UNIVERSITY of the
WESTERN CAPE

FACULTY OF SCIENCE

DEPARTMENT OF EARTH SCIENCE

ASSESSMENT OF THE CONTRIBUTIONS OF WATER ALLOCATION REFORMS TO ACHIEVING EQUITABLE ACCESS TO WATER BY SMALLHOLDER EMERGING FARMERS IN THE BREEDE-GOURITZ CATCHMENT MANAGEMENT AGENCY

A thesis submitted in partial fulfilment of the requirements of the Degree of Masters in Environmental and Water Science

By

Sinazo Mnyaka

Supervisor: Prof Dominic Mazvimavi

Co-supervisor: Dr Bongani Ncube

February 2018

ABSTRACT

Assessment of the contributions of water allocation reforms to achieving equitable access to water by smallholder emerging farmers in Breede-Gouritz Catchment Management Agency

S. Mnyaka

MSc Environmental and Water Science Thesis, Department of Earth Science, University of the Western Cape

The National Water Act of (1998) of South Africa has a goal of achieving equitable access to water resources, as well as achieving environmental sustainability and efficient use of water. Consequently, water resources management is being reformed to ensure the achievement of these principles. Allocation of water through granting of licenses for abstraction and storage of water has been implemented to ensure that historically disadvantaged individuals (HDIs) have access to water and to promote sustainable, efficient and beneficial use of water resources for the whole country. The Water Allocation Reform Policy is a tool that is used to implement the goal of the National Water Act and it is guided by the set objectives, which are to allocate 30% of all water to previously disadvantaged individuals by 2014, 45% by 2019 and 60% by 2025. Despite these efforts, there is evidence that smallholder emerging farmers who are part of the disadvantaged groups do not have access to water for productive use. Many studies conducted so far have shown that equitable, sustainable and efficient water allocation has not been achieved in South Africa. It is not very clear why this trend is continuing despite all efforts to the contrary. The aim of the study was to assess the contribution of the reforms of water allocation systems towards increasing access to water by historically disadvantaged groups in Barrydale area in the Western Cape Province, South Africa. Interviews were conducted to determine how the reforms have influenced access to water for productive use by smallholder emerging farmers. Document review was undertaken to determine the progress in the implementation of the water allocation reform by the Breede-Overberg Catchment Management Agency (BGCMA). The results indicated that small-scale farmers do not have access to water for agricultural activities in Barrydale due to lack of components, which include financial funding, access to farming infrastructure and skills. The BGCMA has not completed the implementation of the Water Allocation Reform and as a result, mechanisms initiated by the BGCMA have not resulted in improved access to water by HDIs. The outcome of the study indicated a lack of implementation of the water allocation reforms by the BGCMA, hence there is still no increase to water access for agricultural use by HDIs.

KEY WORDS

Equity

Access to water

Water allocation reform

Historically Disadvantaged Individuals

Productive use

Small-scale farmers

Large-scale farmers

Sustainable Livelihood Approach

DECLARATION

I hereby declare that **"Assessment of the contributions of Water Allocation Reforms to Achieving Equitable Access to Water by Smallholder Emerging Farmers in Breede-Gouritz Catchment Management Agency"** is my own work and has not been submitted as part of any degree or examination at any University and all the sources that have been used have been acknowledged by means of complete references.

Full name: Sinazo Mnyaka

Student number: 2914354

Date: 26 February 2018

Signature: …….

ACKNOWLEDGEMENTS

I acknowledge God for giving life to me and for his protection, blessings and mercies throughout my life.

I acknowledge the support and advice from my supervisors Professor Dominic Mazvimavi and Dr Bongani Ncube and I appreciate their endless critical contributions that made this work a dream come true.

I wish to acknowledge Nuffic and Water Research Commission for financial support. Without their support this research would not have been possible. I also appreciate the support received from the Community Water Supply and Sanitation Unit at Cape Peninsula University of Technology.

I thank the Barrydale Small-scale Farmers and Barrydale Farming group members for participating in the research. My sincere gratitude goes to Mr Pieter van Tonder and Henry Micheals for facilitating the meetings with farmers.

I acknowledge the South African Weather Services for providing rainfall data for the study area. The assistance of Barend Groenewald from the Swellendam municipality is acknowledged.

I would like to acknowledge my friends Zimkita Mavumengwana, Amanda Gcanga, Zine Matshakeni and Seymour Siwa for their contribution to this research.

I am grateful for my mother's support, encouragement, prayers and believing in me. I thank my family for their encouragement and prayers.

Table of Contents

List of Figures

List of Tables

CHAPTER 1: INTRODUCTION

1.1 Introduction

Water allocation is central to the management of water resources, especially in countries with competing water demands and limited water sources. The allocation of water is aimed at prescribing who can abstract a specified amount of water for a certain purpose from a water source (Speed *et al.,* 2013). The increase in water demand is the result of a rapidly-growing population. As the water demand increases, conflicts arises between various water users, due to competition for limited water resources. There is a need to establish appropriate institutions and policies to guide water allocation in order to balance the demand and the available resources (Wang *et al.,* 2003).

Most countries have laws, policies and institutions that guide water allocation. Water sector reforms have been undertaken in most countries to improve water allocation, taking population growth into account. Water allocation aims at ensuring that water is used to benefit social, economic and environmental needs (Wang *et al.,* 2003). According to van Koppen (2003), de Loe *et al.,* (2007) and Speed *et al.,* (2013), the universal objective of water sector reforms is to achieve equity, environmental protection, promote development priorities, balance the supply and demand of water and promote efficient use of water.

Professionals within the water sector realised the complexity of water management and also realised that problems facing the water sector are common to other sectors, hence engagement with the relevant sectors is crucial for water resources management (Biswas, 2004). Wang *et al.,* (2003), regard cooperation of all stakeholders during water sector reforms and water allocation as a requirement for achieving the objective of the reforms. The cooperation of all stakeholders minimises conflicts between various water users. In countries where water allocation does not achieve the set objective, water sector reforms that include changes to policies, laws, institutions and administrative processes are initiated and implemented (Mul *et al.,* 2011). These changes are common globally, therefore it is important to understand the motivation for water sector reform and whether the reforms have achieved the intended objectives in various countries.

1.2. Background/rationale for the research

Water sector reforms are aimed at improving the management of water resources by incorporating all factors and elements that affect water management. Water allocation, as a part of water resources management, uses various systems to allocate water for various uses. One of these systems is based on the riparian doctrine, which had been used worldwide as a basis of water allocation. The riparian doctrine is rigid and inflexible in view of development changes and population growth (Casey and Ploeg, 2011). The riparian doctrine links ownership of land adjacent to a watercourse to the right to use water in that watercourse (Fisher, 2009). However, the ownership of water in the watercourse is limited to a set of rights to the use of that water. This is because the use of water must be reasonable and consider the water needs of other riparian landowners (Wang *et al.*, 2003; Cech, 2005; Funke *et al.*, 2007). The riparian doctrine is derived from common law; hence water is not owned by riparian landowners, but reasonably used. However the doctrine only considers the rights of other riparian landowners and excludes other water users who are not riparian landowners.

This means that the riparian landowners are benefiting more from the two interconnected resources, land and water, and thereby able to derive economic and commercial benefits from these resources. Other water users can only benefit from economic and commercial uses of water after the needs of riparian landowners have been satisfied (Wang *et al.*, 2003; Fisher 2009). This leads to inequitable sharing of water resources between various water users and this is mainly dependent on the location of water users in relation to the watercourse.

The prior appropriation doctrine was introduced after it was realised that there are other water users that are not considered by the riparian doctrine. This system exist without the relationship between water and land, instead it considers beneficial use of water. Unlike the riparian doctrine, the prior appropriation doctrine permits use of a specified quantity of water from a specified water source at a specified time, location and for a specific water use. The prior appropriation doctrine used the "first in time, first in right" principle, whereby water uses that were allocated water licenses prior to other water uses get the privilege of receiving the allocated water first, while water uses that received water licences later receive the remaining water during water shortage season (Benson, 2012). The prior appropriation doctrine aimed at encouraging beneficial use of water and led to rivers being fully appropriated by the early 20th century (Tewari, 2009; Benson, 2012). The full appropriation of rivers led to increased water demand, while population growth and environmental water needs also caused stress on rivers in the western United States. The prior appropriation system was not adopted in other countries,

such as South Africa and Zimbabwe. *Dominus fluminis* and riparian doctrines were used in South Africa, while the priority date system was used in Zimbabwe (Tewari, 2009; Derman *et al.*, 2007). The doctrines used in South Africa and Zimbabwe disadvantaged black indigenous people, because most of the water was already allocated to white people meaning the indigenous people could only be allocated the remaining water (Derman *et al.*, 2007).

It is at this stage that water professionals saw the need to reform the water sector and to also focus on the administrative aspect of water management. The water sector reforms were also influenced by many factors such as lack of integration in the management of water resources, lack of decentralisation of water resources management, and the need to redress issues of inequities of race, gender and class caused by the colonial past (van Koppen, 2003). This meant changes in the water sector institutions, including roles and responsibilities and consideration of population growth and environmental water needs during water allocation processes (Benson, 2012). The changes in the institutions were required to implement the changes in the water allocation system and to harmonise the fragmented water institutions in order to achieve the objectives of water sector reforms (Heyns, 2005; Gakubia *et al.*, 2008).

The fragmentation of water sector institutions is attributed by inadequate water governance within the water sector institutions (Fischhendler, 2008). Water governance refers to the operations of water sector institutions which include political, social, economic and administrative systems, assigning of roles and responsibilities, coordination between departments and relevant role players (Nleya, 2005; Fischhendler, 2008). Undefined roles and responsibilities within the water sector departments lead to lack of coordination, which results in conflicts that affect decision-making with regard to water issues. Lack of clearly defined roles, responsibilities, and coordination within an institution are due to a lack of capacity in terms of human, technological and financial resources (Saleth and Dinar, 2005; Heyns 2005). Heyns (2005) and Schreiner (2013) argue that lack of human and technological resources in the water sector are a result of political changes that led to a loss of experienced staff in the water sector. It is argued that the water sector institutions need to be capacitated in order to undertake the delegated functions and to be able to implement the changes made in the legislation during water sector reforms. Due to poor governance, water sector institutions have not achieved the intended goal of reforming the water sector (Heyns, 2005).

Political influence during water sector reforms comes mainly from the parties who have benefited from the water laws that are under review. These parties include traditional and

political actors who had water rights or water access under previous water laws and thus do not support the reforms. The lack of support of the reforms is attributed by the fear of losing water rights or facing increased competition for water use (Laube, 2014). Laube (2014), argues that laws enacted during the reforms of the water sector were designed to abolish existing water rights, vest control of water resources to government and establish new water management frameworks. These are the primary reasons that the political actors with interests in water resources oppose the reforms. These actors therefore make it difficult for the institutions to implement and achieve equality in water access and productive usage of water, especially by small-scale farmers.

The need to reform the water sector became apparent in the 1980s, after water professionals realised that the water problems were becoming more complex and requiring multiple actors in order to be solved (Biswas, 2004; Swatuk, 2005). The water problems included the diminishing availability of water resources due to rapid population growth, declining water quality and quantity, unrealised importance of water in poverty eradication, inequalities in water access and actions to be taken in order to achieve sustainable management of water resources (Swatuk, 2005). To solve such problems and manage water sustainability, cooperation of governmental and non-governmental departments is required as the water problems are becoming complex and affect various departments (Biswas, 2004).

The four Dublin principles incorporated all the integral factors that affect water management and provided guiding principles for sustainable water management (WCED, 1987). These principles were developed prior to the 1992 Earth Summit in Rio de Janeiro to address issues and concerns identified during the International Water Conference held in Mar del Plata in 1977(UNWC,1977) and by the subsequent United Nations World Commission on Environment and Development (WCED), summarised in the Brundtland report of 1987 (WCED, 1987). The main concerns identified during the Mar del Plata conference included lack of coordination between water sector bodies, lack of community water supply, polluted water bodies as a result of anthropogenic activities, and lack of cooperation between countries that share water resources. The Brundtland report launched the concept of sustainable development in order for the coming generations to meet needs that depend on natural resources. The four principles were developed to guide the discussion of issues identified in the two reports (Snellen and Schrevel, 2004).

Prior to the 1992 Earth Summit, the water sector organised a conference where a keynote paper entitled Water and Sustainable Development (Koudstaal *et al.*, 1992) was discussed in preparation for the Summit. The said paper contained all the characteristics of Integrated Water Resource Management (IWRM), except management of land resources. Management of land resources was covered in another keynote paper entitled Coping with Multi-cause Environmental Challenges - a Water Perspective on Development (Falkenmark and Lundqvist, 1992). IWRM had existed for several decades, but it could not be applied successfully at the time, it was therefore discovered in 1992 that this concept would be able to solve the problems facing the water sector (Biswas, 2004).

The concept of IWRM is currently being incorporated in water allocation systems in order to achieve efficiency, sustainability and equality (Senzanje and van der Zaang, 2004; Anderson *et al.*, 2009). However, the operationalisation of the concept varies between countries, and there is a particularly large difference between the Sub-Saharan African countries and countries in other regions. This is a result of scarcity of the economic means to manage Africa's water resources, linking improved agricultural water use to economic growth and poverty eradication (Van Koppen, 2003; Fischhendler, 2008 and Laube, 2014). The abovementioned factors make the implementation of the IWRM concept difficult in the African continent.

There are common and also country-specific aims of water sector reform throughout the African continent. The common aims include the integration of water resources management, reforming fragmented water legislation, articulating government roles decentralising water management to lower level institutions, enhancing water users' participation in water resources management, protecting water quality and environmental needs, and promoting international cooperation in transboundary basins. Country-specific aims include prioritisation of water supply in rural and urban areas for countries such as South Africa, Zambia and Mozambique (Van Koppen, 2003; Msibi and Dlamini, 2011).

In Namibia, water sector reforms aimed at improving institutional arrangements and allocating roles and responsibilities, abolition of unacceptable environmental practices, involvement of local stakeholders in water resources management and recognising environmental issues related to water conservation (Heyns, 2005). In South Africa and Zimbabwe, the aim of reforming the water sector was to redress past inequalities in terms of race, gender and class (Van Koppen, 2003; Msibi and Dlamini, 2011). Botswana is in the process of reforming its water sector and the aim of the reforms is to enhance sustainable management of water

resources (Kgomotso, 2005). The delay in completing water sector reform in Africa and the implementation of IWRM is said to be as a result of scarcity of economic resources (Van Koppen, 2003). According to Saleth and Dinar (2005), other factors, such as political issues, also contribute to the delay in implementation of policies in African countries.

1.3 Problem statement

Many studies assessing the effectiveness of water sector reforms in terms of achieving the objectives of the reforms at global level have been carried out. The studies have shown that the reforms have not achieved equitable, efficient and sustainable allocation of water in developing countries, and specifically in African countries (Wang *et al.,* 2003). This is a result of a lack of sufficient funding for implementation of the reform process (Van Koppen, 2003; Heyns, 2005; Munguambe, 2010; Gallego-Ayala and Juizo, 2011). According to Hurlbert (2007) and Sikazwe (2005), the delay in the implementation of water sector reform polices is caused by fragmented policies and legal documents that guide the water reforms. Pollard and du Toit (2002) argue that there is no balance in the implementation process in terms of the three objectives of water sector reforms. For example, the use of economic efficiency is prioritised in many countries, as opposed to sustainability and equity. To identify the challenges in achieving the aims of water sector reforms, there is a need to assess the progress of water allocation reforms in terms of achieving country-specific objectives of water allocation reforms.

1.4 Research aim and objectives:

The main objective of the study is to assess the contribution of the reforms of the water allocation system towards increasing access to water by historically disadvantaged groups in the Barrydale area in the Western Cape Province, South Africa.

Specific objectives:

- To establish how the reforming of the water allocation system has affected access to water for agricultural uses by historically disadvantaged groups in Barrydale area in the Western Cape Province, South Africa.
- To determine how the reforming of the water allocation system has influenced productive use of water in agricultural activities undertaken in Barrydale area in the Western Cape Province, South Africa.

1.5. Outline of the thesis

The thesis consists of four chapters, which are briefly outlined here. The first chapter sets the background and the context of water law and the evolution of water sector reforms in various countries, describes the research problem, rationale and the research objectives. The literature review in the second chapter provides background to the development of the reforms of the water sector globally, nationally and locally in order to contextualise the argument. The chapter also provides reasons for reforming the water sector, and water allocation systems. Approaches and criteria used for reforming the water allocation system and how the reforms achieved the intended objectives are reviewed. Successes and failures of the water allocation process, gaps in knowledge regarding effectiveness and how the reforms of water allocation intend to achieve their objectives in South Africa are reviewed. The third chapter (Methods and Materials) describes the process used to collect and analyse data in order to achieve the objectives of the study. The advantages and the disadvantages of the methods are also outlined. The fourth chapter provides results and discussion of the data collected from interviews, review of documents and secondary data. Chapter Five presents the conclusions and recommendations.

1.6. Summary

This chapter has provided background to the study, the research rationale, highlighted the problem statement and the objectives of the study. The next chapter provides an overview of the reviewed literature, both South African and international. The next chapter is crucial for the formulation of data collection and analysis methods, which will be sourced from the reviewed literature.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Water allocation is a process of sharing water amongst competing users. The process is complex when the available water resources are limited and fail to meet the needs of various users. The process is mainly used to determine the amount and source of water that will be given to individual water users and the purpose for which the water will be used (Speed *et al.,* 2013). The reform of water allocation occurs as a result of various factors, including changes in social, economic, environmental and political situations (de Loe *et al.,* 2007*)*. According to Speed *et al.,* (2013) and de Loe *et al.,* (2007), the objectives of water allocation are to achieve equity, environmental protection, promote development priorities, balance supply and demand of water and promote efficient use of water. De Loe *et al.,* (2007) also add that stakeholder participation in decision-making in water allocation is critical, not only for preventing conflicts and for equity issues, but also as a social learning opportunity. There are different water allocation mechanisms that are used in different countries (Dinar *et al.,* 2001). There are also various criteria that can be used across countries, and across provinces in one country, depending on how the water allocation is established and created. (Speed *et al.,* 2013).

This chapter focuses on aspects that are relevant to water allocation and its reform. These aspects include the following;

(i) development of water allocation globally and the reasons for reforms;
(ii) mechanisms used to allocate water (including strengths and weaknesses);
(iii) approaches or criteria used to reform water allocation and how the reforms achieved the intended objectives; and
(iv) review of water allocation reform in South Africa focusing on the successes and failures of the process, then identifying the gaps in knowledge regarding effectiveness and the achievement of intended equitable access to water.

2.2. Global Development of Water Allocation Reform

Water allocation reform dates back decades in many parts of the world. The reform processes depend on a number of factors that are usually country-specific. Countries such as England and Wales, Canada, Ghana and Zimbabwe are some of the countries that have implemented water allocation reforms.

The reforms in England and Wales date back to the 1960s, when the abstraction licensing system was used. The system was introduced to address and prevent interference between water users and did not consider or manage water allocation to various water users or protection of the environment. The system has been updated in the last 20 years to include the protection of the environment. However, during the updates, other principles of the system were not changed. When the abstraction licensing system was introduced there was surplus water in most of the areas, as the licenses were issued to existing water users. However over the years the surplus has decreased due to abstraction. This led to the realisation that the system needed to be reformed, together with all its principles. The Water Resources Act of 1991 and the Water Act of 2003 were part of the reform. However, the introduction of the Acts did not change the abstraction licenses that were the cause of negative environmental impacts.

The main reason for water allocation reform in England and Wales was to ease the pressure on water resources. Impacts, which include climate change effects, have resulted in changes in the flow patterns of rivers. Population growth also had an impact on water resources, as the current system of water allocation is not flexible enough to cope with changing demands on water resources. This is evident from the following problems with the system:

- Water use does not drive economic growth.
- Water abstraction is not linked to water availability.
- Some water users have water that is more than the water user needs, while other water users have water that does not meet the users' water needs.
- The approach of changing licenses is inconsistent and slow.
- Every proposed water trade requires individual approval.
- Some catchments are over-licensed; hence trade is restricted in terms of the amount of water used (Barker, 2014).

Canada has a wide range of water resources and there is a perception that the water resources are abundant in Canada (de Loe *et al.*, 2007). This has led to misuse and neglect of water resources, which is likely to result in water shortages in the future. Population growth and climate change are other factors that will likely cause an increase in water demand relative to water supply in Canada. The Canadian Government turned to water allocation as the key area of focus in securing the water resources and managing water demand. There are water

allocation systems in Canada which were created more than a century ago, during the time when water resources were not as stressed as they are today. Due to economic development and changes in climate and also the changes in political, social and economic circumstances, the pressure on water resources also changed and this required changes in the water allocation system. The main reason for changing the water allocation system was the rigidity and inflexible rules, inefficiency in water use and the inability to resolve conflicts (de Loe *et al., 2007)*. The other reason was to utilise groundwater, which was previously not utilised, yet is a significant water resource. Surface water resources are becoming stressed and some Canadian provinces are now issuing licences to abstract groundwater. The water allocation system was also not able to adapt to challenges of environmental concerns and did not pay attention to the needs of the ecosystem (Brandes *et al.*, 2008). The various provinces in Canada have recognised that the water allocation system plays a significant role in securing water resources; hence each province established its own water allocation system (de Loe *et al.*, 2007: Casey & Ploeg, 2011).

In Africa, water sector reform processes started during the late 1980s with many of the reforms focusing on reorganisation of water supply systems in rural and urban areas. In the mid-1990s African countries such as South Africa, Zimbabwe and Ghana enacted new water laws that are in line with Integrated Water Resource Management (IWRM). The concept of IWRM tries to balance the economic and environmental concerns with participatory management strategies that will promote socially acceptable and equitable allocation and management of water resources (Laube, 2009). Water law and water allocation in Ghana was introduced in 1906 after the River Ordinance of the British colonial government was enacted. The law and water allocation were meant to regulate domestic water supply, and the water law and allocation mechanism prevailed until 1996 (Laube, 2009). The main reason for water sector reform and water allocation reforms was water scarcity, especially for the domestic water supply. This scarcity resulted from political and economic problems. It was also apparent that environmental and social concerns were previously not considered in water allocation; hence the stress thereon once the IWRM approach was used (Laube, 2014; Laube, 2009).

In Zimbabwe the water sector reforms started after the enactment of two water laws in 1998. The reason for the reform was to balance the water legislation with the country's socio-political realities and developments (Senzanje and van der Zaag, 2004). The first law was the Water Act of 1998, which introduced the concepts of equity in water allocation, efficient and sustainable use, and ecological integrity. The second law was the Zimbabwe National Water Authority

(ZINWA) Act (1998) aimed at establishing a water authority (Senzanje and van der Zaag, 2004; Manzungu 2001). The objectives of the water reform were to;

- ensure fair access to water by all Zimbabweans;
- improve the management of water resources;
- increase protection of the environment; and
- improve the administration of the Water Act (Manzungu, 2001).

The objectives are guided by a set of principles which help in achieving the objectives. The principles include state ownership of water resources, the inclusion of all people with interest in using water in the decision-making processes, the management of water at catchment level, the use and development of water resources that take into account the sustainability and protection of the environment, the polluter pays principle, and the recognition of water as an economic good. According to Manzungu (2002), and Derman and Hellum (2007), stakeholder participation was regarded as a cornerstone of the reforms. The increase in women's access to water enhanced their participation in water management decision-making (Hellum, 2001).

2.3. Mechanisms for water allocation

The administrative approach to water allocation is currently used in England and Wales (Simpson and Elliott, 2011). This water allocation mechanism includes public water allocation, in which water is publicly managed across sectors and within basins and irrigation systems through quantity-based water pricing schemes. Quantity-based administered water allocation is the most commonly used mechanism for allocating water for large irrigation schemes in developing countries. The state decides on the quantity of water that should be distributed and used in different parts of the irrigation systems (Meinzen-Dick and Mendoza, 1996). However, the allocation of water is not only based on quantity, but also on physical norms and political influence (Dinar *et al.,* 2001). In the case of England and Wales, this type of allocation approach is difficult and hard to implement, because the approach is not suitable for addressing problems of over-abstraction, in which more licenses contribute to the problem. The approach does not consider a likely decline in water availability in the future (Simpson and Elliott, 2011).

The mechanisms of water allocation in Canada vary across provinces. Each province is responsible for its own water allocation system (Casey and Ploeg, 2011; Brandes *et al., 2008).* Surface water is the main water source used in Canada and was shared based on the English

common law practice of riparian rights (Brandes *et al.*, 2008). The riparian rights evolved in Canada to address various changes in climate, geography and development issues. The evolution of riparian rights resulted in various systems which are regulated by riparianism, civil law tradition, prior allocation and authority management approach. These systems are used in various provinces of Canada. The regulated riparian system is used in Atlantic Provinces. The system uses an administrative mechanism in which a user requires a license to use water and the licenses are issued by the administrative agency. The civil law tradition is used in Quebec and the system is based on riparian rights and adapted from the civil law tradition. The prior appropriation system is used in Alberta and Manitoba. This system uses the first in time, first in right approach, in which water is used based on allocation for beneficial use. The administrative system is used in Yukon, Nunavut and Northwest Territories. Under the administrative system, the government controls the allocation of water (Brandes *et al.*, 2008). There are three mechanisms of water allocation and management that are used in Canada. The mechanisms are used in various provinces of Canada and none of these mechanisms is used exclusively from the other (Hurlbert, 2007). For example in Alberta all of the three mechanisms are used. The three mechanisms are:

- **Government agency management mechanism:** Under this mechanism water is regarded as public property, of which the government is the custodian. The government regulates who is entitled to water rights in terms of applying and receiving water licenses. This is carried out in accordance with bureaucratic policies and procedures.

