

Sandra Hake

The Mission of Supplying Maputo with Freshwater  
A political and environmental water history



UPPSALA  
UNIVERSITET

Master's thesis in Global Environmental History

## Abstract

Hake, S. 2016. The Mission of Supplying Maputo with Freshwater - A political and environmental water history. Uppsala, dep of Archaeology and Ancient History.

Within the broad field of global environmental history this master thesis analyses the question of supplying the city of Maputo with freshwater focusing on transboundary river basins, international treaties and the impact of the interrelated history of the region, applying a holistic approach. The thesis shows that the biggest challenges in water management through history up till now has been a combination of the following: Not speaking the same language in the early days of negotiating treaties, creating distrust. Conflict in the region affecting cooperation and the economic situation, leading to neglected maintenance. The conflicts and war in the region also increased the population in Maputo as well as later population increase has, in combination with overall higher pace of urbanization. The political history has played a role affecting the relation between the three river basin sharing neighbors not only when focusing on conflicts but also in economic development and power relations within various fields. One of these power relations have been the differential educational level of official representatives, but also power relations that goes beyond the individual negotiators. In addition, the fact that Maputo is located downstream on all three rivers means it becomes more vulnerable. Competing demands and different interests post another main challenge in having enough water reaching the city. The fact that the distribution between the three sharing countries is uneven and that Maputo with for future development will increase its water needs raises questions about the large outtake of water for sugar plantations and mines in South Africa and Swaziland and also use water for inter basin transfers. Lack of data is also a challenge in the sense that evaluations and estimations of water flow, outtake and use is inadequate for negotiations and management plans. Also the fact that there has not been adequate monitoring supervision of water flows crossing the border into Mozambique, which has led to that lower amounts of water than agreed crossing the border has presented a challenge. The ecology of the region possesses challenges setting limits to water outtake from the river basins. The weather in the region with droughts and floods, in combination with increasing population, irrigated agriculture and industry takes the question of sharing water to a new level. Adding climate change to the equation and the fact that climate change makes weather patterns even harder to predict the difficulty of making estimations of the water that will be available and then how to use and distribute it is made even more difficult. With climate change and raising temperatures, evaporation will increase and the construction of more dams exposes more water to evaporation as the body of surface water increase. During colonial rule supplying the local population in Maputo was not a priority. Later, the fast growth of the city has resulted in unplanned neighborhoods and a water supply system that are not expanding at the same pace as the city is growing. With increasing demands of water equity of water share and distribution is not only a transnational issue but also an internal national problem.

Keywords: Maputo, Mozambique, Water Treaties, Sharing water, Southern African Development Community (SADC), Access to water.

Master's thesis in Global Environmental History (45 credits), supervisor Anneli Ekblom, Defended 160609.

© Sandra Hake

Department of Archaeology and Ancient History, Uppsala University, Box 626, 75126 Uppsala, Sweden

## Acknowledgements

Writing this thesis has really been a process, longer than anticipated, I therefore wish to sincerely thank my supervisor Anneli Ekblom for her endless support; emailing checking in on me wherever in the world I have been, commenting on my text and helping me stay focused. I also wish to thank my fellow student Sarah Trägårdh for being the most positive person I know. When we left for Mozambique the first time in January 2014 we did not know each other that well but now I can say that I know we will be friends forever, I cannot even start to imagine the months spent in Mozambique without you.

Sandra Hake, Stockholm June 6, 2016

# Table of Contents

Chapter 1: Introduction.....	7
1.1 Aims and research questions.....	10
1.2 Disposition.....	11
Chapter 2: Conducting the study.....	12
2.1 Methodology.....	12
2.2 Sources.....	13
2.3 Starting point.....	14
2.4 Field study.....	15
Chapter 3: Context.....	16
3.1 Water in the Southern African region.....	16
3.2 The country Mozambique.....	17
3.3 A short history of Mozambique.....	19
3.4 Mozambican history of politics in the late 20 <sup>th</sup> century.....	20
3.5 The interrelated region.....	22
Chapter 4: Water in Maputo.....	25
4.1. The history, location and ecology of the region.....	25
4.2 Urban planning and water systems.....	27
4.3 Hydropolitics of urbanization.....	29
4.4 Water authorities.....	30
4.4.1 Mozambican Water Law.....	30
4.4.2 The National Directorate of Water.....	30
4.4.3 Ara-Sul.....	31
4.5 The water sector over time.....	31
4.6 Maputo's water supply.....	32
4.7 The mission of supplying Maputo with freshwater – planning for a mega town.....	33
4.7.1 Water data.....	35
4.8 Experience from the field.....	35
4.8.1 Xipamanine neighbourhood.....	35
4.8.2 Inhaca Island.....	37
4.9 Floods and droughts.....	38
4.9.1 Responding to floods.....	38
Chapter 5: The three river basins.....	40
5.1 Incomati River Basin.....	41
5.2 Umbeluzi River Basin.....	43
5.3 Maputo River Basin.....	44

