The Impact of Compulsory Licensing Towards Achieving Equitable Access to Water Resources in Mhlathuze Catchment

John Isaac Phangisa (906091)

Masters in Science by Course Work and Research Report

Supervisors:

Dr Gavin Snow (Wits)

Dr Barbara Van Koppen (IWMI)

University of the Witwatersrand, School of Animal, Plant and Environmental Sciences

Abstract

An assessment was conducted to determine the impact of compulsory licensing (CL) towards achieving equity in access to water resources in the Mhlathuze catchment, which falls within the Pongola-uMzimkhulu Water Management Area. Compulsory licensing in Mhlathuze Catchment was undertaken to address, among other things, over-allocation of water and to promote equity in access to water resources. This report presents quantitative results of the contribution that compulsory licensing made towards the fair allocation of water resources in the Mhlathuze catchment. The findings of this study are important since they may help managers to improve management of water resources and implementation of future CL projects. Several reform initiatives have been implemented at the dawn of democracy in South Africa, including CL, but to date, the actual impacts of these programmes/projects are unknown. This gap in knowledge may result in the misconception by managers and decision makers that the existing reform initiatives are effective, which may result in wasteful expenditure. This study was undertaken as one of the tools aimed at bridging the knowledge gap on the impact of compulsory licensing, which is a water-based reform initiative in South Africa. The assessment was carried out using secondary data collected from the Department of Water and Sanitation and included the proposed, preliminary and final allocation schedules, and the compulsory licensing master spreadsheet. The data were first coded and presented in Microsoft Excel where they were then arranged to reflect the Broad-Based Black Economic Empowerment (BBBEE), Historically Disadvantaged Individuals (HDIs), and Historically Advantaged Individuals (HAIs) categories for ease of comparison and analysis. Further to this, water allocation to afforestation was first converted from hectares to volumetric reduction before analysis. This exercise was important because the Department of Water and Sanitation (DWS) allocate water to afforestation in terms of hectares to be planted. The conversion was done using parameters from the stream flow reduction activities (SFRAs) hydrological tables and a conversion equation. The conversion analysis showed that there was 334.9 Mm^3/a of available water in the catchment, which is made up of 272.9 Mm^3/a available water in the catchment and 62 Mm^3/a of water from the Thukela transfer scheme. Of the available water, 315.2 Mm^3/a (94%) was allocated to active water use sectors, 10.7 Mm^3/a (3%) was set aside for future allocations and 9 Mm^3/a (3%) was surplus. These results reveal that over-allocation of water in the catchment was addressed and a surplus of water secured. Results of the analysis against the Mhlathuze equity target revealed that the minimum target of 10% pertaining to agricultural (irrigation) water in the hands of black people was achieved during CL implementation, with allocation ratios ranging from 30%, 69% and 1% between the HDI, HAI and BBBEE categories, respectively. The results further showed that water allocation ratios of economic sectors ranged from 12%, 35% and 2% between HDI, HAI and BBBEE, categories', respectively. Of the remaining 51%, 45% was allocated to the domestic sector, 3% was set aside and another 3% was surplus water. These results indicate that 35% of available water in the Mhlathuze catchment was in the hands of the HAI group and only 12% in the hands of black people. Although this analysis is at catchment level as opposed to national level, where the 30% water allocation target applies, the results still presented a skewed state of volumetric water allocation in the catchment. However this is justifiable since the primary purpose of undertaking CL in the Mhlathuze catchment was to address the aspect of over-allocation before considering the equity aspect.

Key words: Compulsory licensing, equity, Historically advantaged individuals, Historically disadvantaged individuals, Broad-based black economic empowerment, Mhlathuze catchment, Water resource allocation

Declaration

I, **John Isaac Phangisa**, hereby declare that this report has been composed by me and that it has not been submitted, in whole or in part, in any previous application for a degree except where it is stated otherwise by form of reference and/or acknowledgment. This report is hereby submitted for the fulfilment of the research component of the Degree of Master of Science at the University of Witwatersrand, Johannesburg, South Africa.

Signed on this day 27 March **2019 at** Pretoria

Signature ____________ **Date** 27 March 2019

Acknowledgement

I would like to express my sincere gratitude to my supervisors Dr Gavin Snow and Dr Barbara Van Koppen for their tireless guidance and support throughout my dissertation, their invaluable advices, motivation and the wealth of knowledge they provided are highly appreciated.

I am indebted to Mr Xolani Hadebe, the Director: Water Use Efficiency (Former Scientific Manager: Stream Flow Reduction Activities (SFRAs) in the Department of Water and Sanitation (DWS), for the inputs and comments he provided and for closely guiding me during the estimation of the volumetric reduction for afforestation.

I sincerely extend my appreciation to Mr Tsunduka Khosa, the Director: Water Use Licence Authority in the (DWS), for assisting with the restructuring of this report, and also the invaluable inputs and comments which improved the flow and quality of this report.

I also appreciate my supervisor at work Mrs Thokozani Mazibuko, my Manager Mr Sipho Skosana and my colleague Mr John Malungani for their meaningful inputs and for their support during my study period.

My gratitude also goes to all my colleagues who provided invaluable inputs and comments towards shaping this report.

I also express my deepest appreciation to my wife for the support and the motivation she provided toward the success of this report.

Above all I would like to give glory to the almighty God for the gift of life, health and strength he provided throughout my study period.

Contents

List of abbreviations

BBBEE	Broad-Based Black Economic Empowerment
CAS	Catchment Assessment Study
CL	Compulsory Licensing
DEW	Department for Environment and Water
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ELU	Existing Lawful Use
EMLFR	Eucalyptus Medium Low Flow Reduction
EMTFR	Eucalyptus Medium Total Flow Reduction
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
HAI	Historically Advantaged Individual
HDI	Historically Disadvantaged Individual
IWMI	International Water Management Institute
MAR	Mean Annual Runoff
MC	Mhlathuze Catchment
MCCL	Mhlathuze Catchment Compulsory Licensing
MQCs	Mhlathuze Quaternary Catchments
MWAP	Mhlathuze Water Allocation Plan
NWA	National Water Act
NWA (1998)	National Water Act, 1998 (Act 36 of 1998)

NWAA (1999)	National Water Amendment Act, 1999 (Act 45 of 1999)
NWRS (2004)	National Water Resource Strategy (2004) 1st edition
NWRS2 (2013)	National Water Resource Strategy (2013) 2nd edition
PDF	Portable Document Format
PPR	Preferential Procurement Regulations
RPSW	Revised Protocol on Shared Watercourses
RoR	Record of Recommendation
RSA	Republic of South Africa
SA	South Africa
SADC	Southern African Development Community
SAHRC	South African Human Rights Commission
SFRAs	Streamflow Reduction Activities
SFRAs VR	Streamflow Reduction Activities Volumetric Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
VR	Volumetric Reduction
V&V	Validation and Verification
WAP	Water Allocation Plan
WAR	Water Allocation Reform
NWPWP	White Paper on a National Water Policy
WMAs	Water Management Areas
WUA	Water Use Authorisation
WUL	Water Use Licence
WULA	Water Use Licence Application

List of figures

List of tables

Chapter 1: Introduction

The 1994 elections opened the door for democracy in the Republic of South Africa (RSA) (Stevens and Ntlama, 2016) and paved the way for national redress against the injustices of the past (Nxesi, 2015). Amongst other national reforms that the democratic government needed to consider immediately after democracy was that of the water sector (Quibell *et al*., 2010*)*. One of the major reasons that created a need for an urgent reform of this sector was the skewed state of allocation of water resources (DWAF, 1997). The skewed allocation was encouraged by previous water laws, including the riparian right to water, which linked access to water with ownership of land (Shilombolen, 2006; DWAF, 2008a; Pott *et al*., 2009). This requirement only privileged a minority group that had access to land through the then unjust land ownership laws (DWAF, 1997; FAO, 2004; Walker and Dubb, 2013).

Lack of access to water resources deprived the majority group (the so called Historically Disadvantaged Individuals: HDIs) an opportunity to participate meaningfully in water-based economic activities. An HDI is defined as a "South African citizen who was deprived of the right to meaningfully participate in national elections, a female, or a person with a disability" (PPR, 2001). In contrast, a Historically Advantaged Individual (HAI) is defined in this study as a non-HDI or a South African citizen who had all privileges that an HDI was deprived of, based on apartheid laws.

The imbalance in access to water is inconsistent with the requirement of section 27(1(b)) of the Constitution of the RSA (Act 108 of 1996), which requires everyone to have access to sufficient water. This constitutional requirement created an urgent need for the water policy review in order to reform the water sector to reflect fairness/equity, which is a critical national value enshrined in the country's constitution (DWAF, 1997). The National Water Act (Act 36 of 1998), National Water Resource Strategy (NWRS, 2004) and subsequently the National Water Resource Strategy version 2 (NWRS2, 2013) were borne out of this review. These legal documents are the main water legislative documents that drive water allocation reform (WAR) in the RSA.

Despite the breakthrough in the legislative aspect, the state of water stress in which most of the country's catchments are deemed to be at still hinders the process of fair allocation of water resources (Molobela and Sinha, 2011). This is because the routine process of authorising water use licences administered in terms of sections 28 and 40 of the NWA (1998) is limited to catchments where allocable water is still available.

The NWA (1998) and NWRS2 (2013) legitimise compulsory licensing (CL) as the only legal vehicle to be employed when reallocating water in water stressed catchments of RSA. Compulsory licensing is a process by which water use entitlements in an area are reconsidered in order to, amongst other things, achieve a fair allocation and curb over-allocation of water from a resource that is stressed (DWAF, 2008b; NWRS2, 2013). A water use entitlement refers to a water use licence/authorisation. A water stressed catchment refers to a catchment in which water requirements exceed the available water resources and there is no longer water available for allocation (McCartney *et al*., 2007), hence a need to free some water to maintain system balance and to reallocate to new users through compulsory licensing.

It is against this background that compulsory licensing was piloted in the Mhlathuze catchment in 2010 and subsequently in two other catchments (Tosca Molopo and Jan Dissels catchments). Compulsory licensing is a lengthy and complex process requiring intensive administrative, legal and technical skills, of which some of these skills are often not available in the Department of Water and Sanitation (DWS). In order to meet these requirements, the DWS often out-source most of the functions associated with CL through the use of Professional Service Providers (PSPs), thereby contributing to its high implementation cost.

Slow decision process by the DWS principals towards approval of CL projects has hindered implementation progress over time. As a result, only three CL projects in three catchments have been undertaken nationwide to date. This level of achievement, twenty years since the NWA (1998) was promulgated, reflects poor progress in terms of implementation, particularly in a country where a need for water sector transformation is a matter of urgency (NWRS2, 2013).

1.1. Rationale

Compulsory licensing in the Tosca Molopo, Jan Dissels and Mhlathuze catchments were completed in 2011, 2013 and 2015, respectively. However, since completion of the three projects there is still no information in the public domain that presents results of quantitative analysis of the contribution that CL made towards achieving equitable access to water resources. This lack of information may present a possible misconception to water resource managers, planners, decision makers, policy makers and politicians that CL is one of the main instruments to address the skewed state of water allocation in water stressed catchments of the RSA. If the impact of CL towards achieving equity is not carefully tested through quantitative research, it might lead to the perpetuation of policies that are inefficient, resulting in wasteful expenditure. Therefore, this study seeks to determine, using quantitative analysis, the contribution that CL has made towards achieving equitable access to water resources in the Mhlathuze catchment in order to close the existing gap in this knowledge area.

Improved knowledge in this area will assist water resource managers, decision makers and policy makers to make informed decisions when managing water resources, planning for future compulsory licensing projects and improvement of water policies and their implementation. Making available the quantitative analysis results of CL to the public will serve as platform to showcase one of the initiatives by government towards redressing the injustices of the past. This may help in restoring public trust in government and minimise dissatisfaction that often leads to public unrest. The outcomes of this study will also guide future research related to this subject and guide the DWS when implementing future projects, especially those already in the pipeline.

1.2. Aim and objectives of the study

This study aims to assess the contribution of CL towards achieving equitable access to water resources in Mhlathuze catchment.

The objectives of this study are to:

(i) Determine the ratio of applications for Water Use Licenses (WULs) received from HAIs and HDIs during the call for CL in the Mhlathuze catchment;
(ii) Estimate the streamflow volumetric reduction (VR) of forestry plantations using the quaternary catchment streamflow reduction tables by Gush *et al*. (2002);
(iii) Compare the volume of water allocated to each water use sector, while taking into account the volume of water allocated to HDIs and HAIs through CL in the study area.

(iv) Determine the impact of CL on the water use sector’s demographic setting of the study area;

(v) Determine the equity status in access to water resources before and after implementation of CL in the study area.

Chapter 2: Literature review

2.1. Equity in access to water

Equity in access to water in this study refers to “access to water services, access to water resources and access to the benefits accruing from the use of water resources” (NWRS2, 2013). A report by the South African Human Rights Commission (SAHRC, 2014) showed that implementation progress on redressing equity in access to water services in South Africa had already exceeded 85% during their 2014 reporting year. However, the same report and others were silent about any progress made in relation to the latter two equity categories. This study seeks to research progress on equity in access to water resources, using the Mhlathuze catchment as a case study.

2.1.1. Global perspective

According to Speed *et al*. (2013), equity in access to water is one of the major objectives in water allocation plans and agreements that have the potential to resolve conflicts at global, regional and local levels. Global conflicts, political scores and power relating to access to water resources have been predicted in the future (NWRS2, 2013), and some disputes and dissatisfaction in this subject matter have already been reported in other countries. The latter claim is true in the case of Israel and Palestine who often have disputes over issues of access to water from their shared rivers and aquifers (Amnesty International, 2009; European Parliament, 2016).

Arjoon *et al.* (2016) holds a view that sharing benefits accruing from transboundary river basins equitably, including fair allocation of water resources among countries that lie riparian to these river basins, can help resolve disputes and improve basin development and management activities. A similar view is held by Choudhury and Islam (2015), who suggests that transboundary water sharing can be intensified by acceptance of equity and sustainability as guiding principles of effective resolution. Similar principles were applied in resolving the transboundary water conflict between India and Pakistan that led to the Indus Water Treaty signed in 1960, which promotes fair sharing of water resources and harmonise development and management of basin activities (Choudhury and Islam, 2015).

While most conflicts on water allocation are at transboundary level, racial contentions over fair access to water resources within national level are common. South Africa and Bangladesh are typical examples of countries where contention over water allocation are between racial groups and social classes.

In South Africa fair allocation of water resources is sought between white and black communities, which represent minority and majority groups, respectively. Bangladesh has a different experience altogether, in that its contention over access to water resources and the cost and benefits of water resources development is between the poor and the rich classes, where the rich are said to benefit more than the poor (Rasul and Chowdhury, 2010). Similar cases from Colombia, Ecuador and Peru, where social classes dictate over water allocation, is described by Roa-García (2014) of how those with political power had privilege over the marginalised. A report by Calow and Mason (2014) recognised the advantage of power, whether political or financial over water allocation as a worldwide problem.

Literature reveals that despite most countries embracing the principle of fairness in water allocation, both locally and internationally, implementation capacity, and oversight mechanisms are still lacking in most countries, examples being Colombia, Ecuador and Peru (Roa-García, 2014).