- **User-based mechanism:** Under the user-based mechanism, water is regarded as a common property and water is allocated and managed by a group of water users who have water licenses. Water users work together in managing and sharing the water resources and maintaining the water resources.

- **Market-based mechanism:** Under this mechanism, water is regarded as a private property and is allocated and reallocated through trading between willing water users who have water rights. The trading is through short or long term agreements and temporary and permanent transfers of water rights.

Ghana used the riparian doctrine from 1906 until 1996, when various sectorial laws were enacted and led to government being the regulators of water resources. In 1996, the Water Resource Commission Act was enacted and it led to the abolition of pre-existing riparian rights. The Government passed the responsibility of water allocation and management to the Water

Resource Commission. The Water Use Registration was enacted in 2001 with the aim of registering all raw water use throughout the country. The Water Use Registration used a market-based water allocation, as the individual users who were abstracting water from the water sources were billed, unless the water use purpose was domestic and used manual means of water abstraction. Water prices vary between water uses and scale (Laube, 2009). The implementation of the Water Use Registrations is still in progress and it is very slow, mainly being hindered by political actors which do not support the abolition of the riparian doctrine (Laube and van Giesen, 2005). The implementation of the Water Use Registration is still in process.

The Zimbabwean water laws led to changes in the water allocation system. Surface water was allocated using the priority rights system, where water was granted for infinity and in first in time, first in right basis. The system was against the principle of equity, because the priority to abstract water was given to those who had water rights for a long time before the ones who recently got their water rights were even eligible to apply for licenses. The individuals who had acquired water rights earliest also used water as they pleased, and that affected access to water for those who had recently obtained their water rights. Therefore, the water allocation system militated against the efficient use of water (Senzanje and van der Zaag 2004). The priority water allocation system was replaced by the proportional water allocation system. Under this system, water is shared equally using the water permits, and is based on available water. The system is in line with the concept of equitable water allocation and efficient use of water (van der Zaag, 1998). The system also allows easy establishment of water markets based on its equity in terms of rights to water access (Howe *et. al*., 1986; Lang 1997).

2.4. Principles of water allocation reforms

In England and Wales there are two approaches that are used to reform water allocation. These are called current system plus and the water shares approaches. The current system plus approach focuses on relating water abstraction to available water. This means that water abstractors will be given a limited amount of water to abstract from a water source based on water availability at the source at that given time. The daily and annual limit of water abstraction will be the same for all users. This will help in improving environmental protection, especially during low flows. The water shares approach focuses on ensuring reliability in the sharing of water to all users. This is achieved by giving a share of water to users after ensuring that the amount of water for environmental protection has been put aside. Each water user is given a fixed amount of water to abstract during low flows and during high flows. This also

encourage water users to take shared responsibility of water resources in the catchment. This approach also allows short and long term trading of water between water users (DEFRA, 2013).

England and Wales are guided by a similar set of principles. It is believed that the Water Allocation Reform objectives led to a sustainable water allocation that is efficient in terms of allocating available water amongst competing water uses and which also takes into account the environment. The objectives are:

1. Protecting the environment and users by providing sufficient water to sustain the water ecosystem in relation to climate and demand pressures and by managing effects caused by abstraction and use of water.
2. Ensuring affordable and reliable water supply for public and other water uses.
3. Encouraging dynamic efficiency in the use of water by appropriately giving incentives to users to invest, innovate and increase productivity, which in turn will improve water use.
4. Encourage efficient allocation and use of water by ensuring that water is allocated to its highest value in order to ensure that the maximum benefit for society is derived from the use of available water (Simpson and Elliott, 2011).

The approaches that are used in Canada are in line with the concept of Integrated Water Resources Management (IWRM). The first approach is the holistic approach, which considers all the levels and elements of the environment in the management of water resources, which includes water allocation. The holistic approach considers three specific levels, which are hydrological, interaction between land and the environment, and the social and economic levels. The holistic approach replaced the traditional approach that was based on political and administrative boundaries that resulted in inefficiencies and inequalities in water allocation. The holistic approach is now used to deal with those inefficiencies and inequalities in water allocation. The approach is applicable to the whole country, as it is applied by the Federal Government, not at the level of the individual provinces (Shrubsole, 2004).

The watershed approach is also used in Canada and is applicable at catchment level. The approach is referred to as the most appropriate approach for integration and water management at catchment level. However, the approach is unable to deal with administrative issues and the holistic approach is then applied. Both the approaches consider and have strategies put in place to improve public involvement in water management issues. Unlike the traditional approach that involved the public through consultation means, the two approaches strengthen public

participation by creating the Canadian Environmental Registry, with improved access to information on water management and water allocation issues. Aboriginal people are also included in participation, as they are valued for their traditional ecological knowledge. This inclusion was carried out by establishing the First National Advisory Committee (Shrubsole, 2004: de Loe *et al.*, 2007).

Water allocation reform in Ghana adopted the IWRM principles. This was due to the fact that the reforms were initiated as a result of influence by international donors. The Water Resource Commission has the responsibility of implementing these principles (Laube, 2009). The Water Resource Commission uses the state approach in water allocation and management. This means that the Water Resource Commission takes the decisions regarding how, where and how the water is allocated. Under this approach, water is for the public and is managed by the state. However, the Water Resource Commission also includes traditional approaches by consulting community leaders, such as chiefs, in water management and allocation issues and decision-making. The Water Resource Commission also establishes water acts, laws and policies in order to better manage water resources. The Water Resource Commission also implements these laws, but that seems to be a problem due to political influences and financial difficulties (Pedersen, 2006).

Zimbabwe uses the market approach in water allocation reform. This approach is used as a mechanism of regulating water use and it ensures that water is treated as an economic good by allocating water in accordance with its scarcity value. The market approach also promotes the efficient use of water, which will lead to higher production (Manzungu, 2001; Rashirayi *et al.*, 2013). The Gender and Development approach is used in Zimbabwe to mainstream gender into all areas of water management. The approach is meant to focus on promoting equal water access and participation for all and not just focusing on women alone (Hellum, 2001; Beetham and Demetriades, 2007). However, it was realised that the policies for stakeholder participation and water pricing do not address gender issues in practice, but incorporated gender in polices. The donor countries that supported the Water Resource Management Strategy (WRMS) have agreed and highlighted the significance of using the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) approach. The approach is said to ensure women's rights in participation in the water reform process (Hellum, 2001).

2.5. Effectiveness of Water Allocation Reforms

In England and Wales, water allocation reforms include the concept of economic growth by ensuring that all water licenses that are issued or registered are for the purpose of effective productivity. In instances where the water license owner is not using or has no legitimate need for the water rights, the reform allows trading between water users. The process is then approved between the users without delay (Stern, 2013). Water abstraction is linked with the availability of water, in which priority is placed on the ecosystem and human basic water rights before water can be allocated for other uses. In catchments where water is over-allocated the reforms have also enforced the reduction of volumes licensed for abstraction. This has also led to the abolishment of the allocation mechanism where water was allocated in perpetuity (Young, 2012). Water allocation is now flexible, as this takes into account the availability and the purpose of water use.

The reforms in Canada have achieved several objectives, which include changing the water allocation system that was inflexible (de Loe *et al.,* 2007; Hurlbert, 2007). Water allocation systems have become flexible by considering economic, social, hydrologic and environmental aspects and also development objectives. The reforms also achieved the effective use of water through the use of the market-based allocation mechanism, whereby the use of water is reflected in production and economic contribution. The reforms also resolved the conflicts of water trading by the government, giving the responsibilities to provinces and users. This has helped in eliminating administrative and approval delays. Trading is now allowed between water users (de Loe *et al.,* 2007). Some provinces have also started utilising groundwater and they have issued ground water abstraction licenses. Groundwater was previously not considered as a water resource managed through water allocation (Brandes *et al.,* 2008). When it comes to equity, the water allocation reforms are fair and transparent (Kempton, 2005). The reforms also take into account those who cannot afford to pay for water. However, the water allocation process does not consider the Aboriginal people and their indigenous water rights. This has resulted in some conflicts, as they are raising concerns about how the new water allocation system is affecting them (Kempton, 2005).

In Ghana water allocation reforms have achieved the abolishment of the riparian rights doctrine. The reforms have also managed to achieve some of the objectives in line with the IWRM concept. The water allocation mechanism considers the social and environmental factors, which were not considered under the previous water allocation mechanism (Freshwater, 2004; Padersen, 2006). The Water Resource Commission of Ghana regulates

water allocation and has introduced the registration of water use rights. However, the water allocation mechanism did not abolish the riparian doctrine. This is because Ghanaians still believe that those who are located adjacent to the river catchment area have the right to use water from the river source, but not to refuse access by those who are not located adjacent to the river source. This is because it is morally unacceptable for a person to infringe on another person's right to use water in Ghana (Laube, 2009). This has resulted in difficulties in the implementation of the new water allocation system, which is a prior appropriation rights system. The objective of improving stakeholder participation in water allocation processes has not yet been achieved. This is because the Water Resource Commission of Ghana, which regulates water allocation and management, only consists of major water user agencies, regulatory institutions, major scientific organisations, women, non-governmental organisations (NGOs) and chief's representatives (Laube, 2009). Low-level stakeholders, which include both commercial and small-scale farmers, are not included. The reforms were also not driven by Ghanaian stakeholders, but by international donors (Laube, 2009; Laube, 2014). However, the Water Resource Commission is in the process of improving participation of farmers in water allocation by establishing institutions such as Village Councils (VCs) and Water User Associations (WUAs), where participation of all stakeholders will be improved. This process is very slow, but it has been implemented in three catchments and it seems to be working, as farmers are hands-on in matters of water allocation and management (Pedersen, 2006; Laube, 2009).

In Zimbabwe, water allocation reforms have achieved some of the intended objectives; however some are not yet achieved. The achievements of the reforms include the change in issuing of water, which used to be allocated in perpetuity, and this was unfair. Water is now issued in the form of water permits for a specific period (Manzungu, 2001). The new water rights system allows small-scale farmers to access water permits (Derman and Hellum, 2007). The market approach of water allocation has not achieved the objective of the reforms, because paying for water is only beneficial to those who can afford to pay, leaving those who are unable to pay poor (Hellum, 2001, Derman and Hellum, 2007). For example, women in communal Zimbabwe mainly use water for agricultural purposes to support their families. These women cannot afford to pay for the water; therefore they cannot expand production. There is no private ownership of water; water is treated as a public resource, which was not the case before the reforms. The reforms have also achieved the efficient management of water resources at catchment level. This has improved the participation of all water users in water management

and also reduces the administrative burden, which in turn reduces the delays in the issuing of water permits (Manzungu, 2001). Derman and Hellum, (2007) and Rashirayi *et al.*, (2013), argue that water management at catchment level is barely functioning in Zimbabwe, due to various reasons, which include lack of capacity, lack of authority and skills. Hellum, (2001) also argues that participation in water polices, which promises to improve women's access to and participation in water resources, is not happening in practice. Instead, the approaches that are put in place to improve the role of women in water resources are twisted and interpreted in a way that serves the needs of others, and exclude women.

2.6. Water Allocation Reforms in South Africa

2.6.1. History of Water Allocation in South Africa

Laws for water allocation were introduced in 1656 in South Africa and changed after that, due to the Dutch settlers colonising the land and changing the system. The Dutch water allocation system gave priority to irrigation and agricultural use of water (Kidd, 2011). After the enactment of the Irrigation Act of 1912, use of water for irrigation was placed as top priority. The National Water Act was enacted in 1956 and gave rise to the Department of Water Affairs (DWA) which was mandated to provide and allocate water for development purposes in agriculture. Economic development was exclusive to white people, while black people had few rights and did not have access to land or water. Water became an effective weapon during the apartheid government, used to oppress and control black people and prevent their development (Funke *et al.*, 2007). In 1998, a new National Water Act was enacted and its purpose was to ensure that water resources are protected, used, developed and conserved. This act also ensures that the nation's water resources should be managed and controlled in a sustainable and equitable manner by government as the public trustee. The Department of Water Affairs (DWA), now Department of Water and Sanitation (DWS), was given the responsibility of ensuring allocation of water in an equitable manner and in the interest of the public, and also to take into account environmental concerns (Kidd, 2011). The DWS is in the process of allocating and reallocating water in order to meet the needs of the public, especially those who were historically disadvantaged. The DWS has also implemented various efforts in order to ensure equitable water allocation for the whole nation. The efforts include the water allocation reforms of 2004 and 2011 (Msibi and Dlamini 2009; DWS, 2014). The main purpose of the reforms in water allocation in South Africa is to redress the past imbalances in water access (Msibi and Dlamini, 2009).

2.6.2. Mechanisms for water allocation

Common law prevailed in South Africa before 1652. Under the law, water was treated as a common property and water was allocated by the state. After 1910 the common law changed to the riparian rights system. Riparian rights prevailed until late 1998, when the new National Water Act was enacted. The riparian system was changed, as it was not appropriate for a water-stressed country such as South Africa (Kidd, 2011). The DWS is using the Water Allocation Reform (WAR) as a key to achieving the aims of the 1998 National Water Act, especially the inequalities in water access and participation in water management issues by HDIs (DWS, 2014). The WAR established the General Authorisation (GA) and Compulsory Licensing (CL) as the two mechanisms for water allocation. The GA is a mechanism of water allocation specific to black people and women. The mechanism is also used to reduce the administrative burden. The CL is a mechanism that is used to allocate water in order to achieve fair allocation of water in stressed areas (DWS, 2013). The CL mechanism also converts the existing lawful water use into licences. The CL follows the water allocation plan of the catchment, which indicates the amount of water required by the environmental reserve and for strategic water use, which also indicates how much water can still be allocated to other uses. The water allocation plan also indicates the amount of water that is tied up in existing lawful water use and shows if there is a need to reduce existing lawful water use (DWS, 2014).

2.6.3. Principles of Water Allocation in South Africa

Water allocation in South Africa is based on water availability. In catchments where there is insufficient water, permit applications for water use are evaluated from all interested individuals, but the HDIs are encouraged to apply for water. The main focus of water allocation in these catchments are to promote redress, equity, economic growth and job creation, therefore any application that is in line with the focus of the catchment's water allocation is encouraged. Stakeholder empowerment and communication processes are some of the approaches that will support and highlight ways in which HDIs can improve their livelihoods. There are also principles that are applicable in catchments where water use applications may exceed the allocable water. In such catchments, priority is given to applications for which water use will be in the interest of the general public and with little impact on other water users. In cases where water applications that meet the priority conditions cannot be authorised due to limited water allocation, water trading options are identified. The third principle is applicable in catchments that have been prioritised for compulsory licensing (DWAF, 2005). In these catchments, water is already over-allocated; therefore water is allocated using compulsory licensing. Special attention is given to possible social, economic and ecosystem implications

for the re-allocation process. The re-allocation process will look at other alternatives before reducing existing lawful use in order to meet water demands. These include taking into consideration the following:

- Ending of unlawful use.
- Removal of alien vegetation.
- Promoting the use of groundwater where possible.
- Promoting water conservation and water demand management.
- Curtailment of existing lawful water use.
- Developing the resources such as construction of impoundments.
- Promoting water trading.

After these processes have been considered, if there is allocable water available, the water is then re-allocated to applicants that demonstrate the beneficial use of water in the public interest. The re-allocation of water is also a way of supporting equity, as well as productive and sustainable use of water. Support programmes are established through co-operative government/governments processes for all water users. Compulsory licensing is also paralleled with procedures to help emerging and existing water users in forming water user associations or other co-operative institutions. The process will promote and improve participation, which is very crucial for the users to air their concerns, because the process affects the livelihoods of stakeholders (DWAF, 2005).

2.6.4. Successes and failures of the water allocation reform in South Africa

The National Water Act of 1998 brought about significant changes in the way that water used to be managed prior to 1994. The successes of by the NWA include the abolishment of riparian rights and private ownership of water, which vested the authority in the state to issue water licenses. The NWA also contained the core principles of reallocation of water. However, the act did not stipulate how this should be carried out practically. The NWA therefore highlighted that there is a need for a policy that will guide water allocation reform (Movik, 2009). The main principles of the NWA are equity, sustainability and efficient and beneficial use of water for society at large. These principles are similar to the objectives of Integrated Water Resource Management (IWRM), hence the initiatives of water resources management are within the framework of IWRM. The objectives of IWRM include the achievement of social equity,

economic benefits and environmental sustainability (Levite and Sally, 2002; Anderson *et al.*, 2008).

The Water Allocation Reform programme was developed as a key programme in achieving the objectives or implementing the principles of the NWA. The objectives of the WAR were also in the framework of IWRM. These objectives include:

- Take steps to meet the water needs of historically disadvantaged individuals and the poor.
- Ensure participation by these groups in water resource management.
- Promote the sustainable use of water resources.
- Promote the beneficial and efficient use of water in the public interest (DWS, 2014).

In achieving the objective of meeting the water needs of HDIs the WAR programme has developed mechanisms of allocation water, in which the priority is placed on HDIs when there is water to be allocated. The disadvantage of these mechanisms is that water is first allocated to existing lawful use. The existing lawful water use refers to the verified and validated water use rights that existed under the previous water allocation mechanism, namely riparian rights. According to Speed *et al* (2013), the use of existing lawful rights benefits those who already have the rights and limits economic opportunities for those who do not have water rights. The use of existing lawful water use rights affects other objectives such as participation of HDIs in water resources management, because they will not benefit or will have no interest in water resources management or their ideas, suggestions or comments are clouded by the majority of existing water users.

In achieving the participation objective Water User Associations (WUAs) should be formed. These are lower-level institutions that are regarded as all-inclusive platforms for bringing about water democracy and improving participation in water resource management by HDIs. However, the majority of members in the WUAs are white commercial farmers and the views and suggestions of HDIs are mostly not considered in decision-making (Manzungu, 2002; Saruchera, 2008). Manzungu (2002) suggested that in order to achieve meaningful active participation by HDIs in water resources management, there is a need for addressing development aspects of stakeholders and structural problems that include access to land and financial resources. Sustainable use and efficient use of water objectives are achievable during the application process of water licenses, as the applications are assessed in terms of whether the use of water will achieve these objectives (DWAF, 2005). However the failure in

implementing this with existing water uses becomes apparent. This is because the existing water use is not efficient, but only beneficial in drawing up allocation plans (Speed *et al.*, 2013).

Reforms of water allocation evolved in various countries for various reasons. The reforms are guided by enacted water laws. The implementation is carried out through policies, such as water allocation reform in the case of South Africa. The reforms seem not to have achieved the objectives. The next chapter will assess the contribution of the reforms of water allocation to equitable water access by using a set of methods.

2.7. Summary

The chapter outlined the evolution of water allocation reform as a part of water sector reforms. Various countries use specific mechanisms of water allocation, but administrative, market-based, user-based and government agency management approaches are universally used. Sustainability, efficiency, productive use and maintaining ecological integrity are the main guiding principles of water allocation globally. Water allocation reforms are said to be effective in other countries. However, with changes in aspects such as climate and population, water allocation reforms continue to be reviewed and altered to effect such changes. The reforms of the water sector in South Africa were outlined with reference to the changes in the water legislation. The principles of water allocation are based on water availability in specific catchments and redress of past imbalances in water access. The principles are linked with the water allocation mechanisms, which include general authorisation, compulsory licensing, set-asides and other mechanisms. Based on the reviewed literature, the water allocation reforms have not yet achieved the intended objectives in South Africa, and this is said to be a result of delayed implementation.

CHAPTER 3: METHODS AND MATERIALS

3.1. Introduction

This chapter presents the methods used to collect and analyse data in order to achieve the study objectives. A description of the approach to the study is also given. The location of the study area and the criteria used to select the study area are also described.

3.2. Research design

The study used a case study methodology, involving the use of questions that seek explanations for present circumstances and for extensive and in-depth descriptions of social phenomena of the selected case study (Yin, 2014). Qualitative data were used to assess factors that have contributed and hindered access to water for productive use by historically disadvantaged groups, using a sustainable livelihood approach. According to Mokoena (2006), historically disadvantaged groups (HDGs) are black, coloured and Indian South Africans who were disadvantaged by unfair discrimination based on race and gender, prior to the democratic era that was marked by the coming into effect of the Constitution of the Republic of South Africa Act of 1996 (Act No. 108 of 1996). Amongst other things, the HDGs were denied access to natural resources such as land, water, fisheries and minerals, and were therefore unable to develop economically (Mokoena, 2006). The term 'historically disadvantaged groups' is used interchangeably with 'previously or historically disadvantaged individuals or groups'.

The Brundtland Commission on Environment and Development (1987), introduced the sustainable livelihood idea in 1987 as a way of linking socioeconomic and ecological consideration in an organised policy-relevant structure (Solesbury, 2003). The concept was expanded by the United Nations Conference on Environment and Development (UNCED) in the context of Agenda 21, which set the achievement of sustainable livelihood as a main goal of eradicating poverty (Solesbury, 2003). The sustainable livelihood approach aims at assisting various stakeholders to engage in structured debates in order to work together and support each other in handling factors that affect their livelihoods. The approach is commonly used in areas where people practice farming as a way of life and in new development activities that contribute to the stakeholders' livelihoods (DFID, 1999; Krantz, 2001).

The sustainable livelihood approach (SLA) takes into account five components, which are: natural, social, economic, physical and human components (Morse *et al.*, 2009; Nyumbu, 2013). The components are linked to one another and are used as indicators of livelihood outcomes. These were used in the study to assess the contribution of water allocation reforms

to sustainable livelihoods of the Barrydale farmers in the Western Cape Province of South Africa. The SLA was used to assess how the social, economic, physical and human components have contributed to or hindered access to water, and productive use of water by historically disadvantaged groups. The SLA was also used to assess the status of each component of the SLA to farmers, because these components are said to be important for successful farming or for any type of livelihood strategy. A qualitative data collection method was used to assess existing natural components in Barrydale by reviewing databases and by the use of secondary data from the DWS and interviewing Breede-Gouritz Catchment Management Agency (BGCMA). The hydrological services database from the Department of Water and Sanitation was used to determine the amount of water available in the Huis river catchment at gauging station H7H004 at Barrydale. The monthly rainfall data was sourced from the South African Weather Services to assess annual rainfall of Barrydale to measure the contribution of rainfall to the water availability in the area. The SAPWAT 4 software program was used to compute crop water requirements for selected crop types produced by small scale farmers (SSFs) and large scale farmers (LSFs). Spearman's correlation coefficient method was used to correlate the water used by SSFs and LSFs and the income generated from using water. This was carried out to assess the productive use of water. The thematic analysis method was used to analyse the data by categorising data from the interviews into the five components of the sustainable livelihood approach.

3.3. Sustainable Livelihood Approach

The SLA was applied in the study as a framework to assess the contributions of water allocation reforms in achieving equitable access to water and productive use of agricultural water by HDGs in Barrydale. The assessment was carried out through the use of the five components of the SLA i.e. natural, human, physical, economic and social as indicators of water allocation contribution to HDGs. The components are important for farming members as they influence the success of farming (DFID, 1999; Krantz, 2001). Data on each of the components were collected using various data collection methods that are described in the following section. Results from the data collected were used to determine the livelihood outcome using data analysis methods that are described in the following section. Figure 3.1 provides an overview of the components, influential structures and the expected outcome of the SLA.

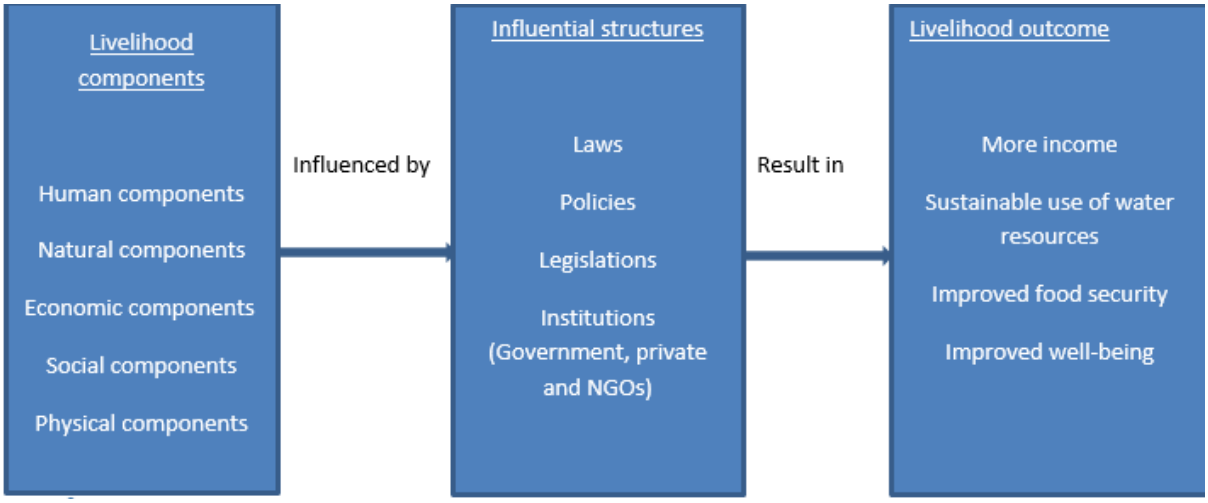

Figure 3.1 Sustainable Livelihood Approach Framework modified from Krantz (2001)

3.4. Site selection criteria

A study site needed to be selected in order to address the objectives of the study site. The criteria of the study site required finding:

a) A site where farming is the main source of income.

b) A site where there are historically disadvantaged farming groups.

c) A site with farmers who are not part of historically disadvantaged groups.

d) A site where there are different views of water allocation process and its benefit to historically disadvantaged groups and a group that was not historically disadvantaged.

