CHAPTER ONE

INTRODUCTION

1.1 Background

This research explored Indigenous Knowledge (IK) related to water management by the Toka Leya people of Chief Sekute of Kazungula District, Southern Province, Zambia. The research aimed at highlighting how IK of the Toka Leya people and Integrated Water Resources Management (IWRM) could be used as complimentary approaches to achieve sustainable water resources management in the study area.

Water forms an integral part of all forms of life on earth. It is useful in all dimensions of people's livelihood. It is, however, in the recent past that sustainable water resources management has taken center stage as it has been realized that other prioritised sectors such as agriculture, mining and tourism all depend on water. Developing countries are seeking to industrialise and develop to the state of developed nations. This has been through investing in macro-economic sectors such as tourism, mining and agriculture. Water is inseparable in all these activities and as such it must be managed sustainably. There is, instead, an inverse relationship between development and the state of the water resource base. Development strides in many developing nations like Zambia have been achieved at the price of the destruction of natural resources such as forests. There has also been an advent of localised pollution of surface and ground water resources around industrial centers. Vast tracks of land are cleared to pave way for mining activities thereby depriving animals and humans of their natural habitat and in so doing, resulting in ecosystem imbalance. Humans are the perpetrators and beneficiaries of this development while

other users such as plant and animal species suffer the effect of diminished resources for their survival.

The climate change [variance] phenomenon brought about by human activities has also impacted on water resources. Higher global temperatures will impact most immediately on water resources, on both the supply and demand side. Higher temperatures will make rainfall more variable and more intense, while higher evaporation and associated impacts on vegetation are likely to result in more extreme river flows than before (Lenton and Muller, 2009).

Zambia is surrounded by 8 neighbouring countries and shares water bodies with six of them. The Zambezi and Congo River Basins cover Zambia, with the former draining three quarters and the latter quarter of the country. The main water bodies are within the Zambezi and Congo watersheds, and these include the Zambezi, Kafue, Luangwa, Luapula and Chambeshi rivers as well as lakes Tanganyika, Bangweulu, Mweru and Mweru wa-Ntipa including the man-made lakes of Kariba and Itezhi- Tezhi (Nyambe and Feilberg, 2009). The quality of water in Zambia is generally good. However, economic activities such as mining and industries on the Copperbelt and Lusaka respectively have resulted in localised pollution along the Kafue River.

Zambia's planners and policy makers developed 'Vision 2030' to plan the development of Zambia. The underpinning vision of 'Vision 2030' is 'A prosperous middle-income nation by 2030' (The Government of the Republic of Zambia, 2006). It was recognized that water plays a cardinal role in socio-economic development and is fundamental for the sustaining all forms of life. Zambia faces many challenges with regard to sustainable water management. One such challenge is the attainment of the Millennium Development Goal (MDG) number 7, target 10. This goal states; To halve, by 2015, the proportion of the population without sustainable access

to safe drinking water and basic sanitation. As of 2006, 40% of Zambians did not have access to improved water source while 36.1% did not have access to improved sanitation (Zambia MDG progress report, 2008). The continued increase in urban population leading to sprawling unplanned settlements that have led to adding more stress on existing water and sanitation infrastructure negates the achievement of MDG Target 10. There has not been corresponding increase of water and sanitation provision infrastructure and services to the growing urban population.

Zambia has also experienced water resources challenges in the form of drought, water logging and flooding. Such natural disasters have reversed gains made in achieving safe water supply and good sanitation for the citizens. To mitigate this, The National Adaptation Programme on Action (NAPA) was developed by the Line Ministries and other environmental protection stakeholders to steer the country forward in adapting and ameliorating problems related to climate change. The nation is divided into three Agro Ecological and Crop regions; Region I and II will experience lower average rainfall while Region III will experience an increase in rainfall (Nyambe and Feilberg, 2009.). This makes Region I and II vulnerable to water stress and therefore, it is cardinal to sustainably manage available surface and ground water resources to cushion the impact of lower rainfall.

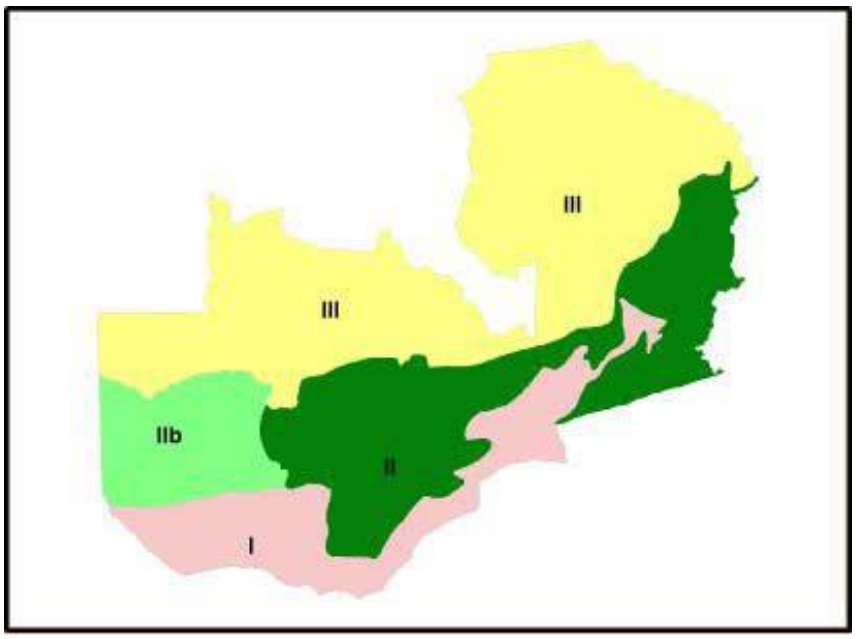

Figure 1: Map showing the Agro-Ecological regions of Zambia (Source: FAO)

The revision of the Zambia's 1994 National Water Policy was as a result of the realisation of the need to improve the prevailing approaches in the management of water resources. The 2010 National Water policy encompasses an integrated approach to water management focusing on planning, development, management and utilisation of water. Zambia's vision in relation to water resource development and management is 'to harness water resources for the efficient and sustainable utilisation of this natural resource to enhance economic efficiency, production and reduce poverty' (National Water Policy, 2010). The policy provides a framework that recognises the importance of involving different stakeholders with the inclusion among others, Traditional Leaders, Research institutions, Line Ministries in charge of natural resource management and the National Assembly. This has brought the principles of IWRM into water management in the nation unlike previous efforts which led to a segmented approach to water management thus not achieving desired results in the management of the resource.

IWRM has been defined by the Global Water Partnership as, "A process that promotes coordinated development and management of water, land and other related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP Toolbox, 2001.)

IWRM as a practice emerged out of concern for the depleting fresh water resources in the world due to the growth in demand for water while the resource is not "growing" to meet the demand. Management of water goes beyond ensuring adequate water supply and sanitation. Water resources management encompasses a wide range of activities, from the development of infrastructure and the allocation of water resource to financing arrangements and the implementation of incentives for the efficient use and protection of water (Lenton and Muller, 2009).

IWRM is based on the premise that sustainable and efficient management of water resources must not be undertaken in sectoral approach but rather engage all stakeholders paying attention to all users, including the ecosystem. This is because all life processes and activities of both humans and other living organisms depend on water. There is a need to take into account the physical or natural systems connected with water such as land, and other factors such as land use activities that have a direct impact on both surface and ground water resources. Sustainable land use practices translate in sustainable water resource management while the opposite will result in pollution and depletion of both surface and ground water resources. A balance between three important outcomes in IWRM is sought and these are, economic efficiency social equity and environmental sustainability.

The Rio-Dublin principles set the framework through which IWRM is to be achieved. In summary the principles are:

- The promotion of a participatory approach of all stakeholders in managing water resources.
- Women's involvement in the decision making in water resources.
- The recognition of water as a finite and vulnerable resource.
- Recognising water as an economic good.

These principles are comparable to historical perception of water resources of indigenous people of Zambia as will be shown in the latter part of the dissertation.

In this research the working definition for Indigenous people is;

> "Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal system" (United Nations, 2004. Pg.2)

IK is knowledge that has been accumulated through a long series of observations transmitted orally from generation to generation. Zambia is inhabited by the Bantu people who believe in the

need for harmony between humans and nature. IK is made up of sets of codes of conduct, taboos, rituals and customs that regulate behavior (Schapera, 1964). Indigenous practices do not call for the perception of natural resources as commodities to be sold and used to gain profit. A good example is the indigenous view of land as a resource, it is viewed as a substance endowed with sacred meanings, embedded in social relations and fundamental to the definition of people's existence and identity (Shetton, 1993). Natural resources such as land never belong to one individual but rather are under the custodianship of families for use and to be passed on. In Zambian ethnic groups, it is widespread to have clans or totems based on animals. This exemplifies an attachment of man to members of the environment and forms part of their social and spiritual life leading to conservation practices. Members of each clan identify themselves with the particular clan and this transcends family ties thus expressing the family spirit.

Indigenous Knowledge is transmitted through song, dance, games, myths, proverbs and kindred sayings. An examination of this intangible heritage reveals vast natural resource management knowledge that can be documented and harnessed for developmental processes. A proverb highlighting the fact that indigenous people believe in co-dependence of human and nature is found among the Tonga and it states that, "a goat gives birth to her young near people so that they can chase the flies away." (Reynolds, 1993). This means that humans and animals depend on each other for survival. Although human beings are superior, they need to take into account their dependence on nature for survival. Seasonal fishing and hunting bans were imposed as a way to preserve the aquatic species and wildlife. Some areas were termed as sacred grounds believed to be occupied by spirits and this ensured no activity in or around the area thus ensuring both forest and biodiversity conservation (Berkes, Colding and Folke, 2000)

Rituals, ceremonies and taboos make up the social fabric through which natural resources are conserved and these strongly governed human behavior with regard to nature. It is believed that for nature to be in favour of man there is need to abide by the code of conduct, rituals and taboos associated with it (Rodriguez-Navaro, 2004). These social and religious sanctions of indigenous life are a means of conservation and resource management.

1.2 STATEMENT OF THE PROBLEM

The Toka Leya make up part of the 73 ethnic groups in Zambia and are found in the Southern Province. This study concentrated on the Toka Leya of Chief Sekute's Chiefdom. The Toka Leya have a rich cultural heritage related to water that should be documented for posterity. There had been many water related projects instituted in the study area that had resulted into the drilling of boreholes, reinforcing of existing water wells and the construction of dams aimed at alleviating water poverty.

There had been minimal inclusion, if at all of Toka Leya IK during the planning and implementation of the water projects in the study area. This sidelining of the Toka Leya IK can be attributed to, the perception that the indigenous people have no knowledge of sustainable resource management, a lack of research into IK and Toka Leya of Sekute not using their IK to its full efficacy in dealing with the challenges of water resources. This situation can result in the loss of such IK. It is against this background that this study sought to document IK of the Toka Leya in water resources management.

The general research question addressed by this study was;

1) How can IK and IWRM be used in synergy to achieve sustainable water resources management among the Toka Leya of Chief Sekute Chiefdom?

The research tackled three specific questions, which are:

i) What indigenous views are held by the Toka Leya of Chief Sekute's Chiefdom about water?

ii) Are the indigenous water practices of the Toka Leya people compatible with IWRM practices?

iii) Is it feasible to incorporate the Toka Leya IK in IWRM and vice versa?

1.3 OBJECTIVES OF THE STUDY

1.3.1 General Objective of the Study

The general objective of the study was to explore and document IK of the Toka Leya people in Chief Sekute Chiefdom in water resources management and assess whether or not Toka Leya IK could be used in synergy with IWRM to achieve sustainable water resources management.

1.3.2 Specific Objectives

In order to achieve the aim of the study, specific objectives were devised, these were;

i) To explore and document indigenous view of water among the Toka Leya of Chief Sekute Chiefdom in the Southern Province.

ii) To assess whether or not indigenous water practices of the Toka Leya in Chief Sekute Chiefdom are compatible with IWRM practices.

iii) To ascertain the feasibility of incorporating Toka Leya IK into IWRM and vice versa.

1.4 THE STUDY AREA OF CHIEF SEKUTE'S CHIEFDOM

Kazungula District is part of the Southern Province of Zambia and is located 65 Km to the west of Livingstone. Kazungula District has an area of 15,873 sq. km with a total population of 98,292. (CSO, 2010). The socioeconomic activities of the people in the study area center on agriculture, fishing and animal husbandry. The study area was chosen due to the fact that it lies in the Southern Province, a region in Agro-Ecological Region I which is prone to drought hence the importance of good management of water resources.

1.4.1 ORIGINS OF THE TOKA LEYA

The Toka Leya of the Southern Province are made up of the Chiefdoms of Mukuni, Musokotwane and Sekute even though they have diverse origins. The three ethnic groups mentioned are indistinguishable from one another and are an apparent mixture of Tonga and Lozi languages. This study is focusing on the Toka Leya of Sekute.