2.1.2. Southern African Development Community (SADC) perspective

Equitable access to water resources is well documented in Article 2(b) of the Revised Protocol on Shared Watercourses in the SADC (2000) (NWRS2, 2013). The revised protocol holds all member states accountable and responsible to ensure that equitable allocation between shared watercourses is achieved. The NWRS2 (2013) also embraces international obligations as priority in water allocation which serves as one of South Africa's vital tools in promoting fair allocation of water resources at regional level.

The issue of equity in access to water resources has also been a subject of on-going discussion between South Africa and Namibia regarding the historic agreement on water allocation from the Orange River, where Namibia views the existing agreement as being inequitable and unfair (Shilombolen, 2006; Kings, 2016). According to Speed *et al*. (2013), failure to resolve this and other water related issues in an amicable manner may result in serious conflicts over water in the future. Although the dissatisfaction over water allocation between South Africa and Namibia is at the regional level, a lesson can be learnt on the significance of promoting equity when allocating water resources even at national and/or local level, especially in South Africa, where water is scarce and fair allocation remains a contentious issue.

2.1.3. South African perspective

The NWRS2 (2013) indicates that the implementation of two of the three major principles of the NWA (1998), i.e. efficiency and sustainability, have received desirable attention; the third principle, i.e. equity, is still lagging behind (Movik, 2009). According to the NWRS2 (2013) the delayed implementation of the equity principle beyond twenty years after the promulgation of the NWA (1998) may represent a ticking bomb, thus calling for a work unusual approach to fast-track implementation going forward. This is because continuation of the existing situation perpetuates the undesired skewed state of water allocation between the minority (HAI) and majority (HDI) groups of South Africa; a historic situation which continues to deprive HDIs an opportunity to participate meaningfully in water resource management and limits them from ownership of water-based industries (NWRS2, 2013). This state of water allocation continues to fuel the existing dissatisfaction within the HDI group.

In realisation of the potential conflict and chaos that can ensue should the current water allocation status quo remain, the NWRS2 (2013) identifies strategic actions to be prioritised towards resolving water allocation crises. One of these strategic actions include the elevation of water allocation reform profile, which promotes among other things, the development of water allocation plans of which CL forms one of the key focus areas to such plans. The water allocation plan is a document that outlines activities that are directed towards reforming the water sector by the implementing authority.

2.1.4. Equity in access to water resources

Equity in access to water resources entails the direct use of water by water use sectors for productive purposes (NWRS2, 2013). The latter document identifies equitable access to water resources as an effective tool to facilitate economic growth, eradicate poverty and to some extent address major inequalities in South Africa’s society. The NWRS2 (2013) also recognises CL as an important mechanism to achieve equitable access to water resources.

There is legislative provision for two other water allocation processes that are relatively shorter and less expensive compared to CL that may be administered to address the skewed nature of water resource allocation in RSA (NWRS2, 2013), namely, the General Authorisation (GA) and Water Use Licence Authorisation processes. These processes are implementable in terms of section 39 and 40 of the NWA (1998), respectively. General Authorisation facilitates water allocation by reducing the administrative burden associated with the WULA process, and thus, ensures that the marginalised groups and the poor are also afforded an opportunity to access water resources for productive purposes. This is because the relatively high cost associated with filing the application for a water use licence is deemed to limit the marginalised and poor groups from accessing water resources, especially considering the amount of money required to undertake relevant specialist studies.

The routine process of authorising a water use by means of a licence makes use of section 27(1) of the NWA (1998) to ensure that redress and sustainable allocation of water resources in catchments is achieved. Section 27(1) (b) of the NWA (1998) seeks to ensure that commitment towards redressing the past racial and gender discrimination is made in every application for a water use licence application, and that WULAs comply with the relevant policies of transformation, including the BBBEE Act (Act 53 of 2003) as amended, and the Codes of Good Practice (DTI, 2013).

Although considerable progress on redress could be made through the legislative provision for the GA and the routine authorisation processes, compulsory licensing is still critical in resolving the imbalance in water allocation as a result of historic water allocation. This is because the two processes mentioned above are only applicable in catchments where allocable water is still available, whereas CL is designed to facilitate reallocation of water in stressed catchments, which commonly occurs due to historic allocations.

The dilemma facing RSA is that most of its catchments are already deemed to be water stressed (Molobela and Sinha, 2011), with the majority of allocation being permissible by means of Existing Lawful Use (ELU) entitlements. These entitlements are verified and confirmed in alignment with the conditions of apartheid laws through the process called verification of ELU in terms of S35 of NWA (1998). This process does not have a legal standing to correct imbalance in catchments but only to confirm existing allocations.

2.2. Existing lawful water use

An ELU is defined as any "water use that has taken place at any time during a period of two years immediately before the date of commencement of the National Water Act, 1998 (Act No. 36 of 1998) and which was authorised by or under any law which was in force immediately before the date of commencement of the NWA" (NWAA, 1999). It is important to note that the ELU is a transitional measure that was put in place during negotiations at the dawn of democracy to allow anyone who lawfully used water based on previous laws to continue with the use until such a time that the ELU may be authorised as a water use by means of a licence through the compulsory licensing process (InformAge, 2012).

The endorsement of the ELU by law-makers during negotiations was to prevent a possible negative impact on the country's economy, which could have been experienced had the then newly elected government declared allocations based on apartheid laws unlawful (NWPWP, 1997); a situation that could have led to the shutting down of most of the water based activities/enterprises leading to food insecurity and a significant fall in the national gross domestic product (GDP). The ELU is confirmed through a certificate that is issued through the Validation and Verification (V&V) process.

2.3. Validation and verification of ELU

The validation and verification (V&V) of ELU is a technical and legal process used by the DWS to determine the extent and lawfulness of an existing water use. The verification process is undertaken in terms of section 35 of the NWA (1998) by DWS, where ELU entitlement holders are invited to apply for the verification of their existing water use(s), and where all conditions of the ELU are satisfied a confirmation certificate for the ELU is issued. However, in cases where the requirements of the ELU are not satisfied or where the user(s) fail to apply within the set application period, the use is to be ceased with immediate effect (NWA, 1998). The results of this process are important for sound management of water resources and serve as indicative figures that inform water resource managers of whether a catchment is over-allocated/stressed or not, and whether to initiate compulsory licensing process or not. In cases where the results for V&V reveal that there is a possible over-allocation of water in the catchment, a water availability assessment study is constituted to confirm the degree of stress. After confirmation of the water stress, CL preparatory studies are initiated to guide the process of reallocation of water resources through CL; preparatory studies include the Catchment Assessment Study (CAS) and Water Allocation Plan (WAP).

2.4. Compulsory licensing preparatory studies

Compulsory licensing preparation studies are critical studies that are undertaken in the catchment to understand the water availability and current water use situation, competing users, economic boosters and existing opportunities (DEW, 2018). The studies facilitate the setting of allocation rules and benchmarks to guide the whole CL process (DWA, 2006). These studies precede the publishing of a call inviting persons to apply for WULs through the CL process with respect to a particular catchment (DWA, 2006). These studies are also referred to as CL initiation studies (refer to subsections 2.4.1 and 2.4.2 below).

2.4.1 Catchment assessment sstudy (CAS)

A CAS is undertaken to assess the historic overview of a catchment, the current water allocation and water use, contribution to economic growth and development, and to estimate future water requirements, as well as checking any opportunities that exist for HDIs to establish viable water based enterprises (DWAF, 2005a).

2.4.2. Water allocation plan (WAP)

The WAP is a legal document that contains a set of rules that govern the allocation/reallocation and use of water resources whilst ensuring that sustainability in the utilisation of water is achieved (DEW, 2018). Water allocation plans in South African catchments are developed in terms of section 9(e) of the NWA (1998) by the DWS in collaboration with key stakeholders. WAP comprises water allocation rules that inform curtailments/ benchmarks and reallocation of water resources in catchments of interest.

2.5. Compulsory licensing process

2.5.1. The concise background and process

Compulsory licensing is unique to South Africa and has never been implemented elsewhere in the world (Seetal, 2012). In South Africa CL is necessitated by over-allocation and skewed allocation of water resources in most of the country's catchments (Water Wheel, 2008; Movik, 2009; Molobela and Sinha, 2011; Seetal, 2012). The unique nature of CL to South Africa limits literature on this subject to the context of this country.

Compulsory licensing is a process by which water use entitlements in an area are reconsidered in order to, amongst other things, achieve a fair allocation and curb over-allocation of water from a resource that is under stress (DWAF, 2008b, NWRS2, 2013). Compulsory licensing also seeks to promote efficiency in water use, and to protect and ensure that water resources are clean and healthy (NWA, 1998). In pursuit of these objectives, when reallocating water through the CL process, the hierarchy outlined in section 45(2) (a-f) of the NWA (1998) is followed.

This hierarchy places reallocation of water to the Reserve and International Obligations first, followed without priority by existing licence holders, water for redress and equity, water for meeting ELU entitlement holders, water for any other applicants, and where applicable water allocation promoted through a public tender and or auction processes (NWA, 1998). Most information of CL, including the call to apply for WULs, is communicated to the public through notices in the Government Gazettes. Public notices are published following the order below;

(i) a call for water use licence applications, followed by
(ii) a proposed allocation schedule,
(iii) a preliminary allocation schedule and
(iv) a final allocation schedule.

2.5.2. Notice calling for water use licence applications

Section 43(1) of the NWA (1998) requires that a responsible authority must publish a notice for the period of 60 days in the Gazette informing people to apply for a water use licence. This section further places responsibility to the responsible authority to use mediums such as newspapers and others, to ensure that the invitation reaches all interested persons (NWA, 1998), including the marginalised and the poor. The notice in question should contain all necessary information and a clear procedure to be followed when launching an application. After collating all information received from the applications, a proposed allocation schedule is drafted and made ready for publishing in terms of section 45 of NWA (1998).

2.5.3. Proposed allocation schedule

The proposed allocation schedule contains application details such as the applicant's details, property details, ELU volumes (where applicable), volume applied for and the proposed allocation volumes. Upon finalisation of this schedule it is published in a Government Gazette for public inspection, and where incorrect information has been furnished on the schedule, the public/applicants are afforded an opportunity to lodge objections within reasonable time to the address provided in the Gazette towards correcting the information captured incorrectly. After resolving all objections received, the preliminary allocation schedule is drafted and made ready for publishing in terms of section 46 of NWA (1998).

2.5.4. Preliminary allocation schedule

The preliminary allocation schedule contains improved information from the proposed allocation schedule resulting from resolution of the objections, if any. This schedule is published in a Government Gazette for public/applicants inspection, and where the public/applicants are dissatisfied with the content of the preliminary allocation schedule they are afforded another opportunity to lodge appeals against the schedule. Appeals lodged are addressed to the Water Tribunal, an institution which is established by the DWS in terms of section 146 of NWA (1998) to hear and resolve water related disputes. After resolving all the appeals, or in the case where there are no appeals lodged, the final allocation schedule is drafted and made ready for publishing in terms of section 47 of NWA (1998).

2.5.5. Final allocation schedule

The final allocation schedule contains applicant's details, property details and the volume of water allocated. Upon gazetting of this schedule, the processing of WULs begins. The final allocation schedule informs the process of issuance of licences which replaces previous ELU entitlements (NWA, 1998).

2.5.6. Issuance of water use licenses

The contents of the final allocation schedule are used to prepare recommendation (record of recommendation (RoR)) and decision documents (water use licences) following the licensing process in terms of chapter 4 of the NWA (1998).

Figure 1 presents a process flow for compulsory licensing from the initial stage (call for licence applications) to final stage (issuance of water use licences). The detailed CL process is well described and outlined in Sections 43 - 48 of the NWA (1998).

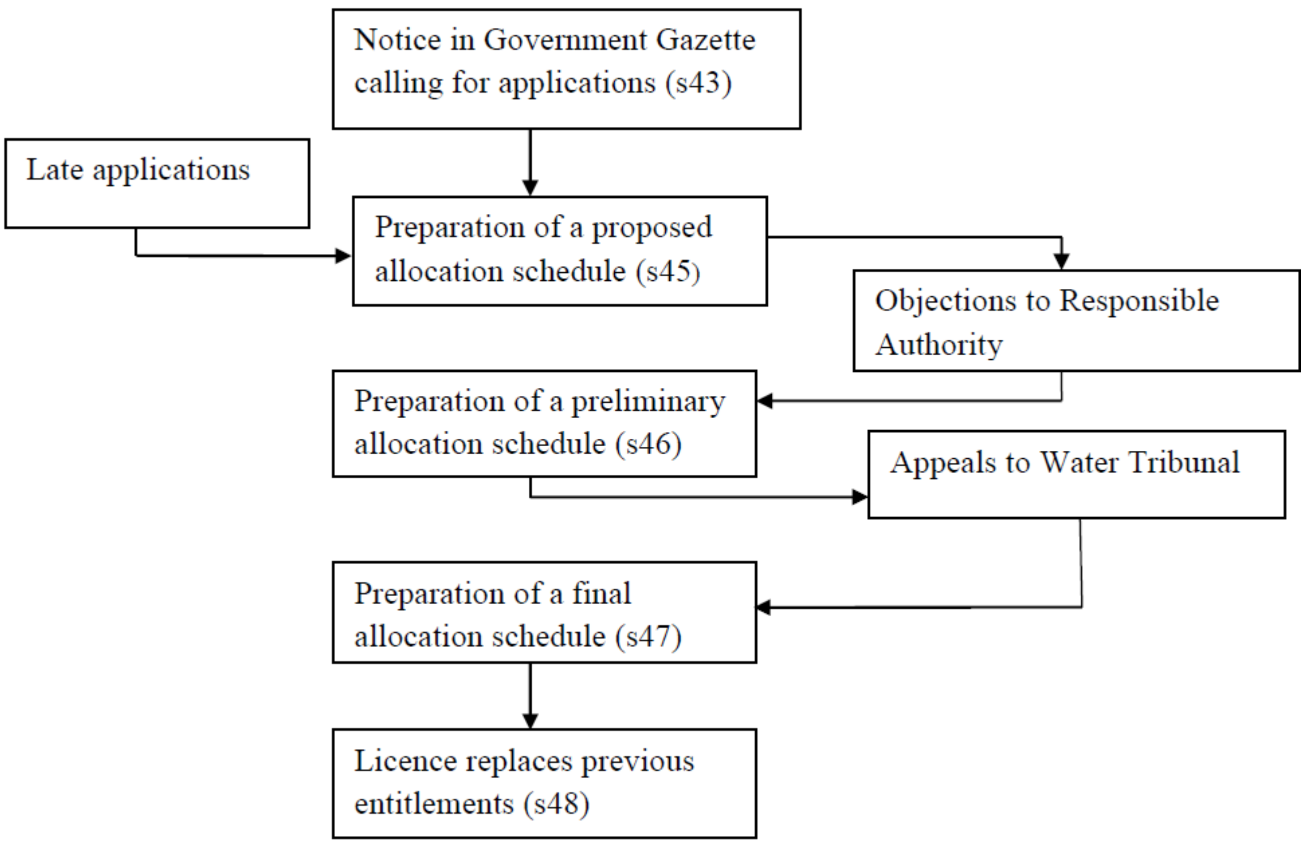

Figure 1: CL process flow (Source: http://www.dwa.gov.za/WAR/compulsorylicensing.aspx)

2.6. Compulsory licensing in Mhlathuze Catchment

2.6.1. Water allocation in Mhlathuze Catchment

The preliminary assessment conducted in the early 2000s indicates that the Mhlathuze catchment was found to be one of the most over-allocated catchments in the country (NWRS, 2004). This study and others recommended that urgent action be taken to address the situation and, as a result, the Mhlathuze catchment was categorised amongst catchments prioritised for piloting compulsory licensing (NWRS, 2004). The major objectives for recommending the piloting of CL in the Mhlathuze catchment were to relieve water stress in the catchment and to redress past racial and gender discrimination in water allocation (DWAF, 2008b). In pursuit of these objectives, upon initiation of CL in Mhlathuze catchment, the responsible authority in collaboration with key stakeholders developed a water allocation plan (referred to as DWAF, 2008b), which outlines water allocation reform (WAR) principles that were applicable to the Mhlathuze catchment CL against the WAR national principles. The DWAF (2008b) also outlined specific water allocation targets applicable to the Mhlathuze catchment CL against the national water allocation targets, the objectives for Mhlathuze catchment CL and water allocation rules. Water allocation rules guided the process of curtailment and reallocation of water in the study catchment.