3.5. Description of the study area

The study is located in the Western Cape Province of South Africa in a farming area called Barrydale (33.9076 S; 20.7182 E) (Figure 3.2), located on the border of the Overberg and Klein Karoo, just after Tradouw's Pass and stretching to Swellendam. The area falls under the Swellendam Municipality and the Breede-Gouritz Catchment Management Area. The area falls within the southern folded mountain ecoregion and the topography is characterised by moderate to high mountainous and hilly landscapes. The mean altitude of the area ranges between 300m and 1900 m. The area is underlain by Bokkoveld and Table Mountain Group with faults (DWAF, 2010; DEADP, 2011).

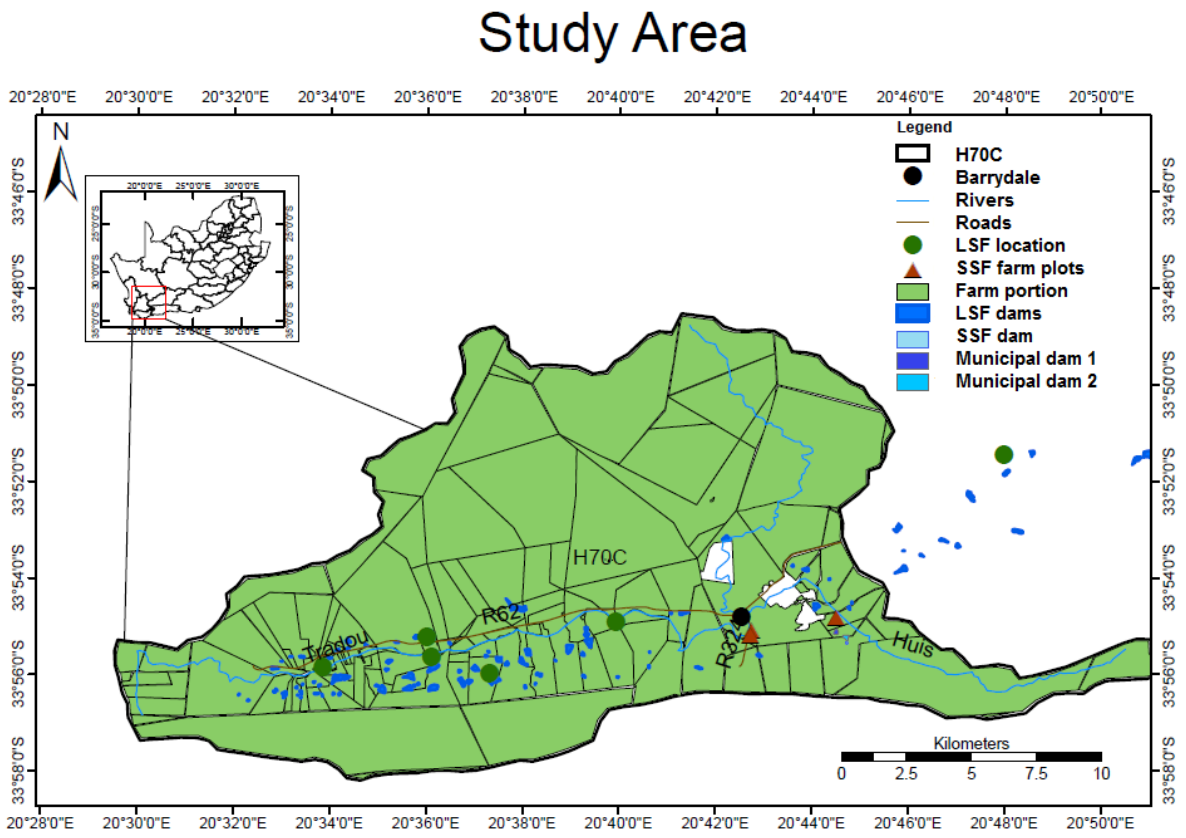

Figure 3.2: Location of the study area

Rainfall occurs from very late summer to winter, with snowfall. The annual rainfall ranges between 1700 and 1900 mm/year on the mountains and decreases to 300 mm/year on the east side of the mountains. The average annual rainfall received in areas on moderate landscapes is 440 mm/year (River Health Programme, 2011; DWS 2011). River discharge in Huis River mimics the rainfall pattern, but the pattern is impacted by abstractions that lead to reduced river discharge, especially during the dry season (River Health Programme, 2011).

Commercial farming comprising deciduous fruit production is the dominant land use in the area, followed by livestock farming and irrigated crops, which include vegetables, fruits and grains (River Health Programme, 2011; Cardoso, 2012). On the central part of the area, urban development is the major land use. Vegetation is dominated by sandstone fynbos and succulent Karoo vegetation (River Health Programme, 2011).

3.6. Data for assessing access to water by HDIs

a) Progress in the implementation of water allocation reform mechanisms by BGCMA in order to increase water access to agricultural water by historically disadvantaged groups in areas under the BGCMA.

b) Human components

- Farmers' education status and skills.

c) Economic components

- Farmers' employment status.
- Farmers' sources of income and average monthly income.
- Average farming income from all sources of income.

d) Natural components

- Rainfall pattern of Barrydale.
- Available water sources in Barrydale, amount of water flowing through the identified water sources and accessibility of the sources by farmers.
- Amount of water used on farming activities.
- Entitlement to abstract water from the available water sources.

e) Physical components

- Size of farm plots and farms used and owned by farmers.
- Farming equipment owned by farmers and means of acquiring farming equipment.
- Water transporting and storing infrastructure available to farmers.

f) Social components

- Farmers' social networks and membership of farming groups.
- Role of farming groups to individual farmers.

3.6.1. Data collection methods for access to water by HDIs

3.6.1.1. Document review method

The BGCMA is responsible for managing water resources within Breede and Gouritz Water Management Area in the Karoo region of the Western Cape Province. The BGCMA was established in terms of the National Water Act (Act No. 36 of 1998) by the Minister of the DWS in 2007. The BCGMA Board was established in 2007 and the CMA became operational

from 2009 (BGCMA, 2012). The study area is located in the Swellendam Municipality and is under the jurisdiction of BGCMA.

Data such as the processes used by the BGCMA to implement the water allocation reform, and the actions taken by the BGCMA to increase access to water by HDIs, were collected from documents reviewed from the BGCMA. The reviewed documents include newsletters, the BGCMA Strategy and annual reports and were reviewed using the documents review method. This was carried out in order to understand actions that have been undertaken by the BGCMA to increase access to water by HDIs in the area, particularly for agricultural uses and to improve the livelihood of HDIs. Document review allows independent verification of the information contained in the document and is cost-effective. However, obtaining and analysing the documents can be time-consuming and the quality of information contained in the document cannot be regulated by the researcher (Witkin and Altschuld, 1995; Bowen, 2009). The documents that were reviewed are public documents and were easily accessible.

3.6.1.2 Referral sampling method

Participants were interviewed in order to obtain the required data listed in the previous section. The referral sampling method was used to select the participants. Key participants from the two selected Barrydale farming groups were selected, based on the participants' roles in the respective farming groups. The key participants referred the researcher to other farmers and facilitated the meetings. Seventeen out of twenty-active Barrydale Small-Scale Farmers (BSSF) and six out of a total of twenty-five Barrydale Farming Group (BFG) members were selected for interviews. BSSF are members of the historically disadvantaged groups, referred to as 'emerging farmers' in South Africa and as 'small-scale farmers' (SSFs) for the purpose of the study. The farmers are located on the east side of the area, about five to ten kilometres from the town of Barrydale. According to Saruchera (2008), there is no universal definition of an emerging farmer, but the term is used freely to describe farmers that recently bought or leased farming lands, have poor physical, natural, economic resources and are members of the historically disadvantaged groups. For the purpose of the current study, emerging farmers are farmers that lack physical, natural, economic, resources and human and social components, who are members of the historically disadvantaged group (HDG). BFG are commercial farmers and not members of the historically disadvantaged group. These farmers are referred to as large-scale farmers (LSFs) in the current study. The farmers are located on the west side of the town, about 15 to 20 kilometres from the town of Barrydale (Trust for Community Outreach

and Education, 2013).The farmers were selected based on availability and willingness to participate in the current study.

The referral sampling method was selected, because it is effective in selecting participants in groups that are difficult to reach (Volz and Heckathorn, 2008). Participants were difficult to reach, because farmers are generally busy. Unfamiliar people around farms are often seen as thieves or trespassers, and farmers discourage their presence around the farms. Selecting this method allowed referral of the researcher to the farming group members and easy access to farms.

The advantage of the method is that it does not require a sampling structure and is very effective for groups that are difficult to reach (Volz and Heckathorn, 2008). It is suitable for various research purposes, especially in research that focuses on sensitive issues such as assessing financial components of an individual or a group, thus requiring the knowledge of a key participant that is known and trusted by other participants during the selection process (Biernacki and Waldorf, 1981).

The disadvantage of the method is that it does not allow random selection of the participants, as they are selected through referral. Referral selection might be biased, as the selection might be limited because of proximity and relationships (Heckathorn, 2002). To avoid bias in the selection process, the selected key participants are representatives of both farming groups, therefore all members of the groups had equal chance of being selected. Both key participants represent the groups in all farming activities and the members from both groups trust the representatives.

3.6.1.3. Structured interviews

To obtain the required qualitative data for the human, economic, natural, physical and social components of selected SSFs and LSFs from Barrydale were interviewed. The two groups have been defined in the previous subsection. The questionnaire in Appendix A was administered to SSFs, while the questionnaire in Appendix B was administered to LSFs. Different questionnaires were administered to farmers, because farmers from the two groups are farming at various farming scales and are conducting different farming activities, necessitating different questions. LSFs are commercial farmers with farms sizes ranging between 140 and 500 hectares and involved in deciduous fruit, dairy, livestock and wine grape farming. SSFs are small-scale farmers leasing farm plots ranging from 2 to 12 hectares and involved in vegetable and livestock farming. The interviews with SSFs were conducted in March 2015 for three days

and a total of seventeen out of twenty-active farmers were interviewed. Interviews with LSFs were conducted in one day in September 2015 and a total of six out of a total of twenty-five farmers were interviewed.

Interviews allowed the participants to give open responses to questions and have been used worldwide on diverse subjects. Interviews also allowed the participants to discuss sensitive issues, such as financial issues, which the participants might not be comfortable discussing in a focus group (Young, 1984; Khalid, 2001). Interviews also allowed the participants to talk about factors that affect individual farmers, rather than farmers as a group. These factors could be factors that hinder the farmers from accessing water or using the water productively, in the case of those who have water access (Longhurst, 2010). The interview method has a disadvantage in terms of constraints in language used during the interview (Letts *et al.*, 2007; Harrell and Bradley, 2009). To overcome the English language constraints, an interpreter was used for the participants that did not understand English. The disadvantage of an interview is that it is time-consuming, because a researcher needs to conduct several interviews with different participants (Keller and Conradin, 2010).

3.6.1.4. Secondary data collection

Monthly discharge data from the Hydrological Services database of the DWS, covering a time period of 30 years (from 1985 to 2015), was used to determine the amount of water passing through H7H004 flow measuring station in Huis River. The period of the discharge data used were dependent on the availability of data. The discharge data were used to determine water flowing through the catchment. The data were used to assess the impact of water source availability as a factor that promotes or hinders equitable access to water. Annual rainfall data were obtained from the South African Weather Services. The rainfall data from the year 1996 to 2015 were used to establish rainfall patterns and to assess potential for rainwater harvesting for SSFs who are located on the east side of the town and far from the SSFs' Dam, and who were therefore reliant on rainwater harvesting for agricultural activities.

3.6.2.. Data analysis for assessment of access to water by HDIs

3.6.2.1. Qualitative content analysis

A qualitative content analysis method was used to analyse data collected during the review of BGCMA documents. The data were categorised into themes, which are written in such a way that they yield a pattern that outlines the way in which BGCMA increased access to water by HDIs. The themes are the water allocation mechanisms stipulated in the Water Allocation Reform Strategy for implementation by the DWS and Catchment Management Agencies. The

content of the documents was interpreted and described with reference to the objective of Water Allocation Reform to allocate water to HDIs in order to improve their livelihood.

The qualitative content analysis method is widely used in both qualitative and quantitative research and it has few rules, which reduces the risk of confusion in matters concerning the concepts and discussion of data (Zhang and Wildermuth, 2016; Bengtsson, 2016). The rules include formulation of themes, following a pattern given in the document and the research question, and discussion of the pattern without giving meanings to data. The method is descriptive in nature and it does not reveal the underlying motives for the observed pattern. Availability of data is the limitation to the method. The method is useful for analysis of historical material, especially for documenting trends over time (Bowen, 2009). The documents that were reviewed are public documents and are easily accessible.

3.6.2.2. Thematic analysis

To analyse the data collected during interviews and the secondary data, a thematic analysis method was used. Prior to data collection, questions for the interviews were categorised under the five components of SLA, namely: human, economic, natural, physical and social components. After the interviews were conducted the data were captured based on the five categories. The capturing of data involves the transcription stage of thematic analysis, whereby data from the interviews and secondary data are transcribed into written form and recorded under their respective SLA component. The five components, with the collected data, were used as themes, in order to organise and interpret data based on specific component. Data on each category was analysed and the outcome of the analysis gave the overall outcome of SLA.

The outcome of SLA is the overall indicator of how reforms of water allocation in South Africa have or have not affected access to water by SSFs. Positive outcomes were determined by assessing the contribution of water allocation reforms to natural and economic components and how this contribution improved human, physical and social components. Positive outcomes indicated positive effects of the reforms of water allocation to SSFs, while negative outcomes indicated negative or no effect of the reforms of water allocation to SSFs. The positive outcome is achieved when there is an increase in water access by HDIs and productive use of water is achieved, while a negative outcome is achieved when increases in water access and productive water use are not achieved. The outcome is determined through assessment of the impact of Water Allocation Reform to each of the SLA components and the assessment of whether the impact of these components resulted in increased access to water and productive use of water by HDIs.

Thematic analysis is a widely used qualitative method of identifying, analysing and reporting themes or categories within data sets. The thematic analysis method describes data in detail and interprets different aspects of the study being undertaken (Miles and Huberman, 1994; Braun and Clarke, 2006). The advantages of thematic analysis compared to other methods include flexibility and detailed analysis of data. The disadvantage of the method is the limited interpretation of the meaning of data, if it is not in accordance with the existing framework (the SLA in the current study) that contains the identified themes (Braun and Clarke, 2006). To overcome the disadvantages of the method, proper planning of research interviews and categorising of required data into themes was carried out before interviews were conducted.

3.6.2.3. Assessment of crop water requirements

SAPWAT 4 is a software program for estimating water irrigation requirements for crops, farms and drainage regions for water planning and management purposes. It is widely used in South Africa as a tool by water users, water service providers and by learning institutions for water conservation and management (van Heerden and Walker, 2016). This program is an upgrade of the previous version SAPWAT 3. It was developed in order to overcome difficulties encountered in calculating evapotranspiration and linking it to specific crop stage growth through use of crop coefficients in order to get an estimation of crop evapotranspiration. SAPWAT 4 was therefore developed based on FAO published Irrigation and Drainage Report No. 56 titled "Guidelines for Predicting Crop Water Requirements" (van Heerden and Walker, 2016).

Weather, soil, crop type, irrigation management, drainage basins, catchment datasets are all included in SAPWAT 4. However, the user is required to know and select the area of study in order to compute results for the area of study. The catchment, crop type, soil type and irrigation method of the study area were obtained from both literature and through interviews. SAPWAT 4 was used in the current study to estimate crop water requirements for crops produced by SSFs and LSFs in the study area.

3.7. Data for assessing productive water use

To achieve the assessment of productive water use, the following data were required:

a) Economic components:

- Farmers' sources of income and average monthly income.
- Average farm produce sold per month.

b) Natural components:

- Amount of water used on farming activities.

3.7.1. Data collection for assessing productive water use

Data were collected using the methods described in subsection 3.6.1. The methods were interviews and secondary data collection methods. The methods are therefore not described in the current section.

3.7.2. Data analysis methods for productive water use

3.7.2.1. Spearman's rank correlation coefficient

Spearman's rank correlation coefficient is a nonparametric rank statistical measure of strength of association between two variables. It assesses how well an arbitrary monotonic function can describe the relationship between two variables. It does not make assumptions regarding the frequency distribution of the variables, does not assume a linear relationship between the variables or require the variable to be measured on an interval scale (Spearman, 1904; Hauke and Kossowski, 2011).

The method was used in the current study to assess the level of association between water used by farmers for farming activities and income generated from farming activities. This was achieved using the Statistical Package for the Social Sciences software used for data analysis. The outcomes of the assessment were used to achieve objective two in assessing the impact of water allocation reform in improving productive use of water. This was carried out because productive use of water is associated with using the available water effectively, in such a way that it improves the economic status of the water user. Therefore it was deemed important to assess the association between water used by various farmers and the income generated from using water.

The disadvantage of Spearman's rank correlation coefficient is that it recognises that the two variables being compared are distinct, meaning the research must ensure that the selected variables are indeed distinct. To overcome such a disadvantage, the study compared two distinct variables: the economic component and the natural component. The advantage of the method is that it eliminates errors and disparities between the variables by not making assumptions, as well as recognising use of distinct variables (Spearman, 1904).

3.8. Summary

Barrydale is located in the Western Cape and it was selected as the suitable study area for the current study. Two case studies, consisting of SSFs and LSFs, were selected. Data on mechanisms undertaken by the BGCMA to implement the water allocation policy and to increase access to agricultural water by HDIs were collected and analysed using various methods described in this chapter. The SLA was used as the study framework and the five components of the approach were used to assess and identify resources available to farmers which are crucial for farming activities and sustaining of livelihoods. Rainfall and river discharge data were collected from South African Weather Services and the hydrology database of the Department of Water and Sanitation, respectively. SAPWAT 4 was used to determine crop water requirements for crops produced by SSF and LSF in the study area. Spearman's correlation coefficient was used to determine the association between water used by farmers and the income derived from the use of water.

CHAPTER 4: RESULTS AND DISCUSSION

4.1.Introduction

This chapter presents and discusses the results obtained during the study. Section 4.2 presents mechanisms initiated by the BGCMA to increase access to water by HDIs, as prescribed by the Water Allocation Reform Strategy. This section addresses the main objective of the study. Sections 4.3 to 4.7 assess and discuss findings on the five components of the SLA and the discussions are in relation to the 2 objectives of the study, which talks to the increase in water access and influence in productive use of water by HDIs in Barrydale. Section 4.8 summarises the findings and the discussion of such findings.

The BGCMA implementing of the water allocation reform mechanisms

The targets set by the Department of Water and Sanitation in reforming water allocation are the following:

- To allocate 30% of water to the HDIs by year 2014;
- To allocate 45% of water to HDIs by 2019 ; and
- To allocate 60% of water to HDIs by 2024.

In order to achieve the above targets, the following mechanisms were supposed to be implemented:

- Set-asides;
- General authorisation;
- Strategic alignment with other national initiatives;
- Compulsory licensing;
- Development support;
- Partnerships;
- Business enterprises using water as a productive asset.

4.2.1. Set-aside mechanism

The set-aside mechanism was assessed in the current study, because it is one of the mechanisms prescribed by the DWS for achieving the objectives of water allocation reforms and it aims to increase access to water by HDIs. The assessment of this mechanism is expected to indicate the impact of the water allocation reforms in increasing access to water for agricultural use by

SSFs who are members of the historically disadvantaged group in Barrydale, through implementation of the set-aside mechanism.

The BGCMA initiated the set-aside mechanism, which refers to water that has been set aside for allocation to HDIs, to redress imbalance in water access. The water that is to be set aside comes from either water conservation, water demand management practices or from illegal water use recovered from the validation and verification process. The BGCMA initiated the set-aside mechanism by starting with the validation and verification process, which aimed at verifying and validating all existing lawful water uses and all registered water uses such that if illegal water use is recovered, the water will be taken and be set aside for allocation to HDIs. This is a way of increasing access to water by HDIs.

The implementation of water allocation reform has been delayed in all of the water management areas in South Africa. As a result seven of the water management areas have completed validation process and initiated verification process in some catchments within the water management areas. These water management areas include BGCMA, Mzimvubu-Tsitsikamma, Pongola-Mzimkulu, Inkomati-Usuthu, Orange, Vaal and Limpopo Water Management Areas. The validation and verification from various catchments of these water management areas resulted in a recovery of 102, 895, 159.6 m^3 of water from water users who under declared their volumes of registered water use. The recovered water is therefore added to the water uses that were under declared (Keet, 2016). This means that no illegal water use was recovered and no water is been set aside for or already been allocated to HDIs.

Validation and Verification processes have been completed in some catchments in BGCMA. About 13,975,448 m^3 of water have been recovered during the process and this water was returned to water users who under declared the volumes of their registered lawful water use (Keet, 2016). No illegally-used water has been recovered in BGCMA and set aside for allocation to HDIs. This is because the validation and verification process is not yet completed in the entire Catchment Management Agency. There is a delay in the processing of water use registration applications and this is due to lack of required information from the applicants. The information includes details of the applicant, water use and the property in which the water will be used (BGCMA, 2010). The other reason for delayed processing of water use registration applications is because the DWS, the department processing applications, being understaffed (BGCMA, 2012). The assessment of the set-aside implementation in Barrydale showed that the delays in the implementation of the set-aside mechanism delayed the process of increasing

access to water by HDIs in the area, meaning the SSFs still do not have access to water for agricultural activities through this mechanism.

The validation process was initiated in Mokolo River Catchment and the existing lawful water uses were validated. It was discovered that there was an additional abstraction of about 1.7 million m^3 of surface water, 700 000 m^3 of groundwater and additional storage of 3.1 million m^3 of water that is more that the validated existing lawful water uses. The lawfulness of the additional abstraction and storage will be verified during the verification process (DWS, 2007). If the verification process confirms that the water abstraction and storage is illegal, then there is a chance that water might be allocated to HDIs if the reserve water requirements are met and there is water remaining in the catchment.

Some water management areas such as Mhlathuze Management Area have also completed Compulsory Licencing (CL). The CL in Mhlathuze resulted in the allocation of 7123 594 m^3 to HDIs (DWS, 2015). This indicates progress towards achieving the objective of water allocation reform. The BGCMA have not initiated CL and the validation and verification of lawful water use have not been completed in the entire CMA. In Berg-Olifants, Mzimvubu-Tsitsikamma, Pongola-Mzimkulu and Inkomati- Usuthu Water Management Areas validation and verification processes are planned to be completed in financial year 2017/18. While other areas are still initiating validation process (Keet, 2016). These findings indicate that the implementation of the water allocation reform have delayed in the rest of the country, because the first target of water allocation reform was set for the year 2014. This target has not been achieved, due to delays in the implementation of the mechanisms of water allocation reform.

4.2.2. Development support mechanism

The development support mechanism was investigated to establish how the reforming of water allocation systems has influenced water access and productive use of water through implementation of this mechanism. The mechanism is linked with both objectives of the current study because it provides for capacity building, training and infrastructure revitalisation support. It is therefore expected that the implementation of this mechanism by the BGCMA will increase access to water for agricultural use and improve productive use of water in agricultural activities conducted by SSFs in Barrydale.

No capacity building or training have been provided by the BGCMA to the SSFs or LSFs in Barrydale as part of the water allocation reform implementation. Six SSFs were provided with 5000 litre water storage tanks that are placed at each farmer's household. One of the five

farmers that received water storage tanks also received a fence, which was used to fence the farm. The LSFs have not received development support from BGCMA. This means that the BGCMA have initiated a mechanism that increases water access for SSFs through sponsorship of water storage tanks, but the mechanism does not influence productive use of water by SSFs. This is because the SSFs are not able to utilise the tanks productively within the farming business, because the tanks are located at the farmers' households and cannot be utilised on the farms. The distance between the SSFs households and the farm plots is approximately 2 to 10 km, an impractical distance to transport or for the use of a hose pipe to get water to the farms. The tanks are located at SSF's households, because the tanks are for domestic water use, meaning the tanks were not meant to be utilised for farming activities.