Chapter 6: Sharing water .....	47
6.1 Cooperative management of international rivers .....	47
6.2 Negotiating water with other countries .....	48
6.3 International water law.....	49
6.3.1 UN Convention on Law of the Non-navigable Uses of International Watercourses.....	50
6.3.2 Helsinki Rules on the Use of the Waters of International Rivers.....	50
6.3.3 Berlin Rules on Water Recourses.....	50
6.3.4 SADC Shared Watercourse System Protocol .....	51
6.3.5 The SADC Protocol on Shared Watercourses.....	51
6.4 Water sharing management.....	52
6.5 Agreements and river basin commissions.....	52
6.6 Upstream-downstream.....	53
6.7 Mozambican Water Law and Urban Water Supply Reform Process.....	53
6.8 SADC.....	54
 Chapter 7: Conclusions.....	 56
 Bibliography.....	 60
Archives and Libraries.....	60
References.....	61

# List of Figures

## Acronyms

AMCOW – African Minister’s Council on Water  
FAO – Food and Agriculture Organization of the United Nations  
FLS – Front Line States  
ITCZ – Inter-Tropical Convergence Zone  
IPCC – Intergovernmental Panel for Climate Change  
MDG’s – Millennium Development Goal’s  
SADC – Southern African Development Community  
SARDC – Southern African Research and Documentation Centre  
UN – United Nations  
UNDP – United Nation Development Programme

## List of Illustrations

Figure 1.....	23
Figure 2.....	25
Figure 3.....	26
Figure 4.....	32
Figure 5.....	34
Figure 6.....	36
Figure 7.....	37
Figure 8.....	39
Figure 9.....	40
Figure 10.....	40
Figure 11.....	41
Figure 12.....	41
Figure 13.....	43
Figure 14.....	44
Figure 15.....	44
Figure 16.....	48
Figure 17.....	51
Figure 18.....	54

# Chapter 1: Introduction

This thesis study the challenge of supplying Maputo, the capital of Mozambique, with freshwater, looking at the challenges that have been faced throughout history up until today and how they have interplayed with the surrounding region. The study takes place on three levels; the water supply system within Maputo town, the three rivers in the region, and the political and ecological complexities of sharing water with other countries. One of the recurring challenges affecting water supply in the region is taking place at this very moment; a severe drought in the eastern part of southern Africa, especially affecting Madagascar, Mozambique and Zimbabwe. The Government of Mozambique activated on April 12 2016 the institutional Red alert due to the drought ([reliefweb.int](http://reliefweb.int)). At the same time, the northern parts of Mozambique have been experiencing heavy rainfall. This shows us the high level of rainfall variability, not just between years, but also within the country itself, with heavy rainfall in the north and severe drought in the south simultaneously. According to the World Food Programme “many areas have seen the driest October-December period since at least 1981” ([floodlist.com](http://floodlist.com)). Over the 20<sup>th</sup> century and probably longer, the region experienced recurring drought and flood in a cyclic decadal pattern, but now the effects of climate change makes the rainfall harder to predict and the droughts and floods more extreme (Tyson and Preston-Whyte 2000: 162-165). Climate change are also effecting the sea current phenomenon called el Niño, causing the winds and clouds that normally bring rains to the summer rainfall region of southern Africa to concentrate along the equator, causing floods in central and eastern Africa and drought in southern and northern Africa<sup>1</sup> (Tyson and Preston-Whyte 2000: 162-165).