The Toka Leya of Sekute attribute their origin from the Nzanza people, a group closely related to the Subiya of Sesheke-Senanga area upto Namibia. (Phillipson, 1975). Local accounts and European explorer's accounts place them on the Kalai Islands before settling around the Victoria Falls area.

Political and religious power rests in the incumbent Chief Sekute. Religious rituals are presided over by the *Ina-Sing'andu*, the priestess chosen from the royal family. In order of descent in power, the organs of authority in the Chiefdom are as follows: The Chief; The Ngambela; Silalo Indunas; Senior Headmen; Village Headmen and subjects as the last in the tier.

The economic activities of the Toka Leya of Sekute are farming, hunting and animal husbandry. Early European explorers such as Emil Holub and David Livingstone give accounts on the large herds of livestock and the growing of crops such as maize, millet, groundnuts and beans. Hunting also formed a large part of the lives of the inhabitants in the Chiefdom. The royal graveyard at Kalai Islands was surrounded by elephant tusks symbolising the hunting prowess of the Toka Leya of Sekute. (Christa, 1975). The census of Sekute Chiefdom in 1923 sums up the livestock population to have been 1487 cattle, 52 sheep and 16 goats (Livingstone District Notebook, 1924). Figure 1depicts the location of the study area.

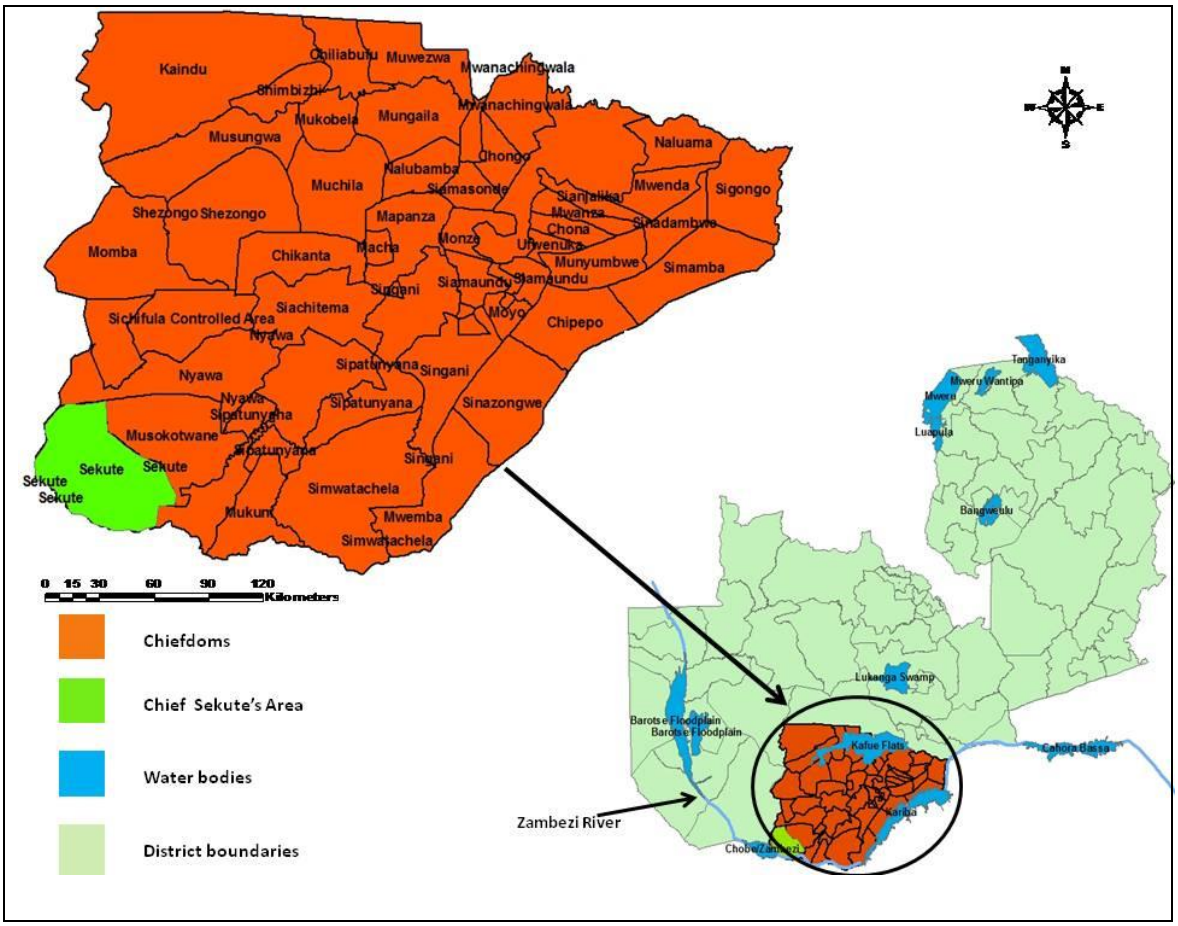

Figure 2: The Study Area: Chief Sekute is highlighted in green. (Source: Choolwe Shalwindi 2011)

The above figure has a map of Zambia showing the location of the Southern Province, and that of Chiefdoms and including the location of the study area: Sekute Chiefdom highlighted in green.

1.5 SIGNIFICANCE OF THE STUDY

The findings of this study can be useful to implementing agencies of water development and provision projects as they aim to ensure people driven projects that will stand the test of time. The inclusion of IK in the water projects may not only 'legitimise' and 'popularise' the knowledge, but it will also instill in the community the need for the preservation and use of IK. The people may be able to draw upon the knowledge transmitted from generation to generation

to solve water related challenges such as managing existing water points and digging wells when in lack of pump boreholes. The findings may also add to the existing body of knowledge on indigenous knowledge and water management that will in turn stimulate more debate and research.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

A review of secondary sources of literature relevant to the study is presented in this chapter. Literature specific to the Toka Leya practices in water management proved to be scarce but efforts were made to cushion this inadequacy. The review of literature on IWRM and natural resource conservation has revealed that there is need for integration of indigenous views and modern practices for sustainable management of natural resources.

2.2 WATER AND CULTURE

The United Nations Educational, Scientific and Cultural Organization (UNESCO) declared the March 2006 World Water Day theme was, 'Water and Culture'. The main thrust of the theme was to highlight the intricacies of cultural values in how water is viewed, used and consequently conserved. According to the announcement released by UNESCO on the 2006 World Water Day, culture should be regarded as a set of distinctive set of spiritual, material, intellectual and emotional features of society. The way water is used and valued constitutes an integral part of a society's cultural identity. UNESCO also recognised that water resources management practices should be adapted to specific cultures as they constitute distinct systems of knowledge and behaviour. In areas where there is cultural diversity, intercultural dialogue should be used as a way of raising awareness and promote water resource management practices. The recognition that cultural values cannot be separated from water management reinforces the need to use both traditional and modern approaches to water management. This, however, falls short of indicating

how the traditional and modern approaches to water management should be undertaken. It also does not clearly indicate if it is all cultural values or just aspects of it that should be used in synergy with modern practices.

Researches undertaken in other regions of the world indicate how water is of great cultural, social and economic significance to indigenous societies thus the need to include the indigenous people in planning and managing of the resources. Jackson and Robinson (2009), wrote on the National Water Initiative (NWI) in Australia, the objective of the organisation is to recognize needs in relation to access and management, including the provision of water for the protection of native title. This is because indigenous rights and interests in water governance and management have been neglected in Australia. In order to achieve this objective, the agency outlined a number of action plans. Two of the action plans are the inclusion of indigenous representation in water planning and the incorporating of indigenous social, spiritual and customary objectives and strategies in the management plans. However, there are also a number of challenges impeding the inclusion on indigenous participation in water decision making and resources such as poor understanding of indigenous cosmology, environmental philosophies and resource management institutions amongst settler society. The researchers also cited the incompatibility between IK, its aspirations for holistic management and the scientific knowledge and technical forms of rationality. The lack of institutional capacity in both indigenous communities and water resources agencies to address cross-cultural issues and full range of technical issues underpinning water planning is another impediment to the involvement of indigenous community in decision making. All the above challenges have led to marginal inclusion into practice of IK even though there is ‘political will’ to include the grassroots in managing water resources. Two consequences of this unfortunate outcome emerge, these are: the

more organized groups over run the indigenous people in terms of access and use of water resources even though the latter have a right to equal access. The second consequence is the loss of IK which is expertise that can be harnessed for effective management of water resources. The panacea of this impasse between IK and science based management is reforming and tailoring water governance and management legal and policy instruments to clearly include indigenous participation in management and decision making.

The above study although not in Africa is applicable in this study. The study showed that the inclusion of IK goes beyond recognition of the value of IK and that this inclusion is facing a number of challenges such as a lack of understanding by other communities and the planners. This in itself may result in the continued ignoring of IK which in turn results in enforcing natural resource solutions to indigenous communities that they could not understand thus proving ineffective.

2.3 INTEGRATING TRADITIONAL KNOWLEDGE IN NATURAL RESOURCE MANAGEMENT

Shetton (1993) argues that development must recognise that traditional values and beliefs are important. Traditional communities are repositories of vast accumulations of traditional expertise that if forgotten would be a great loss to society. Society can learn a great deal from traditional knowledge in sustainably managing very complex ecological systems. The fact that communities have lived for centuries in their environment or habitat and survived exemplifies that these communities devised ways and means of survival which modern day science can tap from. Instead of harnessing this knowledge, “development” reaches more deeply into natural resources destroying the resource base of these communities. This however, may not be necessarily

applicable to settler communities that have made the specific area their habitat. He went on to define development as a "conversation which recognises the traditional values, beliefs and practices of the tribe [ethnic group]… attributes value to things which fields of economy and accounting have not yet learned to measure and count". Shetton also underscores the value that indigenous people have for land and the environment. In the study he shows that it is the value of natural resources that defines the characteristic and identity of indigenous people. His research brought to the fore that traditional values, knowledge and experience should be harnessed and taken into account in the development process. Another aspect highlighted in this book is the importance of legal recognition of indigenous knowledge, rights. Shetton clearly brought out the value of traditional values that should be preserved but fell short of showing how the traditional values can not only be recognised but fused in modern practice.

Legal recognition of IK will lead to the protection of the knowledge and inclusion in development processes of any nation. Zambia has been working towards goal of formulating and enacting a bill that will protect Zambia's indigenous knowledge systems through the Ministry of Science and Technology. This is an ongoing process that is yet to be finalised. This is very important as it will not only provide direction but pave the way for the required documentation of all aspects of IK of the nation's ethnic groups.

The focus of many developmental and conservation projects is on flora and fauna neglecting sustainable water resource management. The management of flora and fauna cannot be effectively achieved without focus on water as water is essential to all processes. Sharma, et. al (1996) calls for water resources management that is built on local experiences and good practices. The study recommends an integrated, cross-sectoral, catchment area approach to water

resources management. This is the basic principle of IWRM and works well with IK which does not single out any part of the natural system in its management practices. This cross sectoral approach in IK is achieved due to the value of interdependence of all life forms and systems imbedded in the cultural fabric of the indigenous people.

According to *Ambio* (Royal Swedish Academy of Sciences, 1993), "diachronic" observations can be of great value and complement the "synchronic" observations on which western science on water use and conservation is based. These observations make up IK of the indigenous people. Where indigenous peoples have depended, for long periods of time, on local environments for the provision of a variety of resources, they have developed a stake in conserving, and in some cases, enhancing biodiversity. They are aware that biological diversity is a crucial factor in generating the ecological services of water and natural resources on which they depend. Some indigenous groups manipulate the local landscape to augment its heterogeneity, and some have been found to be motivated to restore biodiversity in degraded landscapes. Their practices for the conservation of water were grounded in a series of rules of thumb which are apparently arrived at through a trial and error process over a long historical time period. This implies that their knowledge base is indefinite and their implementation involves an intimate relationship with the belief system. Such knowledge is difficult for western science to understand. It is vital, however, that the value of the knowledge-practice-belief complex of indigenous peoples relating to water use and conservation is fully recognized if ecosystems and biodiversity are to be managed sustainably. Conserving this knowledge would be most appropriately accomplished through promoting the community-based resource-management systems of this knowledge.

This study with merits in its bid to establish the importance of conserving indigenous practices related to natural resource management does not go a step further in clearly showing how this conservation is to be undertaken. It also does not include factors such as the assimilation of new people who may have different ethnic background into other societies who may bring along both constructive and at times destructive practices detrimental to natural resources. This assimilation may occur in times of conflicts or natural disasters that may displace people.

Natural disasters such as flooding and drought have become a common phenomenon partly attributed to effects of climate change. Indigenous communities may at times be ill equipped in dealing with these disasters due to them not having the backbone of IK that has coping strategies. Kamara (2005) underscores the importance of integrating indigenous knowledge and science based knowledge in natural disaster reduction in Africa. Kamara writes that local communities have developed indigenous knowledge systems for environmental management and coping strategies, making them more resilient to environmental change. An erosion of this base can have disastrous effects on communities when struck with natural disasters. Indigenous knowledge is a precious national resource that can facilitate the process of natural disaster prevention, preparedness and response in cost-effective, participatory and sustainable ways. Hence, a blend of approaches and methods from science and technology and from traditional knowledge opens avenues towards better disaster prevention, response and mitigation.

