*, 17 (2): 181-205.

Goebel, A., Dodson, B. and Hill, T. (2010). Urban advantage or urban penalty? A case study of female-headed households in a South African city. *Health and Place*, 16: 573–580.

Goldblatt M., Ndamba J., van der Merwe B., Gomes F. and Haasbroek J. (1999). *Water demand management: towards developing effective strategies for Southern Africa*, IUCN Report.

Graymore, M. and Wallis, A. (2010). Water savings or water efficiency? Water-use attitudes and behaviour in rural and regional areas, *International Journal of Sustainable Development & World Ecology*, 17(1): 84-93.

Gumede, V. (2011). *Social and economic inclusion in post-apartheid South Africa,* http://transformationaudit.org/blog/wp-content/uploads/2012/02/Opinion-Social-and-economic-inclusion-in-post-apartheid-South-Africa.pdf; accessed [12:02:2014].

Haughton, G. (1998). Private profits. public drought: the creation of a crisis in water management for West Yorkshire, *Transactions of the Institute of British Geographers*, New Series, (23) 4: 419-433.

Hawkes, D. (1999). Thomas Traherne: a critique of political economy, *The Huntington Library Quarterly*, 62(4): 369-388.

Henrard, K. (2002). Post-Apartheid South Africa's democratic transformation process: redress of the past, reconciliation and 'unity in diversity'. *The Global Review of Ethnopolitics*, 1(3): 18-33.

Hosque, S.F. and Wichelns, D. (2013). State-of-the-art review: designing urban water tariffs to recover costs and promote wise use, *International Journal of Water Resources Development,* 29(3): 472-491.

Jackson, R.B., Carpenter, S.R., Dahm, C.N., McKnight, D.M., Naiman, R.J., Postel, S.L. and Running, S.W. (2001). Water in a changing world, *Ecological Applications,* 11(4): 1027–1045.

Jenkins, M.W. and Lund, J.R. (2000). Integrating yield and shortage management under multiple uncertainties. *Journal of Water Resources Planning and Management-ASCE.* 126(5): 288-297.

Jones, M. (2008). Recovering a sense of political economy. *Political Geography*, 27: 377-399.

Kahinda, J., Taigbenu A.E. and Boroto, R.J. (2007). Domestic rainwater harvesting to improve water supply in rural South Africa. *Physics and Chemistry of the Earth*, 32: 1050-1057.

Kahinda, J., Taigbenu A.E. and Boroto, R. J. (2010). Domestic rainwater harvesting as an adaptation measure to climate change in South Africa, *Physics and Chemistry of the Earth*, 35: 742-751.

Kidd, M. (2008). *Environmental law*, Cape Town: Juta and Company, South Africa.

King, N, and Horrocks, C. (2010). *Interviews in qualitative research*. London: Sage.

Laher, S. and Botha, A. (2012). Methods of sampling, In Wagner, C., Kawulich, B., and Garner, M. (Eds.), *Doing social research: A global context*. London, UK: McGraw-Hill.

Lam, S.P. (2006). Predicting intention to save water: Theory of planned behaviour, response efficacy, vulnerability, and perceived efficiency of alternative solutions, *Journal of Applied Social Psychology*, 36: 2803–2824.

Leedy, P.D., and Ormrod, J.E. (2010). *Practical research: planning and design*, 9th Edition, Harlow: Pearson Education.

Levite, H., and Sally, H. (2002). Water demand management scenarios in a water stressed basin in South Africa. *Waternet symposian,Arusha*.

Liebenberg, S. (2000). Human Development and Human Rights South African Country Study. http://www.communitylawcentre.org.za/projects/socio-economic-rights/Research%20and%20Publications/research/Socio-Economic%20Rights%20Poverty%20and%20Development/Human%20Rights%20and%20Human%20Development%20-%20South%20African%20Country%20Study.pdf;
accessed [10/01/2014].

Maharaj, B. and Khan, S. (n.d). *Urban sustainability rhetoric and neo-liberal realities: Durban – a city in transition*, Michigan, Michigan State University Press with Brij Maharaj, eds. Igor Vojnovic.

Mathipa K.S. and Le Roux C.S. (2009). Determining water management training needs through stakeholder consultation: Building users' capacity to manage their water demands. *Water South Africa*, 35(3): 253-260.

Martínez-Espiñeira, R. and García-Valiñas, A. (2013). Adopting versus adapting: adoption of water-saving technology versus water conservation habits in Spain, *International Journal of Water Resources Development*, 29(3).

McNeill, P. and Chapman, S. (2005) Research Methods. Third Edition. Routledge, USA, New York.