The WAR national principles as presented on Table 1 are sourced from the draft water allocation reform strategy (DWAF, 2008a) and the Mhlathuze catchment principles were sourced from the Mhlathuze Water Allocation Plan ((DWAF, 2008b). Although the water allocation strategy still bears the name "draft", it was approved by the DWS top management as an implementable document, as confirmed by Skosana (2018). Hence, its targets were used as a guide during implementation of CL in the Mhlathuze catchment.

Table 1: WAR national principles, as well as the Mhlathuze compulsory licensing principles (DWAF, 2008a; DWAF, 2008b:3 -1)

National principles	Mhlathuze catchment CL principles
1. “The primary focus of water allocation processes will be to redress past imbalances in water allocations to Historically Disadvantaged Individuals (HDIs)”.	1. “A minimum of 45% of the water available for irrigation will be in black hands by 2014. This may also be achieved by allocating water to joint venture schemes that comply with a minimum of 50% black partnership”.
2. “The water allocation process must be supported by capacity development programmes that support the use of water to improve livelihoods and to support the productive and responsible use of water by all users. These capacity development programmes should also help HDI and the poor to participate equitably in the process of informing the allocation of water”.	2. “Water will be made available in the form of General Authorisations for persons that wish to participate in any of the support programmes. The General Authorisations will be set at the minimum that is required for successful participation in any of the programmes”.
3. “The water allocation process will contribute to Broad-Based Black Economic Empowerment (BBBEE) and gender equity by facilitating access by Black- and women-owned enterprises to water”.	3. “Allocation of water that has become available as a result of the curtailment of existing lawful use will only be made to persons who can use it (have land, resources) and have the intent to use it. Those applicants who comply with the minimum requirements will be considered on a preferential basis based on Black ownership. The order will be: (i) Black women (ii) Groupings with Black shareholding, ranked in order of the percentage Black shareholding (minimum of 50% Black ownership) (iii) Existing users. (iv) All others on a first come, first served basis”.
4. “The water allocation process will respond to local, provincial and national planning initiatives, as well as to South Africa’ international obligations and regional SADC initiatives”.	4. “The economic viability of individual irrigation users will not be compromised to provide water for industrial/urban use”.
5. “The water allocation process will be undertaken in a fair, reasonable and consistent manner and existing lawful uses will not be arbitrarily curtailed”.	5. “The water allocation process will be undertaken in a fair, reasonable and consistent manner and existing lawful uses will not be arbitrarily curtailed. In this respect the criteria described in item 6 below will be applied”.
6. “The water allocation process will give effect to the protection of water resources as outlined in the NWA (1998) by promoting the phased attainment of both developmental and environmental objectives”.	6. “Water allocations will not compromise the Reserve, and that an acceptable assurance of supply for the different user groups is maintained”.

2.6.2. Objectives for the Mhlathuze catchment CL (DWAF, 2008b)

The objectives of the Mhlathuze Compulsory licensing project were to;

(i) solve the problem of over-allocation,

(ii) bring about equitable distribution of water,

(iii) address the plight of the rural poor, and

(iv) promote gender equality.

This study only focused on the resolution of the over-allocation and equitable distribution of water.

2.6.3. National water allocation targets

In pursuit of the desire to redress the racial and gender discrimination in water allocation and attainment of equity in access to water resources in South Africa, the WAR national targets for water allocation were developed. These targets are outlined in the draft strategy on water allocation reform (DWAF, 2008a). The draft strategy on water allocation reform sets national targets for water allocation as indicated in Table 2.

Table 2: National water allocation targets as captured on the draft water allocation reform strategy, DWAF (2008a)

Objective	Year	Target
Water in black hands	2014	30%
	2019	45%
	2024	60%

The national water allocation targets are not based on the percentage of water allocated to a particular water use sector(s), rather on allocation of the nation's available water resources. The targets in Table 2 relate to water that should be in the hands of black South Africans set to be achieved progressively in a five year intervals originally from 2009 to 2014, 2014 to 2019, and 2019 to 2024. Achievement of these targets does not only rely on CL but also through GA, routine WUL processes and other mechanisms outlined in the NWRS2 (2013) and the draft WARS (DWAF, 2008a). This study focuses on the Mhlathuze catchment only, thus, comparison of the performance of CL in the study area will only serve to provide indicative figures as opposed to actual performance against the national water allocation targets. This is because proper comparison at national level can only be done when all catchments have been considered for WAR initiatives.

2.6.4. Specific water allocation target for Mhlathuze catchment CL (MCCL)

The test for achieving equity in the Mhlathuze catchment during CL was set in order to satisfy the minimum targets presented on Table 3:

Table 3: Mhlathuze catchment equity targets for water allocation (DWAF, 2008b)

Objective	Year	Target
To curb water over-allocation	During CL implementation	100%
Irrigation water in black hands	During CL implementation	10%
	2014	30%

The water allocation targets set for the MCCL are in principle relatively lower than those of the national water allocation targets. This is because the MCCL water allocation targets only focus on agricultural (irrigation) water as opposed to the national water allocation targets that focus on total water available at the catchment level. It can also be noticed that the 2014 target in Table 3 is lower than the 45% minimum target set to be achieved by 2014 under the WAR principles for Mhlathuze catchment CL. The need to first address water over-allocation before other targets might have been the limiting factor from aligning the MCCL targets with the 45% minimum target and the national water allocation targets. To ensure that the MCCL targets are achieved, rules for water allocation were developed and incorporated into the DWAF (2008b) document.

2.6.5. Water allocation rules for Mhlathuze catchment

The DWS, in collaboration with relevant stakeholders from the Mhlathuze catchment, developed water allocation rules to set a reference basis for reallocation. The water allocation rules were also designed to set curtailment rules to help ensure that some water is gained back to the system to facilitate relief of water stress in the catchment, and to promote equitable allocation. Table 4 lists the allocation and curtailment rules adopted in Mhlathuze catchment during implementation of CL.

Table 4: Water allocation rules that are applicable to each water use sector for the Mhlathuze catchment (DWAF, 2008b)

No.	Rule		Description
1	SFRAs rules	1a	All existing SFRAs (Forestry plantations) applicants should be given their full ELU allocation;
		1b	All new HDI and Level 3 BBBEE applicants should be given their full application volume;
2	Irrigation rules	2a	All existing applicants forming part of an irrigation board should be given 66% of their full ELU allocation;
		2b	All existing applicants not forming part of an irrigation board should be given their full application volume, except for:
		2c	The Inkasa irrigators who should be given 1.3 Mm^3/a (13% of their full allocation).
		2d	All new HDI applicants should be given their full application volumes;
3	Domestic/urban & industrial rules	3a	All existing applicants should be given 90% of their application except for:
		3b	Rule 3b: Richards Bay Minerals should be given 14 017 500 M m^3/a (56% of their full allocation);
		3c	All new applicants should be given 90% of their application

Chapter 3: Study site and methods

3.1. The study site

The Mhlathuze catchment (28^{o}40’0.0”S; 31^{o}33’32.4”E) is a rural area of 4 209 km^2, has a population of about 525 000 people, and falls within the Pongola to uMzimkhulu Water Management Area of the Kwa-Zulu Natal Province (Figure 2) (Kidd, 2016).

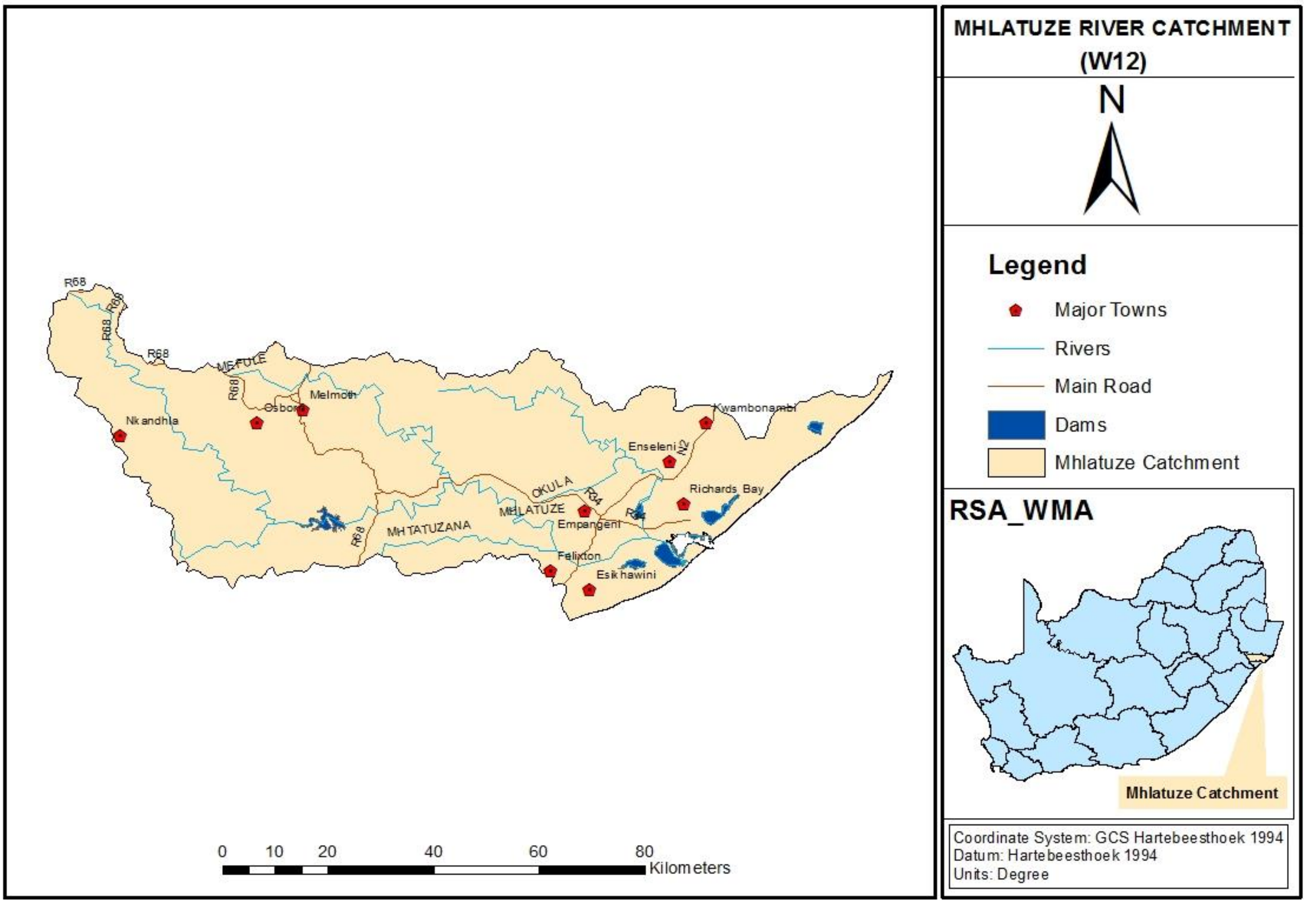

Figure 2: Locality map of the Mhlathuze catchment

The catchment's headwaters are located at an altitude of 1 519 m, the river length is over 100 km long (Wilson, 2001), and its mean annual runoff (MAR) is approximately 583 Mm^3/annum (DWAF, 2000) (Table 5). The catchment is comprised of nine (9) quaternary catchments. Table 5 presents the quaternary catchments codes and MARs for Mhlathuze catchment.

Table 5: Mhlathuze quaternary catchments **(**MQCs) and associated mean annual runoff (MAR) (DWAF, 2000)

Quaternary catchment	MAR (Mm^3/a)
W12A	69
W12B	94
W12C	56
W12D	49
W12E	41
W12F	92
W12G	30
W12H	71
W12J	81
Total	**583**

3.2. Methods

This study used secondary data that were made available by the DWS. The main data used for this study were neither classified nor confidential and could be accessed from the DWS website: (http://www.dwa.gov.za/WAR/compulsorylicensing.aspx). The secondary data in question were produced by the DWS through a review of existing literature, use of GIS software, field surveys, water user interactions and from water use licence application forms received from applicants. Additional information was also received during the process of resolving objections lodged by applicants.

The secondary data used include the proposed, preliminary and final allocation schedules, and the compulsory licensing master spreadsheet. The proposed allocation schedule entails the first schedule containing water use licence application details and proposed water allocation volumes. The preliminary allocation schedule is the improved water allocation schedule that was gazetted after all objections filed against the proposed allocation schedule were resolved. There were no appeals lodged with the water tribunal against the preliminary allocation schedule, thus the content of the preliminary allocation schedule was converted to the final allocation schedule, which was gazetted and followed by the processing of the water use licence applications and issuance of WULs.

3.3. Data collection

The proposed, preliminary and final allocation schedules, and compulsory licensing master spreadsheet were collected from the DWS national office. These data sets contain WULAs information for agriculture, industry, forestry and domestic sectors. The allocation schedules were received in PDF format and the master spreadsheet was a Microsoft Excel spreadsheet.

3.4. Data analysis

The CL master spreadsheet contains information on HDI, HAI and BBBEE categories as well as quaternary catchment information for the applications received. The information on the spreadsheet was first coded and filtered through the Microsoft Excel spreadsheet to separate the HDI and HAI applications from the BBBEE applications to determine the ratio of applications received between HDI and HAI categories. The BBBEE applications have been included in the analysis only for indicative purposes, and not for the purpose of achieving objective one (1) of this study, which sought to determine the ratio of applications received between the HDI and HAI groups. This is because there is no clear procedure to quantify the actual application portion that represents the HDI and or HAI groups from the BBBEE applicants.

The proposed, preliminary and final allocation schedules were first converted from the PDF format into Microsoft Excel's spreadsheet for ease of analysis using the freely accessible PDF to Excel Converter software. The three allocation schedules contained information on applicant details, property details, ELU information, volume/hectares applied for, and those allocated, as well as water user-sector information. However, all these schedules did not provide information on the HDI, HAI and BBBEE categorisation, and information on quaternary catchments for each application received. This missing information was sourced from the CL master spreadsheet. The HDI, HAI and BBBEE information was exported from the CL master spreadsheet to the spreadsheet of the three schedules' using the Vlookup function. The Vlookup is a function that is included in the Microsoft Excel software and is capable of automatically exporting large data volumes from one Excel spreadsheet to another.