Kamara's study also brings to the fore the African perception of environmental resources such as land and water. Natural resources are not just production factors with economic significance but also have their place within the sanctity of nature. Usually, places of spiritual significance used for rituals and sacrifices such as mountains and rivers are often patches of high biodiversity

because they are well conserved and protected by the community. This can be termed as a sanction that promoted sustainable natural resource management not only as a means but as an end in itself. It however, still remains a challenge to reconcile indigenous knowledge and modern science without substituting each other, respecting the two sets of values and building on their respective strengths. Kamara (2005) falls short of highlighting how the two approaches should be integrated rather than substituting each other.

Sustainable agricultural development research has added voice to the call of the legitimacy of building IK not only to improve agriculture but useful in adapting to changes in the natural system. Rajasekaran (1999), points out the diversity of IK and its propensity to adapt to prevailing conditions. He points out that the major obstacle standing in the way of incorporating IK into science based knowledge was the perception outsiders had of IK as being part of a romantic past and an obstacle to development. Thus it was rarely treated as knowledge per se that contributes to our understanding of agricultural production and the maintenance and use of environmental systems. Rajasekaran also brings to the fore the undesirable attributes of the Top Down science agricultural research that has been adopted over the years. It shows that the knowledge is generated in universities, laboratories and research stations and is packaged to the people for adoption unlike IK which is based on continuous production passed on from generation to generation. The Top Down approach may prove to be disastrous and ineffective especially in cases where unsustainable technologies are introduced. IK is capable of devising adaptive solutions in the face of new challenges and tailored to their specific needs. One feature of this conceptual framework is building upon local people's knowledge acquired through farmer to farmer communication and farmer experimentation.

2.4 INDIGENOUS KNOWLEDGE AND DEVELOPMENT

Preservation and conservation of cultural heritage in development should be related to the needs of the people thereby making them allies i.e. making them direct beneficiaries of conservation as opposed to concentrating on the envisaged foreign exchange to the country. This has been the focus of development agencies that quote development of nations using economic instruments such as Gross Domestic Product (GDP). This does not always translate very well the ground where the lives of the people are impacted adversely as a result of the development projects that result in displacement of the people. Kashoki (1989) writes that there is need for preservation and conservation to be considered indispensable strategies for all round development. Development should not be limited to Gross National Product and per capita income of a country. Rather, all round development goes beyond putting food on the table and foreign earnings of the country. Kashoki used the term 'Conservation Development' which can be sumarised as that development which puts special emphasis on the needs of tomorrow and takes appropriate steps to ensure that the needs of today do not undermine the needs of tomorrow. This conservation development takes into account the culture of the nation in its development process. However, the usual practice ignores certain aspects of culture and considers them as an obstacle to development. This is because to most people culture is limited to 'our past' the so called traditional way of life exemplified in traditional dances, songs and art. This study shows that cultural heritage goes beyond traditional ceremonies, song and dance but includes practices that include natural resource management. The emphasis of cultural heritage conservation is unfortunately more often than not limited to ceremonies, dance, art and song leaving the practices of natural resource management to fall off thereby, endangering the continued use of these practices.

In this study, Kashoki defines culture as the total sum of people's accomplishments (the past), their actions and activities (the present), and their aspirations, intentions and hopes (the future). A balance must be struck between exploiting and conserving the same natural resources. The study concludes by stating that balanced development takes into account the social, cultural, economic, spiritual, scientific and related needs of the people thus there should be no distinction between culture and development.

A conduit through which the integration of IK in development can be achieved is through environmental education in academic curriculum. This will ensure that the essence and value of IK is inculcated into the system of education of future generations thereby ensuring that the knowledge is integrated in development approaches tailored-made to fit communities. Mwanang'ono (2001) in his study advances that the developmental problems that have been experienced have been due to the alienation of Indigenous Knowledge Systems in not only Environment Education but development planning too. The modern approaches apparently lack relevance to societies they are applied in thus justifying the inclusion and relevance of indigenous systems. The study focused on the Tonga and Lozi indigenous knowledge systems in relation to environmental activities. He cites the Lozi construction and management of the canal system known as *litongo*. These canals' use was twofold, namely, to provide irrigation for farming activities and as water transport for mobility. Regular dredging of theses canals was embedded in traditional system but it has since been relegated due to the adoption of 'modern' systems of managing the canals leading to water logging and loss of ingenuity in food production. This study however had little documentation on the IK of the Tonga of Siavonga District relation to environmental education. The study has shown that there were no clearly defined systems of environmental education among the Tonga of Siavonga District due to the

displacement of the local people at the construction of the Kariba dam across the Zambezi River. This, apparently presented new challenges in the new area they were resettled in, thereby obliterating their lifestyles and inherent nature with the environment.

2.5 DOCUMENTATION OF IK

The fact that IK has not been formally recorded and documented adversely affects its inclusion into mainstream literature and practices. The documentation of this dynamic knowledge is singled out as a solution to bridge the gap that exists between IK and formal science. Warren (1992) in a keynote address at the International Conference on Conservation of Biodiversity in Africa intimates how indigenous knowledge and biodiversity are a complementary phenomenon essential to human development. IK represents an immensely valuable data base that provides humankind with insights on how communities have interacted with their changing environment including its floral and faunal resources. A factor that negates progress in employing the use of IK is the fact that very little of this knowledge has been recorded inspite of its usefulness to humankind. Warren notes how IK, particularly in Africa has been ignored and maligned by outsiders. Infact some studies and literary works depicted local communities and their knowledge as primitive, simple and static. Recent studies by both biological and social scientists have described local communities and their knowledge as complex and sophisticated adapted to their environments for natural resource management. However, recently this is been redressed by respective Governments and international agencies who have recognized that local knowledge and organisations provide the foundation for participatory approaches to development that are both cost effective and sustainable. These local organisations and communities provide basis for bottom-up approach to decision making in development projects thereby increasing the

effectiveness of the programmes. A consequence of this acknowledgment is the formation of international, regional and national bodies to document in-situ and ex-situ this knowledge and regulate IK appropriation such as Centre for Indigenous Knowledge for Agriculture Development(CIRARD); African Resource Centre for Indigenous Knowledge(ARCIK). Warren (1992) points out that IK can be documented through participant observation and unstructured interaction.

There is need for guidance on how IK and indigenous people can be included in the development process of any nation. The World Conservation Union and the World Foundation have established and adopted five principles and guidelines on how IK and indigenous people can be included in development processes. Some of the five principles can act as a guide in incorporating IK and indigenous people in the formulating, implanting and monitoring of development projects that include water reticulation. Some of these principles are:

- Indigenous and other traditional peoples should be recognised as rightful equal partners in the development and implementation of conservation strategies that affect their lands, territories, waters, coastal seas and other resource.

- The principles of decentralization, participation, transparency and accountability should be taken into account in all matters pertaining to the mutual interests of protected areas and indigenous and other traditional peoples.

- The rights of indigenous and other traditional peoples in connection with protected areas are often an international responsibility since the lands, territories, waters, coastal seas and other resources which they own cross national boundaries.

The foundation on which the principles are based on is the inclusion of not only indigenous people but their knowledge in management practices. This inclusion should be that of building on the IK of the people who have the right in the area rather than engineering conflict through the exclusion of the indigenous people. It is worth mentioning that actual practice of these principles is not enforced and may not be strictly adhered to by development agencies who may perceive indigenous people as a stumbling block to development.

CHAPTER THREE

METHODOLOGY

3.1 INTRODUCTION

This chapter outlines the research methods and techniques used to collect, analyse and present both quantitative and qualitative data.

3.2 RESEARCH DESIGN

The aim of the study was to explore and document IK of the Toka Leya people of Chief Sekute Chiefdom in water resource management and assess whether or not their IK can be used in synergy with IWRM to achieve sustainable water resources management in the study area. Data collection involved the use of qualitative methods as IK is intangible and unquantifiable in statistical formats.

3.2.1 Sample Size

The target population for this research consisted of all adult dwellers and children in Chief Sekute Chiefdom since they are all users of water. However, due to time and logistical limitations, this researcher sought to describe and explain what their water traditions were with a smaller group of people only. In this regard, a total of one hundred and thirty-two (132) respondents were chosen. All the respondents were purposively sampled. The constitution is as follows:-

i) Older Generation- Ninety respondents above the age of 35 were interviewed. These were chosen because they are the custodians of traditional knowledge, the older they get the more

respect they get from society hence they get consulted on matters affecting the village. However, the ninety respondents were divided into forty male and fifty female. The sample size of female was higher due to the fact that they play a pivotal role in the use and conservation of water especially at household level.

ii) Youth- Twenty respondents aged between 20 and 34 years were interviewed. The sample size was divided into seven male and thirteen female. This group of respondents was chosen due to the fact that they are the intermediate generation and interpreters of IK in water use, management and conservation.

iii) Young adults- Twenty children aged 7-19 years of the community randomly selected in the chiefdom were interviewed to ascertain extent of indigenous knowledge transfer. The twenty respondents were divided into eleven males and nine females. These children were chosen to assess the extent of IK transfer from the older generation to the younger generation.

iv) One Ministry of Lands and Water Development (MLWD) District Water Officer. The Government arm is responsible for the development of water resources in the study area. The District Water Officer oversees the water projects initiated by the Ministry in the district.

v) One Ministry of Local Government Housing, Early Education and Environmental Protection (MLGHEEEP) official- Kazungula District Rural Water and Sanitation Officer. This officer is responsible through the parent Government Ministry for the provision of safe water and proper sanitation for rural section of the district.

3.3 DATA COLLECTION TECHNIQUES

3.3.1 Secondary Data

Secondary data on natural resource management in line with IK was sourced from the libraries in Lusaka and Livingstone Museums. Literary works on the World Wide Web provided valuable secondary data. Due to the limited published works on indigenous knowledge and specifically on the Toka Leya, the study greatly benefited from primary data derived during the field research.

3.3.2 Primary Data

In this study techniques used to collect primary data were, standardised questionnaires; focus group discussions; interaction with community members and the researcher's observations of water points and the use of water. Each of the questionnaires was administered to the respondents because most respondents could neither read nor write in English. The responses were translated into English during the interviews.

Audio visual equipment was used to get photographs of sources of water in the Chiefdom. Observations of activities at water points and observation of water indicator flora at different points was employed during the field research. There was also observation of various uses of water and its abstraction.

The older interviewees were chosen because they are the repositories of the tradition and knowledge in the rural context. The young adults were interviewed to ascertain IK transfer from generation to generation.

A Government officer from the Ministry of Lands, Energy and Water Development was interviewed because of the principal role the Ministry has to play in the development of water resources in the nation. A Rural Water Supply and Sanitation Officer under the Kazungula District Council, under the Ministry of Local Government, Housing, Early Education and Environmental Protection, Rural Water Supply and Sanitation Officer was interviewed due to the ongoing programme of rural water supply and sanitation spearheaded by the Ministry in the study area.

3.3.3 Data Analysis and Interpretation

Interview responses were coded and classified for the purpose of comparing and quantifying the responses and to determine the frequency distribution in the sample. The quantified and classified data were analysed and interpreted using Statistical Package for Social Sciences (SPSS). Digital data such as photographs and audio recordings were also used to bring out aspects of IK.

3.3.4 Data Collection Procedure

The initial contact with the people in the study area was undertaken during the as preliminary visit with the aim of formally requesting for permission to conduct the research from the traditional authority. Permission was granted verbally by the Headmen acting in the absence of Chief Sekute. The localised research was undertaken in villages on the outskirts of the palace and Makunka area in Chief Sekute Chiefdom. Interviews were carried out using the structured questionnaire to the respondents. The questionnaires were administered to each of the 130 respondents. In order to achieve the task, a local resident was hired as a research assistant and

also to serve as a guide. Focus Group discussions were organised and split into two groups- Male and Female, each group with researcher of the same sex. This was to facilitate the flow of information from the respondents freely as they interacted with researchers. Visual images were documented using digital camera.

3.4 LIMITATIONS OF THE STUDY

A number of limitations were encountered in this study. The following are the limitations:

- The practice of burning vegetation to prepare for the new planting season and to allow regeneration of plants palatable to livestock impacted negatively in data collection. The result of this was the difficulty in locating fresh flora cited in the study to be photographed. A number of trees that make up part of Toka Leya IK as water indicators could not be photographed as a result of the burned bush.