Middlestadt, S., Griesser, M., Herndandez, O., Tubaishat, K., Sanchack, J., Southwell, B. and Schwartz, R. (2001). Turning minds on and faucets off: Water conservation education in Jordanian Schools. *The Journal of Environmental Education*, 32 (2): 37-45.

Mollinga, P. (2000). Water for food and rural development: approaches and initiatives in South Asia, *The Political Economy of Water in South Asia: Policy, Problems and Proposals*, Sage, New Delhi.

Moore, M.R. and Negri, D.H. (1992). A multicrop production-model of irrigated agriculture, applied policy of the Bureau-of-Reclamation. *Journal of Agricultural and Resource Economics*, 17(1): 29- 43.

Mulwafu, W., Chipeta, C., Chavula, G., Ferguson, A., Nkhoma, B.G. and Chilima, G. (2003). Water demand management in Malawi: problems and prospects for its promotion. *Physics and Chemistry of the Earth*. 28(27): 787-796.

Mwendera, E.J., Hazelton, D., Nkhuwa, D., Robinson, P, Tjijend, K. and Chavula, G. (2003). Overcoming constraints to the implementation of water demand management in southern Africa. *Physics and Chemistry of the Earth*, 28: 761–778.

Naidoo, D. and Constantinides, G. (2000). Integrated approaches to efficient water use in South Africa, *International Journal of Water Resources Development*, 16(1): 155-164.

Narsiah, S. (2010). The Neoliberalisation of the local state in Durban, South Africa, *Antipode*, 42(2): 374-403.

Narsiah, S. (2008). Discourses of privatisation: the case of South Africa's water sector, *Development Southern Africa*, 25(1): 21-35.

Neuman, W.L. (2011). *Social research methods: qualitative and quantitative approaches*, 7th Edition, Boston: Pearson Education.

Ngigi, S.N. (2003). What is the limit of up-scaling rainwater harvesting in a river basin? *Physics and Chemistry of the Earth*. (28): 943-956.

Page, B. (2005). Paying for water and the geography of commodities. *Royal Geographical Society* (with the Institute of British Geographers).

Peterson, J.M., and Ding, Y. (2005). Economic adjustments to groundwater depletion in the high plains: Do water-saving irrigation systems save water? *American Journal of Agricultural Economics*. 87(1): 147-159.

Plooy, G.M. (2009). Communication research: techniques, methods and applications, Cape Town: Juta and Company.

Pott, A., Hallowes, J., Backeberg, G. and Döckel, M. (2009). The challenge of water conservation and water demand management for irrigated agriculture in South Africa, *Water International*, 34(3): 313-324.

Randolph, B. and Troy, P. (2008). Attitudes to conservation and water consumption, *Environmental Science and Policy*, 11: 441-455.

Renwick, M. and Green, R. (1999). Do residential water demand side management policies measure up? an analysis of eight California water agencies, *Journal of Environmental Economics and Management*, 40: 35-55.

Rijsberman, F.R. (2006). Water scarcity: fact or fiction? *Agricultural Water Management*, 80: 5-22.

Rijsberman, F.R. and Molden, D.J. (2001). Balancing water uses: water for food and water for nature. *Thematic Background papers*. International Conference on Freshwater, Bonn, 3-7 December: 43- 56.

Rockstrom, J., Lannerstad, M. and Falkenmark, M. (2007). Assessing the water challenge of a new greening revolution in developing countries, *National Academy of Sciences*, 104(15): 6253-6260.

Roma, E., Buckley, C., Jefferson, B. and Jeffrey, P. (2010). Assessing users' experience of shared sanitation facilities: A Case study of community ablution blocks in Durban, South Africa. *Water South Africa* (36)5: 589-594.

Roseth, N. (2006). *Community views on water shortages and conservation*, Research Report 28, Cooperative Research Centre for Water Quality and Treatment, Salisbury, South Australia.

Saunders, M., Lewis, P., and Thornhill, A. (2003). *Research methods for business students.* Third Edition. Harlow: Prentice Hall.

Schaible, G.D. (1997). Water conservation policy analysis: An interregional, multi-output, primal-dual optimization approach. *American Journal of Agricultural Economics*. 79(1): 163-177.

Schreiner, B., Van Koppen, B. and Khumbane, T. (2002). From bucket to basin: a new water management paradigm for poverty eradication and gender equity (Eds), *Hydropolitics in the developing world: a South African perspective,* African Water Issues Research Unit, South Africa: 127-140.

Sekaran, U., and Bougie, R. (2009). Research methods for business. A skill building approach. Fifth Edition. West Sussex, John Wiley and Sons Limited.