The updated proposed and preliminary allocation schedules were used to determine the HAI: HDI ratio of water use license applications received during the call for WULAs. This exercise was done through exporting HDI and HAI applications to a new Microsoft Excel spreadsheet, where all of the applications were analysed, followed by the application of filters and determination of the total number of applications per category, and subsequently, the application ratios between the HDI and HAI categories were determined by dividing the number of the individual categories by the total number of the total applications received multiplied by 100.

The final allocation schedule and the CL master spreadsheet were used to extract parameter information used in the equation to estimate the stream flow volumetric reduction. This exercise was necessary to be able to estimate the volume of water equivalent to the hectares allocated to forestry plantations. The practice of commercial forestry plantation is authorised in terms of section 21(d) of NWA (1998) as engaging in Stream Flow Reduction Activities (SFRAs). Stream Flow Reduction Activities (SFRAs) is defined as "land-based activities which reduce stream flow" (NWA, 1998). Forestry plantations mainly impact rainfall run-off through interception and evapotranspiration of precipitation and or rainfall water, and thereby reduce runoff water which could enhance the stream flow of adjacent streams (Pugh, 2017). Currently, the regulated SFRAs in terms of NWA (1998) are forestry plantations which include eucalyptus, conifers and wattle trees (NWA, 1998). The conversion equation used when estimating the stream flow volumetric reduction is expressed as:

$$VR = Reduction \times Area \times 10$$

Where,

VR = *stream flow volumetric reduction;*

Reduction = *reduction of stream flow by forestry plantations;*

Area = *area of forestry plantations to be authorised, and*

10 = *conversion factor*

Table 6 and Table 7 present the SI units and the input parameters to the conversion equation used for estimating the volumetric reductions for the Mhlathuze catchment, respectively.

Table 6: Parameters for estimating volumetric reduction and their units

Parameter	Unit
Volumetric reduction	m^3/a or Mm^3/a
Area	Hectare
EMLFR	Mm
Conversion factor (10)	Dimensionless

* ***EMLFR: Eucalyptus medium low flow reduction***

Table 7: Mhlathuze quaternary catchments and associated eucalyptus medium low flow reduction (Gush *et al*., 2002)

Quaternary catchment	EMLFR (mm)
W12A	8.2
W12B	88.0
W12C	36.0
W12D	5.1
W12F	10.6
W12H	20.6
W12J	4.6

Estimating volumetric reduction using Eucalyptus Medium Low Flow Reduction (EMLFR) is important in this study since one of the objectives is to compare the volume of water allocated between the HDIs and HAIs before and after CL. EMLFR focuses on the period when the environment is depended on the base flow, thus, the use of this parameter in estimating volumetric reduction, protects that flow during an extended dry period. This is particularly important in perennial streams where a pause in flow will have massive ramifications on in-stream biota and ecosystem function. Water allocation before CL, refers to allocation before the call for CL, and water allocation after CL refers to the water allocation status after gazetting the final allocation schedule. The EMLFR parameter provides information of the impact of afforestation on the yield of the system, especially during the dry periods, as opposed to the Eucalyptus Medium Total Flow Reduction (EMTFR). EMTFR includes high flows, floods included, so it won't be as sensitive as the EMLFR with regards to ecosystem function but it is an important estimate when deciding how much water is available in the catchment. The use of EMTFR parameters result in higher volumetric reduction values compared to those found when using the EMLFR parameters, because the EMTFR accounts for the catchment MAR and not the yield. After estimating the stream flow volumetric reduction of authorised forestry plantations, the proposed preliminary and final allocation schedules were further updated in a Microsoft Excel spreadsheet format to reflect afforestation allocation in terms of volumetric reduction as opposed to hectares. This estimation was necessary to enable ease of comparison of the volume of water allocated to sectors against the HDI and HAI groups before and after CL.

To enable ease of comparison, the volume of water allocated to each sector was summed per quaternary catchment; followed by the aggregation of all sectoral total volumes of water, to establish the holistic picture of water allocation per sector before and after CL. After this, the results are presented as tables and graphs.

In order to compare the volume of water allocated to HDI and HAI groups before and after CL, authorised users were categorised as HDI, HAI and BBBEE in a Microsoft Excel spreadsheet from where the HDI and HAI categories were then exported to a new Microsoft Excel spreadsheet. This exercise was followed by categorisation of water allocation volumes under HDIs and HAIs against quaternary catchments. Summation of the volumes allocated to the HDI and HAI groups was done to reflect the total volume of water allocated between the two categories.

The determination of the impact of CL on the water use sectoral demographic setting/change of the study area was done by summing up all the water use entitlement holders before CL and those after CL separately, followed by comparison of the two values. The values of the entitlement holders were compared to establish if there was any change in the sectoral demography of the study area after CL. Any decrease and or increase in entitlement holders would mean downward change (decrease) or upward change (increase) in the sectoral demography of the study area. Volumetric sectoral gain and loss per quaternary catchments were also determined. This was done by comparing the volumes of water allocated to each sector before CL and comparing them with the volumes allocated after CL, the difference in terms of the decrease or increase denoted that the sector had either lost or gained some volume of water.

In order to determine equity in access to water resources before and after implementation of CL, the updated preliminary and final allocation schedules were used. The above mentioned data sets were arranged in terms of entitlement holders per HDI, HAI and

BBBEE categories taking into account the volume of water allocated and the sectoral participation per category. The HDI: HAI ratios in terms of the above categorisation were determined to reflect the holistic picture of the degree of access to water resources between the HDI and HAI groups before and after implementation of CL. This information was then compared to the Mhlathuze catchment CL water allocation targets (equity targets) and the national water allocation targets outlined in the DWAF (2008b) and the WARS (DWAF, 2008a), to establish whether the targets were met or not.

It is important to note that water allocation volume before CL was made up of the ELU and the NWA (1998) licence volumes (only WULs issued before CL), whereas, water allocation volume after CL was made up of the volume of water allocated through the CL process and the volume of the NWA (1998) licences (WULs issued before and after CL).

Chapter 4: Results

4.1. Ratio of WUL applications between HDI and HAI applicants

4.1.1. All water use sectors

The notice calling persons to apply for WULs in Mhlathuze catchment was published in the Government Gazette on 12 August 2010 for 60 days. The period of notice was extended by 30 days making the total days for WUL applications 90. WUL applications were received from three categories namely, HAI, HDI and BBBEE representing four water use sectors; agriculture (irrigation), Stream Flow Reduction Activities (SFRAs), industry and domestic. Stream Flow Reduction Activities (SFRAs) refers to “land-based activities which reduce stream flow” (NWA, 1998).

A total of 807 WUL applications were received from HDI, HAI and BBBEE applicants, and the proportions of their applications were 43%, 42% and 15%, respectively (see Table 8). The HAI applications dominated the agriculture (irrigation) and industry sectors with ratios of 23% and 2% of applications, respectively. On the other hand the HDI applications dominated the SFRAs and domestic sectors with ratios of 20% and 10%, respectively. The overall analysis of Table 8 revealed that applications from HDI applicants were slightly higher than those from HAI applicants. It is important to note that these analyses include the domestic sector being categorised under HDI applications, which may be misleading since water allocated to the domestic sector equally benefits HDI and HAI applicants. Thus, it is not prudent to include it in analyses aimed at establishing the relationship of water resources allocation between the HDI and HAI groups. In order to observe the fair indication of the ratio of WUL applications received from HDIs and HAIs, the domestic sector was excluded in the analyses below, and the three remaining sectors were referred to as economic sectors.

Table 8: WUL applications per water use sector and associated HDI, HAI and BBBEE status.

Sector	HDI		HAI		BBBEE	
	No.	%	No.	%	No.	%
Irrigation	108	13	188	23	2	0
SFRAs	161	20	134	17	123	15
Industry	-	-	14	2	-	-
Domestic	77	10	-	-	-	-
Total	**346**	**43**	**336**	**42**	**125**	**15**

- **Indicates that there were no applications received**

4.1.2. Economic water use sectors

Economic water use sectors are important for the country's Gross Domestic Product (GDP). This is because these sectors use water for commercial purposes that contribute to employment, income and revenue. Analysis based on economic water use sectors is important in this study, especially since one of the objectives of CL in Mhlathuze catchment was to address the plight of the poor. Thus, determining the number of HDIs who came forward to apply for WULs provided an indication of the willingness by this group to participate in water-based activities, which may possibly address the plight of poverty in their communities.

Economic water use sectors accounted for 730 WUL applications from HDI, HAI and BBBEE applicants, where the ratios were 37%, 46% and 17%, respectively (see Table 9). HAIs came forward in slightly higher numbers to apply for WULs compared to HDIs. The HAI applications dominated the agriculture (irrigation) and industry sectors, and the HDI applications dominated the SFRAs sector. The dominance of the HDI group to the SFRAs sector may have been encouraged by the fact that afforestation developments are relatively affordable and easy to maintain. The support provided to the HDI group by Mondi (Pty) Ltd through the Mondi Zimele programme, which includes the provision of seedlings, might have contributed to HDIs dominating the SFRAs sector (Mondi Zimele Programme summary report, 2013)

Table 9: WUL applications per economic sector and associated HDI, HAI and BBBEE status'

Sector	HDI		HAI		BBBEE	
	No.	%	No.	%	No.	%
Irrigation	108	13	188	23	2	0
SFRAs	161	20	134	17	123	17
Industry	-	-	14	2	-	-
Total	**269**	**37**	**336**	**46**	**125**	**17**

- **Indicates that there were no applications received**

4.2. Estimation of SFRAs volumetric reduction

Afforestation activities may require water and this can result in a reduction in river discharge; referred to as Stream Flow Reduction Activities (SFRAs) in this study. This aspect is important for determining the volume of water allocated to sectors and also to enable comparison of volumes of water allocated between the HDI and HAI categories. Table 10 shows the number of hectares of land authorised for the purpose of forestry plantations after CL.

A total of about 57 028.2 ha of land was authorised for afforestation purposes after CL (Table 10). This total was determined through the addition of the hectares authorised through the NWA process (1 279.66 ha) with the hectares authorised through the CL process (55 748.54 ha). The reason for adding hectares authorised in terms of the NWA (1998) routine authorisation process with hectares of the CL process is that the CL process did not affect the afforestation hectares authorised in terms of NWA (1998) licences.

The 57 028.2 ha of forestry plantations were estimated to have resulted in a 12.859 Mm^3/a stream flow volumetric reduction (see Table 11); this relates to an annual average of 225.5 m^3/ha of stream flow volumetric reduction by eucalyptus plantations to the catchment yield. The value of 12.859 Mm^3/a was found by multiplying the EMLFR (mm) applicable to the individual quaternary catchment by the conversion factor (10) and the quaternary catchment area in hectares using the conversion equation.

Table 10: Water allocated in terms of NWA per quaternary catchment, allocation in terms of CL and total allocation after CL

Quaternary catchment	NWA allocation (ha)	Allocation during CL (ha)	Allocation after CL (ha)
W12A	138.43	17401.55	17539.98
W12B	89	5113.9	5202.9
W12C	528.6	6271.36	6799.96
W12D	58.24	450.45	508.69
W12F	282.8	3680.71	3963.51
W12H	127.32	14238.21	14365.53
W12J	55.27	8592.36	8647.63
Total	**1279.66**	**55 748.54**	**57 028. 2**

Table 11: Eucalyptus medium low flow reduction information per quaternary catchment, area of plantation and volumetric information after CL

Quaternary catchment	EMLFR (mm)	Area of plantation (ha)	Volumetric reduction (Mm^3/a)
W12A	8.2	17539.98	1.438
W12B	88.0	5202.9	4.579
W12C	36.0	6799.96	2.448
W12D	5.1	508.69	0.026
W12F	20.6	3963.51	0.816
W12H	10.7	14365.53	1.537
W12J	23.3	8647.63	2.015
TOTAL	__	**57 028. 2**	**12. 859**

4.3. Allocated volume of water between sectors after CL

In order to assess the volumetric allocation in a catchment, catchment yield and water availability play central roles. The total available water (334.9 Mm^3/a) in the study area is made up of the yield volume (262 Mm^3/a), SFRA volume (10.9 Mm^3/a) and the volume from Thukela transfer scheme (62 Mm^3/a).

During determination of the yield in Mhlathuze catchment, the SFRAs volumetric reduction was included as one of the inputs in the yield model set up (DWAF, 2008b). Hence, the catchment yield and the SFRAs volumetric reduction were added together to make 272.9 Mm^3/a of available water in the catchment. This available water was not sufficient to meet the competing sectoral water demand in the Mhlathuze catchment so additional water to supplement available water needed to be sourced. To respond to this need the Mhlathuze catchment CL planning team successfully sourced water from the uThukela basin amounting to a volume of 62 Mm^3/a through the Thukela interbasin transfer scheme. When adding the transferred volume of 62 Mm^3/a to 272.9 Mm^3/a the available water increased to 334.9 Mm^3/a. This available water as described above refers to the water that was available for allocation, which excludes water for the ecological reserve since it was already implemented in the model set up. The breakdown of water allocation after CL can be observed in Figure 3.

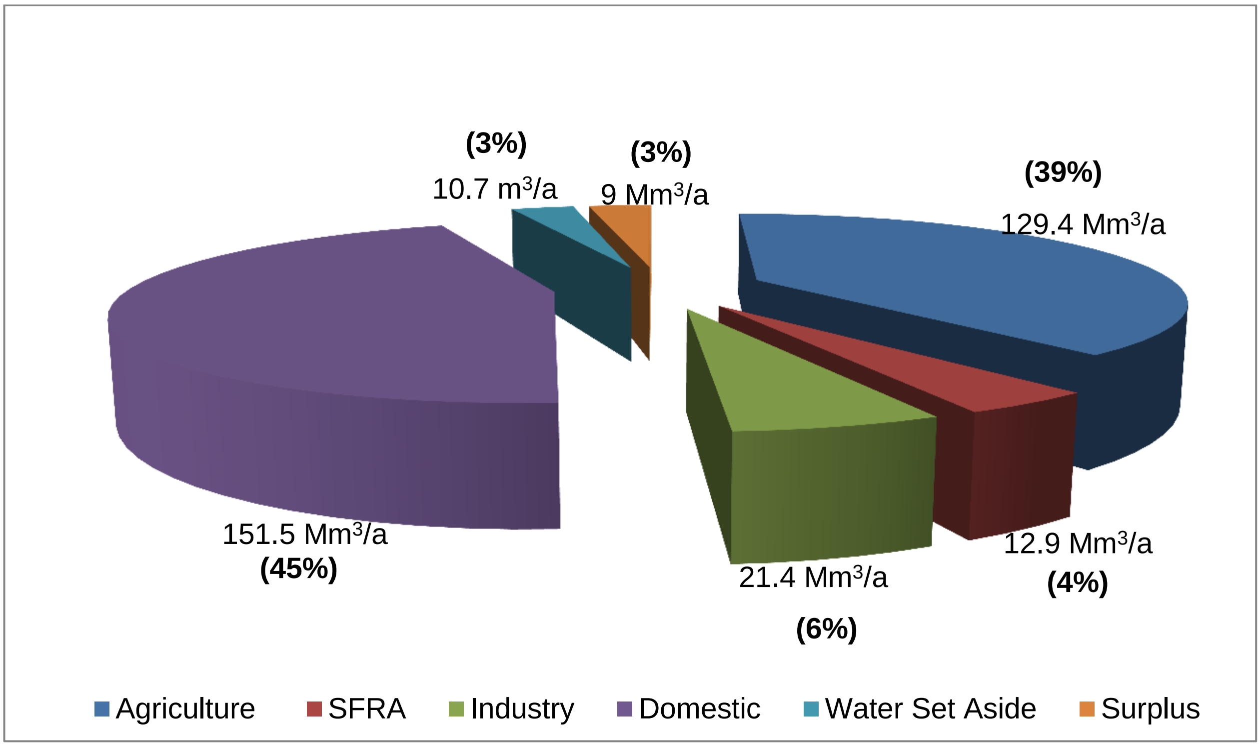

Figure 3: Sectoral water allocation from catchment yield plus Thukela interbasin transfer scheme water after CL (Mm^3/a)

About 94% of available water in the catchment was allocated to four sectors and about 3% of this water was set aside for future allocation and another 3% was surplus (Figure 3). The largest users of water in the Mhlathuze catchment are the domestic and agricultural sectors, with the usage reaching 45% and 39%, respectively, followed by industry with 6%

and SFRAs 4%. The remaining 6% is shared between water set aside and surplus water, each with 3% share of water (Figure **3**).