- The study findings in a localised Chiefdom can not be generalised to the rest of the country due to differences in both cultural and geological landscapes, among the 73 ethnic groups.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 INTRODUCTION

The focus of this study was to explore and document IK of the Toka Leya on water management and highlight points of synergy between IK and IWRM. One of the greatest challenges in Africa is the lack of access to clean and safe water. The prevailing situation in the study area was that of inadequate water points to provide clean and safe water for the people. There was a cry for the construction of boreholes to provide clean and safe water for their basic needs. However, there is little or no application of IK in addressing water related challenges by both recipients and implementing agencies. The lack of innovation on how to locate ground water and subsequently dig wells has perpetuated the water poverty in the study area.

Presented in this chapter are research findings on the sources of water, the indigenous view of the Toka Leya on water and their practices on use of water. The findings of the research were obtained through the administering of the questionnaires and focus group discussions with 130 respondents in the study area.

4.2 SOURCES OF WATER IN SEKUTE CHIEFDOM

According to respondents, the main sources of water in the study area were pump boreholes, reinforced wells and a reservoir at Makunka. Although the Makunka reservoir is located in the neighbouring Musokotwane Chiefdom, it was also accessible to the people of Sekute Chiefdom for their use. The pump and well water sources serve domestic purposes although in other

villages which have had no access to the reservoir, they used the ground water even for gardening and for livestock. Villages around the Makunka reservoir took advantage of the surface water to sustain their livestock and gardens. The Toka Leya in Chief Sekute's territory preferred the pump boreholes to wells due to guaranteed quality of water from boreholes, unlike the uncovered wells. Figures 3, 4 and 5 show the water sources in the study area.

Figure 3: Pump borehole serving as one of the water sources in the study area. (Source: Choolwe Shalwindi, 2011)

As shown in the figure above, pump boreholes are the main sources of water in Sekute Chiefdom and they were located strategically in the study area. It was viewed as safest source for water and the most preferred by the Toka Leya in the study area. This water source was used primarily for domestic purposes, in watering gardens and for livestock in villages without a reservoir or surface water source.

Figure 4: A reinforced well which serves as a source of water for People in Chief Sekute Chiefdom. (Source: Choolwe Shalwindi, 2011)

As shown in Figure 3, water wells were reinforced with concrete rings by the Cooperating Partners to ensure the wells did not collapse and avoid contamination of the water. The drawing of water from reinforced wells was relatively harder than operating the pump on the pump boreholes. This required skill as the mechanism originally installed to pull up the water container using a chain that supported the poles was no longer present.

Figure 5: Makunka reservoir which is used for livestock and other auxiliary activities such as gardening. (Source: Choolwe Shalwindi, 2011)

As shown in figure 4, the Makunka reservoir serves the Sekute and Musokotwane Chiefdoms needs for surface water. This water is used mainly for livestock and gardening for the surrounding villages.

4.3 TOKA LEYA INDIGENOUS VIEWS OF WATER

As gathered from the Toka Leya of Sekute Chiefdom, the local term for water among the Toka Leya is *Maanzi*. Water is highly avowed by the Toka Leya as it touches all aspects of the lives of the Toka Leya. The climatic characteristics of the study area are that of low rainfall and prone to drought, therefore, water is a precious resource. There are two non-perennial streams that drain the study area although these were dry at the time of field research in August and September, 2011. The main sources of water for the Toka Leya were wells and boreholes.

A proverb that aptly illustrates the perception the of the Toka Leya on water is;

> *"Kotila maila, watila menda wabatola kulubeta."*

English translation:

> Do not misuse water, it is not like millet which we can grow. If it is misused and runs out, no one can 'grow' water.

This shows that water from time immemorial among the Toka Leya was viewed as a vital resource that should never be taken for granted or misused. It was considered a finite resource in IK, this is in line with the tenets of IWRM.

Extracts from an interview aptly sums up the point that the Toka Leya value water and are willing to bear the cost for the provison of this vital supply.

Toka leya:

"...Mulizi kuti maanzi ncitu cipati ku muntu? Maanzi mane nzala ilimusule. Nkambo kuti maanzi tako muntu olo kufwa ulafwambana"

English Translation:

Water is vital for life surpassing the lack of food. A human being will die quicker in the absence of water than food.

Toka Leya

"Tulazumina kubaddela nkambo nkotuteka maanzi nkule, tucita kutwika. Kuti twaba a ka nguju a fwafwi inga bantu bazumina kubaddela"

English Translation:

We can pay for water because currently our water point is far from our home stead. We can pay to have a water point opened near our home stead.

The above extracts show just how the Toka Leya viewed water and its provision. They not only acknoweldeged that water was very vital for life but were willing to pay for its provision. This is contary to the perception that indigenous people view water as a free gift that is infinite.

4.4 TOKA LEYA INDIGENOUS WATER PRACTICES

As gathered from the interviews with respondents, the Toka Leya indigenous water practices encouraged innovation and sustainable practices that served the needs of past generations. These practices also ensured that this resource was available to all the people in an equitable manner yet non-destructive to other members of the ecosystem such as wildlife and plants. The Toka Leya ecological knowledge employed local observational knowledge of flora and fauna to locate and ensure water supply to the people. However due to lack of more research on Toka Leya IK, not all of the aspects of the Toka Leya IK has been 'scientifically' backed. This in no way disqualifies the findings of this study or the IK owned by the Toka Leya. This knowledge is used to manage and cope with any environmental change that occurs. This field data collected generated the following methods of locating water points using Toka Leya IK.

4.4.1 The use of Flora to locate water points.

Trees are used for various purposes in society, such as for medicinal, ornamental, providing shade, sacred groves and as sources of food for both humans and animals. There are other use of trees is as high water table indicators. According to the respondents, the Toka Leya used various trees and grasses to determine the availability of ground water. The presence of either one or a group of the trees outlined in this study is used as an indicator of high water table and chosen as a water point. Observational methods on how to locate ground water resource using flora, as water indicators was highly useful to the Toka Leya. According to the respondents a number of trees were cited as water indicator trees, these were: Acacia albida (*Muunga*[L], *Mujagwe*[T]); Ficus sycomorus (*Mukuyu*[T,L]); Combretum collinum (*Mulamana*[L]); Diospyros mespiliforms (*Muchenje*[T,L]); Syzygium cordatum (*Katope*[T], *Mutoya*[L]); Brachytegia boehmii

(*Mubobo*[L]) Diplorhynchus condylocarpon (*Mutowa[T], Mulya[L*]). The letter 'L' stands for Lozi, while 'T' stands for Tonga, this is because the Toka Leya is a mixture of Lozi and Tonga languages, hence, the names of the trees were given in either language by respondents. It is for this reason that the indigenous names of the trees cited in the subsequent table are in both languages. Table 1 gives a summary of the water indicator trees. The information is extracted from the books Know Your Trees and More about Trees (Storrs, 1995 ed; 1982)., and from the Toka Leya themselves during fieldwork.

Name	**Description**	**Habitat**	**Uses**
Acacia albida (*Muunga*[L]; *Mujagwe*[T]; *Mtubetube*[N]; *Muchesi*[B])	A large, deciduous tree growing up to 30m. The bark is whitish to grey-brown, rough with shallow fissures and horizontal cracks. The alternate leaves are bi-pinnate, having 3-10 pairs of pinnae, each of which consists of 6-20 pairs of very small, grey green leaflets. The fragrant, white to	Found throughout Zambia, with the exception of the North-Western and Copperbelt Provinces and Isoka and Lundazi Districts. It is a tree of river banks and alluvial flood plains growing either singly or in colonies.	The wood is fairly hard, but not very durable, can be used for buildings, canoes, tool handles and rough furniture. The ripe pods, beans and leaves are good cattle food. Decomposed leaves enrich the soil with nitrogen and calcium. Various medicines are

	pale cream flowers are produced in spikes (5-12cm long) between May and June. The pods are pinkish to yellowish brown, 7-15 cm long and spirally twisted or contorted. The pods ripen between July and September.		made from its bark and roots.
Ficus sycomorus (*Mukuyu*[L,T,K,LU] *Mkunyu*[B] *Mkuyu*[N])	A large semi-deciduous tree growing up to 20m high. The bark is pale brown or grey. The leaves are heart-shaped and rough to touch. The rounded fruits are	Ficus sycomorus is found throughout Zambia. It is a river bank tree.	The wood is very light and durability is very low. It is used for mortars and stools. The fruit is edible, sought after by birds and monkeys. Local medicine is made from its bark,

	yellow or pale orange when they ripen, between December-March and September-October.		leaves and fruit.
Combretum collinum (*Mulamana*[L]; *Mukunza* [T]; *Mufuka*[B,K]; *Kalama*[N])	A semi deciduous tree up to 18m high, with a rounded or flat rounded heavy crown. The bark varies from creamy-brown to grey to reddish to brown-black in colour. The opposite, simple leaves vary in shape, and are grey on the underside and glossy green above. The fragrant yellow-green to pale cream flowers are produced in large dropping sprays	Combretum collinum is found throughout Zambia. It is a common tree of marginal Baikiaea forest, deciduous thicket, and of the Kalahari and Lake Basin chipya woodland.	The timber has whitish-brown sapwood. It is fairly hard, not very durable, and has an interlocked grain and coarse texture. It is used for wagon building, canoes and tool handles.

	between August and October.		
Diospyros mespiliformis (*Mucenje*[T,L]; *Muchenja*[B]; *Mukyengya*[K]; *Mchenja*[N])	An evergreen or semi-evergreen tree up to 26m high. The leaves are soft, brown and hairy when young become dark dull green and leathery. The bark is brown when fresh, becoming blackish or grey, deeply fissured and scaly. The fragrant white, pale cream or greenish yellow hairy flowers appear between September and December. It has yellow-green	Diospyros mespiliformis occurs in all districts of Zambia. It is found occasionally in thickets, dry evergreen and dry deciduous forests and most types of woodland except miombo.	The wood is variable in colour, usually pinkish-white or grey which darkens on exposure. It is hard, heavy and very strong, almost termite proof and fairly resistant to rot. It is used for canoes, furniture, wagon making and turnery. The leaves are browsed by elephant and eland, whilst the fruit is popular with man and other mammals. The roots and bark are

	fleshy fruits.		used to stop purging, to enhance fertility and to treat skin eruptions.
Syzygium cordatum (*Mutoya*[L]; *Katope*[T]; *Msombo*[N]; *Mushingu*[B])	A large evergreen tree growing up to 22m. The bark varies from red-brown to grey-black, is deeply fissured and with oblong scales giving a slightly gartered appearance. The leaves are oblong shaped, leathery and have a slightly blue-green tinge. The leaves are sessile 9no stalk) and up to 10 x 17cm in size. The fragrant white or creamy feathery flowers are produced in dense	Syzygium cordatum is found throughout Zambia, confined to gallery woodland of river or lake and to swamp forest.	The heartwood is pinkish brown, fairly hard but not very durable. It has been used for building work, furniture and boat planking. The leaves are browsed by elephants, and the fruits are eaten by many birds, fruit bats and bush babies. The leaves, bark and root are used in the preparation of medicines for treatment of stomach

	terminal bunches between July and November.		to giddiness.
Brachystegia boehmii *(Muombo*[T,B,N]; *Mubombo*[L,K,LU])	A medium sized. Semi deciduous trees growing up to 18m high. The alternate leaves vary from brown to grey-black. The fragrant, greenish-white flowers are produced in terminal bunches between October and November. The pods ripen between June and September. The bark varies from brown to grey-black, has wide fissures and is scaly.	It is found throughout Zambia, but not in the northern tip nor in the Western Province.	The wood is reddish-brown, heavy tough and strong. It is not very durable and not easy to work with. The fiber from young roots is used to make baskets and fish traps. It is a suitable tree to hang bark beehives.

Diplorhynchus condylocarpon (*Mutowa*[T]; *Mulya*[L,LU]; *Mwenge*[B,K]; *Mtowa*[N])	A semi deciduous tree up to 11m. The thin leathery leaves may be hairless and the foliage tends to droop. Fragrant white flowers appear in loose sprays from August to November. The bark is light reddish brown when fresh becoming grey or dark brown, fissured and reticulately scaly like crocodile skin.	Diplorhynchus is found all over Zambia. Occurs in all types of woodland.	The wood is cream coloured, but the logs are usually small and main uses have been as roofing poles and fence posts.

Table 1: Water Indicator Trees among the Toka Leya of Zambia (Source: Storrs,1995.pgs 21-22,33-34,43-44,111-112,241-242,319-320,359-360)

Botanical research has proven that the following trees are high water table indicators. These are the; Acacia albida (*Muunga*), Ficus sycomorus (*Mukuyu*), Syzygium cordatum (*Mutoya*), Diospyros mespiliformis (*Mucenje*) and Brachystegia boehmii (*Muombo*). Toka Leya IK

recognises the tress aforementioned as high water table indicators. Toka Leya IK affirms that the Combretum collimun (*Mulamana*) and Diplorhnychus condylocarpon (*Mutowa/Mulya*) are also high water indicator trees although not scientifically proven. The fact that there is no scientific backing does not disqualify the above mentioned as water indicator trees.