Water (meaning the ocean coasts, the rivers and lakes) is the number one most important feature in the history of human settlement, region development and state formation, in some regions even more than in others. Having an ocean coast or a navigable river for travel and commerce has been essential in forming the world we live in today. Having access to a river or lake providing freshwater for irrigating agriculture, watering cattle, supplying villages and cities with water for drinking and sanitation has, as already stated above, always been the most important factor in the history of settlement since human life is not possible without access to water, hence providing the perfect example of the point made by the field of environmental history, studying human and nature interaction over time, not as separate subjects (Radkau 2008: 93 and 108-109). Some parts of the world are more water scarce than others, but the biggest problem concerning access to water is not scarcity of the resource in itself, but rather the problem lies in the question of distribution of water and level of outtake. Global warming is changing weather patterns, causing the weather to be more unpredictable and making some areas of the world dryer and others wetter. In the case of Mozambique, global warming entails that it is likely that droughts will occur more often and that floods will be more extreme. The IPCC's Global Circulation Models predict a future, overall, increase in extreme weather events for southern Africa and overall drier conditions (Christensen et al., 2007). Other projections with higher resolution forecast a decrease of rainfall in northeastern South Africa and a higher incidence of extreme rainfall events (Engelbrecht et al., 2009, 2012) or more unpredictability (Haensler et al. 2010, 2011). Such scenario puts enormous demands on the water provisioning systems of Mozambique. There are two forms of

---

<sup>1</sup> Also known as the Inter-Tropical Convergence Zone (ITCZ), area of turbulence created by the convergence of trade and anti-cyclonic winds around the equator that causes Africa's bimodal rain fall pattern.

distribution which affects water supply, one is the national distribution in terms of supply and management of water; the second form of distribution is the transnational one. In the transnational distribution an important factor is states sharing lakes and river systems – transboundary river basins. Here the challenge lies in distributing the water in an equitable, faire and effective way, but also in taking shared responsibility when it comes to flood control management. At present in Mozambique only c. 36% of the total population has access to safe drinking water (Adonis 2007) and Maputo is almost the only city with a functioning central sewage system for collection and treatment of domestic sewage (Global Atlas of Excreta 2008: 435). In this thesis I will look into how the demand for water by the city of Maputo is and has been provided for. Maputo is a fast growing city absorbing more and more of its surroundings; Maputo city together with Matola and Machava is now called Greater Maputo. By integrating this towns and other new areas into one, Greater Maputo, the population is estimated to double to a total of four million in 2035. At the same time, the total area that are to be serviced with water infrastructure is estimated to triple in size (Fipag 2013: 1). This of course means that the demand for water will increase. New dams are being built to meet the demand, but still, the most important factor is the cooperation and international relations with the water basin sharing neighbors Swaziland and South Africa securing access to enough water to meet the city's needs.

Arriving in Maputo for the first time in January 2014 I knew little of what to expect since this was my first ever visit to the African continent. I had of course over the years gathered some preunderstanding that had shaped my image of the place I was just entering, that it would be dry and not so green was one of these things I had imagined. Therefore, the amount of rain and in particular the vast flooding's of the city that followed while I was staying there, was somehow still hard for me to take in. Especially when at the same time the public discussion concerning water most of the time focused on the lack of it, especially when concerning agricultural production. Pretty soon, it became clear to me that the problem in Maputo (as also southern Mozambique in general) was the reality of having either too much water or too little. The problem of water management thus lie to a large extent in the distribution of rainfall over the year, the region having a dry (March-October) and a wet season (November-February). But such seasonal and also annual variability can be amended or mitigated through a well-built water provision system. For Maputo, the even bigger problem than rainfall variability is water management, in terms of planning and distribution. The way the water is managed can help even out the dry and wet peaks. Having enough water all year around is to a large extent about management and allocation, as stated below by the Southern African Research and Documentation Centre (SARDC)<sup>2</sup>:

Most of the current water problems in southern Africa arise from inadequate or improper management of water resources, rather than shortages. Thus it is essential to raise awareness of water availability and use, and of management approaches that are sustainable. (SARDC 2009: 9)

The city obtain its freshwater from two rivers; Incomati River and Umbeluzi River. A third river, Maputo River serves people on the south bank of the city with water and might also be subject for future development as the city are prospecting further water resources to support its growing demand. The different stakeholders are many and located on various levels. Throughout this thesis, I will follow the three rivers from the city of Maputo back to the source. I will begin by looking at water supply in Maputo and then zoom out studying the region and the transboundary perspective of water management. To write the history of water management in the region I will present the political and ecological situation over time and look into national,

---

<sup>2</sup> SARDC works in partnership with the Southern African Development Community (SADC).



regional and international documents and actors guiding water management. The most obvious actors are the three states sharing the river basins; namely Mozambique, South Africa and Swaziland and their respective government bodies. Above these bodies, we have the Southern African Development Community (SADC) and above them the African Minister's Council on Water (AMCOW). Last but not least, the operation of water management in any member country is regulated by the UN that states access to water as a basic human right. On the national level, apart from the national government we have the local municipal governments, companies and the local population.