4.3.1. Sectoral gains and losses

In order to determine the amount of water gained or lost by sectors during the process of compulsory licensing, one must first analyse the sectoral allocation of water before and after CL. The results of the analysis of sectoral water allocation before and after CL are presented in Figure 4.

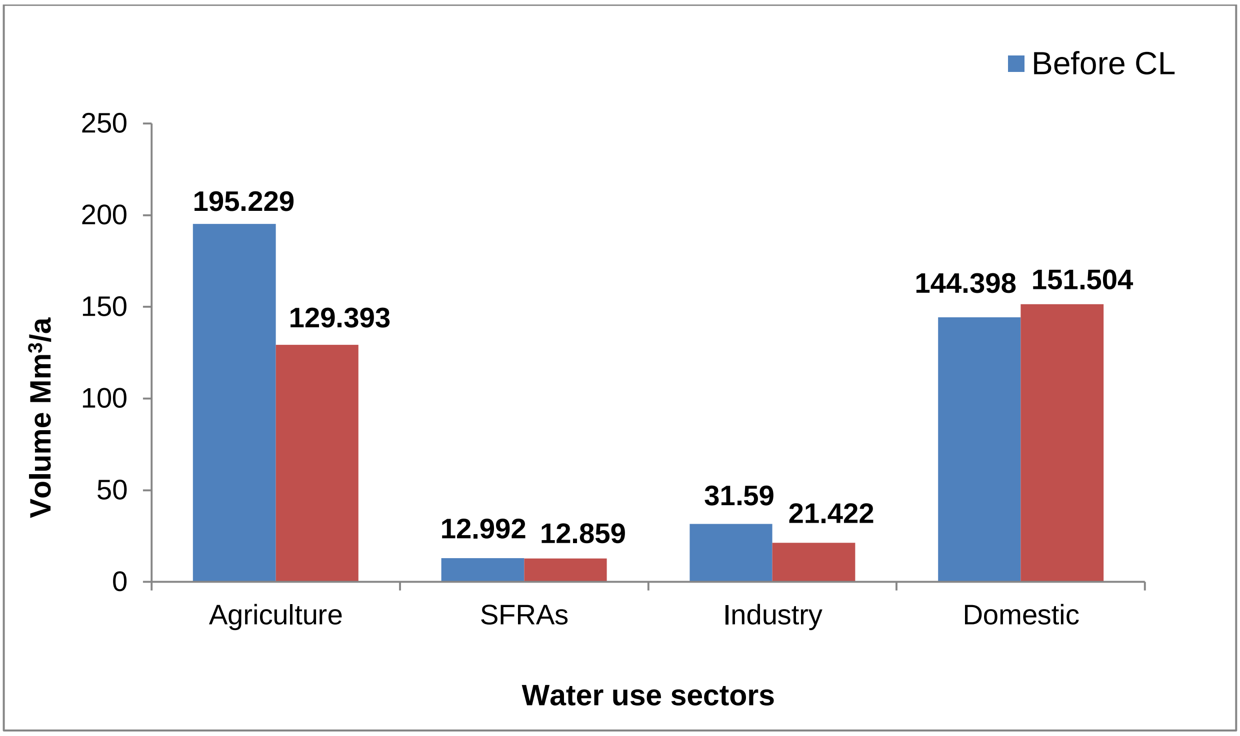

Figure 4: Sectoral water allocation (Mm^3/a) before and after CL

Addition of the values presented in Figure 4 revealed that the sectoral water allocation before CL was 384. 209 Mm^3/a and after CL was 315.178 Mm^3/a. Further observation revealed that agriculture, SFRAs and industry water allocations before CL were higher compared to water allocation after CL, with the exception of the domestic sector, which had higher water allocation after CL. The equivalent values of losses and gains are presented in Figure 5.

The domestic sector gained 7.106 Mm^3/a, whereas agricultural, industrial and SFRAs sectors lost 65.836 Mm^3/a, 10.168 Mm^3/a and 0.133 Mm^3/a, respectively (Figure 5). Ultimately, the results revealed that the total volume of sectoral water lost was 68.65

Mm^3/a, which accounts for 18% of the total loss. This means that less water was allocated to the sectors and sufficient water remained in the environment.

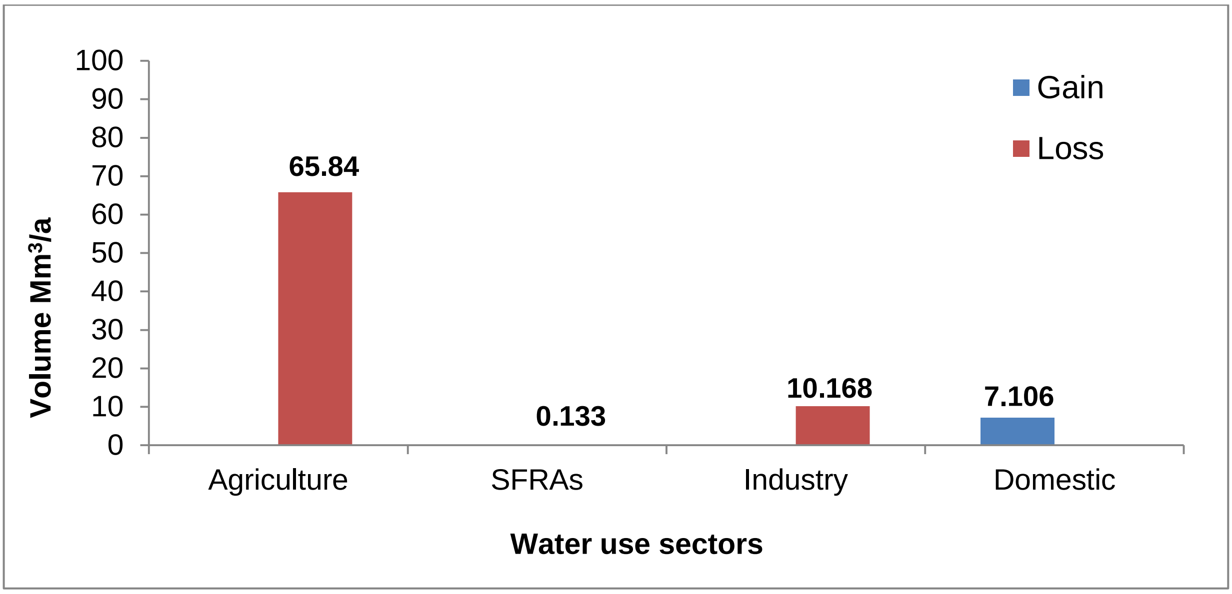

Figure 5: Water allocation situation after CL; sectoral gains and losses (Mm^3/a).

4.4. The volume of water allocated between HDIs and HAIs

To establish the water allocation situation before and after CL between the HDI and HAI categories, analysis of the volumes of water allocated in both periods were calculated. Figure 6 shows the volumetric water allocation between the HDIs and HAIs before and after CL for all water use sectors.

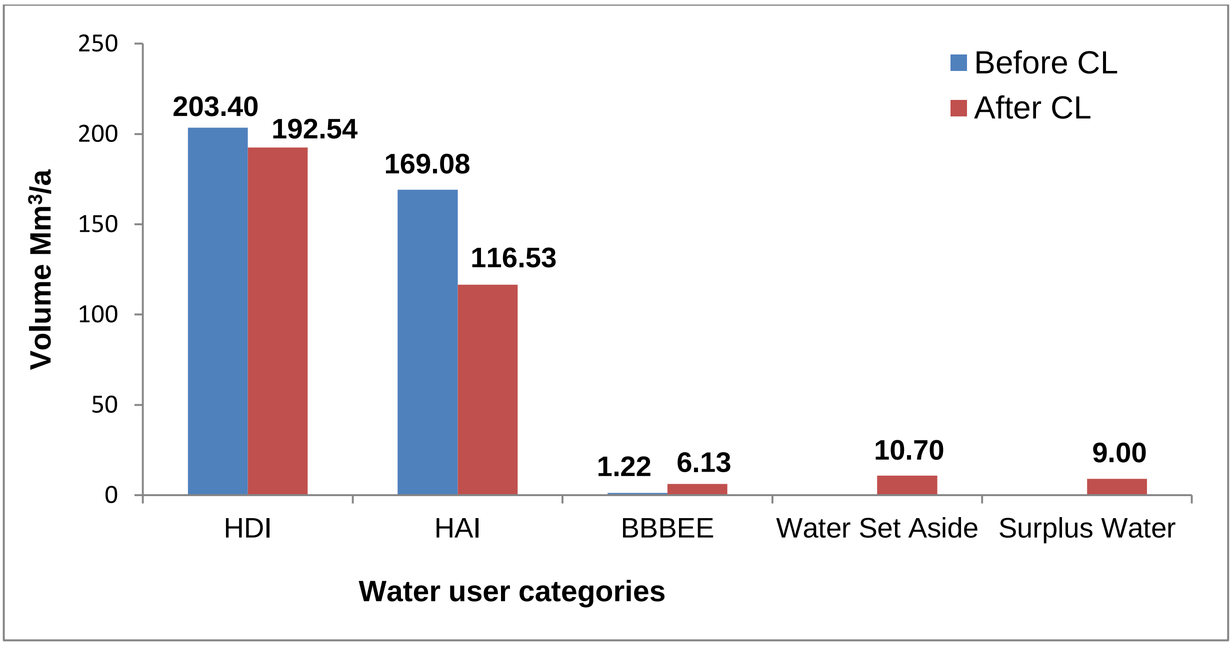

Figure 6: Water allocation situation before and after CL: all sectors

The HDI group had a higher allocation of water than the HAI group, whereas the opposite was the case within the economic sectors (Figure 6 and 7). The higher volume in the HDI category for all sectors was influenced by the volume of the domestic sector. The domestic sector, although categorised under HDI, does not provide a fair analytical judgement between the two groups under comparison, this is because the water for domestic use equally serves both the HAI and HDI categories. Thus, the economic sectors should remain the basis for analysis in order to fairly compare water allocation situation between the HDI and HAI categories.

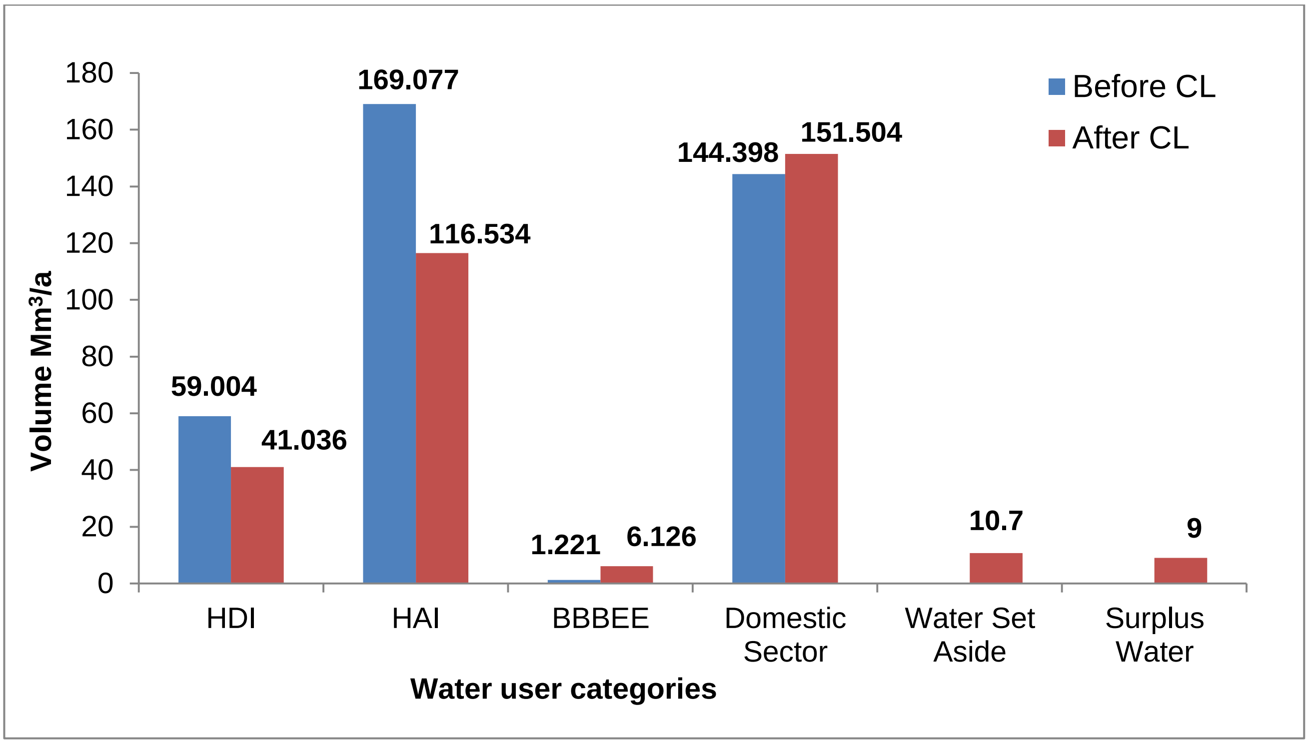

Figure 7: Water allocation situation before and after CL: economic sectors

Based on the analysis for volumetric allocation, water allocation was skewed with the difference of 110.073 Mm^3/a (48%) of water before CL and 75.498 Mm^3/a (48%) of water after CL favouring the HAI group. The percentage volume of water allocated to HDIs before (25.9%) and after (26.0%) showed no improvement towards addressing skewed volumetric allocation between the two groups. The possible reason for this may be that the process of land reform had not been concluded during implementation of CL in Mhlathuze catchment, thus, lack of sufficient land of the HDI group may have been the limiting factor.

4.4.1. Volumetric allocation between HDI and HAI after CL versus the WAR national targets

Any reform initiative has to align with the relevant national target, thus, results in this sub-section compares the achievements of MCCL against the Water Allocation Reform (WAR) national targets. Figure 8 presents the percentage of water allocation after CL in Mhlathuze catchment, which enables the observation and comparison of MCCL achievement against the national target.