The Acacia species is widespread and 30 species occur throughout the country (Storrs, 1995). It is found in flat and rich soils and cardinal among pastoral and farming communities. Acacia albida (*Muunga)* is part of the Acacia species, they were usually left standing in agricultural fields because of their ecological value. Acacias have long roots that tap water from deeper depths of the soil; the pods and leaves provide fodder for livestock in dry season and add the much needed nitrogenous fertiliser to the land. This makes them popular among many ethnic groups in the country. Acacia albida (*Muunga)* also known as *Mutubetube* among the Toka Leya, is particularly associated with high water table and is used as a high water table indicator. This tree is widespread in the Toka Leya countryside and made up a significant percentage of the flora in the plains and riparian land. Acacia albida (*Muunga)* was also evident around the Makunka reservoir and at all boreholes and wells thereby providing empirical evidence of the efficacy of the traditional knowledge. Figure 6 below shows the Acacia albida tree as photographed in the field.

Figure 6: An Acacia albida (*Muunga*) tree cited as a water indicator tree among the Zambian Toka Leya (Source: Choolwe Shalwindi, 2011)

The above photograph of the Acacia albida tree in the plains of the study area shows the pinnate leaves and thorns characteristic of the specie.

The Ficus Species are widespread, there are 34 species in Zambia (Storrs, 1995). Ficus sycomorus (*Mukuyu)* is a high water table indicator tree among the Toka Leya of Sekute. *Mukuyu* is known as a river bank tree and frequently found on dambo margins and chipya woodland (Fashawe, 1982). IK of the Toka Leya affirms that wherever a *Mukuyu* tree is found, it means that area is a possible water point due to the fact that the tree roots tap large volumes of water from lower depths. The presentation of *Mukuyu* was used to locate suitable points for wells and boreholes. Physical siting during the field research affirmed the presence of *Mukuyu* trees in the vicinity of water points as well as the dam and riparian land, this is direct evidence of the efficacy of IK in water resources. The felling of *Mukuyu* was not allowed by traditional authority due to its use in monitoring and ensuring water supply. Figure 7 shows the Mukuyu tree.

Figure 7: Ficus sycomorus (*Mukuyu*) tree, an indicator of high water table among the Zambian Toka Leya IK. (Source: Choolwe Shalwindi, 2011)

Mukuyu trees were present in the study area not only in riparian land but in the forest cover around the villages. The type of leaves of that the Ficus sycomorus (*Mukuyu)* has is what differentiates it from other species of the Ficus family. The photograph figure 8 illustrates the leaf structure of *Mukuyu* tree.

Figure 8: Ficus sycomorus (Mukuyu) leaves (Source: Choolwe Shalwindi, 2011)

Syzygium cordatum (*Mutoya* [L] or *Katope* [T]) also known as the water berry is another tree that has been identified as a ground water indicator tree by the Toka Leya. The tree is widespread in Zambia localised to gallery woodland of river or lake and to swamp forest. Botanic research has proven that *Mutoya* is a high water table indicator tree. Wherever this tree was cited it was automatically marked as a point with good ground water reserve and picked as a borehole site.

Diospyros mespiliformis (*Mucenje* [L; T]) also known as African Ebony is a common tree in Zambia. It was mentioned as one of the tree used in Toka Leya IK used to identify viable ground water points. *Mucenje* is also popular for its fruits, the tree is found in thickets, dry evergreen and deciduous forests. IK indicates that the forefathers were on the lookout for the *Mucenje* tree when choosing water points. Felling of *Mucenje* was highly prohibited due to its usefulness not only for identifying underground water resources but for its fruits which are popular among humans and animals.

Brachystegia boehmii (*Muombo* [T] or *Mubombo* [L]) is a high water table indicator tree as its presence indicates shallow soils partially water logged. There are 16 species present in Zambia. The tree has other uses albeit negative in it being sought after by charcoal burners in *Miombo* forests. It is also useful for hanging bee hives. The tree formed part of the ecological knowledge of the Toka Leya in locating ground water points and is present in the chiefdom. Cutting of *Muombo* was prohibited. In this way they preserved *Miombo* forests thereby encouraging the proliferation of other organisms that make up the ecosystem.

Combretum collinum (*Mulamana* [L] or *Mukunza* [T]) tree is a semi deciduous tree that forms part of the ecological knowledge of the Toka Leya as an indicator of underground water availability. It is common throughout the country, present in deciduous thickets, Kalahari and

Lake Basin chipya woodland. The tree was widespread in the study area and was cited as one of the water pointers when the Toka Leya searched for sites to dig wells or sink boreholes. There has been no scientific research to ascertain that this particular tree is an indicator of high water table however, this does not imply that IK is wrong. The observational knowledge and empirical evidence are used in IK to arrive at these conclusions. In situ, at the time of the research *Mulamana* had fresh green leaves in comparison to other trees in the forest which had dried leaves in the dry season. The green leaves were a sign that the tree had enough water in its system to keep them fresh. The photographs in figures 9 and 10 show *Mulamana* tree and leaves as photographed in the study area at the time of the field research.

Figure 9: Combretum collinum tree in the study area. (Source: Choolwe Shalwindi, 2011)

The leaves of *Mulamana* tree in figure 10 as shown below were green at a time when it is characteristic of other trees not to have fresh leaves in the dry season. Figure 10 also shows the texture and colour of the leaves of the tree.

Figure 10: *Mulamana* tree fresh leaves (Source: Choolwe Shalwindi,2011)

Diplorhynchus condylocarpon tree (*Mutowa* or *Mulya*) is used by the Toka Leya to point our places that have high water table hence suitable for digging wells. It is a semi deciduous tree though small in comparison to the other water indicator trees. The *Mutowa* tree is widespread in Toka Leya land. The presence of this tree means that water is near to the surface in the vicinity.

Respondents also added another method of identifying possible water points by observing the nature of grass in certain areas. The presence of green grass in dry season served as an indicator that the water table in the particular point was high and favourable for use as a source of ground water. The temperature in the study area in the dry season rages between 35ºc-40ºc, akin to arid environments hence the presence of green grass in the dry season was not ordinarily possible unless there was high moisture content in the soil. Such sources are used in times of severe water scarcity and in the absence of water indicator trees.

4.4.2 The use of long term water retention areas to locate ground water sources.

IK recognises the phenomenon of soil moisture to pick ground water points. The basic principle of duration of water retention after the wet season is employed. The points could be in riparian areas or flood plains of the chiefdom.

According to the information derived from the interviews, the indigenous names for the water logged places were; *mubulolo*, *mweezi* or *ma bbazo.* Wells are called *cikaala* (singular) or *zikaala* (plural) by the Toka Leya. By observation the forefathers concluded that they could dig wells for their use in the flood plain because the water level would be higher than that of other grounds in the village. The depth of these wells was dependent on level of demand for the water, but they are usually deeper if serving domestic purposes and shallower if used as source of water for gardening. The wells for human needs were dug much deeper and protected from disturbance by livestock and children by hedging them. The gravel or sand around in the soil provided natural means of filtering out impurities from the water. This knowledge is still in use though limited in application by the current generation due to their dependence on mechanised boreholes.

4.4.3 The use of aspects of the belief system to locate ground water sources.

Dowsing is a type of divination employed in attempts to locate ground water and other things such as minerals. It is also called water witching although this denotes negative image of the method which should otherwise be taken in its positive light. This method is employed by the Toka Leya in locating points of high ground water. This method should not to be considered as evil but as another way of locating water points. The Toka Leya use a twig of Piliostigma

thonningii (*Musekese*) as a way to locate high ground water table points suitable for sinking boreholes and digging wells.

The use of a *Musekese* twig to locate a point with sufficient ground water is based on the Toka Leya belief system. A fresh twig is used when locating ground water resources. A detailed explanation on how the search is carried out was given and demonstrated by respondents during field data collection. Extracts from recorded interviews on how to use the fresh twig to locate ground water are transcribed from voice recordings and are as follows:

A respondent of Nyambe Sitali Village stated as follows:

> *Cisamu camusekese… Mpoona bala tema kasamu ka siizi kajesi mpanda. Mpoona balakajata a maanza obile, bano bwenda kuyandaula maanzi. Abusena ajesi maanzi kayosunama kulanga ansi. Balaziba ati awa a janika maanzi.*

English Translation:

> They get a twig from Piliostigma thonningii (*Musekese*) tree; hold it horizontally to the ground by the alternating branches of the twig. They will be walking around the ground looking for a point where ground water table is high. When they reach a point where the water table is high the single end of the twig will on its own point downwards. It will be pulled downwards by an invisible or unexplained force.

A village headman stated the following:

> *Musekese biya,it is a good remedy. Nkutema kasamu ka musekese kala mpanda zyobile mbuli kasamu kamalegeni… Nkujata ku mpanda, bazoenda. Ali maanzi kumbele* [*kasamau*]*kala langa ansi.*

English Translation;

> …Pluck a twig from the Piliostigma thonningii (*Musekese*) tree which has branches like that for making a catapult. … Hold the two ends of the alternating branches and walk in the designated area looking for the point with high ground water table. When you get to the area with high ground water table the end of the twig will point downwards.

The photographs in figures 11 and 12 show the way the twig of the Piliostigma thonningii is used to search for ground water.

Figure 11: A Village headman illustrating how to hold the twig while walking in the plains in search for sites of high ground water table (Source: Choolwe Shalwindi, 2011)

According to the respondents, the single end of the fresh twig bends or points downwards at the point where there is high ground water table and this point qualifies as a possible water point. Figure 12 shows the way the said part of the twig points or is pulled downwards by an invisible force as illustrated by a village headman.

Figure 12: A Village headman illustrating how the part of the twig bends at a point of high ground water table (Source: Choolwe Shalwindi, 2011)

Another method that is based on the belief system of the Toka Leya used to locate water points is known as '*kushanga maanzi'*, translated literally as 'planting water'. Respondents in the Chiefdom state that their forefathers with this spiritual knowledge are long gone, no one can now claim to 'plant' water. The spiritual aspect of *Kushanga Maanzi* created mysticism and in turn acted as a social sanction to generate respect and awe for the resource points thus ensuring that there was no abuse by the users.

Respondents in the Chiefdom stated that an *ililombba* which forms part of a witch or wizard's paraphernalia and other charms were used to plant water. These objects form part of the belief system that is however attributed to evil and aligned to secret societies of witchcraft. The objects were supposedly placed in the well or 'lake' and as long as the objects and individual that 'planted' them was alive the water would never dry up. Two places in the chiefdom were mentioned as points that had water that was 'planted'; these are Dube Village and De level.

In Dube Village the past Headman is said to have planted water in the village, this surface water was available throughout the year. Physical inspection of the water point revealed that the area is

in fact a point of convergence of the Siambizzi and Ngwezi streams. This should guarantee surface water flow and not attributable to planting water. The current Headman Dube, a grandson of the aforementioned narrated that the late Headman Dube planted reed grass in and around the stream bed to prevent all the water flowing downstream into the Zambezi River. This is a water harvesting technique that was employed, but has been mistakenly attributed to spiritual powers. The Headman also controlled amounts of water drawn from this source, this ensured conservation of the available surface water. The reeds are still present though presently dry in some places due to the absence of surface water. The water level in the stream bed is still high, evidenced by the shallow wells used to water gardens around the area. This part of the stream still gets flooded but all the water flows into the Zambezi River as the water harvesting technique of the past Headman is no longer practiced.

The high soil moisture content in the area allows for fresh grass even in the dry season has been turned into communal grazing land for the Chiefdom. Turning the riparian ground into grazing land is against Toka Leya IK which discourages animals from grazing in and around underground water sources. IK asserts that when animals were let to roam in and around areas that are water sources, the ground or soil would harden as a result of the trampling and eventually this will result in ground water not rising upwards. Plainly put, in Toka Leya territory as one respondent stated, "*mohi lyatauka maanzi inga aleka kuzwa"*, meaning that wherever animals trampled, the water will stop seeping out of the ground. This grazing practice is a direct abrogation of IK even though the grazing lands serve the whole community. The availability of surface water in the stream would benefit the community a lot more than dry grazing ground. The drying up of the reeds and the use of the area as grazing land may account for all the water flowing to the Zambezi River and none being retained as surface water in the stream during the

dry season. Figure 13 illustrates area of the Dube Village water point that was cited by the respondents as an area that had water planted by a Headman in the past.

Figure 13: Fresh weed that was planted by a Headman in the past to trap water at the confluence of the Siambizzi and Ngwenzi streams (Source: Choolwe Shalwindi, 2011)

The reed that was planted to trap water at the point of convergence was dry at the time of the study in 2011, due to lack of surface water. Figure 14 shows the nature of the weed at certain points of the riparian land.

Figure 14: Dry reed that had lost their ability to trap water at the point of convergence of the Siambizzi and Ngwenzi streams (Source: Choolwe Shalwindi, 2011)

There is auxiliary activity of gardening around the convergence point. The people use water from shallow wells dug on the stream bed to sustain the gardens. Figure 15 shows a shallow well on the stream bed.