The development support that is prescribed by the DWS includes capacity building and training, infrastructure revitalisation and access to rainwater harvesting infrastructure (Department of Water and Sanitation, 2014). The results showed that the SSFs have not received capacity building support, while 5000-litre rainwater harvesting tanks have been received by six out of the twenty active SSF members. The provision of these tanks has not increased access to water and achieve productive use of water, because the tanks are located at farmers' households and the water cannot be used at the farms. This is because the tanks are for domestic use and are not adequate for farming activities. According to the DWS (2004), the rainwater harvesting tanks are for domestic use, meaning the tanks are not adequate for farming activities. According to Khapayi and Celliers (2016); Xaba (2014) and Nchabeleng (2016), SSFs need to be capacitated through farming and business training in order to increase production and improve the farming business. This means that even though SSFs have been provided with water storage tanks and fences, the lack of financial and technical capacity to utilise the sponsored equipment will hinder productive use of water. The results therefore show that the SSFs have been provided with water storage tanks, but this does not increase access to water for agricultural activities. The lack of capacity building hinders the productive use of water.

According to Mmbengwa (2009), food production by small-scale farmers in Swayimana District in KwaZulu-Natal Province is low due to lack of farming skills and capacity building from government departments and institutions. Lack of institutional support in terms of credit, marketing and draught power, lack of extension and farmer support are some of many factors hindering productivity of small-scale farmers in irrigation schemes in South Africa (Van Averbeke *et al.*, 2011). These findings indicate that development support and capacity building

are key for the success of small-scale farmers, as these enable farmers to improve productivity and access to markets.

4.2.3. Strategic alignment with other national initiatives mechanism

This mechanism encourages the relevant departments to work together in assisting HDIs in gaining access to water for agricultural use and to ensure that the water is used productively in order to improve the HDI's livelihoods. The relevant departments include the DWS, the Department of Rural Development and Land Reform (DRDLR) and the National Department of Agriculture (NDoA). This mechanism therefore addresses both objectives of the current study.

There was no information about the strategic alignment with other national initiatives found in BGCMA documents. The national initiatives include the land reform programme of the DRDLR and the special purpose vehicle of the NDoA. The special purpose vehicle was established for the purpose of accelerating land distribution and providing land and agricultural support services to land reform beneficiaries (NDoA, 2007). The SSFs and LSFs indicated during the interviews that BGCMA, NDoA and the Department of Rural Development and Land Reform (DRDLR) are not working together in assisting farmers to access water for agricultural activities. However, each institution is working individually to assist SSFs. The DRDLR Land Reform Programme has been integrated in the IDPs of municipalities, including Swellendam Municipality. This has resulted in the leasing of farm plots to the SSFs in Barrydale by the Swellendam Municipality. The NDoA assists all of the SSFs with vegetable seeds and also assisted two of the SSFs with electric water pumps. While the LSFs receive advice on specific aspects such as drought management, this advice has to be actively sought out. The Swellendam Municipality supplied the SSFs with a 10 000 litre water tank that is filled every month with water by the municipality, for the purpose of watering pigs. The municipality also constructed a 70 000 m^3 capacity dam (see Figure 3.2) for SSFs for watering crops and livestock. SSFs who acquired the farm plots from the municipality have changed from crop farming to livestock farming due to lack of access to water. One of the seventeen interviewed SSFs has not received lease agreements, but has received seeds from the NDoA, and these are planted in a backyard garden. The farmers who received water pumps from the NDoA did not have water use licences or water use registration certificates. These findings indicate that there is no alignment in the initiatives undertaken by the three institutions.

All of the actions taken by the Swellendam Municipality to assist SSFs were influenced by the water allocation reform. This is said to be because the municipalities have incorporated the

requirements of water allocation reform in their Integrated Development Plans (IDPs). This was carried out in terms of the Municipal Systems Act (Act no.32 of 2000), which provides for sector departments to participate in the assessment and development of the municipality IDPs. The DWS motivated for the inclusion of the water allocation reform requirements in the municipality IDPs through the said act (DWS, 2013). The actions of the Swellendam Municipality that were influenced by the water allocation reform shows that the reforms of water allocation have increased access to water for agricultural activities by SSFs. The NDoA also assisted SSFs with vegetable seed, which aims at increasing vegetable production, however this has not been influenced by the reforms of water allocation. Five out of the seventeen interviewed SSFs had benefitted from the vegetable seed provided by NDoA.

4.3.Natural component

This section assesses the availability of water for agricultural activities undertaken by SSFs in Barrydale. The water sources available to SSFs and LSFs and how the farmers are entitled to abstract water from the water sources are presented. Constraints in accessing water from the available water sources are presented. Water required by the LSFs and SSFs is presented and compared with the amount of water used on farming activities per year. Economic and physical components that directly influence access to water are presented and discussed in this section.

4.3.1. Water sources for SSFs

The Huis River, SSFs' Dam, and municipal tank are the main sources of water used by SSFs. The Huis River is a perennial river with monthly average discharges shown in Figure 4.1. The discharge was less than the average of 0.145 m/s for 9 months, while November had the highest discharge of 0.326 m/s. SSFs' farm plots are located approximately 3km from Huis River.

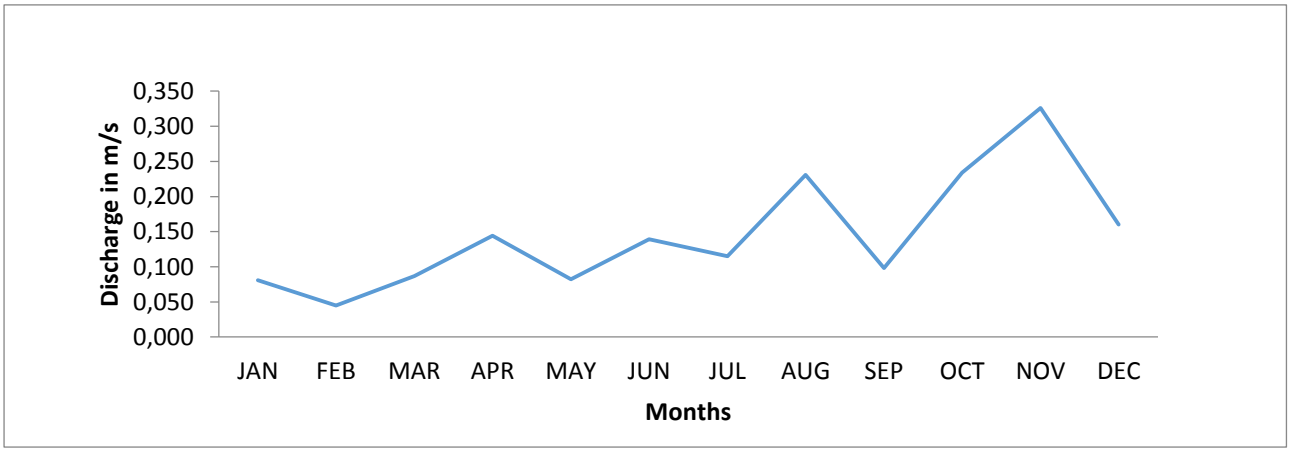

Figure 4.1: Huis River discharge from 1985 to 2015

Two of the seventeen SSFs abstract water from Huis River for farming activities and the farm plots are located at approximately 1 km from this river. One of these farmers abstracts about 584 m^3 of water per year, while the other farmer abstracts 175 m^3 of water per year. Both farmers do not have water use licences and have not registered their water uses. The access to this river is not influenced by the water allocation reforms. The water from this river is used for watering cattle, sheep, vegetables and lucerne. Water is collected by means of buckets and drums and transported in a vehicle to the farm plots. The farmers experienced constraints in accessing water from Huis River. One of these constraints included the hard physical labour associated with collection of water using buckets and drums, due lack of water distribution infrastructure. As a result, fifteen out of seventeen interviewed Barrydale SSFs could not endure the physically-taxing labour of collecting water using buckets and drums and therefore stopped collecting water from the Huis River. These farmers abstract water from the SSFs' Dam and the municipal tank, as these sources of water are located approximately 300 m from the farm plots (see Figure 4.2). Fourteen out of the initial thirty-four SSFs of the Barrydale Small-Scale Farming Group have abandoned farming activities altogether due to these constraints.

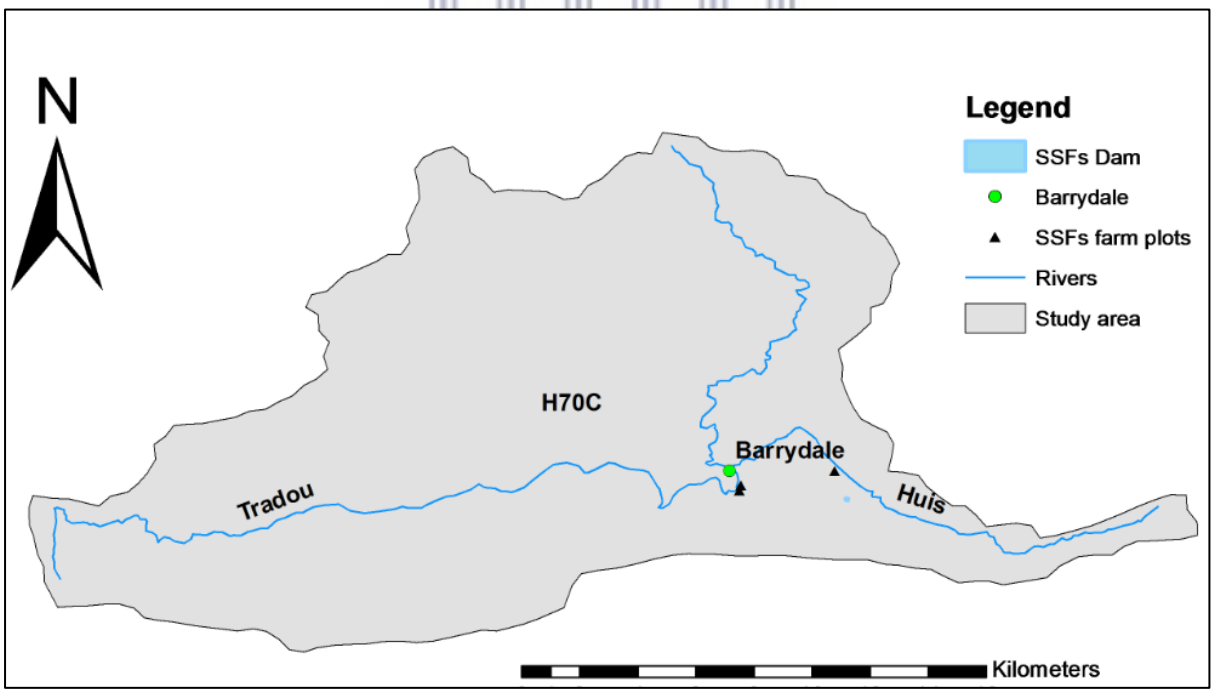

Figure 4.2: SSFs' farm plots location and water sources

The Swellendam Municipality initiated ways of supporting SSFs with farming water as a strategy of job creation and implementing the requirements of water allocation reforms, as incorporated in the municipality's IDP. These include construction of a dam with a storage

capacity of 70000 m^3 for SSFs, provision of the 10000 litre tank and filling of the tank with water every month. The dam was constructed by the municipality for storing water for SSFs and the farmers manage the dam and have access to the dam. The dam is located approximately 300 m from the farm plots (see Figure 4.2), while two plots belonging to two of the seventeen interviewed SSFs are located approximately 10 km from the dam and the municipal tank (see Figure 4.2). SSFs indicated that the SSFs' Dam is fed by the Swellendam Municipal Dam through a pipe during the dry season. But according to the Swellendam Municipality, the SSFs' Dam is fed by the mountain spring during the dry season through a pipe. Water from the spring is used to supply the water requirements of the Barrydale Town residents. If there is water left after the needs of town residents have been met, water is pumped from the spring to the SSFs' Dam on Mondays. The amount of water pumped to the SSFs' Dam is not known, because the pipe that is used is not metered. During the dry season the SSFs' Dam is always dry, as shown in Figure 4.3, because farmers use the water as soon as it is available on Mondays and no rainfall is received during the dry season in the area.

Figure 4.3: SSFs' Dam during dry season (taken on 31st January 2015)

During the wet season, the SSFs' Dam is fed by rainfall and the water overflowing from the municipal dam. During the wet season, the dam is always full, and the dam overflows during this season, as it is not being used by farmers, because the vegetable planting season starts during the dry season (in summer). Figure 4.3 shows the SSFs' Dam during dry season and

during this season, the dam is always dry and only receives water on Mondays from the spring after the water has been distributed to Barrydale Town residents. Water from the dam is collected by buckets and stored at individual farmers' plots in drums in order to be used for farming activities.

The Swellendam Municipality provided a 10000 litre tank of water for SSFs to water their pigs. The tank is filled once a month and every farmer is required to pay a monthly fee of R30.00. The SSFs have a total of 111 pigs, with each farmer owning between 4 and 25 pigs. The SSFs also use water from the tank for watering other livestock (sheep and cattle) and for watering vegetables. Water abstraction from the municipal tank and the SSFs' Dam is not controlled. Each farmer abstracts any amount of water from the tank or dam at any given time for as long as there is water in the tank or dam. The lack of controlled water abstraction results in the depletion of water before the end of each month and before all the farmers have an opportunity to collect water from the tank and the dam.

The lack of controlled abstraction of water from the two water sources negatively affects the two farmers who are located at about 10 km from the dam and the municipal tank. This is because these two farmers are not able to collect water as easily, or as often, as the farmers located near the SSFs' Dam and the municipal tank. These two farmers need a vehicle to transport water from the dam and the tank. The lack of controlled abstraction of water also affects farmers who are located close to the tank and the dam, because some farmers are abstracting more water in order to meet the needs of livestock and crops. The other farmers do not get a chance to abstract an amount of water that will meet the needs of pigs.

According to NWA (1998) and DWA (2014), agricultural water uses must be registered. However the SSFs who abstract water from Huis River have not registered their water use. This is attributed to a lack of knowledge of the requirements of abstracting water from a water source in terms of the water legislation. This shows that the water allocation reform mechanisms that are prescribed in order to redress issues of inequalities in water access have not been implemented in the research area. This is because the water sources that have been made available to SSFs are not adequate to enable SSFs to achieve productive use of water in agricultural activities and improve SSF livelihoods. This means that the reforms of water allocation have not influenced access to agricultural water for SSFs in Barrydale. The constraints experienced by the Barrydale SSFs during water collection are similar to the ones experienced by other SSFs in Nigeria, as outlined by Ogunjimi and Adekalu (2002). As a result

of these constraints, fourteen out of the thirty-four initial SSFs have abandoned farming as a livelihood strategy in Barrydale. This indicates that the reforms of water allocation have not achieved an increase to access to water for agricultural uses in Barrydale for SSFs, as these farmers have not gained access to the water in the nearby river and also experience constraints in abstracting water from this river.

The Swellendam Municipality has constructed a dam and provided a water tank for the SSFs to create jobs in the community in the agricultural sector and this is in line with the objective of water allocation reform (Swellendam Municipality, 2014). The incorporation of water allocation reform requirements in the municipalities has influenced access to water for agricultural uses by SSFs in Barrydale. This is evident in the increase in availability and access to water sources created by the municipality. These water sources are easily accessible to SSFs and do not require water use licences, as the water is provided by the water service provider, as stipulated in the National Water Act (1998). However, the interviewed SSFs indicated that the water sources made available by the municipality are not adequate, because the water does not meet the water needs of farming activities conducted by SSFs, and the lack of infrastructure such as water pumps hinders meaningful access and use of the available water.

According to Breedt (2005), a pig's water requirements range from 5 to 23 litres per day, depending on the size of the pig. Based on these figures, the minimum water requirements for the 111 pigs owned by SSFs is between 16650 and 76590 litres per month. The 10000 litres of water provided by the municipality on a monthly basis is thus inadequate for the 111 pigs owned by the SSFs. This means that the efforts made by the municipality in increasing water access to SSFs in Barrydale are not sufficient, as these efforts have not resulted in meaningful use of water as the water is not sufficient for the needs of the farmers. In this case, the water allocation reforms have influenced access to water; however this influence is not sufficient to redress issues of access to water for agricultural activities to SSFs.

The uncontrolled abstraction of water from the tank and the dam is attributed to a lack of permits or written agreements that state the amount, time and the sources from which each farmer can abstract water. The incorporation of the water allocation reform requirements in the municipalities IDPs has a negative impact in a way in which water is used by farmers. This is because the municipality does not use the same system of water allocation as the DWS, which permits a water user to abstract a specified amount of water from a specified source. The municipality has not set rules or provided water use agreements for each farmer that state the

amount of water that can be abstracted by each farmer from the sources provided by the municipality. This results in uncontrolled abstraction of water from the available water sources. To resolve the issue of uncontrolled abstraction of water from the two sources, rules on how the water is to be shared amongst SSFs need to be in place and agreed upon by the SSFs. In the case where such rules are not being adhered to, an external party is required to monitor water abstraction. Considering that Swellendam Municipality is the owner of the tank and the dam was built by the municipality for SSFs, it is appropriate for this municipality to serve as the proposed external party, as recommended by Van Averbeke (2008), as such a solution has worked in solving issues of uncontrolled abstraction of water from a canal shared by a group of small-scale farmers in the past.

Small-scale farmers in Dzindi Irrigation Scheme in Limpopo share water from one canal. The Extension Officer appointed to the scheme set rules for water management and distribution. The rules were accepted by the scheme members and these rules included a time schedule for water abstraction by each farmer from the canal. If the rules set are violated by one of the scheme members, then that member will be called to a meeting by the Scheme Management Committee and be fined an agreed-upon amount of money. If the member does not accept the fine, the case will be escalated to the chief (Van Averbeke, 2008). Stevens (2006) found that small-scale farmers in Low's Creek Irrigation Scheme have a well-controlled water abstraction system. These farmers are sharing water from one canal and each farmer is responsible for pumping water to the irrigation plot. The farmers follow a fixed schedule programme of daily irrigation. The daily irrigation cycle is 10 hours with overhead sprinkler and floppy irrigation systems, spaced at 14 m by 12 m for litchis and bananas. A dripper irrigation system is used for 3m spaced sugarcane rows with one line drip tape per row. The emitters are spaced at 0.75 m apart and have a flow of 1.5 litres per hour. Sugarcane farmers follow a two-hour daily cycle during hot summer periods and decrease this to an hour during overcast days. The irrigation schedules and volume of irrigation water was recommended by the South African Sugar Research Institution, which provides expert knowledge on production aspects of sugarcane to farmers in the Low's Creek Irrigation Scheme (Stevens, 2006). The finding from the two irrigation schemes from Limpopo and Mpumalanga indicated that small-scale farmers need external personnel to assist in controlling water sharing between famers.

4.3.2. Water sources for LSFs

The LSFs have access to various rivers, which include Seven Streams, Palmiet, Kogmanskloof, Palmiet, Troudou, Huis and Doring Rivers, according to the interviewed LSFs. Access to these rivers is in terms of water use licences that were obtained in terms of the 1956 National Water Act. However, all the other rivers are outside the catchment of interest of the study and the area where the farms are located, except for the Troudou and Huis Rivers, as shown in Figure 4.4. Based on this, the LSFs are abstracting water from the Troudou and Huis Rivers, which are in the catchment and close to the farms. One farmer located outside of the study catchment area is abstracting water from Doring and Huis Rivers. The following results on water access and water source availability for LSFs are based on interviews.

Five out of the six LSFs interviewed abstract between 69 000 m^3/yr. and 2 000 000 m^3/yr. of water from various water sources. Two LSFs abstract water from Seven Streams, Palmiet, and Kogmanskloof Rivers, one abstracts water from Groot River, one abstracts water from the Sand River and Troudous River and one abstracts water from Doring and Huis River. One of the six LSFs interviewed abstract 3600 m^3 of water per year from three private dams. The farmers abstract water for ten to 14 days a month from these rivers. The volume of water abstracted by LSFs was obtained during interviews. Five out of the six have an average of two boreholes that are used during dry season, when there is not enough water to meet the requirements of the farmer.

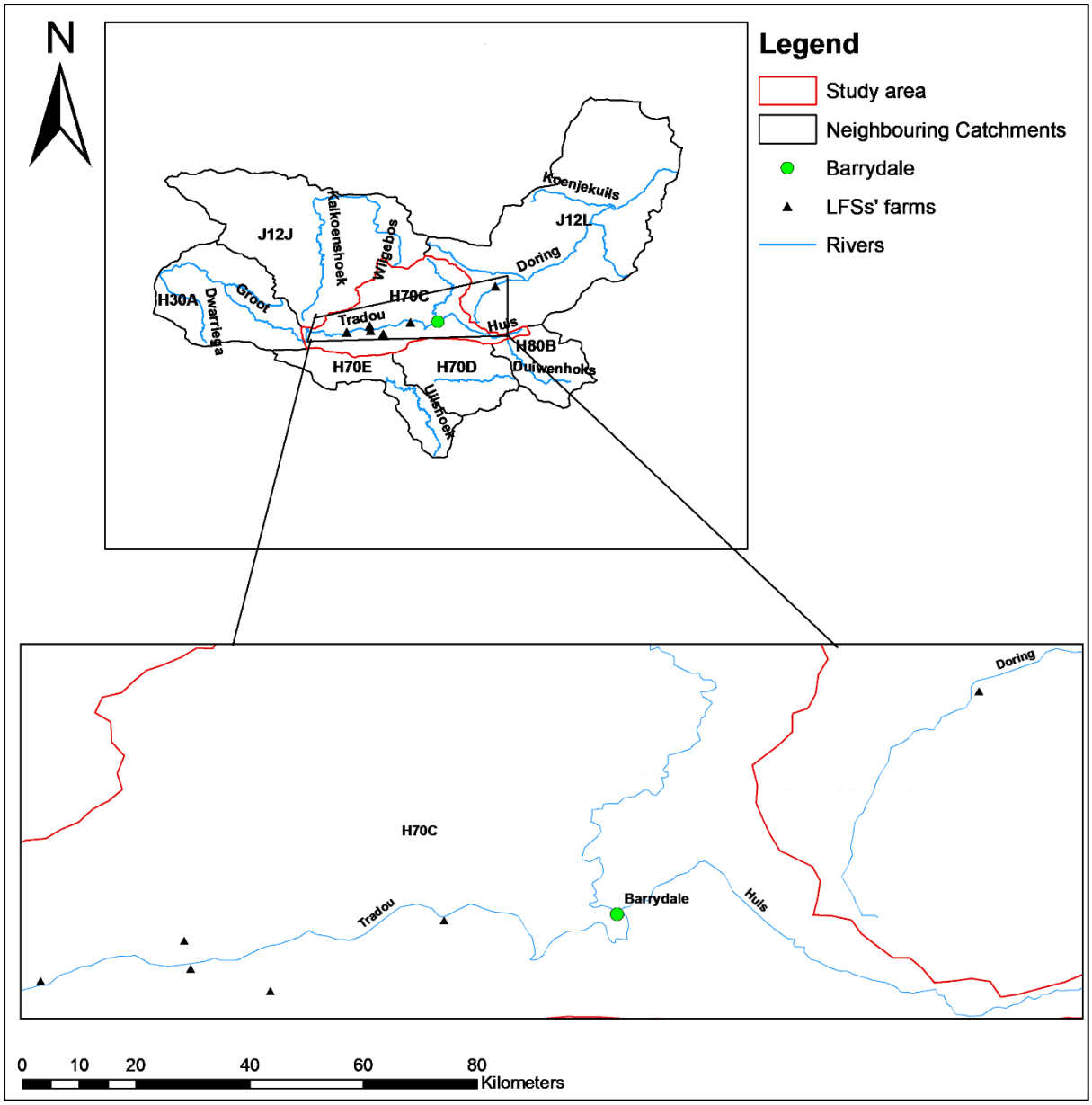

Figure 4.4: LSFs' farm location and rivers in the study area and neighbouring catchments

Two of the LSFs have been affected by the changes in the water allocation system. This was during the validation and verification process undertaken by the BGCMA to verify and validate lawful and unlawful use of water. The BGCMA used a combination of methods to calculate the amount of water required by the farmer by considering the farm size, farming activities, irrigated area, soil type and climatic conditions. During this period, a farm portion owned by one of the LSFs that is used for irrigation was not captured as an irrigated area by the Consulting Company that was appointed by the BGCMA to conduct the V&V process. This resulted in BGCMA reducing the farmer's allocated water, which negatively affected the farmer's business. The other farmer was suspected of illegally diverting water from the Huis River and was suspended from diverting water while the investigation was in progress. It was later found

that the farmer was not diverting water illegally. The investigation process and the suspension from diverting water negatively affected the farmer's crop production. Based on these findings, the water allocation reform process had negative impacts on two of the six interviewed LSFs.

The verification of water use is carried out in terms of Section 35 of the National Water Act of 1998 (Act 36 of 1998). This is required for water uses that existed prior to the commencement of the National Water Act of 1998, so that the existing water uses can be converted to water use licences. This is important for continuing with lawful water use and for the Department of Water and Sanitation to determine amount of water that has already been allocated. The process is also crucial for assessment of the amount of water that can be further allocated to HDIs if there is water that is found to be used illegally (DWS, 2014). In this case the LSFs in Barrydale must have their water use verified and validated.

4.3.3. Access to available water sources and constraints in accessing water by SSFs

The SSFs are not entitled to use water from Huis River, because the water use for agricultural activities must be registered in terms Section 26(1) and 34(2) of the National Water Act of 1998 (Act 36 of 1998) and the SSF's water uses are not registered. However, two of the seventeen SSFs interviewed abstract water from the river using buckets, while fifteen of SSFs are located at 10 km from the river and are unable to abstract water from the river due to lack of water pumps and means of transport. The farmers reported that they cannot afford to buy and maintain water pumps or meet the associated electricity bills. Purchasing and installing a water distribution system costs between R58 335 and R184 300 (Vansan Water Technologies, 2016). The SSFs have an income of about R36000 to R172 000 per year and thus cannot afford to install a water pump and the water distribution systems.