When it comes to the question of international sharing of water sources, sharing can be done in different ways, either sharing the water equally, sharing the revenue gained equally, or by one country compensating the other countries if taking out a larger share of water. In international treaties, as I will discuss in this thesis, the terms 'fair' and 'just' have become increasingly common in UN articles and SADC statements over the recent decades and are now also commonly used in international water treaties. Access to water is, as already stated above, a basic human right and every country and government has the responsibility to provide clean drinking water at a reasonable price for its citizens. We can manage without a lot of things, but we cannot, as already stated above, survive without access to freshwater. As also stated by the World Bank, "Water is one of the most basic human needs" (<http://www.worldbank.org>). On the 28th of July 2010 therefore Resolution 64/929 was established and "United Nations General Assembly explicitly recognized the human right to water and sanitation and acknowledged that clean drinking water and sanitation are essential to the realization of all human rights" ([www.un.org](http://www.un.org)). The resolution means that states and international organizations should help with finance and technology to develop and expand water management, especially in developing countries. The goal is to provide safe, clean, accessible and affordable drinking water to all people everywhere. In the new Agenda 2030 and the Sustainable Development Goals from November 2015 (replacing the MDG's) goal number six states; clean water and sanitation for all. Today approximately 900 million people around the world still lack access to a stable, secure and safe source of water. As shown in the case of Mozambique not only drought but also flood is threatening the availability of adequate water for domestic use with serious impacts on human health and biological life. Water supply and sanitation coverage levels in Mozambique are still among the lowest in Sub-Saharan Africa. According to official data in 2008; 51.8% of the rural population and 50 % of the urban population has access to safe water. In the same year 40% of the rural population was said to have access to adequate sanitation services compared to 50% in urban centres (WaterAid 2010).

Now, wanting to place water management in a political and environmental history frame, aiming in this thesis to create a holistic understanding of the water supply challenges Maputo faces and have faced through history, we first shortly have to remind us of the fact that most of the time a distinct divide between human history and environmental history has been the norm. For a long time the focus of the subject of history has been on human beings, what humans have accomplished through time and space. Nature has merely been a background, the scene where history has played out. Looking more precisely at natural resources it is sadly still and has for a long time to a large extent mostly been seen as a never ending source for primarily human use.

Water, as was the case with other natural resources, was often ignored as a critical determinant of historical events. Whenever water was mentioned, it was essentially to show it as part background information for such historical events. Rarely were water and the environment studied as resources that over time affected or transformed human experience (Mulwafu 2005: 1).

When the subject of environmental history was introduced this meant that the history of the human beings was complemented with the equally important story of the former background player, together creating a more holistic field of history. Environmental history, studying human and nature interaction over time, gives a much needed understanding of how to understand today's challenges (Mulwafu 2005: 1). We as humans are clearly, looking at the state of the world today and the difficulty in changing our behavior, not used to consider the fact that we are depleting our natural resources. We are not used to having to share natural resources, not even with other human beings. As the world's population is rapidly increasing, it is a fact that we have to share, amongst other things, the earth's freshwater. Humanity have to become better at both sharing water between countries but also taking better care of the ecosystems so that the water in the rivers and lakes are not contaminated or drying out from overuse or misuse.

As mentioned above El Niño or the inter-tropical convergence zone (ITCZ) play an important role in rain variability and distribution in Africa. In the area in southeastern Africa where the three river basins in this study are located, rainfall is the number one water provider. Being the downstream country on all three rivers supplying the area with fresh water, Mozambique is not only highly depend on rainfall for its access to water, but also very much on its neighboring countries. Maputo therefore depend on the fact that outtake of water upstream is regulated and that enough water flows downstream to reach the city. In the book *Sustainable Development in Mozambique*, Chutumia (1999: 176) state that:

Water is a driving force of development, it is important therefore that development plans take into account water resources issues and relations of interdependence with the country's upstream neighbors. The national interests of Mozambique are unavoidably dependent on external factors.

The, as expressed above "unavoidably", dependence that Maputo experience made it inevitable not to study the political history of the region if to have any chance of understanding the challenges of supplying Maputo with freshwater. Therefore the political history of the region was chosen as my second framework. Maputo's and hence Mozambique's dependence on having agreements with its neighboring countries is being discussed in chapter 6.