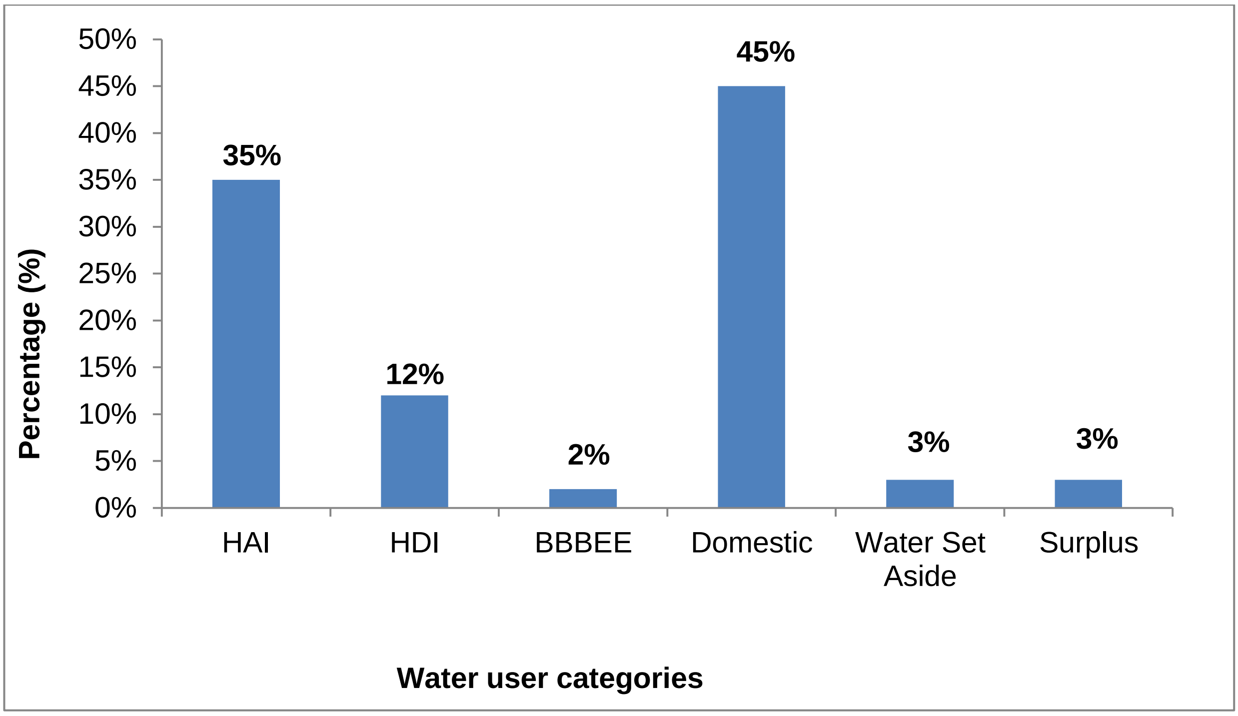

Figure 8: Percentage of water allocation after CL in the Mhlathuze catchment

The percentage of water allocated after CL with special interest focused on the HDI and HAI allocations showed that 35% of water was allocated to HAI and 12% to HDI categories, respectively (Figure 8). The national water allocation target set for 2014 was 30% of the available water in the hands of black people. When scaling down the analysis to the catchment level, this achievement indicates that Mhlathuze catchment CL has not satisfactorily achieved the 30% national target for 2014.

4.5. Sectoral demographic change and quaternary catchment volumetric gains and losses

4.5.1. Sectoral demographic change

Knowledge of the record of entitlement holders before implementation of CL in Mhlathuze catchment was important as it served as a basis for comparison with the entitlement holders after implementation of CL to establish any observable change. Figure 9 and 10 show the sectoral water use entitlement holders before and after CL in terms of numbers and percentages, respectively.

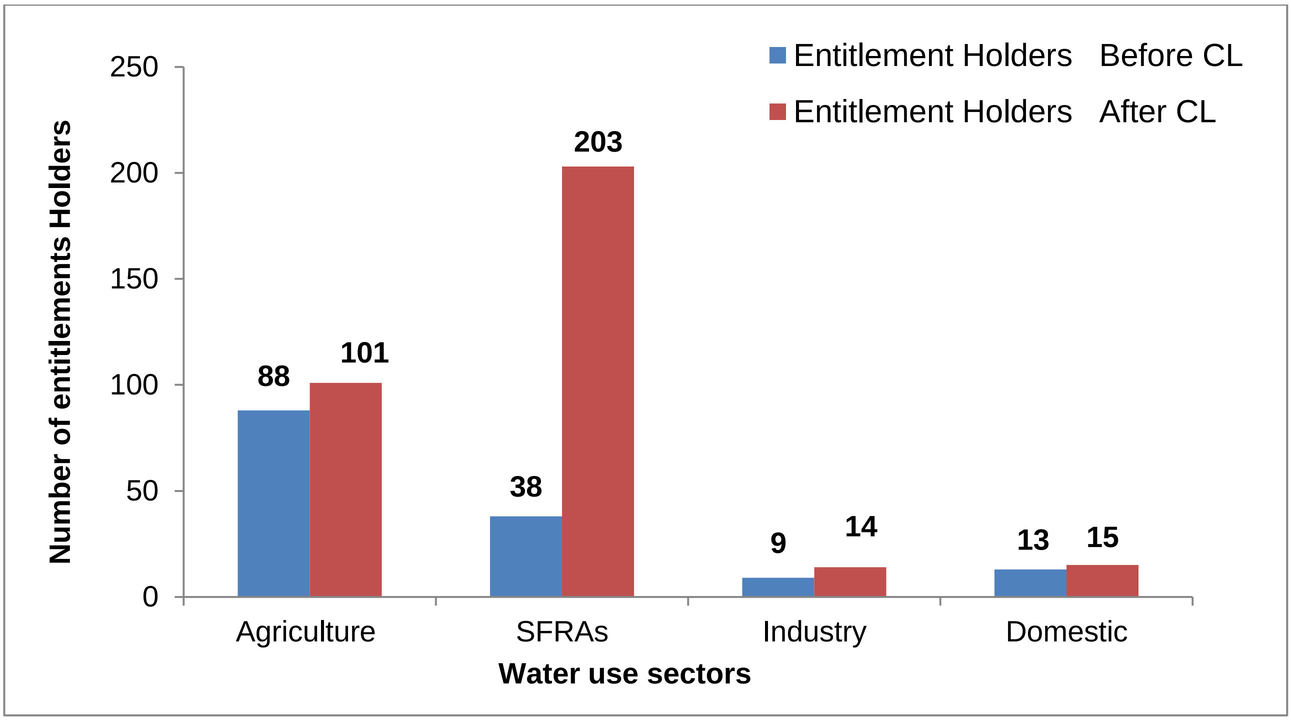

Figure 9: Number of water use entitlement holders before and after CL

The agricultural sector's demography, increased by 13 entitlement holders but its dominance decreased by almost 29% after CL (Figure 9 and 10). The forestry sector's demography increased by 165 entitlement holders and 35% in dominance. The industry and domestic sectors' demography increased by 5 and 2 entitlement holders yet decreased by 2% and 4% dominance, respectively.

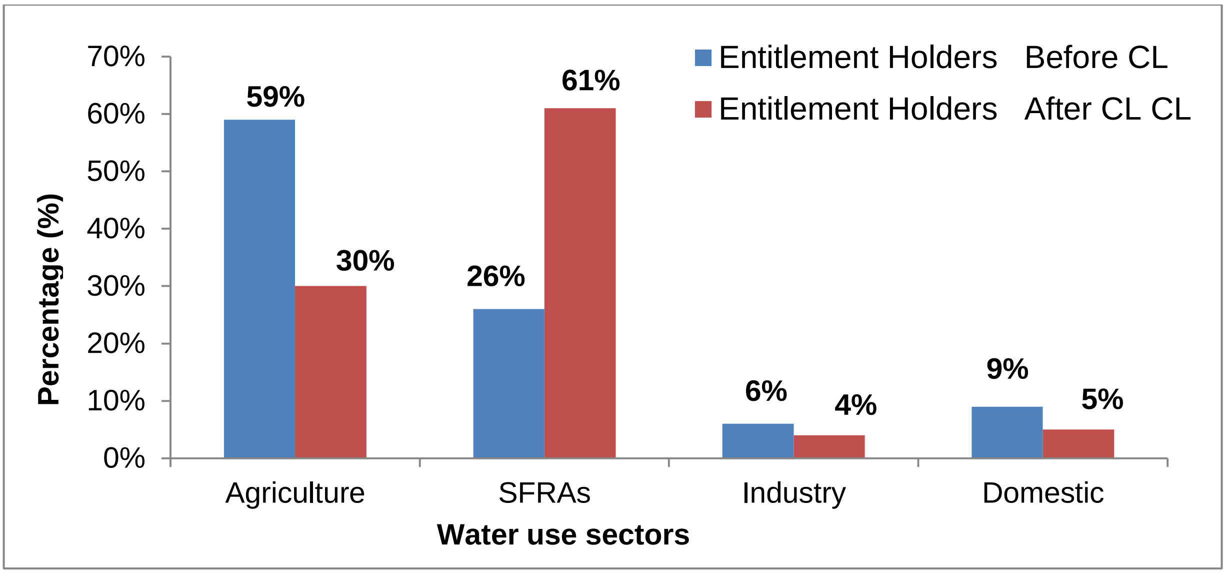

Figure 10: Percentage of water use entitlement holders before and after CL

4.5.2. Quaternary catchments volumetric gains and losses

Whilst the main focus of this section was to determine the change in sectoral demography of the study area, it is also important to establish any quaternary catchment change in terms of volumetric water allocation.

The quaternary catchments W12D, W12E, W12G, W12H and W12J lost water allocations, whereas, W12A, W12B, W12C and W12F gained water during the CL project; the greatest loser was W12H and the highest gain was W12F (Table 12). It is important to note that figures presented in Table 12 do not include the water set aside and the surplus water. Their exclusion is motivated by the fact that they are not allocated against any particular quaternary catchment.

Table 12: Volumetric information of water allocation per quaternary catchment, before and after CL, as well as losses and gains within the quaternary catchments

Quaternary catchment	Before CL (Mm^3/a)	After CL (Mm^3/a)	Losses (Mm^3/a)	Gains (Mm^3/a)
W12A	1.817	1.848	-	0.031
W12B	7.963	18.229	-	10.266
W12C	3.028	5.876	-	2.848
W12D	148.142	92.272	55.87	-
W12E	10.023	8.417	1.606	-
W12F	26.579	114.913	-	88.334
W12G	15.52	10.735	4.785	-
W12H	117.601	16.413	101.188	-
W12J	53.159	46.473	6.686	-
Total	**383.832**	**315.176**	**170.135**	**101.479**

4.6. Equity in access to water resources before and after CL

4.6.1. System yield versus sectoral allocation

There were discrepancies when comparing the ELU volumes recorded by the DWAF (2008b) and the preliminary allocation schedule (Table 13). The Mhlathuze water allocation plan (MWAP) (DWAF, 2008b) records that the existing water use before CL was

334.577 Mm^3/a; given the catchment yield of 262 Mm^3/a plus 10.9 Mm^3/a of water (SFRAs VR), the total available water in the catchment became 272.9 Mm^3/a. Thus, the over-allocation of water in the Mhlathuze catchment accounted to about 61.77 Mm^3/a, which is approximately 22% over-allocation. According to the information sourced from the preliminary allocation schedule, the ELU was 373.3 Mm^3/a, which accounted for 37% of water over-allocation; whereas a report by Seetal (2013) indicated that the ELU for the study area was 393.51 Mm^3/a.

The reason for this discrepancy may be attributed to the underestimation of the ELU for water use sectors and exclusion of NWA licences by the DWAF (2008b). This is observed when comparing the ELU as presented on the MWAP DWAF (2008b) with the information furnished in the allocation schedules for ELU and NWA licences. The ELU value for Seetal (2013) was slightly higher than that of the preliminary allocation schedule, but still comparable. The reason for this difference may be that Seetal (2013) presented the ELU value in a form of total flow volumetric reduction, whereas, in this study the low flow volumetric reduction was used.

The total flow volumetric reduction relates to the actual water used by afforestation and is always higher than the low flow volumetric reduction, which relates to the impact that afforestation has on the yield of the system. This study made use of ELU entitlements and existing licence records as provided for in the allocation schedules, and the information on the allocation schedules was reliable since it was subjected to rigorous inspection and verification by both the Department of Water and Sanitation and the affected stakeholders before publishing the preliminary and final allocation schedules on the Government Gazette. Thus, the ELU sourced from the preliminary allocation schedule was added together with the volume of allocation through NWA licences and compared against the yield of the catchment.

Table 13: Existing lawful water use information (DWAF, 2008b) and preliminary allocation schedule

Sectors	MWAP volume (Mm^3/a)	Preliminary schedule volume (Mm^3/a)	NWA licences volume (Mm^3/a)
Irrigation	175.042	191.049	4.180
Mining, Industrial and Urban	159.535	175.988	0
SFRAs (Included in the model set-up (SFRAs VR = 10.9 Mm^3/a)	-	(12.624 - 10.9 Mm^3/a) 1.724	0.368
Total	**334.6**	**369.3**	**4.6**
	334.6	**373.3**	

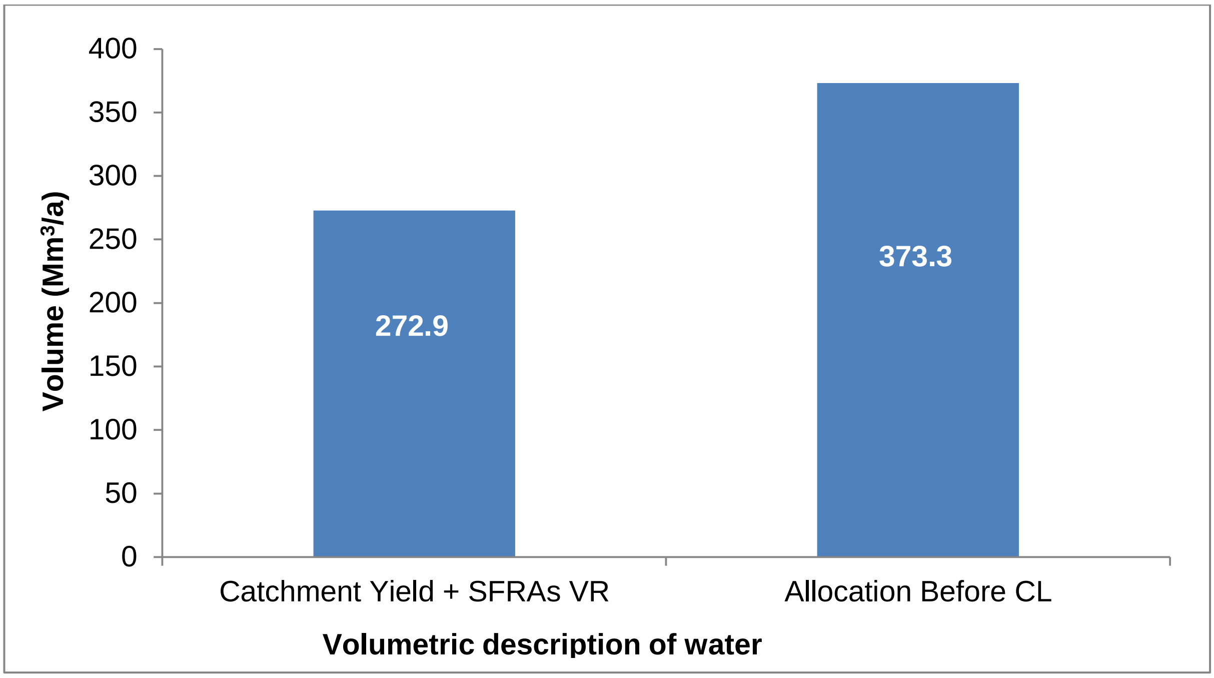

Figure 11: Mhlathuze catchment yield + SFRAs VR versus water allocation before CL

The historic allocation of water in the Mhlathuze catchment was higher than the available total water (yield + SFRAs VR) of the catchment (Figure 11). Although several studies including the DWAF (2008b) indicated that over-allocation was on paper, meaning that the DWS had recorded a higher volume in the WARMS system compared to the actual use, the situation was undesirable and needed to be corrected. It was for this reason that compulsory licensing was constituted in the Mhlathuze catchment. The allocation of about

100.4 Mm^3/a, approximately 37%, was over and above what the catchment could yield thus putting the catchment under water stress (Figure 11).