The SSFs who abstract water from Huis River are required to register their water use, because the water is used for agricultural uses, which include crop irrigation and watering of livestock for commercial purposes. The registration of water use is carried out when a legal notice or advertisement is published in local media to inform water users to register for specific water uses in a specific geographic area (DWS, 2014). The SSFs have never received such a notice and are not aware of the registration process. Hence, the SSFs are abstracting water from Huis River without water use registration certificates. The BGCMA reported that there was a target of 500 water use registrations in the financial year 2014/2015 but only achieved 373 water use registrations. This was said to have been hampered by incomplete water use registration application forms. This indicates that the implementation measures of the BGCMA for the water allocation reform are not effective for Barrydale SSFs. Even if the SSFs had legal access

to abstract water from Huis River by means of acquiring water use registration certificates, the lack of water pumps would have hindered access to water from this river. Farming without water infrastructure makes successful farming impossible (NDoA and AgriSETA, 2006). This also shows the importance of having access to physical components in order to access water and thus engage in productive farming.

The SSFs abstract a minimum of 56 m^3 and a maximum of 920 m^3 of water per year from the Huis River, the municipal tank and the SSFs' Dam, while the area receives an average of 440 mm of rainfall per year, as described in Chapter 3. The water from the dam, Huis River and the tank is used for both crop and livestock watering. Table 4.1 shows crop water requirements for selected crop produce by SSFs. The crop water requirements were calculated using SAPWAT 4 software. Total crop water requirement for crop types produced by SSFs ranges from 321 to 838 mm per hectare. The rainfall requirements for selected crop types produced by SSFs ranges from 34 to 234 mm per hectare of crop type, which is about 11% to 29% of the total crop water requirements. This indicates that the annual average rainfall (440 mm) received in this area per year is sufficient for producing the selected crop types.

Based on Table 4.1, certain crop types, such as maize and lucerne, have high water requirements (506 and 838 mm respectively) as compared to other crop types. Maize and lucerne require 4780 and 7960 m^3 per hectare of irrigation water respectively, which is more than the maximum volume of water (920 m^3) abstracted by SSFs per year from the available water sources. It is therefore not advisable for SSFs to cultivate maize and lucerne, as these two crop types have high water requirements.

Table 4.1: Crop water requirements for crops cultivated by SSFs

Crop Type	Total crop water requirements in (mm/ ha)	Irrigation water requirements in (mm/ha)	Rain water requirements in (mm/ha)	Period	Required volume of irrigation water from rainfall in (m^3 / ha)	Required volume of irrigation water in (m^3 / ha)
Cabbage	321	278	34	Nov-Apr	340	2780
Potato	314	292	72	Jan-Sep	720	2920
Spinach	264	226	116	Apr-Jun/Jul-Oct	1160	2260
Maize	506	478	132	Aug-Dec	1320	4780
Lucerne	838	796	234	Feb-Apr/Sep-Nov	2340	7960

Maize yield potential depends on the climate and soil type of the area (du Plessis, 2003). According to le Roux *et al* (2016) and du Plessis (2003), maize is a warm weather crop and optimal production is reached in regions that receive mean summer annual rainfall of 670 mm. The study area receives rainfall in winter from late April to early October (Esau, 2005; River Health Programme, 2011). This area is dominated by sandy and loamy soils (Palmer and Ainslie, 2005). According to du Plessis (2003), sandy, clay and clay-loamy soils are suitable for maize production, because such types of soils have air and moisture regimes that are required for optimal production of maize. This means that the climatic conditions of the study area in terms of rainfall are not suitable for production of maize; though the soil type is suitable.

Hence, the SSFs abandoned maize production, as it requires water that is not available in the area during summer season. The reforms of water allocation can improve crop production in the area, only for suitable crop types by improving access to components that influence crop production through implementation of water allocation reform mechanisms. These could be carried out by aligning the supporting policies and initiatives with the water allocation reform mechanisms. These components include physical, economic and human components and the LSFs have access to these crucial components, and hence LSFs have high crop production than SSFs.

Table 4.2 shows the crop water requirement for crop types cultivated by five SSFs who are involved in crop farming. The crop water requirement was calculated by multiplying the size of the area cultivated for each crop type by each farmer by the volume of water required to produce a hectare of each crop type. The area cultivated by the farmers ranges from 0.5 to 7.5 hectares. Out of five SSFs cultivating selected crop types, only two are cultivating maize and two are cultivating lucerne. This could be due to the high irrigation water requirements of the two crop types. The total water requirement ranges from 1353 to 30400 m^3 for the area cultivated. The SSFs only abstract a minimum of 56 and a maximum of 920 m^3 of water per year from water sources available to SSFs. The maximum volume of water abstracted by SSFs per year is not sufficient to meet minimum and maximum irrigation crop water requirements of these crops. This means that the SSFs do not have access to adequate irrigation crop water required for cultivating selected crops. As a result of inadequate irrigation water, SSFs are now moving to livestock farming. This is indicated by the number of farmers who are still cultivating, which are five out of the seventeen interviewed SSFs.

Table 4.2: Irrigation crop water requirements for five SSF cultivating crops

Area cultivated in hectares					
	Farmer A	Farmer B	Farmer C	Farmer D	Farmer E
Cabbages	1	0,5	0,17	1	0,5
Potato	0,5	0	0,17	0,5	0
Spinach	1	0,5	0,17	0,5	0,5
Maize	5	0	0	1	0
Lucerne	0	3	0	0	1
Total	**7,5**	**4**	**0,5**	**3**	**2**
Crop Water Requirement in cubic metres					
	Farmer A	Farmer B	Farmer C	Farmer D	Farmer E
Cabbages	2 780	1 390	473	2 780	1 390
Potato	1 460	0	496	1 460	0
Spinach	2 260	1 130	384	1 130	1 130
Maize	23 900	0	0	4 780	0
Lucerne	0	23 880	0	0	7960
Total	**30 400**	**26 400**	**1 353**	**10 150**	**10 480**

Table 4.3 shows livestock water requirements for the livestock bred by SSFs. The livestock water requirements were calculated by multiplying the water requirement of each livestock type by the total number of each livestock type owned by all members of SSFs. The livestock water requirement was obtained from Breedt (2003) and Harner *et al*., (2016) and refers to livestock that is bred in the Karoo. The total livestock water requirement was calculated by adding the water requirement of each animal. Jersey cows have high water requirements, while sheep have the lowest water requirement. SSFs could therefore breed livestock that requires the lowest water requirements, such as sheep. The combined water requirement for SSF livestock in the area is 5029 m^3 per year. The livestock water requirement is more than the minimum of 56 m^3 and a maximum of 920 m^3 of water that is abstracted by SSFs from the available surface water sources per year. This means that the farmers are able to use the available water productively as the farmers are earning a profit from the use of water, despite challenges such as lack of infrastructure and other resources such as financial input. However, the water sources that are made available to these farmers through the influence of water allocation reforms are not adequate to achieve the objective of the reforms, which is to increase access to agricultural water by HDIs in order to improve their livelihoods.

Table 4.3: Water requirements for livestock bred by SSFs

Livestock type	Livestock water requirements in m^3 per year	Total SSF livestock	Total water requirements in m^3 /year
Jersey cows	26.7	93	2483
Pigs	8.395	111	932
Sheep	3.4	111	377
Total SSF livestock water requirements in m^3 per year			**5029**

Based on the water requirements of all farming activities and the water currently abstracted by SSFs from various available water sources, the water used by SSFs does not meet the water requirements of the SSF farming activities. Dev (2012), concluded that smallholder farmers in India only have access to depleted groundwater resources and this negatively affects crop production yield. Baloyi (2010), found that access to irrigation water by smallholder farmers in Limpopo is the primary constraint that negatively affects crop production yield. Williams (2015), also found that accessing water for productive agricultural use remains a challenge for a million smallholder farmers in sub-Saharan Africa. All of these findings support the findings of the current study that small-scale farmers do not have access to sufficient water to meet the needs of farming activities and to allow farmers to increase production through use of water.

4.3.4. Access to available water sources and constraints in accessing water by LSFs

The LSFs are entitled to water from the above mentioned rivers, from boreholes and are also entitled to store water in private storage dams. The entitlements are in terms of Section 32 of the National Water Act (Act no. 36 of 1998). Table 4.4 shows the volume of water allocated to each of the six LSFs interviewed and the allocated amount ranges from 300 m^3 to 2000000 m^3 per year. The entitlements were authorised in terms of the 1956 National Water Act and the reforms of water allocation had no influence on these entitlements. Three out of six LSFs interviewed considered the amount of water allocated to each farmer per year inadequate, because the water is used on current farming activities and there is no water stored to be used during drought periods and for expansion of farming activities. Hence, farmers wanted to have

an increased allocation of water. Three out of six LSFs interviewed considered the current water allocation adequate for current farming activities, because having an increased allocation will not enable farmers to expand farming activities, due to other factors such as availability of funds.

Moderate and severe drought conditions were experienced between 1999 and 2013 in the study area, which lasted for about eight months in total. These events resulted in approximately 8.5% deficit in grape yield (Araujo, 2014). The deficit in grape yield was recovered during four severe wet periods experienced between year 2002 and 2008, which resulted in grape yield surplus of more than 10% (Araujo, 2014). Farmers can plan for drought periods using methods recommended by the Agricultural Disaster Risk Management Division of the Western Cape Department of Agriculture (WCDA) (WCDA, 2017).

Table 4.4: Water allocated to LSFs per year

LSF	Water allocated to each LSF in m^3 year
1	69000
2	567812
3	300
4	876
5	450
6	2000000

Table 4.5 shows the water requirements for selected fruits produced by LSFs. The crop water requirements were calculated using SAPWAT 4 software. The table shows that LSFs require between 139 to 189 mm per year of rainfall to produce the selected crops, and this amount of rainfall is less than the annual average rainfall (440 mm per year) received in the area. The required amount of rainfall is about 21% to 26% of the total required crop water requirements. The volumes of irrigation and rainfall water required were calculated. Out of the six LSFs interviewed, three are cultivating peaches, apricots and nectarines, two are cultivating grapes, peaches, apricots and nectarines and one is cultivating apples and pears. A combination of peaches, apricots and nectarines is named crop combination A, combination B is made up of

grapes, peaches, apricots and nectarines and crop combination C is made up of pears and apples. The average irrigation water requirements for each crop combination were calculated. Water requirement for the crop combinations ranges from 4803 to 5155 m^3 per hectare.

Table 4.5: Crop water requirements for crops produced by LSFs

Crop type	Total crop water requirements in mm/hectare	Irrigation water requirements in mm/hectare	Rainwater in mm/hectare	Period	Volume of rainfall required in m^3/ha)	Volume of irrigation water required in(m^3/ha)
Peach	678	1390	139	Oct-May	1390	5750
Nectarine	518	1390	139	Oct-May	1390	4390
Apricot	503	1480	148	Oct-May	1480	4270
Pear	548	1430	143	Oct-May	1430	4650
Apple	679	1490	149	Oct-May	1490	5760
Grape	732	1890	189	Oct-May	1890	6210
Average required irrigation water for crop combination A(peach, apricot and nectarine) per ha						**4803**
Average required irrigation water for crop combination B(grape, peach, apricot and nectarine) per ha						**5155**
Average required irrigation water for crop combination C (apple and pear) per ha						**5205**

Table 4.6 shows the average irrigation water requirements for crop combination cultivated by the interviewed six LSFs. The average volume of irrigation water required by each farmer was calculated by multiplying the average required irrigation water per crop combination cultivated by each farmer by the size of the area cultivated by the farmer. The average crop water requirements ranges between 62439 and 480300 m^3 per hectare as shown in Figure 4.6. LSFs are located between 300 to 2000000 m^3 per year as showed in Table 4.4. Based on Table 4.4, only one LSF can meet the minimum water requirement, two LSFs can meet both minimum and maximum crop water requirement, while the other three of the six LSFs cannot meet crop water requirements. This shows that water allocated to three out of six LSFs annually does not meet the maximum crop water requirement of crops produced by LSFs. This also indicates that LSFs do not have adequate water for their overall farming activities, because the livestock water requirement was not included in the calculation.

Table 4.6: Average irrigation water requirements for crop combination cultivated by six LSFs

LSF	Hectares of fruit produced per year	Crop combination A	Crop combination B	Crop combination C
1	13	62439	-	-
2	44	211332	-	-
3	80	-	-	416400
4	74	-	381470	-
5	47	-	242285	-
6	100	480300	-	-

Table 4.7, showing livestock water requirements for livestock bred by LSFs, using water requirements obtained from Breedt (2003) and Harner *et al*., (2016) analysing water requirements for livestock bred in the Karoo in South Africa. Jersey cows require 26.7 m^3 per cow per year, while sheep require 3.4 m^3 per sheep per year. The water requirements were calculated by multiplying the livestock water requirements prescribed by literature for each animal by the number of livestock bred by each LSF. The total water requirements per type of livestock were added to get the total livestock water requirements. The livestock bred by the LSFs require between 1335 m^3 and 8214m^3 of water per year. Based on crop water requirements calculation and the livestock water requirements, four out of six LSFs do not have adequate water to meet the water requirements of all farming activities. Even though the water allocation reforms had no influence on the LSFs water use licences, the allocation of water is also influenced by water availability in the area.

Table 4.7: Livestock water requirements for LSFs

LSF	Number of Jersey cows per farmer	Number of sheep per farmer	Total livestock water requirements in m^3/ yr.
1	50	-	1335
2	300	60	8214
3	200	-	5340
4	206	-	5500
5	120	-	3204
6	80	500	3836

The LSFs have access to an average of four water sources, while SSFs abstract water from an average of two water sources. Levite and Sally (2002), found that LSFs dominate the agricultural sector and use more than 50% of water resources in Olifants River Basin. Longhurst (2009), found that the majority of river and groundwater resources are accessed by LSFs in Mhlatuze catchment in KwaZulu-Natal. The findings of Levite and Sally (2002) and Longhurst (2009), support the findings of the current study that LSFs have access to more water sources than SSFs. Both SSFs and LSFs do not have access to adequate water to meet the water requirements of crop and livestock. However, water allocation depends on water availability (DWS, 2014). According to Esau (2005), the Western Cape is a water scarce area. The River Health Programme (2011), reported that the water sources in the Swellendam region are impacted by water abstraction. This means that the water allocation reforms' implementation, for both SSFs and LSFs, will not have an influence on water access by these farming groups, as water availability is limited in the research area.

In comparing available water resources and access to the resources by both LSFs and SSFs in Barrydale, it was found that LSFs have access to more available water resources than SSFs,

making LSFs the dominant water users in the area. It can therefore be concluded that there is no equality in productive agricultural water access between water users in the current study area and other areas in South Africa, as found by Levite and Sally (2002) and Longhurst (2009). The lack of water supply infrastructure hinders access to available water resources for SSFs, while LSFs have the entire necessary water supply infrastructure. It was proven in the current study that SSFs cannot afford the irrigation equipment such as water pumps to ensure high water efficiency, and Kujinga (2004), supports these findings. This means that policies that support the water allocation reforms have not assisted small-scale farmers in acquiring necessary components to increase access to water for agricultural activities. These policies include the financial assistance to resource-poor farmers.

The annual water allocated to LSFS is not adequate to meet the annual water requirements and the water abstracted by SSFs from the dam, tank and Huis River is not adequate to meet the annual water requirements. This could be a result of water shortages in the area, as Le Maitre *et al.,* (2009), found that the water resources in the Gouritz Water Management Area do not meet the current water requirements of the area and the WMA is running at a net deficit of 64 Mm^3yr^{-1}. The SSFs are also constrained by lack of financial funding for necessary infrastructure for water abstraction from these sources.

4.4. Economic component

This section addresses the assessment of the influence of water allocation reforms to achieve productive use of water in agricultural activities. The economic component was assessed in order to establish if there is income generated from using available and accessible water by farmers. The income generated from farming activities was used as a measure of productive use of water allocated or used by farmers. The Spearman's correlation coefficient was used to assess the productive use of water by correlating water used by SSFs and LSFs and the income generated from using water. The elements presented in this section include average household income, sources of income and the contribution of various sources of income to SSFs and LSFs household income.

4.4.1. Farmers' average income

The SSFs and LSFs annual average incomes were determined by calculating the average of annual income of all farming group member obtained from all sources of income available to each farmer, which were obtained during interviews. The SSFs have an annual average household income of R110524, while LSF annual average household income is R5790750. The annual average household income of the SSFs is derived from various sources, namely selling

of crops and livestock, pension, informal employment and self-employment. The annual average income for LSFs is derived from farming activities.

Figure 4.5 shows income categories of households engaging in agricultural activities in the Swellendam Municipality (Stats SA, 2011). The income of SSFs fall under income category R1 – 38 400 and according to Stats SA, (2011), 50% of the households in the Swellendam Municipality whose main income is derived from agricultural activities fall under this category. The LSF average household income falls under the income category that is above R1 228 800, which consists of 2% of the households in the Swellendam Municipality whose main income is derived from agricultural activities (Stats SA, 2011).

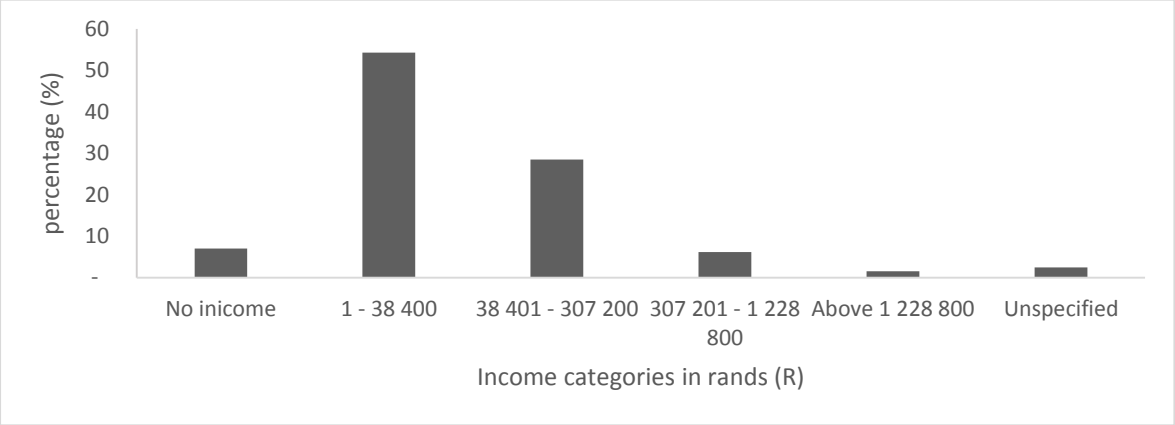

Figure 4.5: Income categories of households engaging in agricultural activities in Swellendam Municipality (StatsSA, 2011)

According to Punt *et al* (2005), the average income for households engaging in agricultural activities in South Africa is R454 231, while the average income for households engaging in agricultural activities in the Western Cape is R189 816. This shows that the Barrydale SSF average household income is less than the average income of households engaging in agricultural activities in the Western Cape, while the average household income of Barrydale LSFs is more that the average income of South African households engaging in agricultural activities. Based on the SSF and LSF average income and the Western Cape and South African average income of households engaging in agricultural activities, Barrydale SSFs have poor financial resources, as the average income of SSFs is below the national, provincial and the municipality average household income. This indicates that the water allocation reforms have not influenced the productive use of water for agricultural activities for the SSFs in Barrydale, because the water used by SSFs is not sufficient for SSF needs. The reforms of water allocation also did not influence the productive use of water for agricultural activities for Barrydale LSFs,

because the water used for agricultural activities was allocated prior to the reforms of water allocation.

4.4.2. Contribution of various income sources and farming activities to farmers' household income

Pension, formal, informal and self-employment contributes 64% of household income of SSFs. Livestock contributes 34%, while crop production contributes 2% to SSF household income, as shown in Figure 4.6. The household income contribution from farming activities of SSFs was influenced by limited access to water sources, as discussed in the previous section. Fruit farming is the highest contributing source of household income (88%) for LSFs, followed by dairy farming (11%), while cattle farming are the lowest contributing source of income to LSFs income, with 2% contribution, as shown in Figure 4.7.

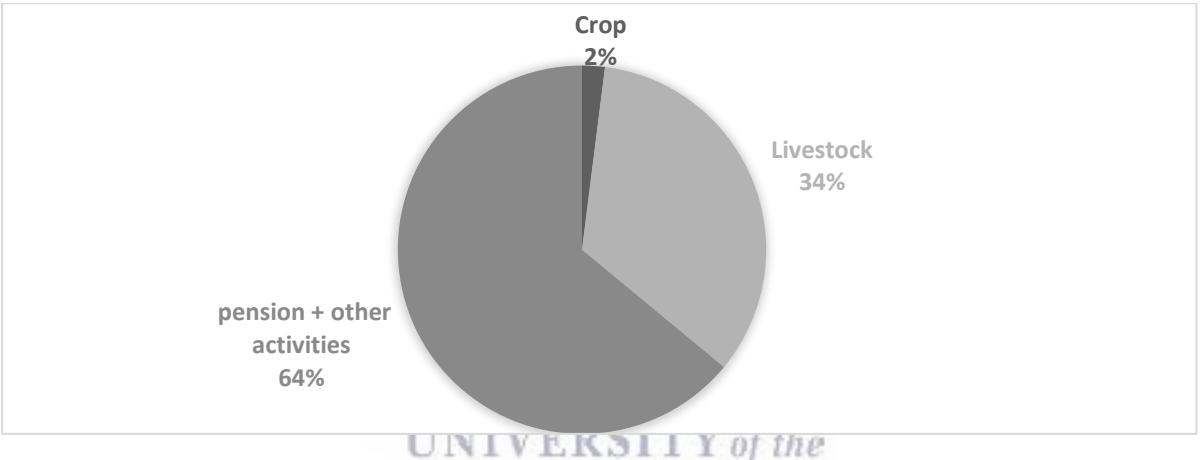

Figure 4.6: SSFs' household income contribution from crop, livestock, and pension and other activities

The South African income statistics of small-scale farmers indicate that about 79% of small-scale farmers' household income is contributed by salaries from informal, formal and self – employment and pension, while farming activities contribute about 3% of the small-scale farmers' household income (Kirsten and Moldenhauer, 2006). The low contribution of farming activities to household income could be a result of lack of access to market, which leads to small-scale farmers selling produce in the community at a price lower than the market price (Thindisa, 2014). These results show that farming is not the main livelihood strategy for Barrydale SSFs and other SSFs in South Africa, as the main contributing activities are not from farm produce. This indicates that the reforms of water allocation have not influenced productive use of water for agricultural activities by SSFs in Barrydale, as it has been shown that the main source of income for Barrydale SSFs is not farming.

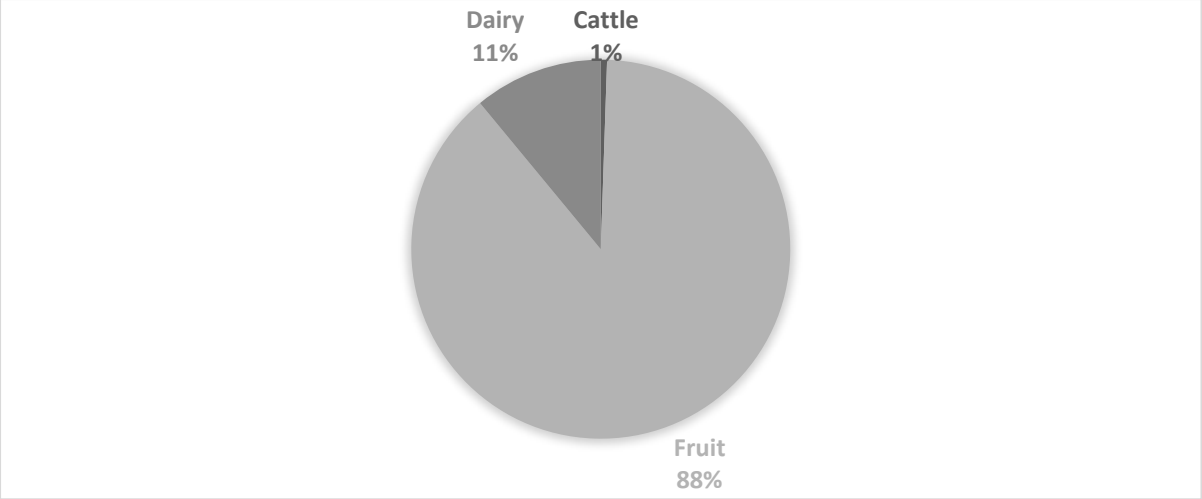

Figure 4.7: Household income contribution of LSFs from farming activities

The high household income contribution is from fruit farming for LSFs and this could be because the fruit is exported, meaning the LSFs have access to a specific market and the fruit price is internationally and nationally agreed on (NAMC and Commark Trust, 1978). Fruit production in the Western Cape is mainly based on irrigation, due to scarcity of rainfall during summer, which is the irrigation season, meaning water storage infrastructure is required (Myburgh, 2006). The LSFs have irrigating infrastructure and dams to store water during the wet season, which makes it possible to produce fruits in a water scarce area. The irrigation infrastructure and dams existed before the initiation of water sector reform efforts. This means that the water allocation reforms have not influenced productive use of water for Barrydale LSFs.