Figure 15: A shallow well dug in the riparian land. This is used to draw water for watering gardens (Source: Field data (2011)

The De level area was also singled out as a place where a previous Headman 'planted' water. Interview accounts revealed that the area of De level had a perennial 'lake' which provided water

for the people in the vicinity. This area is actually a flood plain during wet season hence it is possible that it retains water. It is now used primarily as a communal grazing area. The presence of species of Acacia is indicative of the high ground water table which can be harnessed by the locals for use during the dry season.

The research unearthed another method that the Toka Leya attribute to their forefathers of planting water. This story of 'planting' of water is transcribed below:

> *Bali kutwambila ati, ciindi cee nhula kuti kaiwa bali kulanganya mulya muzi dakalakwa kuti maanzi ayima ciindi cilanfu buti. Kuti bajana kuti maanzi alasika mu August amu September kaciliko…, mbobakali kwamba balo bakali ko yadaula zilya zi matanga suwa… matanga suwa bayeta balikubika sautu,amana bacitula mponyawo cabolela mpawo. Ati mbobali kwa shanga maanzi. Mponya alya bakalikusha,bajana maanzi a kubelesha.*

English Translation:

> Our forefathers used to tell us that, they used to observe places that would be water logged during the wet season. When they did observe that surface water was retained in some areas well up into the dry months, such as August and September, they would then get a species of water melon (Citrullus sp. [*Matanga Suwa]*) and then break it and put salt on it. It would rot at this point. This would become a water source as they would dig up a well at the point.

These Toka Leya IK practices associated with water proved sufficient to acquire the needed resource to sustain life and activities in the chiefdom. They were useful and passed down from

generation to generation and can still be used in modern times although application is now diminished. A resuscitation of this knowledge and practices can go a long way to alleviate the water poverty that exists in the area albeit the low rainfall patterns prevailing.

4.4.4 The protection of flora

An indigenous practice that involved the protection of flora especially water indicator tree was one of the findings of the field research. All water indicator trees were by law protected and never to be felled for any reason. This was enforced by traditional authority that dealt severely with anyone found to have cut a water indicator tree. This was to protect water sources and ensure that future generations had access to the resource.

4.4.5 Controlled drawing of water

The amount of water drawn per household was restricted to basic needs only. The distribution on based on equity such that each household was allowed to draw only as much as they needed for their needs. This shows that Toka Leya water practices were based on sustaining the available water resources and not treating the resource as infinite.

4.5 Feasibility of Incorporating Toka Leya Indigenous Knowledge into Integrated water Resources Management and Vice versa.

Toka Leya IK in water resources management blends well with the ethos of IWRM and vice versa. The bases for the comparisons were the Rio-Dublin principles in IWRM. These principles will be explored in detail with Toka Leya IK in the next chapter. A summary of the principles are stated below along with Toka Leya IK in relation to water resources management.

The first Rio Dublin principle is that Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. The Toka Leya perceived water as a finite resource worthy of sustainable management for the good for all. According to the responses and geographic character of the study area, surface water was not abundant and there is more reliance on ground water. The area is drought prone thus when ground water was located, its use was regulated to make sure that abstraction was not wasteful.

The second principle is that Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. Toka Leya cultural landscape is that of decentralisation of power although there is a paramount Chief. Decisions are made at village level by the people, the villages are presided over by Village Headmen. This creates room to incorporate the principle of participatory approach in Toka Leya IK.

Rio Dublin principle number three states that women play a central part in the provision, management and safeguarding of water. In the traditional fabric of the Toka Leya, women are not considered as lesser beings but rather as important players in decision making especially in relation to water use and management. Generally, women are the main players in household water use and thus they are included when deciding on where to site water points and in monitoring the abstraction.

Last but not the least principle is that, Water has an economic value in all its competing uses and should be recognized as an economic good. Water is valued high by the Toka Leya although the application of economic principles would be lost in traditional society. The value placed on water is exemplified by the way it is used and perceived. Not only do the people need the water,

the livestock which is also highly valued makes the people value water and place it above other needs such as food.

The findings of the study show that Toka Leya IK practices are mutually compatible with IWRM in water resources management. The two approaches though different can work well when used in synergy unlike the introduction of IWRM which is a foreign approach and may not achieve the desired results.

CHAPTER 5

INTERPRETATION OF THE FINDINGS

5.1 INTRODUCTION

This chapter presents an analysis of the findings of Toka Leya IK in relation to water resource management outlined in Chapter 4. The aspects of Toka Leya IK that have been highlighted in the previous chapter will be interpreted in relation to IWRM and their compatibility shall be taken into account. Last but not the least an analysis of how Toka Leya IK can be incorporated into IWRM and vice versa will be tackled in this chapter.

5.2TOKA LEYA INDIGENOUS KNOWLEDGE OF WATER MANAGEMENT PRACTICES

The Toka Leya water management practices are in agreement with tenets of IWRM proving that the two approaches can be used in synergy to achieve sustainable water resources management. The practice of assigning different sources of water for different uses such as for domestic use and for livestock is in line with the sustainable practices that IWRM proposes. This demarcation of these sources of water allows for controlled abstraction and sustainable use of the resource as the people regulate the quantity of water abstracted. This sheds light on the ethos of IK which not only cares for current generation but has foresight into the needs of future generations.

The association between water and trees in Toka Leya IK promotes the proliferation of trees which are cardinal to the water cycle which in turn aids in the recharging of the ground water resources available. Trees not only play a role in the water cycle but they also act as safeguards against flooding by acting as a barrier and also soaking up some of the water that would

otherwise be run-off. This is especially true in riparian forests where these are left undisturbed in traditional society as their use is highly recognised and thus they are preserved. This goes in line with the tenets of IWRM which encourage a cross-sectoral approach to water management and the preservation of forests makes up the other sectors involved directly or indirectly with water resources.

This study wanted to establish the extent the older generation aged above 35 years, of its awareness of the association between trees and water resources as being cardinal to the management of water resources. The response that was established from the respondents is shown in the table below.

Response	**Respondents**	**Percent**
Water sources were left undisturbed and animals were kept away.	66	73.3
The person who planted the water managed the water point.	7	7.8
No IK acquired.	17	18.9
Total	90	100.0

Table 2: Toka Leya water management practices (Source: Choolwe Shalwindi, 2011)

From the results obtained in Table 2, 66 respondents representing 73.3 percent of the respondents indicated that they were aware that activities in and around the riparian land were not in line with sustainable water management practices found in Toka Leya IK. Animals were also to be kept away from the sources of ground water as a way of keeping the water clean and preventing uncontrolled abstraction of the water source.

The religious or spiritual aspects of water management among the Toka Leya such as positioning religious artifacts at water points, were used to evoke awe and respect in turn encouraging sustainable use of the resource. Spiritual sanctions were applied with the aim of discouraging misuse of natural resources. As shown in the previous chapter, the points cited-Ngweezi stream and De level areas, as having had water planted where points that water harvesting techniques had been used and sustainable management of the water resource implemented. The spiritual aspect was incorporated by the Toka Leya to discourage wanton misuse and ensure continued supply of this vital resource. The current lack of water in the places cited can be attributed to unsustainable human practices that abrogate Toka Leya IK such as using the riparian land as pasture grounds.

5.3 COMPATIBILITY OF TOKA LEYA INDIGENOUS WATER PRACTICES AND IWRM.

The sustainable management of water resources entails ensuring that the available resources meet not only the needs of the current generation but that of the future generation as well. The management of natural resources in IK is undertaken as a whole system with the inclusion of local people. This is in line with the cross-sectoral approach encouraged by IWRM. The management of natural resources was governed by regulations set by traditional authority and the use of social sanctions. IK devised ordinances that ensured ecosystems and biodiversity conservation, contrary to outsider views that IK had no regard or practices favourable for environmental conservation.

Prior to the advent of pump boreholes, water for human use was drawn from deep wells. The wells were properly managed and protected. They were fenced by putting hedges and covered

with log to prevent animals from straying into the wells. This practice has also been extended to the present day boreholes as these are also fenced to safeguard them from animal and mischievous children's activities by erecting hedges around them. Figures 16, 17 and 18 show how water points are protected by hedging them.

Figure 16: A method of protecting water sources by fencing of the well using tree branches to keep animals and children away (Source: Choolwe Shalwindi, 2011)

The protecting of water sources included covering the well using tree branches to prevent animals from falling into the water as they graze in the vicinity. Figure 17 below shows how this covering was done using branches.

Figure 17: The covering of the well using tree branches to keep particles from falling into the water (Source: Choolwe Shalwindi, 2011)

The fencing of water points is not limited to wells but extends to pump boreholes. This is to keep animals away from the pump and to keep the point clean. Figure 18 shows how pump boreholes are fenced to stop animals having access to the water point.

Figure 18: A borehole is fenced to prevent animals disturbing the water sources (Source: Choolwe Shalwindi, 2011)

The landscape of the Toka Leya area is characterized by low rainfall thereby making sustainable water management cardinal. To ensure that there was equitable access to water for all, a system of equity in abstracting water from the water source was enforced. By decree each household was permitted to draw only that which was needed for their survival. This encouraged sustainable use of water and prevented over abstraction of the resource by the users. This left water available for other life forms in the ecosystem.

Extract form one interview sheds more light on this practice;

> *" Kuteka biyo a shonto shonto… Muntu a muntu kuzumizigwa kuteka ka ngomo komwe. Kamunya ako kakunwa, kusanzya mitiba aku samba."*

English Translation;

> We would draw water … each person was allowed to fill one container/calabash. That quantity would be used for drinking, personal hygiene and washing dishes.

The underground water source for animals is protected by being fenced and drinking troughs dug out of tree trunks or made of concrete were set up close to the water source. These troughs are used to store water for the animals to drink. This regulates the quantity of water abstracted at a given time for livestock. The following photographs show dug out wooden and concrete troughs used for storing drinking water for animals. This is a way of conserving water.

Figure 19: An example of a wooden trough besides a borehole used to store water for livestock to drink (Source: Choolwe Shalwindi, 2011)

In some villages the troughs for livestock were made out of concrete and set up near the borehole. During dry season water was put in the troughs for livestock. This controlled not only the amount of water abstracted but also ensured that the water point was not disturbed by movements of livestock.

Figure 20: A concrete trough used to hold water for livestock (Source: Choolwe Shalwindi, 2011)

The importance of trees to the continued sustainable natural resources management can never be over-stated. Trees are an indispensable part of the water cycle, as they not only store water but

useful for the evaporation process that is cardinal in the water cycle. There are rules and regulations enforced that prohibited the indiscriminate cutting of trees, ensuring both the management of biodiversity and protecting water supply in the Chiefdom. One of the rules in the Chiefdom was that that riparian vegetation should never be removed served to protect the sources of water thus ensuring the continued presence of surface water in streams. The water indicator trees in the plains and forests also make up the list of vegetation that is never to be cut down. These trees are not just important as water indicators but also serve as sources of food for humans and animals and prevent the degradation of soils. This mechanism of flora conservation ensures that sources of water resources were safeguarded and assured sufficient water supply. The knowledge of the benefits of keeping forest vegetation to ensure water supply was prevalent among the respondents in the Chiefdom.

The study went on further to determined the extent to which Toka Leya IK had been transmitted to the younger generation specifically the generation aged between 7 and 9 years. The transmission of IK is important if IK is to be preserved for posterity. The response to the question: What have parents taught upon you about water management? The response obtained from the children aged 7-19 years is shown in Table 3.

Response	Respondents	Percent
Avoid wasteful use of water	11	55.0
Cutting down of trees will compromise water availability	3	15.0
No IK acquired	6	30.0
Total	20	100.0

Table 3: Toka Leya IK transmission (Source: Choolwe Shalwindi, 2011)

Out of the 20 children that participated in the study, 55.0 percent representing 11 respondents indicated that their parents instilled in them the practice of treating water as a vulnerable resource by avoiding wanton misuse of the resource. The association between water resources and trees was also cited by 3 respondents representing 15.0 percent, as an aspect of IK that parents have imparted to their children in relation to water management. No IK was imparted to 30.0 percent representing 6 of the respondents in this case. This showed that there was indeed transmission of IK into the younger generation by both the intermediate group and the custodians of IK in the study area. This was a positive outcome as the continuity of IK is dependent upon knowledge transfer.

5.4 FEASIBILITY OF INCORPORATING IK into IWRM and VICE VERSA

IWRM was born out of the need for a comprehensive mechanism to manage water resources across sectors due to the apparent pressure that the limited fresh water facing. The growth in population, climatic variations and economic growth have put the resources under strain hence the current water crisis in some regions in the World. There is no universal blueprint for the implementation of IWRM in the world due to the uniqueness of water management challenges in

the respective nations. This led to the formulation of a set of guiding principles of IWRM. These are called the Rio-Dublin Principles and are as follows:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchment area or groundwater aquifer.

- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels. The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

- Women play a central part in the provision, management and safeguarding of water. This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programs, including decision-making and implementation, in ways defined by them.