Sinha, U. (2009). The why and what of water security. *Strategic Analysis*, 33(4): 470-474.

Statistics South Africa. (2011). *Census 2011*. Pretoria: Statistics South Africa.

Stein, R. (2005). Water law in a Democratic South Africa: A country case study examining the introduction of a public rights system. *Texas Law Review*.83: 2167-2183.

Swatuk, L.A. (2002). The new water architecture in Southern Africa: reflections on current trends in the light of 'Rio + 10', *International Affairs*, 78(3): 507-530.

Swistock, B., Oliver,J., Clark,J., Rizzo,D., Boser,S., Wulfhorst,P. and McCarty,T. (2010). *Water for communities*. Pennsylvania, the Phennsylvania State University.

Swyngedouw, E. (2009). The political economy and political ecology of the hydro-social cycle. *Journal of Contemporary Water Research and Education*, 142: 56-60.

Teddlie, C. and Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research*, 1(1): 77-100.

Turton, A. (1999). Hydropolitics: The concept and its limitations, in Turton, A and Henwood, R.(Eds), *Hydropolitics in the developing world: a South African perspective*, African Water Issues Research Unit, South Africa: 187-204.

Tsinde Development Consultants (PTY) LTD. (2002). *Factors affecting the implementation of WDM strategies in Southern Africa Final Report.*

Wagner, C., Kawulich, B. and Garner, M. (2012). Doing social research. A global context. Berkshire, McGraw-Hill Education (UK) Limited.

Ward, F.A., Michelsen, A.M. and DeMouche, L. (2007). Barriers to water conservation in the Rio Grande Basin, *Journal of the American Water Resources Association*. 43(1): 237-253.

Wallace, J.S. and Gregory, P.J. (2002). Water resources and their use in food production. *Aquatic Sciences*, 64: 363-375.

Wallace, J.S., Acreman, M.C. and Sullivan, C.A. (2003). The sharing of water between society and ecosystems: from conflict to catchment-based co-management. *Philosphical Transactions: Biological Sciences*. 358 (1440): 2011-2026.

Williams, P. and Taylor, I. (2000). Neoliberalism and the political economy of the 'New' South Africa. *New Political Economy*, 5: 21-40.

Wright, J., Yang H., Rivett, U. and Gundry, S. (2012). Public perception of drinking water safety in South Africa 2002-2009: a repeated cross-sectional study. *BMC public health.*12: 556.

Yang, H., Zhang, X.H. and Zehnder, A.J.B. (2003). Water scarcity, pricing mechanism and institutional reform in northern China irrigated agriculture. *Agricultural Water Management*. 61(2):143-161.

Appendix 1 (Informed Consent Form)

INFORMED CONSENT FORM

TITLE: Perceptions of Water Conservation among informal settlement dwellers: Case study of the Mpolweni Settlement, Reservoir Hills, Durban.

AIMS/OBJECTIVES:

The aim of this research is to explore the perceptions of water conservation among informal settlements through a case study of the Mpolweni Informal Settlement, Reservoir Hills, Durban, South Africa. In order to achieve this, this study explores: what factors drive water conservation; what water conservation devices are available for water conservation, and the accessibility of such devices for the Mpolweni settlement; what are the views and practices of informal settlement dwellers with regard to water usage and water conservation; to determine what are the limitations/obstacles experienced by the informal settlement in successfully conserving water; and to establish recommendations for the successful implementation of water conservation.

I …………………………………….. Hereby confirm my consent to participate in this project (which is voluntary) and the use of information given by myself during the research (data collection) process. I confirm that I have been briefed regarding the nature of the research project before the focus group/questionnaire/interview was conducted. I understand that all information I have disclosed will be used for research purposes by the investigator only.

I understand that should I require confidentially then my requirement will be fulfilled and that if the need to withdraw from the research arises I am able to do so.

 Signature of Participant: ……………………………..   Date: ……………..

Signature of Investigator: ……………………………   Date: ………………..

Details of Investigator:

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<u>Ukugunyazwa ngemvume</u>

Isihloko

Ukubona uhlelo lokongiwa kwamanzi kubahlali base mjondolo endaweni yaseMpolweni, Reservoirhill ,Durban

Inhloso

Ukuhambela emphakathini wase mjondolo eMpolweni , Reservior Hills,Durban, Ningizimu Afrika ngokujutshwa ukubona uhlelo lokongiwa kwamanzi

Engifuna ukukuthola ukuthi ngabe uhloboluni olusetshenzisiwe ekongweni kwamanzi kulomphakathi kanye nokuthi lusabalaliswe kanjani loluhlobo olusetshenziswe ekongweni kwamanzi kanti futhi umphumela walo ngabe ngingawuncoma ekutheni lusetshenziswe emphakathini ekutheni kongiwe amanzi ezindaweni eziyimijondolo.