4.4.3. Correlation between water use and income generated from the use of water for farming activities

The correlation between annual water use and annual income for SSFs and LSFs shows that the Spearman's correction coefficient r_s for ten of the seventeen SSFs interviewed is 0.250. The ten SSFs' water use and income were selected, because the ten SSFs were able to estimate the amount of water collected from the available water sources, while the other seven SSFs were using domestic and grey water and could not estimate the amount of water used from the said sources. The results showed a weak positive correlation between annual water usage by SSFs and the SSFs' annual income, while the Spearman's correlation coefficient r_s for 6 LSFs interviewed is 0.371. This is also showing a weak positive correlation between the two variables.

The weak positive correlation between the two variables from both SSFs and LSFs could be a result of insufficient water use by SSFs and LSFs, because of water shortage. It has been shown in the previous section that both SSFs and LSFs are using less water than what is required by farming activities. Assessment of water access for agricultural use by SSFs and LSFs showed that the water access by SSFs and water allocated to LSFs is not adequate to meet the requirements of the farming activities. However, both farming groups managed to undertake all of the farming activities using the available inadequate water. This indicate that both SSFs and LSFs have used the available water productively. However, the productive use of water by LSFs was not influenced by the reforms of water allocation, because the water used was authorised before the reforms of the water sector. The productive use of water by SSFs was influenced by the water allocation reforms through incorporation of water allocation reform in the Swellendam Municipality IDP, hence the municipality supported small-scale farmers with water infrastructure and water for agricultural activities.

Based on economic component results, pension and employment are the highest contributing household income sources for SSFs, meaning that farming is not the SSF livelihood strategy. The farming activities also do not result in improved income for SSF livelihood needs. In terms of the sustainable livelihood approach, the farming activities of SSFs do not result in improved economic income or improved food security for SSFs and families, which is a negative outcome of the sustainable livelihood approach. The LSF income is generated from farming activities and is used for various purposes including the farmers' livelihoods. Farming is the livelihood strategy for LSFs because income is derived from farming activities and the income contribute to food security for the farmers' families and workers. This indicates a positive sustainable livelihood approach outcome for LSFs. Based on these results; the water allocation reforms have not changed productive use of agricultural water for LSFS, while SSFs are generating more income from non-farming related sources of income.

4.5. Physical component

This section addresses both objectives of the study, because the physical components are required for accessing water and for achieving productive use of water. This section presents elements that include access to farming land and farming infrastructure. Access to farming land is a requirement for water use applications; hence this element is related to water access. The previous two sections have presented the importance of farmers having access to irrigation

infrastructure in order to utilise the available water productively. Other farming infrastructure is required for increasing production; hence these are related to productive use of water.

4.5.1. Access to farming land

The SSFs lease farm plots from the Swellendam Municipality and the farm plots sizes are shown in Figure 4.8. This is in line with the land reform programme of the DRDLR and it has been incorporated in the municipality's IDP to achieve the requirements of the Land Reform Programme. The largest farm plot size is 12.5 hectares, while the smallest is two hectares. Out of the seventeen SSFs interviewed, 29% have no farm plots, 35% have farm plot sizes ranging from two to three hectares, 6% have farm plot sizes ranging from four to five hectares, 24% have farm plots sizes ranging from six to seven hectares and 6% have 12.5 hectares of land. The 29% of the SSFs who do not have farm plots keep the pigs in pigpens provided by the Swellendam Municipality and farm vegetables in small backyard gardens. The access to the farming land was therefore influenced by the land reform programme through incorporation of the programme in the municipality IDP. However, access to farming land is not significant, due to the small sizes of the farming land leased to SSFs. The access to farming land influences the access to water for agricultural activities, but access to water for agricultural activities is not significant for SSFs, as demonstrated by the water resources available and lack of means to access the water.

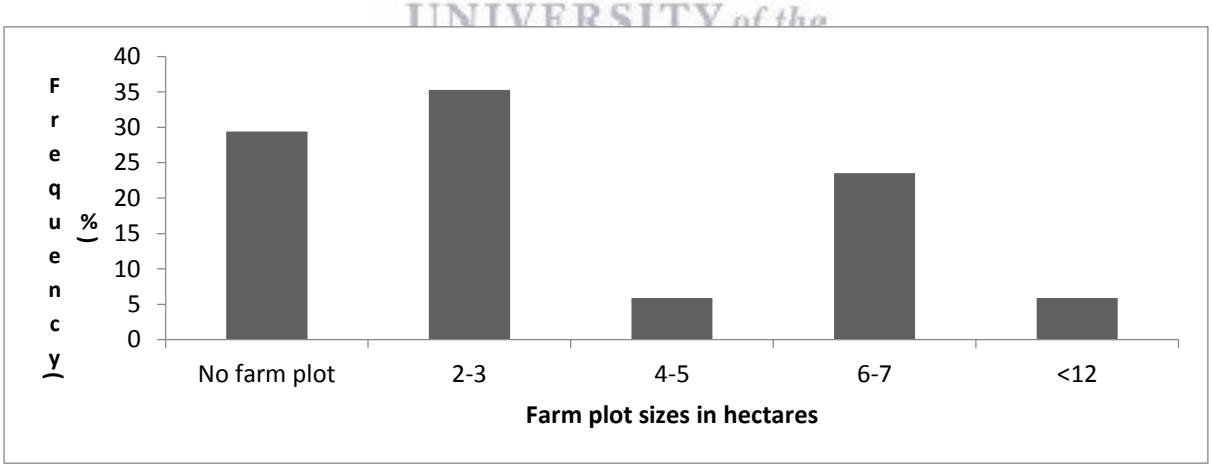

Figure 4.8: Sizes of farm plots leased by SSFs

In South Africa, individual subsistence and small-scale farmers cultivate on farms that are less than two hectares (NDoA and Stats SA, 2000, 2000). The results of the current study showed that 71% of the interviewed SSFs are using farm plots that are more than two hectares in size, which indicates an improvement in farm sizes used by small-scale farmers. According to

Troskie *et al.*, (2016), small-scale farmers are farming on less than a hectare of land in the Western Cape. This is reflected by the 29% of SSFs who do not have farm plots and are currently farming vegetables in small backyard gardens. The said farmers are awaiting responses from the Swellendam Municipality regarding application for farm plot leases. It is also shown that the SSFs are acquiring land for farming purposes from the Swellendam Municipality, since the 71% of SSFs have farm plot lease agreements of nine years and 11 months duration.

The LSFs own land, ranging from 140 to 2000 hectares, but only 140-500 hectares of land is being used due to lack of water resources and financial funding. The LSFs inherited the farms from their late parents; therefore ownership of these farms was not influenced by the water allocation reforms. Even though land access is important for applying for water use licence for agricultural use, the availability of water is not guaranteed, as stipulated in the National Water Act of 1998. This therefore means that, even if the LSFs have large farm sizes, these farms may not be utilised if there is no water available to be used on the farms. This also indicates that having large farm sizes does not always guarantee large production, due to other factors that affect farming, such as water availability.

According to Stats SA and the Department of Agriculture (2000), commercial farmers in South Africa own farms of an average size of 1 349 hectares individually. In the Western Cape, the average commercial farm size is 1381 ha, and is 832 ha in the Swellendam Municipality (Karran and Tregurtha, 2004). The average farm size for the six LSFs interviewed is 1507 hectares and it is above the South African, Western Cape and the municipality farm size average. However, 75% of the farm plots were not being used, due to lack of water resources and financial funding.

In comparing farming land ownership between Barrydale SSFs and LSFs, it was found that the LSFs own farms that were inherited, while the SSFs are leasing farm plots from the Swellendam Municipality. It was also shown that there are inequalities between SSFs and LSFs in terms of access to land. Access to farming land is one of the requirements for accessing water licenses for agricultural uses (DWS, 2014). Lack of access to adequate farming land by SSFs is the hindering factor to accessing water and improving livelihoods (Pineo *et al.*, 2016).

4.5.2. Farming infrastructure

The farming infrastructure is related to the second objective of the study, because access to farming infrastructure enables productive use of water. Farming infrastructure includes tools and equipment such as ploughs, tractors, water pumps and vehicles for transporting produce to the market and transporting inputs from the market to the farm. The SSF lack basic farming infrastructure, which includes irrigation infrastructure such as water pumps, ploughing tools such as tractors and harvesting tools such as balers. All the SSFs rent a tractor for R150 per day to plough farm plots. The tractor is rented from one owner, because the rental fee is cheaper than other tractor owners. The impact of renting the tractor from one owner is the delay in ploughing by other SSFs, as they wait for it to become available. Section 4.2 of this chapter presented the mechanisms implemented by the BGCMA to achieve the objectives of water allocation reforms, showing that the BGCMA did not implement any type of support with regards to infrastructure as part of the development support mechanism.

The LSFs own an average of two tractors per farmer and other ploughing tools such as ploughs and planters. The tractors are also used as farm transport for produce, tools and other farming objects. The LSFs also have permanent irrigation infrastructure and dams for water storage, while the SSFs lack irrigation infrastructure and share water from a dam and tank. The lack of irrigation infrastructure negatively affects the farming activities of the SSFs, as indicated in the natural component section. Three out of six LSFs interviewed hire trucks to transport the produce to the market, two out of six LSFs use own transport and one of the six LSFs use market transport. Sixteen out of the seventeen SSFs interviewed hire a vehicle for transporting produce to the market or use public transport, while the remaining one SSF use own transport. Availability of market transport influences the delivery time of produce, unlike the hired and public transport.

Delays in ploughing results in negative impacts on the quality and quantity of produce (Baloyi, 2010). This negative impact also affects the Barrydale SSFs, because these farmers plough with one tractor that is hired by all members of this farming group. As a result of this, some farmers delay ploughing. Studies conducted in the Eastern Cape and Limpopo provinces where small-scale farmers' challenges were assessed found that unavailability of ploughing equipment limited small-scale farmers' productivity (Baloyi, 2010; Khapayi and Celliers, 2016). Access to ploughing equipment is crucial for farm produce, as indicated by the fact that the lack of ploughing equipment delays ploughing and reduces the expected produce quality and quantity.

Hired or public transport is unreliable and sometimes leads to late delivery of produce (Khapayi and Celliers, 2016). The late delivery of the produce also leads to loss of reliable markets by small-scale farmers and loss of produce quality to farmers who do not have produce storage infrastructure (Nel and Davies, 1999; Khapayi and Celliers, 2016. The Barrydale SSFs sell the produce in the community, due to difficulties in accessing market transport and to prevent quality loss by the produce. The produce is sold cheaply and on credit and that has a negative impact on the farmer's income. Louw *et al* (2004), regard lack of access to transport as the major constraint faced by small-scale farmers in South Africa.

Physical components are linked with human and economic components in terms of utilisation, maintenance, and selection of required infrastructure for various farming activities with regard to human component. In the case of economic components, farmers require funding to purchase or hire the required farming infrastructure (Xaba, 2014). The economic statuses of SSFs and LSFs have been assessed in the previous section and it was concluded that SSFs cannot afford farming infrastructure, while LSFs already own the infrastructure. Studies that were conducted in the domain of assessing small-scale farmers' challenges in South Africa recommended the need for the government to assist small-scale farmers with training that will enhance farmers' knowledge of required physical infrastructure and also to assist farmers in accessing and using the required farming infrastructure and farming skills (Nel and Davies, 1999; Baloyi, 2010; Khapayi and Celliers, 2016; Xaba, 2016).

4.6. Human component

The human component was investigated because elements such as education and farming skills influence productive use of water. This section presents farmers' education levels and skills and how these impact on the farming produce. Education levels and skills are said to be crucial for managing a business such as farming. Required skills for agricultural business were extracted from literature and compared with the SSF and LSF skills. The human component also influences access to water, because having relevant skills and knowledge are useful during the water license application process.

4.6.1. Education and skills

Table 4.8 shows the education levels of SSFs, where twelve out of seventeen SSFs interviewed had only a primary education level, four SSFs had a secondary education level and one farmer had tertiary education level. One of the farmers with primary education also has a certificate in gardening, while one of the farmers with a secondary education level also has been trained in

the liquor business, community services and agricultural training courses. All of the six LSFs interviewed had tertiary education levels, such as certificates, diplomas and degrees in agriculture and horticulture. The SSFs are not able to attend educational training to improve their level of education, because these farmers are heading households and therefore need to work during the day and or manage the farms in order to support the families.

Table 4.8: SSF levels of education

Level of education	Number of SSF
Primary education	12
Secondary education	4
Tertiary	1

Twelve out of the seventeen SSFs interviewed are within the 7.9% of the Swellendam Municipality population with primary education level (Stats SA, 2011). Secondary education level in Swellendam municipality has the highest population (34%), while the tertiary/higher education level is the second lowest (10%) when compared to other levels of education (Stats SA, 2011). Four of the six SSFs are within the secondary education level of the Swellendam Municipality, while one of the six SSFs and all of the LSFs interviewed are within the tertiary education level. The education levels of LSFs and that of the of SSFs in secondary and tertiary fits the socio-economic profile of the Western Cape, with 87% of the population being regarded as literate, while twelve SSFs are within the 12% of the illiterate Western Cape population (WCG, 2015).

These results showed the differences in the education level between SSFs and LSFs in Barrydale, which indicated that LSFs have higher education levels, acquired specifically for agriculture, than SSFs. According to Khapayi and Celliers (2016), education level and farming skills increase production. This means that the SSFs with low education levels and farming related skills are not able to increase production, meaning the productive use of water cannot be achieved.

The majority of small-scale farmers in South Africa are illiterate or have a low education level (Baloyi, 2010). The NDoA put in place various training programmes at various institutions in South Africa. However, small-scale farmers have difficulties in accessing the agricultural

training programmes, due to the programmes' main targeted group being youth and the fact that they are heavily theoretical in nature. The admission requirements to the programmes are secondary education level from grade ten and above, and this is a major hindering factor for small-scale farmers to obtain admission to such programmes (DAFF, 2008). The Barrydale SSFs are also prevented by their low level of education from accessing the training programmes offered by the NDoA. Even if the SSFs met these requirements, work and farm commitments would have prevented the farmers from attending these programmes. The development of support mechanisms for water allocation reform provides for training, specifically practical training for enhancing skills, and will not require farmers to abandon their commitments, as this training is mostly on-the-job training. This means that the farmers who receive this training will be trained and mentored on the farms to gain practical farming experience. However, due to delayed implementation of the water allocation reform mechanisms, these farmers have not received such training.

Table 4.9 presents SSFs skills and twelve of the seventeen SSFs interviewed have painting, plumbing, construction and building skills, which are in line with formal and informal employment undertaken by SSFs as the farmers' sources of income. These skills enable these farmers to earn an income in order to support the households and these skills are not agriculture-related.

Table 4.9: SSF skills

Skills	No. of farmers
Teaching	1
Management	2
Catering	1
Gardening	2
Painting, plumbing, construction, building	12

According to Khapayi and Celliers (2016), small-scale farmers require practical training in order to increase production for specific farming activities and to gain required farming skills. Xaba (2014) and Nchabeleng (2016) found that small-scale and subsistence farmers in South

Africa lack crucial skills that are required in agribusiness and to turn the farming business into commercial enterprises. These skills include management, marketing, production, infrastructural utilisation and financial management skills. Barrydale SSFs also lack agriculturally-related skills, just like other South African small-scale farmers, as indicated by Xaba (2014) and Nchabeleng (2016). This indicates the lack of implementation of development support mechanisms of Water Allocation Reform, which aims at capacitating Water Allocation Reform beneficiaries. The lack of support from NDoA, as the relevant department to assist in capacitating the small-scale farmers, has a negative impact on Barrydale SSFs in terms of required farming skills.

Table 4.10 shows LSF skills and all the farmers have management, production and infrastructure utilisation skills, which are the important skills in agricultural business. The LSFs have more agriculture-related skills than SSFs in Barrydale, which means SSFs need practical farm training in order to acquire such skills and improve the production and management of farms.

Table 4.10: LSF skills

Skills	No. of farmers
Financial management	2
Mechanical	2
Management, production, infrastructure utilisation	6

The SSFs indicated that farmer support services are needed by SSFs in order to improve farming skills and to improve understanding of suitable farming systems for the Barrydale area, as well as access to markets and training on financial management. Such support services are offered by the NDoA, but SSFs in Barrydale do not receive the extension services, even when the SSFs request such services. This could be as a result of a lack of Extension Officers working in the area and the distances between the Extension Officers and the farmers. The Extension Officers are based in Bredasdorp office, which is 116 kilometres from Barrydale.

International experience indicates that small-scale farmers' productivity can increase with adequate access to farmer support services (Bright, 2010). Sikwela (2013) found that farmer support services in Southern African countries such as Zimbabwe, Malawi and Kenya have the

potential to promote agricultural development. In South Africa, farmer support services are offered by agricultural extension services from the NDoA. The said services are meant to support small-scale farmers through transfer of agricultural skills such as farm management and marketing, and to assist in turning small-scale farming into commercial farming (Machethe and Mollel, 2000).

Nchabeleng (2016) also found that the NDoA is understaffed, and as a result, extension officers are unable to spend a day with farmers, as the officers are needed in the office. As a result the available extension officers do not have adequate time to assist farmers. To ensure that the extension officers were in closer proximity to the farmers, the Limpopo Department of Agriculture based extension officers in all municipalities and service centres in the province. This could also be implemented in Barrydale in order to offer support services to the farmers without the need to travel long distances. However, in Limpopo 57% of small-scale farmers in Capricorn and Vhembe district municipalities were either not receiving services, or were not satisfied with the services from the extension officers. It was found that the extension officers were not available to assist farmers and were not adequately capacitated to come up with solutions or advice for farming issues faced by the farmers (Baloyi, 2010).

The NDoA initiated training programmes for small-scale farmers in co-operatives for all provinces. However, the Western Cape, Gauteng and Free State provinces did not receive the training, due to lack of funding, while farmers who received the training from other provinces were not satisfied with the training and indicated that the training was not effective. This was said to be as a result of lack of skills from the extension officers facilitating the training. This was because the NDoA trained a relatively small number of extension officers in preparation for small-scale farmer training, due to delays in procurement processes from the department (Nchabeleng, 2016). Based on the experiences of small-scale farmers regarding the extension services in other provinces and the Barrydale SSFs, the extension services are not effective in the development of small-scale farmers' skills in South Africa. This is therefore hindering success of small-scale farming in South Africa.

4.7. Social component

The social component includes elements such as networks and relationships, which are important in any livelihood strategy. The social component is important for networks and relationships with relevant farming groups, institutions and departments in order to get advice for farming-related issues encountered by farmers or advice on water-related issues such as the

water use licence application process. Networks and relationships with other farming groups enhance skills transfer, which improves farming production for those who lack such skills. The social components are therefore investigated in the current study to assess how these networks and relationships have influenced access to water and productive use of water, as this component is related to both objectives of the study.

4.7.1. Networks and relationships

The SSFs are members of the Barrydale Small-scale Farming Group that was established in 1992 by thirty-four SSFs. When the farming group was established, the SSFs lodged applications to the Swellendam Municipality to lease farm plots. The SSFs established the group with the plan of starting a farming enterprise after acquiring lease agreements. The group was therefore established to serve as a platform for SSFs to advise and assist each other in farming issues, and to be represented in other institutions that can offer assistance and advice to farmers as a group. However, sixteen out of the seventeen SSFs interviewed indicated that they were not deriving meaningful benefits such as advice on farming issues by being members of the farming group, hence fourteen members of the original thirty-four members of the group are no longer part of the group.

These farmers also indicated that there is a lack of trust, transparency and agreement in terms of decisions taken by the members. This relates to the use of funds raised by members and the use of the monthly membership fee, which is R 120. Information on how the said funds are used is not shared with the members. The funds are managed by the farming group chairperson. The chairperson is also responsible for representing the farmers in the process of acquiring lease agreements and getting assistance from various organisations and institutions. However, feedback from such processes is not shared with the farmers. As a result, SSFs are seeking advice and assistance from other parties such as family, individual farmers and institutions individually. Farmers are no longer attending the farming group meetings.

The LSFs are members of the Barrydale farming group, which consist of twenty-five commercial farmers. The group was established several generations ago. The LSFs inherited the farms and continued with membership in the group. The functions of the group are to share farming experiences, discuss and assist in resolving farming issues affecting individuals and the farming group. All of the LSFs interviewed were satisfied with the group's activities.

Nieman (2006); Katungi (2007); Megyesi *et al* (2010), refer to a network and relationship between individual farmers in the same farming or societal group as a bridging social capital. This type of relationship is important for understanding issues of the group and also provides ideas and advice in resolving such issues. Such relationship exist in both SSF and LSF groups. However, there is a lack of trust between members of the Barrydale SSF, which negatively affects the relationship between these farmers. Megyesi *et al* (2010), found that lack of trust, transparency and rejection of decisions taken by the group leaders negatively affected the network and relationship between members of smallholder dairy farming groups in Austria and Hungary, which led to farmers changing farming groups and affecting the marketing networks of the previous groups. Nieman (2006) regards trust, sharing of information and acceptance of norms or actions taken by the group as the three forms of social capital that must exist between members of the same group, or between related groups, in order to strengthen networks or relationship between group members or various groups.

The LSFs seek advice and assistance from other farming groups, such as Montagu farming group and institutions such as the BGCMA, the DoA, and the DWS, marketing institutions, as well as consulting companies. Two of the six LSFs interviewed indicated dissatisfaction with the actions of the DWS with regards to the verification and validation process and the sharing of information regarding laws that govern water allocation. For this reason, the two farmers regarded the relationship between farmers and the DWS as weak and lacking benefits. However, the DWS is still part of the LSF network, because the LSFs are reaping other benefits from the network, such as advice regarding water management issues. The SSFs seek assistance for farming inputs, water and land access, funding from the BGCMA, Swellendam Municipality, and the DoA, but the SSFs indicated that there is a weak relationship between farmers and the institutions, except for the Swellendam Municipality. This is because the farmers are not benefiting from the institutions, while the farmers are being assisted by the Swellendam Municipality with water for farming activities from the tank and the dam and also with farm lease agreements.

Nieman (2006), found that parties involved in networks and relationships have expectations, such as benefiting through information access and assistance. The weak network and relationship between the institutions and SSFs could be the result of the realisation by SSFs that the expected benefits from these networks are not achieved. The networks and relationships between farming groups and other external groups or institutions is referred to as

linking social capital and such networks are required when external advice and assistance is required. They also provide opportunities for additional useful information, ideas and even training when necessary (Katungi, 2007). Such networks also provide opportunities for connections to other networks that are useful for the development of farmers (Thindisa, 2014). The weak network and relationship between the SSFs and between these farmers and other institutions results in SSFs missing out on an opportunity to get advice on water access processes and acquiring farming skills from other experienced farmers and institutions. This means that these weak networks and relationships negatively affect water access and productive use of water. However the water allocation reforms do not prescribe the need for a social component, but focus on development support mechanisms that consider infrastructure and training.

4.7.2. Impact of networks and relationships on farmers

Networks and relationships within and outside farming groups are expected to impact on the farmers' participation and development, as well as improve knowledge and skills through training (Nieman, 2006).The participation in farming group issues and decisions assist farmers in the implementation of ideas or solutions suggested during group meetings (Arowolo *et al.*, 2011). This means SSFs are not able to benefit meaningful from the group, because the farmers are not given an opportunity to participate or come up with solutions to issues faced by the group.

Development of farmers through involvement in farming groups takes place through skills transfer and dissemination of useful information by group members and from other networks (Jordaan and Grove, 2013). Jordaan and Grove (2013), found that small-scale farming groups in the Northern Cape were able to develop through transfer of skills by educated and experienced farmers within the groups. The small-scale farmers in the Eastern Cape received mentorship and training from the DoA and the training resulted in improved skills and increased production. Strong networks and relationships with institutions such as the DoA are recommended for farming groups (Arowolo, *et al.,* 2011). This is not occurring between Barrydale SSFs and the DoA. There is a weak relationship between the SSF group and the DoA and the SSFs have never received training from the Department of Agriculture.

In the LSF group, advice and suggestions concerning farming issues are shared by members and, in cases where external input is required, the group representatives seek such input from the groups' networks and share the outcome with all members. Two of the six LSFs interviewed

indicated that training about the water laws and the verification and validation process of the DWS is required by farmers. This was said to be important for improving understanding of the water laws and the verification and validation process, as these affect farmers in terms of water access and entitlement. However, the farmers have not received such training, as the farmers never approached the DWS for the said training.

In terms of advice related to water access and water licencing issues, the BGCMA Chief Executive Officer launched a meet-and-greet campaign in 2012. This campaign aimed at providing an opportunity to resource-poor farmers/HDIs to air out their issues regarding the water allocation process and to assist farmers with the water application and registration processes. A total of nine meetings were held between 2013 and 2016. These meetings were held in Grabouw, Suurbraak, Riviersonderend, Ashton, Wolseley and Zoar (BGCMA, 2013; BGCMA, 2016). In the entire meet-and-greet campaign meeting held, Barrydale SSFs and LSFs never had an opportunity to attend, because these were never held in Barrydale area.