4.6.2. System yield and Thukela transfer scheme versus sectoral water allocation

According to the DWAF (2008b), a volume of 62 Mm^3 was transferred annually via the Thukela transfer scheme to the Mhlathuze system to augment available water to meet competing demands in the catchment. Due to the cost associated with conveyance systems of the transferred water, the Mhlathuze catchment CL planning committee recommended that the water from the transfer scheme be allocated to the industrial sector, since this sector was deemed capable of carrying the higher costs. The additional flow of water released from the scheme increased the allocable water from 272.9 Mm^3/a in the catchment to 334.9 Mm^3/a; an 18.5% increase in flow. The volumetric reduction from afforestation activities amounted to 10.9 Mm^3/a of water, which was added as input during the yield model set-up. It must be noted that the water allocation volume of 325.9 Mm^3/a included the 10.7 Mm^3/a of water that was set aside for future sectoral demands and developments. Table 14 presents a breakdown of sectoral water allocation and the water set aside.

Table 14: Actual water allocated to each water sector

Sector	Actual allocation (Mm^3/a)
Irrigation (ELU)	122.219
Urban/Industrial	148.667
Afforestation	12.070
New users	32.2
Water set aside	10.7
Total	**325.9**

The 32.2 Mm^3/a of water allocated to "new users" comprised of 7.174 Mm^3/a for agriculture (irrigation), 24.259 Mm^3/a for urban/industrial (domestic/industry) and 0.789 for afforestation (Table 14). The actual allocated volume to "new users" was 10.2 Mm^3/a less than the volume recommended for allocation by DWAF (2008b). This might be one of the reasons for the availability of surplus water in the catchment.

Not all of the available water was allocated in Mhlathuze catchment. Closer observation of Figure 12 shows that when the actual allocated water is subtracted from the available water a surplus of 9 Mm^3/a remained. This is indicative that the catchment is balanced and still has a fraction of allocable water.

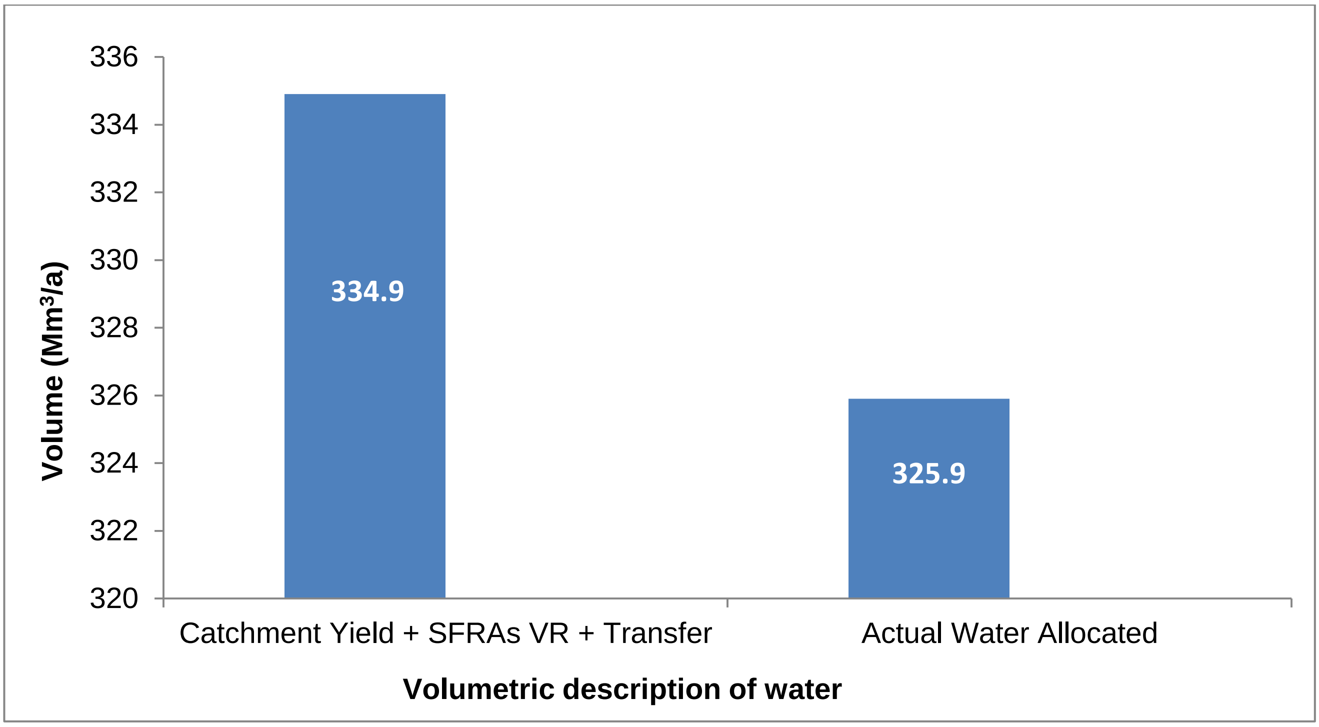

Figure 12: Mhlathuze catchment yield + SFRAs VR + Thukela transfer scheme versus CL water allocation after CL

4.6.3. Water allocation versus equity targets for Mhlathuze catchment

In order to establish whether CL in Mhlathuze catchment did achieve the minimum equity targets or not, analysis of agricultural water allocation to the HDI group against the targets was important. Figure 13 compares the agricultural water allocated to the HDI group against the minimum target of 10% of agricultural water in the hands of black people at the time of CL implementation. Thirty percent of agricultural (irrigation) water was allocated to the HDI group during the implementation of CL (Figure 13). These results indicate that the minimum target of 10% was not only achieved but exceeded, reaching 30%.

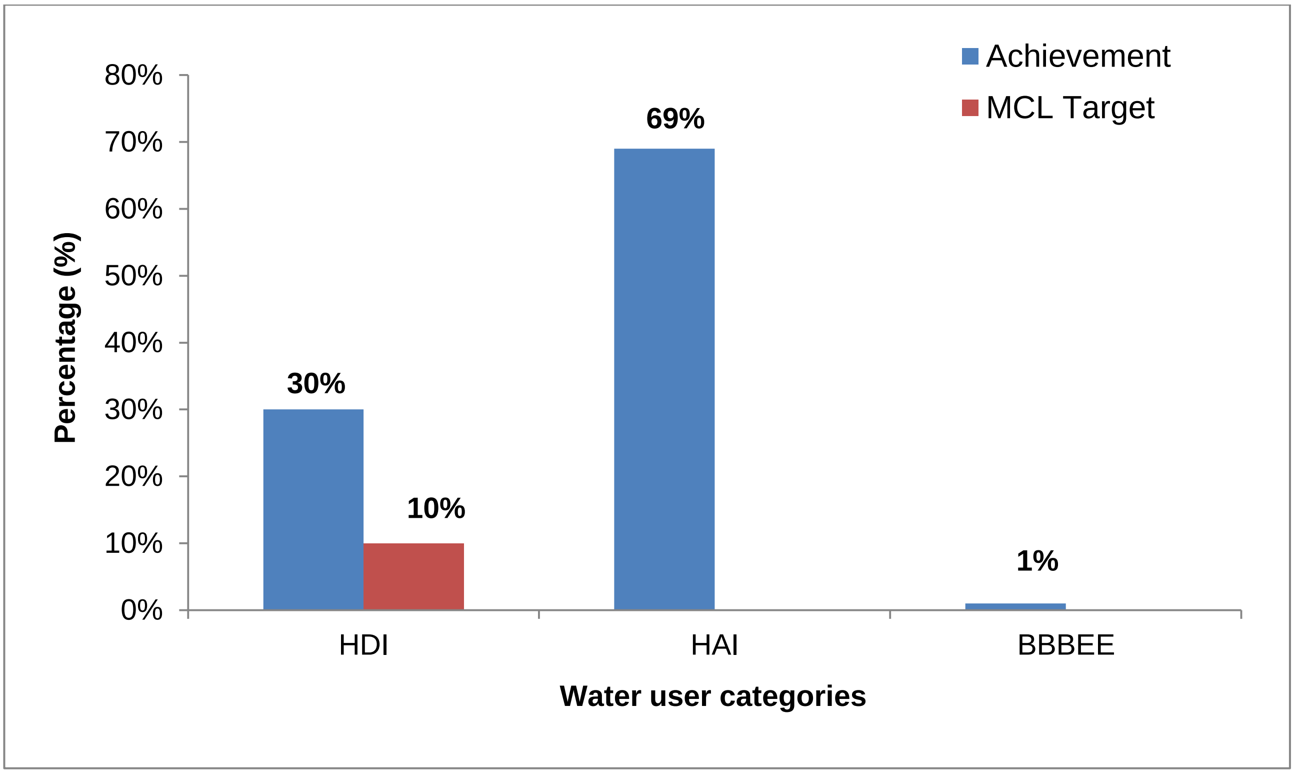

Figure 13: Water allocation for agriculture between HDI, HAI and BBBEE categories versus 10% target

Chapter 5: Discussion

Kidd (2016) and Seetal (2013) recorded a total number of 670 WULAs that were received during a call for CL in Mhlathuze catchment. This figure is 137 applications less than those recorded on the allocation schedules. The possible reason for the discrepancy between the figure used in this study of 807 and the 670 applications may be due to different methods used when interpreting the allocation schedules. It must be noted that some applicants lodged two or more individual WUL applications from within the same property and the record of these applications was captured as such on the allocation schedules. The possibility is that the two reports mentioned above might have combined and recorded WUL applications that fell within a single property as one WUL application. However, in this study, all applications regardless of whether they fell within a single property or not were captured as individual WUL applications following the format of the allocation schedules. The overall assessment show a low turn-up of applicants from the HDI group who applied for the water use licences during the CL process. This may be attributed to lack of sufficient land by HDIs to practice water-based economic activities as opposed to their HAI counterparts who are deemed to have fairly large properties (Khapayi and Celliers, 2016). Although this claim has not been investigated in the case of Mhlathuze catchment, the total hectarage of afforestation and agricultural activities authorised against the WUL authorisations for HDIs may be giving an indication of the land ownership situation. There were a number of on-going cases of land claims during CL implementation, which could be inferred to as another possible reason that land may have been a limiting factor to the HDI group from coming forward in substantial numbers to apply for WULs with significant volumes proportional to their land size (DWAF, 2008b).

The total hectares allocated to SFRAs after CL (57 028.2 ha) are lower than those recommended by the DWAF (2008b) (67 709 ha). However the volumetric reductions correspond with each other (DWAF 2008b). The stream flow volumetric reduction recommended by DWAF (2008b) was 12.8 Mm^3/a and that of the actual allocation after CL was 12.859 Mm^3/a. The differences between the recommended hectares by DWAF (2008b) and the actual allocation were controlled by the number of WUL applications received, meaning that WUL applications received accounted for less hectares compared to those recommended by the DWAF (2008b). It is also important to note that although the actual hectares allocated were lower, the resulting volumetric reduction was slightly higher than recommended; this is because the actual allocation by the DWS was done based on the species with highest water use (*Eucalyptus*) when processing WUL applications, this was confirmed by Hadebe (2018). On the other hand, the DWAF (2008b) estimated afforestation water requirements based on three types of trees that have different water requirements; *Eucalyptus*, conifers and wattle. Conifers and wattle plantations' water requirements are relatively lower than that of *Eucalyptus* (Gush *et al.* 2002), which might have influenced the volumetric reduction.

Some losses from the original sectoral allocation have been observed after the process of compulsory licensing, these were expected since two main objectives of Mhlathuze catchment CL were to address the problem of water over-allocation and inequity in access to water resources. Thus, some allocated water had to be curtailed and returned back to the system in order to meet the objectives in question. It is also important to note that SFRA sector has also lost, although an insignificant volume of water, but one of the adopted rules for water reallocation in the Mhlathuze catchment was that SFRAs ELU and new applications would be given 100% of their applications (DWAF 2008b); although the actual reason for this loss is not known, human error cannot be ruled out.

The overall results show a poor performance of the Mhlathuze catchment CL in terms of meeting the national water allocation targets. This might be attributed to the need to address over-allocation first and only then the equity aspect. This meant that any water saving achieved through the curtailment process was first directed towards the system balance, before any other objective could be considered. However, there is still a chance that if the volume of 10.7 Mm^3/a of water set aside and possibly the surplus water could be allocated towards promoting equitable access to water resources as envisaged, the current situation may improve slightly.

Knowledge of the demographic change in relation to population influx or outflux is important for proper management of water resources in catchments. The Mhlathuze catchment is no exception to this, but due to lack of relevant information in this catchment, the demographic change at catchment level could not be assessed. However, the assessment done focused on sectoral entitlement holders and it showed that CL in the Mhlathuze catchment impacted on the sectoral demography of the area both positively and negatively; i.e. CL caused an increase and a decrease in the number of entitlement holders in different water use sectors. In addition to this, CL also caused increases and decreases in the volumetric allocations of water in the quaternary catchments of the study area.

The results of this study show that the 10% and 30% targets set for MCCL were achieved simultaneously during implementation of compulsory licensing. These findings are important, especially in a country striving to reform critical aspects of public contention, which include land and water. Tools and instruments used for these reform initiatives need to be tried and tested on the ground before their full adoption. The positive findings of this study in relation to CL performance against the minimum equity targets for Mhlathuze catchment may encourage managers to fast-track implementation of CL to qualifying catchments and thereby maximise benefits accruing from use of this instrument. The findings of this study may also improve public trust in government when they perceive that government is implementing initiatives towards transformation.

Chapter 6: Conclusions and recommendations

6.1. Conclusions

6.1.1. Key findings

(i) The proportions of WUL applications received during a call for CL from HDI, HAI and BBBEE groups were 43%, 42% and 15%, respectively. These analyses relate to the applications for all sectors; agriculture (irrigation), SFRAs (forestry), industry and domestic. The ratios of WUL applications received from specific economic sectors representing the HDI, HAI and BBBEE groups were 37%, 46% and 17%, respectively. The fair representation of the all sectors category was boosted by the domestic sector, which falls within the HDI category. The all sectors category is comprised of water service providers and municipalities that are mostly state organs and do not represent individuals or black companies. As a result, analyses based on this broader category were not considered for judgement of fair uptake of water between the HDI and HAI groups. The relatively low uptake in terms of the economic sector (37% for HDIs compared to 46% for HAIs) was indicative that the HDI group, although a majority in the study area, may be lacking interest or resources such as land to venture into water-based activities.