Mina ---------------------- emvumeni engiyitholile ngokubamba iqhaza kuloluhlololumvo lwengqalasizinda yokongiwa kwamanzi ,futhi kwengikuzuzile ngesikhathi ngibheka ukuthi ongiwe kanjani amanzi.

Impela ngilindele noma nananoma imuphi umbuzo engingabhekana nawo ukuze nginikezele ngemininingwaengiyitholile.

Ngiyaqonda ekutheni lonke uphenyo ebengilwenza luzovuleleka kubabbheki kuphela

Konke lokhu bengiqonde ukuba ngikwenze ngokwimfihlo ukuze umsebenzi wami uphumelele kanti futhi ngizimisele ngokuhoxa ophenyweni uma kunesidingo

Isinyathelo sobambe iqhaza_____ Usuku_____

Isinyathelo Somphenyi_____ Usuku_____

<u>Imininingwane yoMphenyi</u>

U Yashveer Neerachand

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Appendix 2 (Focus Group Schedule)

University of KwaZulu-Natal

Perceptions of Water Conservation among informal settlement dwellers: Case Study of the Mpolweni Settlement, Reservoir Hills, Durban

Focus Group Discussion Questions

Community Profile:

1. What does the water infrastructure system that is within the settlement comprise? Is it enough and is it effective? When was it installed?

2. Who is responsible for protecting water infrastructure in the community?

3. Does the community have a water management plan?

4. Does the settlement pay for water?

5. What methods are put in place to monitor and regulate water usage in the Mpolweni settlement? Is the standpipes metered? Who monitors usage and water volumes? Are they recorded?

6. Are water saving devices easily accessible? If yes, how so and do local hardware shops keep these devices, if so how far are the hardware shops from your settlement?

7. Are you aware of any expenditure that goes towards infrastructure, development, maintenance and repairs of taps or any water related infrastructure within the Mpolweni settlement? Who pays for this and how often?

8. Are there any measures put in place to protect water infrastructure against vandalism? If so, what are they?

9. If answer to (8) is no, what are the reasons for not having measures?

10. If vandalism to water infrastructure occurs, how long does it take to be repaired?

11. Since installation, has the water infrastructure been vandalised? Why is this the case?

12. As a settlement how are you aware that there is a leak in the water infrastructure?

13. As a settlement, who do you report leakages and vandalism too? How often?

14. What measures are put in place to ensure safe drinking water is available whenever standpipes are not in working order?

15. Is the settlement aware of water efficient technologies for water infrastructure such as water efficient shower heads, taps and low flush toilets?

16. Are there any water saving devices within the Mpolweni settlement? (E.g. water efficient shower heads)

    16.1.   If yes, what are they?

    16.2.   If no, why?

17. Was there any introductory programme/procedure implemented to educate the Mpolweni settlement of any water saving methods or devices?

<u>Water usage and conservation</u>

18. Would you regard water as an important resource and why?

19. What are your thoughts on the scarcity of water?

20. Do you feel that water conservation is a priority?

21. What is the settlements overall understanding of water conservation?

22. What is the settlements major water use?

23. As a settlement what is being done to ensure that water usage is minimal and that water us recycled and reused?

24. If the settlement is not doing this why is this the case? Are you aware of the strategies that can be adopted? Would you like to be aware of the strategies?

25. Are there any ways/methods in which the Mpolweni settlement promotes water conservation?

26. Do you feel that more can be done to promote water conservation in the settlement? If yes, what can be done?

27. Does the Mpolweni settlement make use of water recycling techniques?

28. Are there water storage facilities in place (such as JoJo® tanks)? If so, elaborate, if not why?

29. Has the Mpolweni settlement created awareness about the need to conserve water? If yes, how so?

30. What is the committee's plan of action to reduce poverty in the settlement and address any water and sanitation related problems/difficulties?

31. Are there any obstacles that prevent the Mpolweni settlement from implementing effective water saving methods? If yes, elaborate.

32. Are there any additional comments/suggestions you would like to contribute?

Thank You!

Appendix 3 (Questionnaire)

University of KwaZulu-Natal

Perspectives of Water Conservation among informal settlement dwellers: Case Study of the Mpolweni Settlement, Reservoir Hills, Durban.