4.8. Summary

This section summarises the findings and the discussion chapter, making reference to the two objectives of the study. The findings and discussions are summarised, together with the elements and components that influence water access. These include water availability in the area, implementation of water allocation reform mechanisms, economic, physical, human and social components. The findings on the assessment of productive use of water are summarised and linked with the elements and components that influence productive use of water. These elements and components include the influence of water allocation reform mechanisms, implementation, economic, physical, human and social components.

4.8.1. Access to water by HDIs

Objective one aimed at establishing how the reformation of the water allocation system has affected access to water for agricultural uses by historically disadvantaged group in the Barrydale area in the Western Cape Province of South Africa. Access to water is influenced by many elements, which include the availability of water in the area, the process of the water allocation system and its implementation, and access to physical, economic and social components. Water is available during winter in the area, because the area receives rainfall in winter (Esau, 2005; River Health Programme, 2011; BGCMA, 2016). However, irrigation and vegetable planting are conducted during the dry season (see Tables 4.1 and 4.5). The surface

water storage sources such as dams dry up in the dry season, as shown in Figure 4.3. Based on these findings, the water allocation reforms cannot influence access to water by SSFs, because of the water availability of the area.

The water allocation reforms aimed at increasing water access to HDIs and women and it prescribed a set of mechanisms for implementation. The BGCMA has not completed implementing any of the mechanisms, but have initiated set-asides, strategic alignment with other national initiatives and development support mechanisms. However, none of the initiated mechanisms have been completed. The general authorisation mechanism is only implemented in specific catchments after being gazetted. The compulsory licencing mechanism is implemented in areas where water use needs to be licenced in order to achieve fair water allocation, to promote beneficial water use in the public interest and to protect water resource quality (NWA, 1998). The findings showed that SSFs do not have water use licences or water use registration certificates to gain access to Huis River, which is the nearest river in the SSF location, while LSFs have access to an average of three water sources in terms of licences. It is also shown that the LSFs have access to about 300 to 2000000m^3 per year, which is more than a maximum of 920 m^3 received by SSFs per annum. These findings indicated that the allocation of water in this area is not equitable, as there is a significant variation in access to water resources and quantities between SSFs and LSFs. The compulsory licencing has not been implemented.

The BGCMA have initiated the set-aside mechanism in order to get water from illegal water use, so that this water can be allocated to HDIs to achieve equity and fair water allocation (DWAF, 2008; DWS, 2014). However, the implementation of this mechanism has not been completed and no water has been either set aside for allocation or been allocated to HDIs. This means that the reforms of water allocation have not increased access to water for agricultural uses by HDIs in Barrydale. This is because the implementation of the water allocation reform mechanisms has not resulted in the recovery of illegal water and the allocation of that water to the SSFs who are HDIs. According to Schreiner (2013), the delay in the implementation of the water allocation reform mechanisms and the National Water Act of 1998 is a result of lack of experience and technical capacity from the staff members of the institutions that implement the Act and the Water Allocation Reform Policy.

The findings show that there is a lack of implementation of the water allocation reform mechanisms. In cases where implementation is initiated, it does not improve access to water

for agricultural used uses, but for domestic use. The incorporation of the Water Allocation Reform requirements in municipality IDPs benefited Barrydale SSFs through access to water resources. However, access to the provided water resources is not adequate, because the water is not adequate for farming requirements and farmers do not have the means to abstract water from the provided water sources. The development support and strategic alignment with other national initiative mechanisms support the set-aside, compulsory licencing and general authorisation mechanisms, because these mechanisms are the ones that result in increase in water access. The findings showed that there is no alignment between the Land Reform Programme, special purpose vehicle initiative and water allocation reform. The alignment of water allocation reform with the Land Reform Programme and special purpose vehicle initiative aimed at supporting the implementation of Water Allocation Reform Policy. Due to lack of alignment between the Land Reform Programme and the special purpose vehicle initiative with water allocation reform, access to water by Barrydale SSFs has not been influenced by the reforms of water allocation. However, the NDoA is assisting the SSFs with seeds and have also sponsored two electric water pumps to two SSFs, while the DRDLR is assisting SSFs with farm plots through integration of the programme with the Swellendam Municipality IDP. The alignment was identified between the water allocation reforms and the Swellendam Municipality's job creation initiative. This alignment was established through incorporation of water allocation reform requirements in the municipality IDP. Through this alignment, the SSFs receive a 10 000 litre tank that is filled every month, the municipality built a 70000 m^3 water storing dam for SSFs, and is leasing farm plots to SSFs. This shows that the reforms of the water allocation process have influenced water access for SSFs in Barrydale through support from Swellendam Municipality. However, the said influence was not meaningful because the water from the sources does not meet SSFs farming needs and also does not improve productive use due to lack of other resources.

The LSFs have not benefited from the water allocation reforms in terms of increasing water access to these farmers. This is because the LSFs accessed water licences in terms of the 1956 National Water Act. The findings show that the water allocated to LSFs in terms of water use licences and the water accessed by SSFs from Huis River without registration, and from the tank and the dam supplied by the municipality, is not adequate to meet farming needs. Access to water is hindered by many factors, including availability of water in the area, as discussed previously in this section. Other elements, such as having access to physical, economic, human and social components also influence access to water access. This means that the reforms of

water allocation are limited in terms of increasing water access in water-stressed areas. In areas where there is water available for allocation, the water allocation reforms can influence increases in water access, but the lack of access to the elements that influence water allocation, as the case with both LSFs and SSFs, will hinder the process.

The physical component that influences access to water is access to land and the SSFs lack of adequate farming land. The access to land is through lease agreements with the Swellendam Municipality, which was influenced by the Land Reform Programme. The land is therefore not owned by the SSFs, while the LSFs own farms ranging from 140 to 2000 hectares. Access to land is one of the requirements for applying for water use for agricultural activities. In the case of SSFs, the land is not owned by the farmers. This indicates that the strategic alignment with other national initiative mechanisms have not been implemented adequately for HDIs in Barrydale, because access to farming plots through leasing has not influenced water access for individuals, or even for the group, for use in beneficial and productive agricultural activities.

The economic component influences access to water, because an applicant for a water use licence is required to demonstrate how the water being applied for will be used. This includes where and how the activities will be conducted, including the infrastructure availability. This means that an applicant need to have financial input in order to undertake the farming activities. This financial input is therefore used in purchasing required infrastructure, such as the irrigation infrastructure and farming land. The findings showed that SSFs cannot afford to purchase the required infrastructure due to financial constraints, while the LSFs have the required infrastructure. The findings have demonstrated that the SSFs lack economic resources and these farmers have not benefited from the financial assistance for poorly-resourced irrigating farmers; which would have assisted in purchasing water distribution infrastructure. However, the financial assistance to resource-poor irrigation farmers provides that the capital cost of water distribution infrastructure support is aimed at supporting Water Users Associations, irrigation schemes and approved legal entities (DWS, 2004). The SSF group are not in this category. The water allocation reform development support mechanism, which provides support for infrastructure, has not given any support to SSFs for infrastructure. This indicates that the financial support for resource-poor irrigation farmers and the development mechanisms have not been beneficial to SSFs, and this supports the water allocation reform implementation. There is no alignment in the initiatives and policies supporting the water allocation reform implementation and, as a result, the SSFs lack supporting components that

influence their access to water. This means that even if the water allocation reform increases access to water for SSFs, lack of alignment between the initiatives hinders use of water, as there is no proper infrastructure to utilise the available water.

The social component is about the networks and relationships between relevant groups and institutions. These networks and relationships assist in understanding the farming business and which institutions and groups to approach for assistance or advice (Nieman, 2006; Arowolo *et al.*, 2011). It was indicated that the SSFs lack these networks and relationships with other group members and institutions. The LSFs have strong networks and relationships between the farming group and other farming groups and institutions. As a result LSFs, share useful information within the groups and institutions, while the lack of strong relationships and networks with farming group members and other institutions disadvantaged the SSFs, because these farmers lack basic information such as water registration procedures or licencing information and are not aware of the relevant department to approach for various issues encountered by the farmers. The development support mechanism also provides training to the beneficiaries of water allocation reform, but the Barrydale SSFs have not received such training, hence these farmers lack basic information that is crucial for farming activities. This means the water allocation reforms have not influenced increased access to water for SSFs through implementation of the development support mechanism.

Based on these findings, the water allocation reforms have slightly influenced the increase of water access for agricultural uses by SSFs. This was through the incorporation of water allocation reform requirements in the municipal IDPs and through implementation of the IDPs by the Swellendam municipality. However, access to this water is not adequate, because it does not meet the needs of the farming activities and has no impact on the livelihood of the SSFs households. The access to water from other sources such Huis River is dependent on availability of water and other factors, but the delays in the implementation of the water allocation mechanisms to increase water access also hindered progress in the process of increasing access to water for the SSFs.

4.8.2. Productive use of water by HDIs

The second objective aimed at determining how the reforming of water allocation has influenced productive use of water in agricultural activities undertaken by farmers in the Barrydale area in the Western Cape Province in South Africa. Productive use of water refers

to the use of water that creates valuable products. In the case of farming activities it refers to using water to produce products for markets and consumers (Williams, 2015). Productive use of water is influenced by access to physical, economic, human and social components.

The physical components that influence productive use of water are irrigation infrastructure and vehicles for transporting produce to the market. These elements require funding, which SSFs do not have. The findings showed that the SSFs lack the irrigation infrastructure and the vehicles for transporting produce to market, while the LSFs lack financial input to purchase farming infrastructure for increasing current farm sizes. Two of the SSFs have received two electric water pumps, but the SSFs have not received funding for resource-poor irrigation farmers, because these farmers are not in an irrigation scheme, water users association or approved legal entity. This means that the SSFs cannot benefit from this financial assistance and, as a result, these farmers lack this required infrastructure. According to Williams (2015), lack of farming infrastructure and the financial funding to purchase such infrastructure impedes many farmers from using water productively. The development support mechanism only provides support for infrastructure revitalisation and not purchasing of new infrastructure (DWAF, 2008). This means that the water allocation reforms have not brought about productive use of water by farmers in Barrydale.

The human and social components influence productive use through the application of farming knowledge and sharing of important farming information. This knowledge and information sharing is important for assessment of risks, and this is beneficial for making informed farming decisions (Williams, 2015). The findings showed that SSFs lack human and social components, while LSFs have both components. The lack of these components is the reason why small-scale farmers are not able to achieve productive use of water in South Africa (Jordan and Grove, 2013; Xaba, 2014; Nchabeleng, 2016). However, the natural and economic components findings showed that both SSFs and LSFs in Barrydale are using less water than the amount of water required to produce the crops and to breed the livestock available to both farming groups. Hence there is no significant association between the water used by both farming groups and the money generated from the use of water, when this is analysed using Spearman's correlation coefficient. The water used by LSFs and the components influencing productive use of water were not influenced by the water allocation reforms, as all of these components, including water, were acquired before the reform of the water allocation system. In the case of SSFs, the reforming of water allocation has not influenced or assisted SSFs with the components that

influence productive water use, as it has been proved that these farmers lack these components. Based on these findings, the reforming of water allocation system did not influence productive use of water by LSFs and SSFs in Barrydale.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The current chapter provides a brief summary of the main outcomes of the study. Conclusions are made in reference to the research objectives and results of the study. The chapter also provides recommendations for policy and future research.

5.2. Summary of the study

The aim of the promulgation of the NWA of 1998 was to redress past imbalances in water access in terms of race and gender. The Act alone is just a guideline that requires tools and processes by means of which its objectives will be achieved. The Water Allocation Reform is one of the tools used to achieve the objective of the NWA through implementation. The reform established its own processes and targets, with the aim of assisting and providing water access to HDIs. The Water Allocation Reform set a target of allocating 30% of water to HDIs and 50% of that water to be allocated to women by 2014. The reform also envisaged changing the livelihoods of HDIs through allocation of water, hence the SLA was used in the study in order to assess the livelihoods of SSFs. Collaboration with relevant departments, which included the Department of Water and Sanitation, the Department of Agriculture and the Department of Rural Development and Land Reform, is emphasised for expediting the process and for capacity development of the beneficiaries of the reform. Involvement of the NDoA is crucial, because HDIs mainly chose agricultural activities as their main livelihood strategy. The DRDLR is important, because of the link of water with land. However, the results of the study have revealed a lack of collaboration between these departments in ensuring increased access to water for agricultural activities by HDIs.

The study used a SLA to assess how the reforms of water allocation have changed the livelihoods of HDIs and how the reforms have influenced the productive use of water in Barrydale. The results of the five components of the SLA shown that the SSFs lack all of the five components, while LSFs have all of the components for undertaking farming as a livelihood strategy. The mechanisms of water allocation reform that have been initiated by the BGCMA have not resulted in the release of water for allocation to HDIs.

5.3. Limitations of the study

The conclusion should be read in light of the following limitations of the study:

- Meaningful communication between the researcher and the participants was constrained by language, which required both parties to depend on the interpreter.
- Only six out of 25 commercial farmers were interviewed due to their busy daily schedule.

5.4 Conclusions and revisiting study objectives

In assessing how the reform of water allocation system affected access to water for agricultural uses by HDIs (to address the first objective of the study), it was established that the reforms of water allocation have increased water access by the HDIs in the research area through incorporation of the water allocation requirements on the municipality IDPs. However, it was shown in the study that the amount of water provided by the municipality does not meet the water requirements of farming activities. Access to the water provided by the municipality does not improve the farmers' livelihoods, as the water is not adequate for the farming activities. Comparison between SSFs and LSFs shown that SSFs have access to water from a dam with a capacity of 70000 m^3 that was constructed by the Swellendam municipality, as well as a 10000 litre tank provided by the Swellendam Municipality. LSFs, on the other hand, had access to various river catchments, an average of three private dams and an average of three groundwater boreholes. The SSFs are faced with constraints in accessing water from the available water sources due to lack of infrastructure such as water pumps and water storing facilities. It was also shown that SSFs cannot afford to buy such infrastructure.

The SSFs do not own farming land, but are leasing farm plots ranging from 2 to 12.5 hectares in size, while LSFs own farms ranging from 140 to 2000 hectares in size. Access to long term farming land is a requirement for acquiring a water use licence, but that was not the case with SSFs, because the farmers still do not have access to adequate water for farming activities. The lack of skills and low levels of education also affect the farming activities of the SSFs, while LSFs are producing crops for export and have access to markets for livestock farming products as a result of the skills acquired and their superior education. The weak relationship between SSF group members and between the group and other institutions limits skills transfer and assistance between group members, as well as the accessing of training and support from other institutions. On the other hand, LSFs assist other group members and also gain assistance from other farming groups and institutions, as a result of strong relationship with the groups and

institutions. The water allocation mechanisms implemented by the BGCMA have not resulted in increased access to water by HDIs, as the process has not yet been completed by the BGCMA. This means there is no water that has been set aside for allocation to HDIs as the Water Allocation Strategy prescribed.

In determining how the reforming of the water allocation system has influenced productive use of water, and to address the second objective of the study, it was found that the system has not influenced productive use of water. This was assessed by correlating water used by SSFs and LSFs and income generated from the use of water, using the Spearman's correlation coefficient, which produced weak correlation between the two variables, indicating little association. This could be because both SSFs and LSFs are using less water that what is required by the farming activities, as shown in section 4.2. However, in the case of SSFs, production was affected by other factors such as lack of skills, infrastructure and social components. Based on the results obtained during the study, it can be concluded that the reforms of water allocations have not influenced access to water and productive use of water by HDIs in Barrydale. This means that the SLA outcome is negative, because the contribution of water allocation reform did not result in a positive impact on all five components of the SLA, and therefore did not ensure sustainable use of water resources and an increase in income generation from farming activities. Nor was food security and the well-being of SSFs improved.

5.5 Recommendations for policy

It is recommended that the DWS ensure that policies to be used in redressing past water imbalances set implementable and achievable objectives. In order to ensure implementable and achievable objectives the following recommendations are made for the water allocation reform policy:

- Capacity building for the institutions that will implement the policy need to be undertaken. BGCMA lacks human capacity to undertake all the water allocation processes and capacitation of the CMA is recommended.
- Use of scientific research and collaboration with research institutions is recommended, as this will enable policymakers to make informed decisions.
- Assessment of methods to be used is implementing the objectives is recommended.
- Involvement of local communities and main beneficiaries of the policy in the planning and promulgation of the policy is recommended.

- Development of guidelines that allow common platforms for participation in the processes that are being implemented in achieving the objectives of the policy by all affected parties.
- Development of capacity-building methods in the form of life, managerial, entrepreneurial and agricultural skills for beneficiaries of the policy. This would then enable the beneficiaries to become commercial farmers and improve their livelihoods through productive use of water.
- Development of a common process of engaging farmers/beneficiaries of the policy with the institutions involved in the implementation of the policy. This would assist beneficiaries to engage easily and freely with relevant institutions for issues faced by the beneficiaries.
- Development of a common process to be followed by all institutions involved in assisting and mentoring policy beneficiaries. The process should also ensure alignment in the requirements and the mandate of each institution. This would speed up the process and also allow all acting institutions to be able to assist and point out the progress of the issues faced by a particular beneficiary, or even advise them accordingly.

5.6 Recommendation for future research

A survey questionnaire was used to assess the livelihoods of the farmers and the questionnaire was general and did not adequately produce in-depth information for a sustainable livelihood analysis. Therefore, specific questionnaires for each SLA component are recommended. The assessment of the human component was based on the assessment of education levels and skills and the wellbeing component was excluded, therefore further in-depth assessment of the human component is recommended. Future studies are also recommended to assess the role of gender in farming in the Barrydale, as the study found that farming in the area is mainly undertaken by males. Contributions of the water allocation reform system in improving water access to women also need to be assessed in the area. This would also reveal if there are any gender-specific livelihood strategy preferences in the area and the progress of the water allocation reforms in rendering these strategies viable.

5.7 Implications for water management and policy

The study enlightens policymakers about the importance of engaging local communities who are intended to benefit from the policies. The research also gives an overview of the lack of capacity of the institutions that are responsible for implementation of the policies. The study also enlightens relevant institutions on the progress of the water allocation reforms, their impact

upon small-scale farmers and the lack of implementation of the prescribed mechanisms of water allocation reforms.

REFERENCE LIST

Anderson, A.J., Mahlangu, M.S., Cullis, J., Swartz, S. 2008. Integrated monitoring of water reform in South Africa. WaterSA 34(6):731-737.

Araujo, J. 2014. Impact of Drought on Grape Yields in the Western Cape, South Africa. [MSc thesis]. University of Cape Town.

Arowolo S., Obi, A., Masika, P., Letty, B. 2011. Analysis of Physical and Social Capital. Draft Document for Comment: Analysis of Food Value Chains in Rain-Fed and Irrigated Agriculture to Include Emerging Farmers in the Mainstream of Economy K5/1879//4.

Baloyi, J.K. 2010. An analysis of constraints facing smallholder farmers in the Agribusiness value chain: A case study of farmers in the Limpopo Province [MSc thesis]. University of Pretoria.

Barker, I. 2014. The case for water allocation reform in England and Wales. Environmental Agency.

Beetham, G., Demetriades, J. 2007. Feminist research methodologies and development: overview and practical application. Gender and Development 15(2): 199-216.

Bengtsson, M. 2016. How to plan and perform a qualitative study using content analysis. NursingPlus. 2: 8-14.

Benson, R.D. 2012. Alive but irrelevant: The prior appropriation doctrine into today's western water law. University of Colorado. Law Review 83(3): 676-711

Biernacki, P. Waldorf, D.1981. Snowball sampling: Problems and techniques of chain referral sampling. Sociological Methods and Research 10(2): 141-163.

Biswas, A.K. 2004. Integrated Water Resources Management: A Reassessment, A water forum contribution. Water International 29(2):248-256

Bowen, G.A. 2009. Document analysis as a qualitative research method. Qualitative Research Journal 9(2): 27-40.

Brandes, O.M., Nowlan, L. Paris, K. 2008. Going with the flow: Evolving water allocations and the potential and limits of water markets in Canada. Canada: The conference board of Canada. p. 44.

Braun, V., Clarke, V. 2006. Using thematic analysis in psychology. Qualitative Research in Psychology 3(2): 77-101.

Breedt, H.T. 2003. Manual on Sheep Facilities. Report Number ISDN1004/5, ARC-IAE, Silverton, RSA.

Breedt, H. 2005. Manual on housing for pigs. 1st edition. Pretoria: Institute for Agricultural Engineering (IAE).

BGCMA. 2010. Breede-Gouritz Catchment Management Strategy. Worcester.

BGCMA. 2012. 2011-2012 Annual Report of Breede Gouritz Catchment Management Agency. Worcester.

BGCMA. 2013. 2012-2013 Annual Report of Breede Gouritz Catchment Management Agency. Worcester.

BGCMA. 2016. 2015-2016 Annual Report of Breede Gouritz Catchment Management Agency. Worcester.

Bright, A.L. 2010. An Exploration into the Opportunities and Barriers of Vegetable Production as a Poverty Reduction Strategy for Small Scale Farmers: Evidence from a Case Study in Nqutu, KwaZulu-Natal, South Africa [MSc thesis]. University of KwaZulu-Natal.

Casey, G. Ploeg, V. 2011. Water as a Policy Issue and the Water Pricing Project. [Online] Canada: Canadian water policy backgrounder. P.4. Available at: http://cwf.ca/wp-content/uploads/2015/11/CWF_WaterBackgrounder1_SEP2011.pdf [Accessed 11 Jan.2015].

Cech, T.V. 2005. Principles of Water Resources: History, Development, Management, and Policy, 2nd Edition. USA. John Wiley and Sons.

Cardoso, L.A. (2012). Environmental and economic impacts of livestock productivity increase in Sub-Saharan Africa. Tropical Animal Health and Production. 44:1879- 1884.

Constitution of the Republic of South Africa. 1996. (Act No.108 of 1996.

DFID. 1999. Sustainable Livelihood Guideline Sheets of the Department for International Development. London: DFID. p.26.

DAFF. 2008. Agricultural Education and Training Access Barriers Report of the Department of Agriculture, Forestry and Fisheries. p.78.

DEADP. 2011. Western Cape Integrated Water Resources Management Action Plan, Status que report of the Department of Environmental Affairs and Development Planning. Cape Town: DEADP. p.23.

DWAF. 2004. Financial Assistance to Resource Poor Irrigation Farmers of the Department of Water Affairs and Forestry. Pretoria. p. 22.

Department of Water Affairs and Forestry (DWAF). 2008. Water Allocation Reform Strategy. Strategy for Water Allocation Reform of the Department of Water Affairs and Forestry. Pretoria. p. 22.

DWS. 2007. The Mokolo River Catchment: Validation of the existing lawful Use of Water of the Department of Water and Sanitation. Polokwane: DWS. p. 71.

DWS. 2011. Western Cape Integrated Water Resources Management Action Plan: Status Quo Report, Final Draft of the Department of Water and Sanitation. Cape Town: DWS. p.16.

DWS. 2013. National Water Resource Strategy of the Department of Water and Sanitation. 2nd edition. Pretoria: DWS. p. 201.

DWS. 2014. Water Allocation Reform of the Department of Water and Sanitation. Available at: http://www.dwaf.gov.za/WAR/

DWS. 2015. High-level Progress Report on the Implementation of the 2nd National Water Resources Strategy (NWRS2). Report No. 1 of the Department of Water and Sanitation. Pretoria: DWS. p. 24.

DWAF. 2005. A draft position paper for water allocation reform in South Africa: Towards a framework for water allocation planning of the Department of Water Affairs and Forestry. Pretoria: DWAF. p. 21.

DWAF. 2010. Reconciliation strategy for Buffeljags River of the Department of Water Affairs and Forestry. Pretoria: DWAF. p. 17.

DEFRA. 2013. Making the most of every drop consultation on reforming the water abstraction of the Department for Environment Food and Rural Affairs. London: Crown copyright. p. 58.

Derman B., Hellum A., Mazungu E., Sithole, P., Machiridza, R. 2007. 15 Intersection of Law, Human Rights and Water Management in Zimbabwe: Implications for Rural Livelihoods. CAB International. pp 248-269.

Derman, B. Hellum, A. 2007. Livelihood rights perspective on water reform: Reflections on rural Zimbabwe. Land Use Policy 24: 664-673.

de Loë, R.C., Varghese, J., Ferreyra, C., Kreutzwiser, R.D. 2007. Water Allocation and Water Security in Canada: Initiating a Policy Dialogue for the 21st Century. Report prepared for the Walter and Duncan Gordon Foundation. Guelph, ON: Guelph Water Management Group, University of Guelph.

Dev, S.M. 2012. Small farmers in India: Challenges and opportunities. Indira Gandhi Institute of Development Research: 1-35.

Dinar, A., Rosegrant, M.W., Meinzen-Dick, R. 2001. Water allocation mechanisms, principles and examples. Washington DC:World Bank, Agriculture and Natural Resources Department. p. 16.

Du Plessis, J. 2003. Maize Production. Pretoria: Department of Agriculture. p. 38.

Dzikiti, S., Schachtschneider, K. 2015. Technical report: water stewardship for stone fruit farmers. Cape Town: World Wide Fund for Nature. p. 48.