- Water has an economic value in all its competing uses and should be recognized as an economic good. Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources. (Global Water Partnership Toolbox, 2001)

Each of these principles will be examined in the light of the research findings and a conclusion will be drawn as to whether the IWRM principles can be applied in IKSPs of the Toka Leya and vice versa.

5.4.1 Fresh water is finite and vulnerable resource essential to sustain life, development and the environment.

It is a fact that the quantity of fresh water resources available is fixed. The hydrological cycle yields a fixed quantity of water each time. Fresh water resources stand at 2.7%, while saline water in oceans accounts for 97% of all water resources. The source of fresh water is primarily rain. The polar region ice makes up a majority of fresh water resources standing at 77% of fresh water resources (Gumbo and van der Zaag, 2001). The rain water recharges underground aquifers, rivers, streams and lakes used by man and animals as source of fresh water. Human activities such as mining and agriculture alter the resource's quality. This principle therefore

calls for an approach that involves the management of the natural interacting systems involved in the hydrological cycle; plan human activities such as land use and industrial activities.

The Toka Leya consider water as a finite and vulnerable resource essential to life and thus it should be safe-guarded. The fact that the area the Toka Leya settled in is drought prone, any viable ground water resource located through IK is valued and governed by the social systems and regulations. The regulation that exemplifies that the Toka Leya are aware of the finite nature of water is the edict on time of drawing water from communal wells. During the focus group discussion, it was revealed that the ideal time for drawing of water was between 4am and 7am. Thereafter it was not encouraged to draw water from the communal well. This system or period of drawing water allows for the regeneration of water during the course of the day. This also indicates that the Toka Leya have the understanding of the recharging abilities and pre-requisites of groundwater resources.

The regulation limiting the quantity of water drawn by each household from the communal wells among the Toka is another aspect of IK that reinforces the fact that water is a finite resource. In the event that it is perceived that there is over abstraction of water from the water point, restrictions are applied on auxiliary activities that need water, such as gardening. Where both man and livestock use the same borehole/ water point, drawing of water for livestock is restricted to set days in a week. This is to prevent over abstraction as livestock demand for more water than the human needs. This however has potential to lead to conflicts in the long run.

Rules that guaranteed the protection of vegetation especially the water indicator trees also aptly illustrate the fact that water was viewed as a vulnerable resource. This shows that the conservation of natural resource in IK is not undertaken in segments but rather holistic in nature. The whole ecosystem is taken into consideration as the aspect of co-existence/dependence of all species including man is the bedrock of IK. The non-destruction of forest resources contributes greatly to the hydrological cycle that generates fresh water supply. It is still prohibited to cut trees in the riparian forest in the study area because these trees provide flood protection and also ensure that water is available in the stream.

5.4.2 Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

Participation of all stakeholders in IWRM requires involvement of users, planners and policy makers in decision making process of water resources management. This is the bottom up approach, which gives decision making power to the masses, traditionally left to political or administrative heads. This participation should be at all levels of water projects such as the planning stage; implementation stage and the monitoring and evaluation stage. This can be done either by household representation or by heads chosen by the communities to represent them. This encourages community ownership and responsibility thereby improving the effectiveness of the project.

The Toka Leya cultural landscape is based on decentralisation of power. The Chief does not hold absolute power and the headmen may make decisions without seeking the Chief's approval. The existence of administrative wings such as village headmen creates for devolution of power and decision level unit for water related projects as each household in each village is included in

the process. Each household is represented at the village meetings where decisions such as where to site boreholes are made and every household has to pledge equal contribution of resources for the project.

Then Ministry of Lands, Energy and Water Development (MLEWD) Kazungula District Water Officer cited the identification of water points for boreholes as the way the community was incorporated in the water provision projects of the area. The community citing of the water points involves the use of IK showing that the community is involved beyond consultation. The community must be involved as they are more aware of their ecology and needs better than the project manager.

The resource mobilisation in the case of the provision of bio-filters by the Kazungula District Council for the community in the study area is another example of how the community was involved in water-related project. Resource mobilisation does not only involve monetary contributions but includes building material and labour that the community offers as contribution to the project. The community is also tasked with monitoring the project to make sure its life span and objectives are met.

Table 4 shows the responses to the question among the respondents aged 20-34 years. Do all people participate in making decisions concerning water use, management and conservation?

Response	Respondents	Percent
Yes	20	100.0
No	0	0
Total		100.0

Table 4: Participatory Approach in decision making in water related projects (Soure: Choolwe Shalwindi, 2011)

From the results obtained in Table 4, 20 youths (20-34 years), representing 100 percent reinforced the aspect of participatory approach among the Toka Leya in water related projects. This unique feature of Toka Leya traditional life blends well with the need for a bottom up approach in IWRM.

5.4.3 Women play a central part in the provision, management and safeguarding of water.

Limited involvement of women in projects and programmes aimed at addressing water resources management is a hindrance to achieving the goal of availing the resource to all members of the community. Women are the managers and main users of water at household level, while men may take interest and use water in activities outside the home. In the study area, this was evident in the responses from the two sexes as to their use of water. Notable is the focus of women on water for home use and consumption while their male counterparts prioritised water for livestock as the main use of water. This is due to the males being assigned the roles of keeping livestock while females' traditional role is a home maker.

Women being the major users of water are the worst affected by any negative changes in availability of water resources. It is imperative that policy makers involve the people who are directly engaged in using, managing and developing water resources in decision making. Women

make up at least half of the population that actively uses and manages water. Examples of this are- women managing domestic water supply, women farmers and entrepreneurs using water resources for production, women acting in their socio-cultural roles as community natural resource managers and guardians of traditional knowledge (GWP policy brief, 2002). This reinforces the need to have women actively involved in water management.

The inclusion of women in decision making of water resources in the study area is interwoven in Toka Leya culture. This is tied in with the decentralisation of power characteristic of the Toka Leya culture. In traditional life, women are recognised as partners in decision making regarding water resources as they play a major role in its management. The study showed that there is the inclusion of women in water resources related decision making among the Toka Leya. Some respondents further added that women sometimes have more viable ideas than their male counterparts hence, the need to include women in the whole process. This is especially evident when selecting ground water points as women and children are the primary users of the water points while the male counterparts are more concerned with water reservoirs to serve livestock needs. This also blends wholly with the principle of participatory approach to water management in the study area.

Table 5 shows results of the respondents on whether women were included in decision making process in water management among the Toka Leya of Chief Sekute.

Response	Respondents	Percent
Yes	88	97.8
No	2	2.2
Total		100.0

Table 5: Women involvement in decision making (Source: Choolwe Shalwindi, 2011)

A deduction of the results in Table 6 shows that 88 representing 97.8 percent reveals that women are not excluded from decision making in the Toka Leya culture. On the other hand, 2 representing 2.2 percent stated that women were not part of the decision making process in water management among the Toka Leya. An analysis of the results in Table 6 show that women were indeed part of the decision making process as 20 representing 100.0 percent asserted to this.

An extract from the interviews and discussions transcribed below adds more evidence that women participation among Toka Leya cultural fabric is a norm.

> *"Kuyandika muntu a muntu, kayi inga tongosi tijaniki ku muntu omwe. Muntu a muntu ulapa tongosi…"*

English Translation:

> There is need to have all members of the community consulted because each individual has unique challenges and they will be able to forward these challenges on their own…

5.3.4 Water has an economic value in all its competing uses and should be recognized as an economic good.

The failures in water resources management is attributable to the fact that water has been viewed as a free good, or at least that the full value of water has not been recognised. There is need to change perceptions among the water users about water values and to recognise the costs involved not only in water allocation but in sustainable water resource management. It is also imperative that the western perception of 'economic good' of water through charging in fiscal terms is aligned with traditional value attached to water which does not ascribe fiscal value to water per se. **Value** and **Charges** are two different things, hence the need to distinguish clearly between valuing and charging for water. The value of water is in its alternative uses and is important for the rational allocation of water as a scarce resource whether by regulatory or economic means. Charging for water applying an economic instrument to affect behaviour towards conservation and efficient water usage, to provide incentives for demand management, ensure cost recovery and to signal consumers' willingness to pay for additional investments in water services (Mei Xie, 2006).

The value of water among the Toka Leya is not in terms of western economic yardsticks, such as net benefits but rather in the intrinsic value of water to the users. The value placed by the Toka Leya is indeed high owing to the non-abundance of surface water resources and the drought prone nature of the area. The fact that they are pastoralists also enforces in their culture the value placed on water resources. There is no wastage of the resource as it is viewed as a finite resource that should be safeguarded.

The full economic cost includes the full supply cost due to resource management, operating and maintenance expenditures and capital charges. The recovery of full cost should be the goal for all water uses and is generally borne by the users. In the case of water projects of the study area, costs of projects are borne by the users through not only financial contributions per household but also through other resources needed for the successful implementation of the project. Other resources such as labour and building materials are sourced by the Toka Leya as their contribution towards the projects. The willingness of the Toka Leya to contribute to the projects exemplifies the fact that they do not view water as a free good but as a good that has value and are ready to pay for its provision. Maintenance costs are also borne by the users in the case of boreholes breaking down.

The study sought to find out whether or not the Toka Leya had the value of water embedded in their cultural fabric and what such a value was attached to. Table 7 illustrate the extent to which the value of water and the recognition of cost implications to the user are accepted by the Toka Leya. The question in relation to table 8 in the interview guide was, Are you willing to pay for safe drinking water?

Response	Respondents	Percent
Yes	82	91.1
No	8	8.9
Total		100.0

Table 6: Willingness to pay for safe drinking water Source: Field Data (2011)

Of the custodians of indigenous knowledge (35 years and above) 82 stated that they would pay for safe drinking water representing 91.1 percent implying that they value water and attach cost

implications to it. A divergent view was held by 8 people representing 8.9 percent of the respondents.

A question was asked; “If Yes to question 25, explain why”, and in response various reasons were given as to why the respondents would pay for water. Table 8 shows the responses and reasons of their willingness to pay for water.

Response	**Respondents**	**Percent**
Resources can be used to repair boreholes and open more water points	56	62.2
Water is vital and good for the health of everyone	26	28.9
Not applicable	8	8.9
Total	90	100.0

Table 7: Reasons of willingness to pay (Source: Choolwe Shalwindi ,2011)

The results show that among the Toka Leya it was accepted that water provision came at a cost and had value. The phenonmenon of paying for water provision had been accepted and embraced by the Toka Leya thereby reinforcing the notion that the IWRM principle of viewing water as an economic good was compatible with Toka Leya IK. The Toka leya accept the fact that in order for more water points to be opened, to provide them with clean water there is need on their part to pay for the cost of this provision. The reason advanced by the respondents that declined to pay for water, does not arise from viewing water as a free gift but rather is the lack of resources to pay for the provision of water.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1CONCLUSION

Water resources management as outlined in Southern Zambia can be achieved by a synergy of IK and IWRM practices in the previous chapter. The study has established a number of pieces of evidence that confirm the integration of IK into IWRM and vice versa. The following constitutes the study's conclusion:

- IK and IWRM are different approaches to water management that can be used to reinforce one another in a bid to achieve optimum water resource management among the Toka Leya of Chief Sekute.

- There is need for planners and authorities not to only acknowledge IK, but also to use the knowledge proactively. There must be a deliberate programme to include IK experts from the communities when planning, implementing and monitoring water resource projects. This will also ensure the IK does not go into oblivion thereby creating knowledge vaccums and over dependence of the people on donor driven water projects.

- The use of IK must go beyond citing of water points for the construction of boreholes. It must include management of natural resource base of the area and embrace management of flora and fauna

- There is need for a revival and appreciation of Zambia's cultural heritage in the management of oir natural resources. This will lead to less dependence on donor and Government intervention by using IK to solving natural resource challenges.

- IK encourages innovativeness that will encourage the Toka Leya to use IK in order to solve some natural resource challenges encountered in their environment.

- IK encourages the use of participatory approach in water management which is pronounced in IWRM as one of the keys to sustainable water resource management.

- The inclusion of women in managemnt of resources is present in IK and traditional society and thus should be encourages especially in management of water resources.

6.2 RECOMMENDATIONS

Arising from the conclusions above, the following recommendations are made:

- There should be capacity building curriculum for personnel involved in National Rural Water Supply and Sanitation to include IK for sustainable water resources management.

- There should be a deliberate move to include the community in all stages of water management projects and encourage the use of their traditional knowledge.

- There should be a nationwide in-depth documentation of IK in all aspects of natural resource management and health and the information should be available to policy makers. It should be emphasised that each ethnic group has a unique set of IK and thus there can be no generalisation of findings.

- Scientific study into aspects of IK will serve to further prove its efficacy. This will stimulate interest and application of IK by the decision makers and owners of the knowledge alike.

6.3 SUGGESTIONS FOR FUTURE STUDY

Based on this study, the following future researches could be explored:

6.3.1 Research and Documentation of Indigenous Knowledge

Although Zambia has acknowledged the efficacy and need for indigenous knowledge, there is need for more research and documentation to be undertaken in all ethnic groups.