Questionnaire for Residents:

Please circle the answers (O)

<u>Household Profile</u>

1. Do you have access to safe portable water?

Yes	No

2. Define the level of service?

A) Standpipe	B) Restricted flow
C) Semi pressure or roof tank or ground tank	D) Full pressure

3. What does your daily usage of water comprise?

_____
_____
_____

4. How many people reside in your household?

1	2	3	4	5	6	7	8	>8

5. What is the current nature of your education level/s?

No Schooling	Some Primary Schooling	Complete Primary Schooling	Some Secondary Schooling	Complete Secondary Schooling	Higher then Secondary Schooling

6. What is your combined household income per month?

No income	R1-R500	R501-R1000	R1001-R1500	R1501-R2000	R2001-R2500	R2501-3000
R3001-R5000	R5001-R7500	R7501-R10 000	R10 001-R 15 000	R15 001-R20 000	R20 001-R30 000	R30 000+

7. Are you satisfied with your water services?

Yes	No

7.1. Please explain the reason for your answer.

_____
_____
_____

Water usage and water conservation awareness

8. What is your understanding of water conservation?

_____
_____
_____

9. Are you aware that the South African law entitles everyone to a free basic water amount 25 litres per person per day?

Yes	No

10. Are you aware that it cost's the municipality money to provide the Mploweni community with clean safe drinking water?

Yes	No

11. Are you aware that the more water you use the higher the cost is to the municipality?

Yes	No

12. Do you pay for water?

Yes	No

13. Are you willing to pay for water?

Yes	No

14. Are you aware that water is a limited resource?

Yes	No

15. Do you feel that water is an important resource?

Yes	No

15.1 If yes, how so?

_____
_____
_____

16. Do you feel that there is an adequate supply of safe drinking water:
       a. Globally

Yes	No

       b. In South Africa

Yes	No

       c. In the Mpolweni Settlement

Yes	No

17. If answer to (16) is no then, do you feel there that water is a resource that will soon become scarce?

Yes	No

18. Do you feel that the need to save water is a priority?

Yes	No

19. Are you aware that South Africa is trying to conserve water?

Yes	No	Not Sure

19.1 If yes, then what is the main reason for saving water?

_____
_____
_____

19.2 How were you informed?

Television	Radio	Internet	Newspapers
Email	Friends	Community meetings	Other

20. Are you aware of any awareness programmes with regard to water conservation, water demand management strategies?

Yes	No

21. Are there any water saving devices that you are aware of that has been put in place by your community?

Yes	No

22. If yes, what are they?

_____
_____
_____

23. Are these water saving devices easily accessible to you?

Yes	No

23.1 If yes, where can you find/buy these devices?

_____
_____
_____

24. Was there any introductory programme/procedure implemented to educate the Mpolweni settlement of any water saving methods or devices?

Yes	No

24.1 If yes, by whom?

_____
_____
_____

25. Would you like to be informed about water conservation management strategies or programmes?

Yes	No

26. Do you think wastage of water will affect the environment?

Yes	No

27. Do you currently engage in any water saving activities or initiatives?

Yes	No

28.1 If yes, what are they?

Recycling of waste water	Use of aerator/ flow restricting taps
Rainwater harvesting	Other (specify below)
Water efficient showerheads	

28.2 If no, is there any reason/s for this? Please elaborate.

_____
_____
_____

29. Do you engage in any activities that prevent *wastage of water*?

Yes	No

29.1 If yes, what are they?

_____
_____

30. What could be done to improve the conservation of water in your home and community?

_____
_____

31. Do you think more can be done to implement water conservation in your area or the country at large?

Yes	No

    If yes, how so?

_____
_____

32. Are there any obstacles that prevent you from implementing effective water saving methods like rain water harvesting?

Yes	No

    If yes, elaborate.

_____
_____

33. Do you have any additional comments or suggestions with regard to water management and conservation?

_____
_____
_____
_____
_____
_____

Appendix 4 (Ethical Clearance)

13 November 2014

Mr Yashveer Neerachand (207522424)
School of Agriculture, Earth and Environmental Sciences
Howard College Campus

Dear Mr Neerachand,

Protocol reference number: HSS/0873/014M
Project title: Perspectives of water conservation among informal settlement dwellers: Case study of the Empolweni Settlement, Reservoir Hills, Durban

Full Approval – Expedited Application

In response to your application received on 31 July 2014, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**
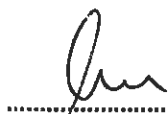
Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

....
Dr Shenuka Singh (Chair)

/ms

CC Supervisor: Dr Noel Chellan
Cc Academic Leader Research: Dr O Mutanga
Cc School Administrator: Ms Marsha Manjoo