Esau, M. 2005. Investigating channel change in relation to land use change in the Klein Berg River, Tulbagh [MSc thesis]. University of the Western Cape.

Falkenmark, M., Lundqvist, J. 1992. Coping with Multi-cause Environmental Challenges - a Water Perspective on Development. Keynote paper, International conference on water and the environment, Dublin, Ireland. p.22.

Fischhendler, I. 2008. Institutional conditions for IWRM: The Israel Case. Ground Water 46(1):91-102.

Fisher, D. 2009. The law and governance of water resources: The challenge of sustainability. United Kingdom, Cheltenham. Edward Elgar Publishing Limited.

Freshwater. 2004. Freshwater Country Profile. Ghana. p. 9.

Funke, N., Nortjie, K., Findlater, K., Burns, M., Turton, A., Weaver, A., Hattaingh, H. 2007. Redressing Inequality: South Africa's New Water Policy. Environment Magazine. pp. 1-7.

Gakubia, R., Gichuri, W., Mwangi, P., Mbuvi, J., Sitton, T., Njaya, R., Wambulwa, P., Maina, S. 2008. Water sector reforms: five years on. Kisima, A forum for Analysis and debate on water and sanitation issues in Kenya. (5). pp 1-20.

Gallego-Ayela, J., Juizo, D., 2011. Strategic implementation of integrated water resources management in Mozambique: An A'WOT analysis. Physics and Chemistry of the Earth 36: 1103-1111.

Harner, J.P., Brouk, M.J., Potts, J., Brandford, B., Smith, JF. 2016. Scientific data for developing water budget on a dairy. In: Western dairy management conference. p. 90-104.

Harrell, M.C., Bradley, M.A. 2009. Data Collection Methods: Semi-structured Interviews and Focus Groups. Rand Corporation. Santa Monica. p.139.

Hauke, J., Kossowski, T. 2011.Comparison of values of Pearson's and Spearman's correlation coefficients on the same sets of data. Quaestiones Geographicae 30(2): 87-93.

Heckathorn, D. 2002. Respondent-driven sampling 2: deriving valid population estimates from chain-referral samples of hidden population. Social problems 49(1):11-34.

Hellum, A. 2001.'Towards a Human Rights Development Approach: The Case of Women in the Water Reform Process in Zimbabwe'. Law, Social Justice & Global Development Journal (LGD). (1):1-32.

Heyns, P. 2005. Water institutional reforms in Namibia. Water Policy 7: 89-106.

Hurlbert, M. 2007.Canada's water law: prepared for the National Council of Women of Canada.

Howe, C., Schurmeier, D., Shaw, D. 1986. Innovative approaches to water allocation: The potential for water markets. Water Resources Research, 22(4): 439 – 445.

Jordaan, H., Grove, B. 2013. Exploring social capital of emerging farmers from Eksteenskuil, South Africa. Development Southern Africa 30(4-5): 508-524.

Karran, M., Tregurtha, N. 2004. Agricultural sector study: Boland district municipality. Stellenbosch, South Africa: Department of Agricultural Economics: University of Stellenbosch. p. 61.

Katungi, E.M. 2006. Social Capital and Technology Adoption on Small Farms: The Case of Banana Production Technology in Uganda. [PhD Phil]. University of Pretoria.

Keet M. Briefing to the Portfolio Committee of the Riparian and Related Historical use of Water and is Implementations on the current allocations. Department of Water and Sanitation.

Keller, S., Conradin, K. 2010. Semi-structured interviews. Sustainable sanitation and water management toolbox.

Kempton, K. 2005. Bridge over troubled waters: Canadian law on Aboriginal and treaty water rights and great lakes annex Toronto, Ontario. Olthuis Kleer Townshend.

Khalid, M. 2001.Social Work Theory and Practice. 3rd edition. Kifayat Academy, Lahore-Karachi.

Khapayi, M., Celliers, P.R. 2016. Factors limiting and preventing emerging farmers to progress to commercial agricultural farming in the King William's town area of the Eastern Cape Province, South Africa. S.Afr. Tydskr. Landbouvoorl. /S. Afr. J. Agric. Ext.44 (1):25-41

Kidd, M. (2011). Environmental Law. 2nd ed. Cape Town, South Africa: Juta.

Kirsten, J. Moldenhauer, W. 2006. Measurement and analysis of rural household income in a dualistic economy: The case of South Africa. Agrekon 45(1): 60-77.

Kgomotso, P.K. 2005. The challenge of implementing Integrated Water Resources Management (IWRM) in the lower Okavango River Basin, Ngamiland district, Botswana [MSc thesis]. University of the Western.

Koudstaal, R., Rijsberman, F.R., Savenije, H. 1992. Water and Sustainable Development. International Conference on Water and the Environment (ICWE). In: Keynote Papers by ICWE Secretariat, World Meteorological Organisation, Geneva, Switzerland.pp.13-38.

Krantz, L. 2001. The sustainable livelihood approach to poverty reduction: an introduction. Swedish International Development Cooperation Agency. Stockholm Sweden. p.38.

Kujinga, K. 2004. The dynamics of stakeholder participation in water resources management in Zimbabwe: A case study of the agricultural sector. [MSc thesis]. University of the Western Cape.

Lang, H. 1997. Options for a new water rights system. Unpublished Draft Paper. October.

Laube, W., van de Giesen, N. 2005. Ghanaian water reforms: Institutional and hydrological perspectives. In: Wallace *et al* (eds), hydrological information in water law and policy: current practice: Kluwer.

Laube, W. 2009. Changing the course of history? Implementing water reforms in Ghana and South Africa. ZEF Working paper No.10. Bonn: Econstor. p. 16.

Laube, W. 2014. The promise and perils of water reforms: Perspectives from Northern Ghana. GIGA Institute of African Affairs, Hamburg 42(3):419-437.

Le Maitre, D., Colvin, C., Maherry, A. 2009. Water resources in the Klein Karoo: the challenge of sustainable development in a water-scarce area. South African Journal 105(1): 39-48.

Le Roux, B., van der Laan, M., Vahrmeijer, T., Annandale, J.G., Bristow, K.L. 2016. Estimating Water Footprints of Vegetable Crops: Influence of Growing Season, Solar Radiation Data and Functional Unit. Water 8(473): 1-20.

Letts, L., Wilkins, S., Law, M., Stewart, D., Bosch, J., Westmorland, M. 2007. Guidelines for critical review form: Qualitative studies (version 2.0). p.12.

Levite, H., Sally, H. 2002. Linkages between productivity and equitable allocation of water. Physics and Chemistry of the Earth 27(1): 825-830.

Longhurst, B. 2009. An Investigation into water trading as an appropriate instrument to promote equitable resource sharing in the Mhlatuze catchment: A Case Study [MSc thesis].University of KwaZulu-Natal.

Longhurst, R. 2010. Key methods in geography.2nd ed. London: SAGE.

Louw, A., Madevu, H., Jordaan, D., Vermeulen, H. 2004. Regoverning markets: Securing small producer participation in restructured national and regional agri-food systems. London: International Institute for Environment and Development (IIED).

Machethe, C.L., and Mollel, N.M. 2000. Extension and Support Services for Smallholder Agricultural Development in South Africa: Who is the Smallholder Farmer? In. B. Cousins. (ed.) At the crossroads: Land and agrarian reform in South Africa into the 21st century. Cape Town: University of the Western Cape .pp. 340-348.

Manzungu, E. 2001. A loss opportunity: the case of the water reform debate in the fourth parliament of Zimbabwe. Zambezia 28(1):97-120.

Manzungu, E. 2002. More than a headcount: towards strategic stakeholder representation in catchment management in South Africa and Zimbabwe. Physics and chemistry of the earth 27: 927-933.

Megyesi, B., Kelemen, E., Schermer, M. 2010. Social Capital as a Success Factor for Collective Farmers Marketing Initiatives. International Journal of Sociology of Agriculture and Food 18(1): 89-103.

Meinzen-Dick, R., Mendoza, M. 1996. Alternative water allocation mechanisms: Indian and international experiences. Economic and Political Weekly. pp. 25-30.

Miles, M., and Huberman, A. 1994. An Expanded Sourcebook: Qualitative Data Analysis. Thousand Oaks: Sage Publications Ltd.

Mmbengwa, V.M. 2009. Capacity building strategies for sustainable farming SMMEs in South Africa. [PhD thesis]. University of Free State.

Mokoena, M.B. 2006. Improving the lifestyles of previously disadvantaged individuals through a personal life planning program [PhD thesis].University of South Africa.

Morse, S., McNamara, N., Acholo, M. 2009. Sustainable Livelihood Approach: A critical analysis of theory and practice. Geography Paper No 189.p. 67.

Movik, S. 2009. The dynamics and discourses of water allocation in South Africa, STEPS working paper 21. Brighton: STEPS Centre. p.31.

Msibi, M.I, Dlamini, P.Z. (2011). Water Allocation Reform in South Africa: history, processes and prospects for future implementation. WRC Report No. 1855/1/111.

Mul, M.L., Kemerink, J.S., Vyagusa, N.F., Mshana, M.G., van der Zaag, P., Makurira, H. 2011. Agricultural Water Management 98(1): 1752-1760

Munguambe, P., Chilundo, M., Massingue, F. 2010. The IWRM planning process: Achievements, lessons and challenges. Global water Partnership, Southern Africa, Final Report. p. 35. Myburgh, P. 2006. Irrigation management with particular reference to wine quality – A brief overview of South African research. Wine Land magazine: p. 6.

NAMC. Commark Trust. 1978. Subsector study: Deciduous fruit of the National Agricultural Marketing Council. Pretoria: NAMC. p. 58.

NDoA, Stats SA. 2000. Employment trends in agriculture of the National Department of Agriculture and Statistics South Africa. Pretoria: Statistics South Africa. p. 122.

NDoA, AgriSETA. 2006. Elementary farm layout and infrastructure. Department of Agriculture Learner Guide, Primary agriculture version 1 of the National Department of Agriculture. Pretoria. p. 37.

NDoA. 2007. Annual Report2006/2007 of the National Department of Agriculture. Pretoria. p. 208.

National Water Act. 1998. (Act No. 36 of 1998).

Nchabeleng, M.J. 2016. Assessing the Impact of the Department of Agriculture Farm Together Programme on Development and Growth of Selected Agricultural Co-operatives in Capricorn District Municipality in Limpopo Province [MSc thesis]. University of Limpopo.

Nel, E., Davies, J. 1999. Farming against the odds: an examination of the challenges facing farming and rural development in the Eastern Cape province of South Africa. Department of Geography, Rhodes University, Grahamstown, South Africa.

Nieman, A. 2006. Social capital and social development. Social Work 42(2):161-172.

Nleya, N. 2005. Institutional Overlap in Water Management in the Eerste River Catchment [MSc thesis]. University of the Western.

Nyambo, P., Wakindiki, I.I.C. 2015. Water footprint of growing vegetables in selected smallholder irrigation schemes in South Africa. Water SA 41(4): 571-578.

Nyumbu, M.E. 2013. POVERTY AND ENVIRONMENT: A case study of stone crushing as a sustainable livelihood in Lusaka [MSc thesis].University of South Africa.

Ogunjimi, L.A.O., Adekalu, K.O. 2002. Problems and constraints of small-scale irrigation (Fadama) in Nigeria. Food Reviews International 18 (4): 295–304.

Palmer. A.R., Ainslie, A.M. 2005. Grasslands of South Africa. In: Grasslands of the World. FAO Plant Production and Protection Series (FAO). NO. 34. Suttie, J.M., Reynolds, S.G., Batello, C. Rome, Italy. Plant Production and Protection Div. p.77-120.

Pedersen, C.A. 2006. Water Reform and Access to Water for the Rural Poor. In: DIIS conference. Copenhagen. p.9.

Pineo, C., Cloete-Beets, L., Tshehla, M., van Vuuren, P.J. 2016. Agriculture market intelligence report. Cape Town: GreenCape 2016. p. 60.

Pollard, S. du Toit, D. 2002. Towards adaptive Integrated Water Resources Management in Southern Africa: The role of self-organization and multi-scale feedbacks for learning and responsiveness in the Letaba and Crocodile Catchments. Springer. pp. 1-17.

Punt, C., Pauw, K., van Schoor, M., Nyhodo, B., McDonald, S., Chant, L., Valente, C. 2005. A profile of the Western Cape Province: Demographics, poverty, inequality and unemployment. Provide project background paper 1(1): 1-24.

Rashirayi, T., Mapedze, E., Zhou, G. 2013. Decentralising Zimbabwe's water management: The case of Guyu-Chelesa irrigation scheme. Physics and Chemistry of the Earth 66 (2013): 139-147.

River Health Programme. 2011. State of Rivers Report: Rivers of the Breede Water Management Area. Department of Water Affairs, Western Cape, Republic Of South Africa

Saleth, M.R. Dinar, A. 2005. Water institutional reforms: theory and practice. Water Policy 7: 1-19.

Saruchera, D. 2008. Emerging Farmers in the Water User Associations Cases from the Breede Water Management Area [MSc thesis]. University of the Western.

Schreiner, B. Viewpoint-Why Has the South African National Water Act Been so Difficult to Implement? 2013. Water Alternatives 6(2): 125- 131.

Senzanje, A., van der Zaag, P. 2004. Institution aspects of proportional water allocation in practice: case of the Odzani River Irrigation Company, Save Catchment, Zimbabwe. Physics of the Earth 29(1): 1343-1348.

Shrubsole, D. 2004. Canadian Perspectives on Integrated Water Resources Management. Cambridge, Ontario: Canadian Water Resources Association. p.125.

Sikazwe, O. 2005. Water and Sanitation Sector Reforms in Zambia-Achievements and Challenges. International workshop boosting basic needs services in Africa-Tapping on Asia best practices. Bremen. Germany.

Sikwela, M., Mushunje, A. 2013. The impact of farmer support programmes on household income and sustainability in smallholder production: A case study of the Eastern Cape and KwaZulu-Natal farmers, South Africa. African Journal of Agricultural Research 8(21):2502–2511.

Simpson P., Elliott, D. 2011. A right to water? Meeting the challenge of water allocation. p. 157.

Snellen, W.B., Schrevel, A. 2004. IWRM: for sustainable use of water 50 years of international experience with the concept of integrated water management, Background document to the

FAO/Netherlands Conference on Water for Food and Ecosystems. Netherlands, Waneningen. p. 14.

Solesbury, W. 2003. Sustainable livelihoods: A case study of the evolution of DFID policy. Working paper 217. Overseas Development Institute. London. p. 36.

Spearman, C. 1904. The proof of measurement of association between two things. The American Journal of psychology 15(1): 72-101.

Speed, R., Li, Y., Le Quesue, T., Pegram, G., Zhiwei, Z. 2013. Basin water allocation planning: principles, procedures and approaches for basin allocation planning. UNESCO. Paris.

StatsSA. 2011. Swellendam local municipality agricultural statistics of Statistics South Africa [online] StatsSA. Available at: http://www.statssa.gov.za/?page_id=993&id=swellendam-municipality [Accessed 12 Jan.2017].

Stern, J. 2013. Water rights and water trading in England and Wales, Policy Brief. The foundation for Law, Justice and Society: Oxford. p. 10.

Stevens, J.B. 2006. Adoption of irrigation scheduling methods in South Africa. [PhD thesis]. University of Pretoria.

Swatuk, L.A. 2005. Political challenges to implementing IWRM in Southern Africa. Physics and Chemistry of the Earth 30: 872-880.

Swellendam Municipality. 2014. 2013/2014 Review of the third generation Integrated Development Plan 2012-2017. p. 240.

Tewari, D.D. 2009. A detailed analysis of evolution of water rights in South Africa: An account of three and a half centuries from 1652 AD to present. Water SA 33(5):693-710.

Thindisa, L.M. 2014. Participation by smallholder farming entrepreneurs in agro-processing activities in South Africa [MSc thesis] University of the Witwatersrand.

Troskie, D., Mandondo, Kelly. 2016. Complexities in government support for the agricultural sector: programme evaluation findings analysis. In: 15th International Winelands Conference. 30 March –1 April 2016.Stellenbosch: Western Cape Government. p. 26.

Trust for Community Outreach and Education. 2013. Where has the water gone? Rights of the poor to water. Cape Town: TCOE. p. 44.

United Nations Water Conference (UNWC). 1977. Report of the United Nations Water Conference. Mar del Plata, 14-25 March 1977. pp. 188.

Van Averbeke, W. 2008. Best management practices for small-scale subsistence farming on selected irrigation schemes and surrounding areas through participatory adaptive research in Limpopo Province. WRC Report No TT 344/08.

Van Averbeke, W., Denison, J., Mnkeni, P.N.S. 2011. Smallholder irrigation schemes in South Africa: A review of knowledge generated by Water Research Commission. WaterSA 37(5): 797-808.

Van der Zaag, P. 1998. Water Law. Lecture Notes, WREM Programme. Department of Civil Engineering, University of Zimbabwe, Harare, Zimbabwe.

Van Heerden, P.S., Walker, S. 2016. Upgrading of SAPWAT3 as a management tool to estimate the irrigation water use of crops. Revised edition, SAPWAT4. WRC Report No. TT 662/16.

Van Koppen, B. 2003. Water reform in Sub-Saharan Africa: what is the difference? Physical and Chemistry of Earth 28(1): 1047-1053

Vansan Water Technology. 2016. Pretoria. p. 29.

Volz, E., Heckathorn, D. 2008. Probability based estimation theory for respondent driven sampling. Journal of official statistics 24(1):79-97.

Wang, L.Z., Fang, L., Hipel, K.W. 2003. Water Resources Allocation: A Cooperative game theoretic approach. Journal of Environmental Information 2(2): 11-22

Western Cape Department of Agriculture. 2017. Agricultural Risk Management. Disaster Risk Management. Cape Town. p. 35.

Western Cape Government. 2015. Socio-economic Profile Overberg District Municipality. Working Paper. Cape Town. p. 37.

Williams, T.O. 2015. Accessing and putting water to productive use in sub-Saharan Africa. Brief for GSDR 2015. p. 3.

Witkin, B.R., Altschuld, J.W. (1995). Planning and Conducting Needs Assessments: A Practical Guide. Sage Publications, Inc.

World Commission on Environment and Development (WCED). 1987. Oxford University Press. Geneva, Switzerland. pp. 352.

Xaba, G.G. 2014. Identifying entrepreneurial skills required by South African black farmers – An entrepreneurial model [MSc thesis] University of Witwatersrand.

Yin, R.K. 2014. Case study research: design and methods. 5 ed. California. SAGE.

Young, P.V. 1984. Scientific Social Survey and Research. 1st edition. New Delhi, India: Prentice Hall of India.

Young, M. 2012. Towards a Generic Framework for the Abstraction and Utilisation of Water in England and Wales. UCL Environment Institute: visiting Fellowship report. London. p. 23.

Zhang, Y., Wildermuth, M. 2016. Qualitative Analysis of Content. Applications of Social Research Methods to Questions in Information and Library Science. p. 318.

APPENDICES

APPENDIX A: Barrydale Small Scale Farming Group Questionnaire (Small Scale Farmers)

Interviewer ----------

Date ----------

Venue ----------

Introduction

My name is ----------

This interview is part of data collection for the University of the Western Cape Master research entitled "Assessment of the contributions of water allocation reforms to achieving equitable access to water for smallholder emerging farmers in Breede-Gouritz Catchment Management Agency**"** and Cape Peninsula University of Technology, for the Water Research Commission Project 2310 entitled "Approaches for Emerging Farmer Participation in Water Resource Management: The Case of the Breede-Gouritz Catchment Management Agency (BGCMA), Western Cape. The information collected in this interview will be treated as confidential.

PART A: Farmer characteristics and human capital (farming knowledge and skills, ability to work)

1. How are you related to the farm owner?

01 Farm owner

02 Wife

03 Husband

04 Daughter

05 Son

06 Worker

2. Name of Respondent----------

3. Age of the respondent---------- 4. Number of people in the family? ----------

5. Ages of the family members----------

6. Approximately how many years has your family lived on this farm? ----------

7. What is the size of your farm in hectares? ----------

8. How did you obtain the farm?

01 Inherited 02 Purchased 03 Renting

9. Type of farming

01 Livestock farming 02 Crop farming 03 Mixed Farming

10. Livestock numbers

01 No. of cattle ----------02 No. of goats---------- 03 No. of sheep---------- 04 Other----------

11. Crop types

01 vegetables 02 Citrus fruit 03 Vineyards 04 Other----------

12. Where did you learn about farming?

01 at school 02 working on a farm 03 Received training

13. Do you know about the water laws and other farm related laws? ----------

14. What is your highest level of education?

01 Primary 02 Secondary 03 Certificate

04 Diploma/Degree 05 None 06 Other ----------

15. Do you have any other skills besides farming (e.g. plumbing, construction, etc.)?

Yes No 3

16. If yes to question 15 please specify----------

PART B: Economic/financial capital

17. Employment

01 Formal 02 Informal 03 Unemployed

04 Self-employed 05 other----------

18. What is the main source of income for the household?

01 Formal employment 02 Self-employment 03 Sale of livestock

04 Sale of vegetables 05 Pension 06 other----------

19. If employed or on Pension, what is your average monthly income in Rands?

01 1000-3000

02 3000-6000 036000-9000

04 9000-12000

05 >12 000

20. Have you ever applied for financial assistance from the government?

01 Yes 02 No

21. If yes which department? ---------- Was the application successful?

01 Yes 02 No

22. What were the funds used for in your farm? ----------
-

23. What is the average number of livestock sold per month?

Type of livestock	Number sold per month	Price per batch

APPENDIX B: Barrydale Farming Group Questionnaire (Large Scale Farmers)

Interviewer ----------

Date ----------

Venue ----------

Introduction

My name is ----------

This interview is part of data collection for the University of the Western Cape Master research entitled "Assessment of the contributions of water allocation reforms to achieving equitable access to water for smallholder emerging farmers in Breede-Gouritz Catchment Management Agency**"** and Cape Peninsula University of Technology, for the Water Research Commission Project 2310 entitled "Approaches for Emerging Farmer Participation in Water Resource Management: The Case of the Breede-Gouritz Catchment Management Agency (BGCMA), Western Cape. The information collected in this interview will be treated as confidential.

PART A: Farmer characteristics and human capital (farming knowledge and skills, ability to work)

1. How are you related to the farm owner?

01 Farm owner

02 Wife

03 Husband

04 Daughter

05 Son

06 Worker

2. Name of Respondent----------

3. Age of the respondent---------- 4. Number of people in the family? ----------

5. Ages of the family members----------

6. Approximately how many years has your family lived on this farm? ----------

7. What is the size of your farm in hectares? ----------

8. How did you obtain the farm?

01 Inherited 02 Purchased 03 Renting

9. Type of farming

01 Livestock farming 02 Crop farming 03 Mixed Farming

10. Livestock numbers

01 No. of cattle ----------02 No. of goats---------- 03 No. of sheep---------- 04 Other----------

11. Crop types

01 vegetables 02 Citrus fruit 03 Vineyards 04 Other----------

12. Where did you learn about farming?

01 at school 02 working on a farm 03 Received training

13. Do you know about the water laws and other farm related laws? ----------

14. What is your highest level of education?

01 Primary 02 Secondary 03 Certificate

04 Diploma/Degree 05 None 06 Other ----------

15. Do you have any other skills besides farming (e.g. plumbing, construction, etc.)?

Yes No

16. If yes to question 15 please specify----------

PART B: Economic/financial capital

17. Employment

01 Formal 02 Informal 03 Unemployed

04 Self-employed 05 other----------

18. What is the main source of income for the household?

01 Formal employment 02 Self-employment 03 Sale of livestock

04 Sale of vegetables 05 Pension 06 other----------

19. I what is your average monthly income in Rands?

01 20 000-50 000

02 70 000-90 000 03 60 000-90 000

04 180 000-210 000

05 >250 000

20. Have you ever applied for financial assistance from the government?

01 Yes 02 No

21. If yes which department? ---------- Was the application successful?

01 Yes 02 No

22. What were the funds used for in your farm? ----------

23. What is the average number of livestock sold per month?

Type of livestock	Number sold per month	Price per batch

APPENDIX C: Consent Form

Consent Form

My name is Sinazo Mnyaka.

I am a Masters student from the University of the Western Cape

I am very grateful that you have agreed to participate in this interview session for my research project entitled "**Assessment of the contributions of water allocation reforms to achieving equitable access to water for smallholder emerging farmers in Breede-Gouritz Catchment Management Agency**. We want to gather information from people like yourself, living in this area, so that we know more about the people who we are working with.

The purpose of this study is to understand whether the reforms of water allocation have contributed to your livelihood.

Your participation is entirely voluntary. You may refuse to take part in the interview and you may stop at any time if you do not want to continue. You also have the right not to respond to any issues during the interviews if you feel uncomfortable.

The interview and/or focus group discussions is about 30 minutes to an hour.

- By signing below, you signify that you agree to participate in the study and that your participation is entirely voluntary.
- If you have questions about this interview or project you can contact my supervisors at:
- **Doctor Bongani Ncube**

Contact numbers/email address: 079 700 3943& 021 953 8706/ ncubeb@cput.ac.za

Professor Dominic Mazvimavi

Contact numbers/email address: / 072 945 7126 & 021 959 3118/mazvimavid@uwc.ac.za

---------- ----------

SIGNATURE DATE