REFERENCES

Ambio (1993) "Ecology, Economics, Policy", in Biodiversity Vol. 22, No. 2/3. Royal Swedish Academy Institute. Download at http://www.jstor.org/stable/4314060.

Berkes F., Colding J. and Folke C. (2000). "Rediscovery of Traditional Ecological Knowledge as Adaptive Management," in Ecological Applications, Vol. 10, No. 5. Ecological Society of America. Download at http://www-.links.jstor.org/sici?sici=1051-0761.

Celtel (2008). Ceremony: Celebrating Zambia's Cultural Heritage. Celtel, Lusaka.

Central Statistical Office. (2010). 2010 Census of Population and Housing Summary Report. Central Statistical Office, Lusaka.

Christa J. (1975). Emil Holub's Travels North of the Zambezi. Manchester University Press, Manchester.

Fanshawe D.B, Mutimushi J.M. (1971). A Check List of Plant Names in the Lozi Languages. Ministry of Rural Development, Lusaka.

Fanshawe D.B. (1972). Fifty Common Trees of Northern Rhodesia. Ministry of Rural Development, Lusaka.

Fanshawe D.B (1975). "The Flora," in Phillipson, David W (ed). Mosi-oa-Tunya: A Handbook to the Victoria Falls Region. Longman, Zimbabwe.

Global Water Partnership (2009) Policy Brief 9: Lessons from Integrated Water Resources Management Practice. Download at www.gwp.org/Toolbox/Publications/Policy-Briefs/

Government of the Republic of Zambia. 2006. Vision 2030: A prosperous Middle-income Nation By 2030. Government of the Republic of Zambia, Lusaka.

Government of the Republic of Zambia. (2010). National Water Policy. Government of the Republic of Zambia, Lusaka.

Government of the Republic of Zambia. (2008). Zambia Millenium Goals Progress Report. Government of the Republic of Zambia, Lusaka.

Gumbo, B., van der Zaag, P. 2001. Principles of Integrated Water Resources Management. Paper presented at the Southern Africa Youth Forum, Global Water Partnership Southern Africa. Zimbabwe.

Kamara J. (2004). "Indigenous Knowledge in Natural Disaster Reduction in Africa," in Poverty Times # 3. Download at http://www.grida.no/publications/et/ep3/page/2608.aspx.

Kashoki M.E. (1989). "Conservation, Preservation, Development and Violence to the Environment," in Musonda, Francis (ed). Zambia Museums Journal, Vol. 7. National Museums Board.

Lenton R. and Muller, M. (ed) (2009). Integrated Water Resources management in Practice: Better Water Management for Developement. Earthscan Publication Ltd. London.

Livingstone District Notebook. (1924).

Mie Xie. (2006). Integrated Water Resources Management-An Introduction to Principles and Practices. World bank Institute. Download at http://wbi.worldbank.org/wbi/content/mei-xie.

Ministry of Finance and National Planning. (2011). Sixth National Development Plan 2011-2015: Sustained Economic Growth and Poverty Reduction. Government of the Republic of Zambia, Lusaka.

Ministry of Tourism, Environment and Natural Resources, (2007). National Adaptation Programme of Action on Climate Change. Government of the Republic of Zambia, Lusaka.

Mubitana K. (1977). "Christian Missions and the Toka Leya of Southern Zambia", Ph.D. Thesis, University of Edinburgh.

Mubitana K. (1975). "The Traditional History and Ethnography," in Phillipson, David W (ed). (1975). Mosi-oa-Tunya: A Handbook to the Victoria Falls Region. Longman,Zimbabwe.

Mwanang'ono M. (2011). "Proposed Synergies between Indigenous and Modern Systems of Environmental Education in Addressing development Planning in Zambia". MA Thesis, The University of Zambia.

Nyambe, I.A., Feilberg M. (2009). Zambia_National Water Resources Report for WWDR3. The Government of the Republic of Zambia, Lusaka.

Reynolds P, Cousins C.C, (1993). Lwaano Lwanyika, Tonga Book of the Earth. Panos Publications Limited.

Sharma N.P, Damhaug, T, Hunt- Gilgan, E., Grey D., Okanu V, Rothberg, D. (1996). World Bank Technical Paper No. 331, Africa Technical Department Series: African Water Resources Challenges and Opportunities for Sustainable Development. World Bank, Washington DC.

Shetton, D.H. (ed) (1993). World Bank Discussion Papers 188. World Bank, Washington DC.

Storrs, A.E.G. (1995). Know Your Tress. Regional Soil Conservation Unit, Nairobi.

Storrs, A.E.G. (1982). More About Trees: interesting Facts and Uses of Common Zambian Trees. The Forestry department, Ndola.

Warren, D.M. (1992). Indigenous Knowledge, biodiversity Conservation and Development. Keynote address at the International Conference on Conservation of Biodiversity in Africa: Local Initiatives and Institutional Roles. Kenya.

United Nations. (2004) The Concept of Indigenous people. Background paper prepared by the Secretariat of the Permanent Forum on Indigenous Issues. Download at http://www.un.org/esa/socdev/unpfii/.../workshop_data_background.doc

APPENDICES

Appendix I: Interview guide administered to adults aged 35 years and above.

Section A: Characteristics of respondents

1. Sex: ……

1. Male ☐ 2. Female ☐

2. Age: …….

1. 35-40 ☐ 2. 41-45 ☐ 3. 46-50 ☐ 4. 51+ ☐

3. Marital Status: …….

1. Single ☐ 2. Marriage ☐ 3. Divorced ☐

4. Widowed ☐ 5. Separation ☐

4. Village: …….

5. Headman: ……

Section B: Water Use

6. What is the Indigenous name of water: ……

7. What are the Sources of water you use: ……

……

8.What challenges do you face in accessing water? …….....

……

……

9.What are the various uses of water? ……

……

10.What household responsibilities have been assigned to you? …….....

……

11. What are the Indigenous knowledge and practices surrounding water use?

……

……

12. What are the Indigenous knowledge and practices surrounding water management? ……..

……

……

13. What are the Indigenous knowledge and practices surrounding water conservation?……

……

14. Which of the IKSPs you have outlined above are you using currently?

……

……

15. Which of the IKSPs you have outlined are no longer in use? ……

……

……

16. Do you perceive any change in how water is used and conserved over the years?

1. Yes ☐ 2. No ☐

17. If Yes to question 16, what are the changes? …….

……..

18. What practices in use would you like to be included in IWRM science? …….

…….

……..

19. Do all people in the village participate in making decisions concerning water use,

management and conservation?

1. Yes ☐ 2. No ☐

20. Are the women involved in decision making on water use, management and conservation?

1. Yes ☐ 2. No ☐

21. At what level are women involved in discussions: …….

…….

……..

22. Are you willing to pay for water?

1. Yes ☐ 2. No ☐

23. Are you willing to pay for safe drinking water?

1. Yes ☐ 2. No ☐

24. If Yes to question 22, explain why? .....……..

25. If No to question 22, explain why? ……..

…….

THANK YOU FOR YOUR COOPERATION

Appendix II: Interview guide administered to the Youth aged 20-34 years.

Section A: Characteristics of respondents

1. Sex: ……

1. Male ☐ 2. Female ☐

2. Age: …….

1. 20-24 ☐ 2. 25-29 ☐ 3. 30-34 ☐

3. Marital Status: …….

1. Single ☐ 2. Marriage ☐ 3. Divorced ☐

4. Widowed ☐ 5. Separation ☐

4. Village: …….

5. Headman: ……

Section B: Water Use

6. What is the local name of water? ……

7.What are the Sources of water you use? ……

……

8.What challenges do you face in accessing water?

……

……

9. What are the various uses of water? ……

……

10.What household responsibilities have been assigned to you? …….....

……

11.What are the Indigenous knowledge and practices surrounding water use?……

……

12. What are the Indigenous knowledge and practices surrounding water management? ……..

……

……

13. What are the Indigenous knowledge and practices surrounding water conservation?

……

……

14. Which of the IKSPs you have outlined above are you using currently? ……

……

15. Which of the IKSPs you have outlined are no longer in use? ……

……

……

16. Do you perceive any change in how water is used and conserved over the years?

1. Yes ☐ 2. No ☐

17. If Yes to question 17, what are the changes? …….

18. What practices in use would you like to be included in IWRM science? …….

…….

……..

19. Do all people in the village participate in making decisions concerning water use,

management and conservation?

1. Yes ☐ 2. No ☐

20. Are the women involved in decision making on water use, management and conservation?

1. Yes ☐ 2. No ☐

21. At what level are women involved in discussions?

…….

……..

22. Are you willing to pay for water?

1. Yes ☐ 2. No ☐

23. Are you willing to pay for safe drinking water?

1. Yes ☐ 2. No ☐

24. If Yes to question 22, explain why? **....**……..

…….

……..

25. If No to question 22, explain why? ……..

…….

THANK YOU FOR YOUR COOPERATION

Appendix III: Interview guide administered to the children aged 7-19 years.

Section A: Characteristics of respondents

1. Sex: ……

1. Male. ☐ 2. Female. ☐

2. Age: ……

1. 7-11. ☐ 2. 12-16. ☐ 3. 17-19. ☐

3. Marital Status: ……

1. Single. ☐ 2. Married. ☐ 3. Divorced. ☐ 4. Separated. ☐

5. Widowed. ☐

4. Village: …….

5. Headman: ……..

Section B: Water Use

6. What is the local name of water? …….

7. What are the sources of water you use? ……...

……

8. What challenges do you face in accessing water? …….....

……

……

9. What are the uses of water? …….

……

10. What Household responsibilities have been assigned to you? …….....

……

……

11. What have parents impressed upon you as regards to water use, management and

conservation? …….

……

……

12. Is there any traditional knowledge that has been passed on to you on water use,

management and conservation that you would like to continue using?

1. Yes ☐ 2. No. ☐

13. If Yes to question 12, what traditional knowledge would you like to keep and pass

on? ……

……

…….

14. Is there any traditional knowledge that has been passed on to you on water use, management and conservation that you would like to stop using?

1. Yes. ☐ 2. No. ☐

15. If Yes to question 14, what are traditional practices on water use, management and conservation would you stop using? …….

……

16. How beneficial is this knowledge been to you? ……..

……

……

17. What have been the consequences of ignoring the advice given by parents regarding the use of water? ……

……

……

18. What changes have you seen with regard to water over the past years? …….

……

……

19. What would you like to do about water in your area? ……

…….

…….

THANK YOU FOR YOUR COOPERATION

Appendix IV: Interview guide administered to the Government of the Republic of Zambia officials.

Section A: Characteristics of respondents

1. Sex: ……

1. Male. ☐ 2. Female. ☐

2. Age: ……

1. 25-30. ☐ 2. 31-35. ☐ 3. 36-40. ☐ 4. 41-45. ☐

5. 45+. ☐

3. Marital Status: ……

1. Single. ☐ 2. Married. ☐ 3. Divorced. ☐ 4. Separated. ☐

5. Widowed. ☐

4. Ministry/Institution: …….

5. Position held: …….....

Section B: Water Use

6. Have you heard about Integrated Water Resources Management (IWRM)?

1. Yes. ☐ 2. No. ☐

7. What is your understanding of IWRM: ……

……

……

8. How many water provision projects have been implemented in Chief Sekute's Area?

……

……

9. Briefly outline these projects ……

……

……

10. What was your involvement in the project? ……

……

……

11. How did the projects contribute to achieving the objectives of the Ministry you serve?

……

……

12. What are the positive outcomes of the projects? ……

…….

……

13. Did you face any challenges in the implementation of the projects? :

1. Yes. ☐ 2. No. ☐

14. If Yes, to question 13, Explain the challenges encountered …….

…….

…….

15. Was traditional knowledge incorporated in the formulation of the projects?

1. Yes. ☐ 2. No. ☐

16. If Yes to question 15, how was traditional knowledge used in water related

projects? ……..

…….

17. At what level do you involve local people in the projects? ……

……

……

18. Is there equal representation of male and female participants when involving the

community in the projects? ……

……

……

19. How have the projects been received by the intended beneficiaries? ……

……

……

THANK YOU FOR YOUR COOPERATION

GLOSSARY OF BOTANICAL TERMS USED IN THIS DISSERTATION (STORRS, 1995)

Bonsai: the cultivation of dwarf trees, which originated in Japan.

Bipinnate: when the primary divisions of the pinnate leaf are themselves pinnate.

Deciduous: describes a tree which sheds its leaves annually or periodically.

Fissured: refers to the longitudinal splits or cracks in a bark.

Gallery: a long narrow strip of vegetation on either side of the stream.

Lobe: a division of a leaf by a deep fissure.

Oblong: describes a leaf that is egg shaped.

Pinnate: refers to a compound leaf with leaflets arranged along each side of a common stalk.

Pod: a dry dehiscent fruit.

Reticulate: net veined.

Reticulately scaly: a pattern of scales on bark like meshes of a net.

Riparian: river bank.