(ii) It was found that afforestation in the study area covered an area of 57 028.2 ha, which accounted for a 12.859 Mm^3/a volumetric reduction in the yield of the catchment; this indicates that each hectare of *Eucalyptus* sp. in the area has an impact of approximately 225.5 m^3 of water per annum to the catchment yield. The value of the volumetric reduction was important in determining the volumetric allocation of water between the HDI, HAI and BBBEE categories. This volumetric reduction value was also used in comparing the volumetric allocation between the sectors.

(iii) The findings revealed that the domestic and agricultural sectors were the largest users of water in the Mhlathuze catchment, with usage reaching up to 45% and 39%, respectively. These were followed by industry and SFRAs with 6% and 4%, respectively. Water set aside and surplus water accounted for 3% each making a total of 6% of the volume of the total available water. It was also found that sectoral water allocation shrunk by approximately 18% after CL. The biggest sectors to lose water allocation were agriculture (irrigation) by 65.836 Mm^3/a and industry 10.168 Mm^3/a. The sector that lost the least was SFRAs with a 0.133 Mm^3/a reduction. The domestic sector made a gain of 7.106 Mm^3/a and the total volume of water lost became 69.032 Mm^3/a (18%).

(iv) The results revealed that CL in the Mhlathuze catchment impacted on the sectoral demography of the area both positively and negatively; i.e. CL caused an increase in the number of entitlement holders but decreases and increases in the dominance of different water use sectors. Agriculture increased by 13 entitlement holders, increasing its dominance over other sectors by 29%, and the SFRAs sector increased by 165 entitlements holders and gained dominance by 35%. The industry and domestic sectors increased by 5 and 2 entitlement holders, but decreased in dominance by 2% and 4%, respectively.

(v) It was found that volumetric allocation of water between the HDI and HAI groups before and after CL was skewed, with higher allocation favouring the HAI group. The interesting finding is that even after CL the difference in allocated volumes between the two groups still remains the same i.e. 48% before and after CL. The possible reason for this might be the unanswered question of land ownership by the HDI group; this is likely because the process of land reform was not concluded when CL was implemented.

(vi) The CL process simultaneously achieved the targets of 10% and 30% of irrigation water in the hands of black people during implementation. These targets were achieved simultaneously in the year 2015 when the CL process was concluded, thereby achieving the 10% and 30% targets simultaneously.

(vii) When comparing the CL achievement against the national water allocation targets, considering the economic sectors, it was found that 35% of water was still in the HAI category and only 12% in black hands, with the difference of the available water shared between water set aside and surplus water. This achievement represents poor progress in terms of equity. However, acknowledging that the main reason for undertaking CL in the Mhlathuze catchment was to bring balance to the system, the achievement of 12% is relatively acceptable.

(viii) The results also revealed that balance in the system was achieved and a surplus of 9 Mm^3/a of water secured. It must however be noted that the major solution to over-allocation was brought by the transfer of 62 Mm^3/a of water from the Thukela interbasin transfer scheme to the Mhlathuze catchment, and curtailment alone would have left a number of sectors without sufficient water.

6.1.2. Limitations of the research

There were a number of aspects that may have been important to include in this report but a lack of relevant data and supporting information hindered their inclusion to this study. These aspects are discussed in sections below:

Promotion of gender equality

The national water allocation target relating to equity in access to water resources in relation to females could not be assessed in this study due to lack of relevant information on male and female applicants. Although gender equality might have been promoted during implementation of CL, it cannot be discussed with confidence in this report due to lack of sufficient data to enable proper analysis and presentation of quantitative results.

Addressing the plight of the poor

The assessment of the plight of the poor can be done through the interrogation of data representing the benefits accruing from the use of water resource. Obtaining the data would require intensive field work and interaction with the water users, including direct and indirect beneficiaries of the use. This exercise could not be achieved in this study, since it is too lengthy and extensive and is suitable to be an area of research on its own.

6.2. Recommendations

6.2.1. Future research

Equity in access to water resources covers three aspects, including the benefits that accrues from the use of water resources, an aspect that has not been researched on in South Africa. It is thus, recommended that a study at the same level as this be undertaken to assess the impact of CL in achieving equity in access to benefits that accrue from the use of water resources. The proposed future research may focus on any catchment where compulsory licensing has already been undertaken, which may include Mhlathuze or Jan Dissels catchment.

Future CL projects

(i) The domestic sector and government departments should not be grouped under the HDI category when reallocating water for the purpose of achieving redress and equity. The domestic sector and government departments should be treated as neutral during the analysis.

(ii) In order to effectively implement compulsory licensing projects in the catchments of South Africa land and water reform programmes should be properly aligned.

References

Amnesty International (2009). Troubled Waters - Palestinians denied fair access to water. Retrieved from: https://www.amnestyusa.org/pdf/mde150272009en.pdf (Accessed on 21/10/ 2017).

Arjoon, D.; Tilmant, A.; Herrmann, M., (2016). Sharing water and benefits in transboundary river basins. *Hydrology and Earth System Sciences, (20): 2135–2150.*

Broad-Based Black Economic Empowerment Act (BBBEE) (2003). BBBEE Act, 2003 (Act 53 of 2003) as amended by Act No. 46 of 2016. *Government Gazette No. 38126, 24 October 2014.*

Calow, R.; Mason, N. (2014). The real water crisis: inequality in a fast changing world. Retrieved from:
https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8953.pdf (Accessed on 16 March 2019).

Choudhury, E.; Islam, S. (2015). Nature of Transboundary Water Conflicts: Issues of Complexity and the Enabling Conditions for Negotiated Cooperation. *Journal of Contemporary Water Research & Education Issue, (155): 43-52.*

DTI (2013). BBBEE Codes of Good Practices, Department of Trade and Industry Government *Gazette No. 36928, 11 October 2013: Notice No. 1019 of 2013. Repubic of South Africa.*

DEW (2018). Water Allocation Plans in the SA Murray-Darling Basin region, Government of South Australia, Department for Environment and Water. Retrieved from: http://www.naturalresources.sa.gov.au/samurraydarlingbasin/water/water-allocation-plans (Accessed on 05/06/ 2018).

DWA (2006). A Guide to Water Allocation Reform and Compulsory Licensing. Department of Water Affairs, Republic of South Africa.

DWAF (1997). *White Paper on a National Water Policy for South Africa*, Department of Water Affairs and Forestry, Pretoria: South African Government.

DWAF (2000). Strategic Environmental Assessment, Chapter two: Characteristics of the Catchment. Department of Water Affairs and Forestry, Republic of South Africa

DWAF (2005a). Mhlathuze Catchment Assessment Report. Water use in the Mhlathuze catchment towards compulsory licensing, Department of Water Affairs and Forestry.

DWAF (2005b). Olifants/Doorn WMA Internal Strategic Perspective. Prepared for the Department of Water Affairs and Forestry by Ninham Shand Consulting Services.

DWAF (2008a). Strategy: Water Allocation Reform. Chief Directorate: Water Use. Department of Water Affairs and Forestry.

DWAF (2008b). Development of a Water Allocation Plan to Guide Compulsory Licensing in the Mhlathuze Catchment, prepared for the Department of Water Affairs and Forestry. Draft Water Allocation Plan, Project Number: WFSP/WRM/CON6009, March 2008, Final Version.

European Parliament (2016). Water in the Israeli-Palestinian conflict. Retrieved from http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573916/EPRS_BRI%282016%29573916_EN.pdf (Accessed on 05/07/2017).

Food and Agriculture Organization of the United Nations (FAO) (2004). *Land and water - the rights interface*. Rome: FAO legislative study 84.
Retrieved from http://www.fao.org/docrep/007/y5692e/y5692e00.htm#Contents (Accessed on 15/07/2017).

Gush, M.B, Scott, D.F., Jewitt, G.P.W., Schulze, R.E., Lumsden, T.G., Hallowes, L.A., Görgens, A. H. M. (2002). Estimation of stream flow reductions resulting from commercial afforestation in South Africa, WRC Report No.TT 173/02, Water Research Commission, Pretoria.

Hadebe, X. (2018). Conversation with John Phangisa, 14 August 2018.

InformAge (2012). Compulsory Licensing pilot study in the Jan Dissels Catchment, Clan William. Retrieved from: http://informage.co.za/index.php/using-joomla/extensions/templates/atomic/home-page-atomic/82-compulsory-water-use-licensing/93-project-2wdqewqddeedwdwdwdwdwd (Accessed on 01/07/2017).

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.
Retrieved from: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0301-603X2016000100003 (Accessed on 31/10/ 2018).

Kidd, M. (2016). Compulsory licensing under South Africa's National Water Act. *Journal* of *Water International,* 41(2): 916-927.
https://www.tandfonline.com/doi/abs/10.1080/02508060.2016.1214776 (Accessed on 01/07/2017).

Kings, S. (2016). Southern Africa can avoid climate strife with water agreements. *Mail & Guardian*, 5 December 2016.Retrieved from:https://mg.co.za/article/2016-12-05-00-southern-africa-can-avoid-climate-strife-with-water-agreements (Accessed on 07/07/ 2018).

McCartney, M.P., Lankford, B. A., Mahoo, H. (2007). Agricultural water management in a water stressed catchment: Lessons from the RIPARWIN Project.
Retrieved from:
https://books.google.co.za/books?id=WHzMBAAAQBAJ&pg=PA1&lpg=PA1&dq=stressed+catchment&source=bl&ots=YCDx3VMygg&sig=uJdvj4WaVCMLnAF0HatWaRnQu4&hl=en&sa=X&ved=0ahUKEwjSpMKt8DbAhVI1xQKHVbDCYQQ6AEIRTAF#v=onepage&q=stressed%20catchment&f=false (Accessed on 07/06/ 2018).

Molobela, I.P and Sinha, P. (2011). Management of water resources in South Africa: A review. *African Journal of Environmental Science and Technology,* 5 (12): 993-1002.

Mondi Zimele Programme summary report (2013). Community forestry business on the way up. Retrieved from:

http://www.mondizimele.co.za/docs/Programme%20Summary%20Report%202013.pdf (Accessed on 31/10/ 2018).

Movik, S. (2009). The Dynamics and Discourses of Water Allocation Reform in South Africa, STEPS Working Paper 21, Brighton: STEPS Centre.
Retrieved from http://steps-centre.org/wp-content/uploads/Reform_web_version.pdf (Accessed on 27/06/2017).

NWA (1998). National Water Act, 1998 (No. 36 of 1998). *Government Gazette Vol. 398. 26 August 1998*. Office of the President, Cape Town.

NWAA (1999). National Water Amendment Act (NWAA), 1999 (Act no. 45 of 1999). *Government Gazette* No. 20706, Parliament of the Republic of South Africa, Cape Town.

NWPWP (1997). White Paper on a National Water Policy for South Africa (WPWNWP), 1997, Department of Water Affairs, *Government of South Africa.*

NWRS (2004). *The National Water Resource Strategy 1st edition.* Pretoria, Government of South Africa.

NWRS2 (2013). *The National Water Resource Strategy 2nd edition.* Pretoria, Government of South Africa.

Nxesi, T.W. (2015). *Socio-economic impact of Land Restitution in the Ehlanzeni District, Mpumalanga.* Masters Dissertation (MSc), University of Witwatersrand.

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

PPR (2001*). Pertaining to the Preferential Procurement Policy Framework Act: No 5 of 2000,* Preferential Procurement Regulations (PPR).
Retrieved from:http://www.treasury.gov.za/legislation/pfma/supplychain/gazette_22549.pdf (Accessed on 20/10/2017).

Pugh, D. (2017). Clearing our rainfall away. NEFA background paper. Retrieved from: https://d3n8a8pro7vhmx.cloudfront.net/ncec/pages/50/attachments/original/1486958794/NEFA_BP_Clearing_Our_Rainfall_Away.pdf?1486958794 (Accessed on 21 March 2019).

Quibell, G., Stein, R., Seetal, A., Ncapayi N. (2010). Transforming Legal Access to Water to Redress Social Inequity and Economic Inefficiency. In: Schreiner B., Hassan R. (eds) Transforming Water Management in South Africa. Global Issues in Water Policy, volume 2. Springer, Dordrecht.

Rasul G, Chowdhury AKMJU (2010) Equity and Social Justice in Water Resource Management in Bangladesh. International Institute for Environment and Development.. The Gate Keeper Series, IIED, 146. Retrieved from: http://pubs.iied.org/pdfs/14600IIED.pdf (Accessed on 15 March 2019).

Roa-García, M.C. 2014. Equity, efficiency and sustainability in water allocation in the Andes: Trade-offs in a full world. *Water Alternatives,* 7(2): 298-319.

Seetal, A. (2012). Compulsory licensing case studies: First Lessons. Unpublished presentation paper at: *International Conference on Fresh Water Governance for Sustainable Development*, November 4-7 2012, Drakensberg Sports Resort, KwaZulu-Natal, South Africa.

Seetal, A. (2013). A Snapshot: Issues and Perspectives on Water & Agriculture in South Africa. Unpublished presentation paper made at: *International Conference on the Political Economy of Agricultural Policy in Africa*, March 18 – 20, 2013, Roodevallei, Pretoria, South Africa. Retrieved from: https://www.future-agricultures.org/wp-content/uploads/pdf-archive/PEAPA%20conference%20-%20Session%20PE%20of%20Water%20-%2001%20Seetal.pdf (Accessed on 10/10/ 2018).

Shilombolen, A. (2006). Equitable water allocation: A case between South Africa and Namibia on the Lower Orange River. Retrieved from: http://www.orangesenqurak.com/UserFiles/File/OtherV2/Equitable%20Water%20Allocation%20SA-NA%20Shilomboleni%202006.pdf (Accessed on 03/06/2017).

Skosana, S.M. (2018). Conversation with John Phangisa, 08 November 2018.

Southern African Development Community (SADC) (2000). Revised Protocol on shared watercourses in the Southern African Development Community (SADC*).*Signed in Windhoek on 7 August 2000. SADC, Gaborone.

South African Human Rights Commission (SAHRC) (2014). Report on the Right to Access Sufficient Water and Decent Sanitation in South Africa. Retrieved from: https://www.sahrc.org.za/home/21/files/FINAL%204th%20Proof%204%20March%20-%20Water%20%20Sanitation%20low%20res%20(2).pdf (Accessed on 02/07/2017).

Speed, R., Li Y., Le Quesne, T., Pegram, G., Zhiwei, Z. (2013). Basin Water Allocation Planning. Principles, procedures and approaches for basin allocation planning, UNESCO, Paris.

Stevens, C., Ntlama, N. (2016). An overview of South Africa's institutional framework in promoting women's right to development Retrieved. *Law Democracy & Development*, 20(3): 40 – 60. Retrieved from: http://www.scielo.org.za/pdf/ldd/v20/04.pdf (Accessed on 25/10/ 2017).

The Constitution of the Republic of South Africa (1996). The Constitution of the Republic of South Africa, Act 108 of 1996. *The Parliament of South Africa, Cape Town.*

Walker, C., Dubb, A. (2013). Fact Check 1: The Distribution of Land in South Africa: An Overview. Retrieved from: http://www.plaas.org.za/plaas-publication/FC01 (Accessed on 07/07/ 2018).

Wilson, A.J. (2001). Draft Usutu to Mhlathuze Situational Assessment. Retrieved from: http://www.dwaf.gov.za/Documents/Other/CMA/usutu/UsutuAppendixA2.pdf (Accessed on 12/07/2017).

NWPWP (1997). White Paper on a National Water Policy for South Africa (WPWNWP), 1997, Department of Water Affairs, *Government of South Africa.*