## 1.1 Aims and research questions

As introduced above, I will in this study focus on the transboundary river basin perspective on the development of water infrastructure and the supply of freshwater to the capital of Mozambique, the city of Maputo. By mapping and describing the history and present day situation of the water management situation in Maputo I aim to better understand the challenges when it comes to water management and water provision, and the challenges that has to be addressed and overcome to be able to practice sustainable water management in the region. Here, environmental history can make a contribution towards a better understanding of the importance and complexities of water management as a natural resource. A central question is here how through history the water resource has been managed in the region. By identifying and understanding the challenges of water management over time, we will be better able to understand the present situation, the challenges ahead and to contribute to a more holistic knowledge about water management in the region, the city of Maputo and between the three river basin sharing countries. I also find it important to study and understand the complex regional political context and its impact on water sharing in the region. How this context affects and have affected the arenas were agreements have been concluded as this has bearings on future transnational agreements on water sharing.

In this thesis I set out to ask then: What have been and still are the biggest challenges of getting water to supply the city of Maputo? What are the critical components? How do the International water agreements look like between Mozambique, Swaziland, and South Africa? How did, and still do the historical past of the region affect the relationship between the countries and the ability to cooperate, reach and maintain water agreements?

The main question this thesis will aim to answer can be put forward in one sentence:

- What has through history up until today been the biggest challenges of accessing enough water to supply the city of Maputo and for the water to be accessible for all its residents?

This question is very broad but I have formulated a number of sub-questions to address the issue of past and present challenges:

- What and where are the critical components in water management negotiations?
- What does the water agreements and treaties between Mozambique, Swaziland, and South Africa look like?
- How did, and does, the political past and historical trajectories of the region affect the relationship between the countries and the ability to cooperate, reach, and maintain water agreements?
- What is the situation of water management today and what can we learn from this study when it comes to future scenarios?

By studying international water treaties I aim to analyse how they are formulated and understand what impact they have on the water accessibility for Maputo. How then the water are being distributed within the city of Maputo is the second half of my main question. The study takes place on three levels; the water supply system within Maputo town, the three rivers in the region, and the political and ecological complexities of sharing water with other countries. Mozambique as a sovereign state negotiate internationally with its neighboring countries in trying to reach agreements to have enough water entering the country from the shared river basins. Then on household level, people living within the area of the city and its municipal borders are trying to gain access to the city's water infrastructure system. I will focus on international commissions and rules for the international level, and water as a human right which every state has to provide for its citizens on the national level, looking at water management and how this has changed over time.

## 1.2 Disposition

Below follows a brief summary of the disposition of the thesis and the content of the various chapters. The overall idea has been first to give the reader enough contextual knowledge needed to then move on to focus on the main actor; the city of Maputo, then continue with describing the three river basins in question for this thesis, and last but not least look at international commissions and rules concerning water sharing and transboundary river basins.

In chapter 2 I describe the methodology I have used to guide me through this thesis. I also present my sources and research background as well as how and why I conducted my fieldwork. Chapter 3 then presents the quite extensive, but what I found necessary, context of the region. Moving on to chapter 4 we are now looking at the water management within the city of Maputo, the different actors within water management, the urban development of the city and experiences from the field. In chapter 5 I present information on the three river basins; their natural features, how they have been developed, dams, and the main uses of the water. Chapter 6 then focuses on the subject of sharing water with other countries and here I describe the

different international rules and conventions and also protocols within SADC. The conclusions are then put forward in chapter 7.

## Chapter 2: Conducting the study

Clearly, there is need to document changes in the water sector over time so that we can re-conceptualise the role that water has played in Africa's history. (Mulwafu 2005: 2)

### 2.1 Methodology

The importance of understanding the history cannot be overestimated in the case of understanding the water situation in Maputo and the surrounding region. Knowledge of the historical context, both the environmental and political, are key in understanding the present water situation. Here I study the questions of how the water management has been planned and distributed, which actors has been making the decisions and in what interest. This query will of course lead up to questions around organization of water today. The study include archive materials and results from fieldwork observations of the present day situation. The work aim for a holistic understanding by describing the context and the events through history that has led up to today and the present water situation. I focus on the history of the region; politics and conflicts and the ecology; climate and weather patterns aiming to understand the challenges Maputo has faced and is facing concerning access to and distribution of water. Other aspects that I will take into consideration is economic development, corruption and climate change. The quote below is from Heather J. Hoag's book *Developing the Rivers of East and West Africa* explaining her view on the importance of historicizing the development process in Africa, I will repeat them here as these are words that has been inspiring to me while developing this study:

I returned to my graduate studies convinced of the importance of historicizing the development process in Africa. As development projects have played an important role in shaping the African environments we see today, environmental historians have much to contribute to understanding what has worked and what has not. Our interest in understanding how human societies have interacted with their natural surroundings places us in a position to contribute a much-needed ecological perspective to development studies. Historical sources and methods allow for the reconstruction over time of the environmental and social conditions that have created Africa's diversified landscapes. By focusing on the development process, historians are able to connect broader global processes of change to the African communities and environments that these processes affected. (Hoag 2013: ix)

As Heather J. Hoag, I aim to bring in the historical and ecological perspective to an issue that is often treated from a solely presentist and/or developmental perspective. In the introduction to the book *African Water Histories – Transdisciplinary Discourses* Johann WN Tempelhoff also states that "There are lessons to be learnt from history" (Tempelhoff 2005: viii). That we should learn from history, and learn from our mistakes not to allow them to be continual is a statement that is often repeated, but the challenge is *how* we learn from history. Tempelhoff points out how:

Geographically unique historical discourses, are important tools for the understanding of the complex framework of urban water planning in this part of Africa where development strategies have had to take cognizance of rapid urbanization at a time when effective water management requires suitable strategies (Tempelhoff 2005: viii).

In this thesis I will follow Tempelhoff's lead by looking at formulations of UN Watercourses Convention and international water law. I will then study specifically the SADC Protocols (from 1995 and 2000) focusing on these treaties specifically from a Mozambique perspective e.g. from the perspective of the interests of Mozambique and that of Maputo city.

To create an overview and a better understanding of the different levels of international conventions, rules and water laws that apply for the water agreements concerning the region of this study I am using Latour's actor network theory. In doing this I map two networks; one describing the different treaties concerning the three rivers and how this treaties are interrelated with the international conventions and rules. The other network concerns the different organizational bodies and states in water resources concerned within this study. Since the actors in this study are located on multiple levels I found it useful to use the actor network theory as defining the network allows me to better understand their relations, and to better understand where an actor or an organization is located, or as Latour puts it;

the first advantage of thinking in terms of networks is that we get rid of "the tyranny of distance" or proximity; elements which are close when disconnected may be infinitely remote if their connections are analyzed; conversely, elements which would appear as infinitely distant may be close when their connections are brought back into the picture. (Latour 1996: 2)

These networks are not created to be networks but by using network theory we are in search of understanding the relations that create a network and in which we place the actors and act is held together in relation to each other. That is, one also produces the network as one studies it, in Latour's words:

No net exists independently of the very act of tracing it, and no tracing is done by an actor exterior to the net. A network is not a thing but the recorded movement of a thing. (Latour 1996: 14)

So aiming to understand the context in which water treaties in the region are being created and discussed I am tracing the actors involved in the process and record their movements particular social network are mapped. Further, in recreating the context that the international treaties are negotiated I am in effect combining mapping two networks, both that of the different actors shaping the treaty but also that of the guiding document itself and the way it may or may not shape national policy. None of these networks are static and they have, as shown here, changed over time depending of shifting political landscapes, one example is for instance when new international water laws have been written or when there has been a power shift between the countries sitting at the negotiating table. In understanding this, the contributing factors of the history of water sharing between countries we have the knowledge needed in creating new and better forms of cooperation leading to better chances of succeeding in reaching an following through when creating new treaties. Therefore it is important to understand these dynamics as the lives of individuals and in this case their access to water are depending on it. Similar shifts in power balances will have immense effects on water access in the future and therefore it is important to better understand the processes of water negotiations and its impact historically.

## 2.2 Sources

The thesis have a transboundary perspective on river basins, focusing on how the sovereign states that are sharing the river basins are interacting and have been interacting through history. I have analyzed the UN Watercourses convention and International Environmental Law to establish what international agreements there are, how they have changed, and how they have

been used and followed. I have studied this on several levels from individual households in the Maputo region, to its implementation into urban planning in Maputo, and regionally in the case of the national sharing of water in the three river basins. The last part of the thesis focuses on international sharing of water, analyzing the international agreements that are in place between the three countries Mozambique, South Africa and Swaziland. I have also studied the SADC Protocols (from 1995 and 2000) to learn how the agreements and treaties have been constructed and what they include. Specifically, I have looked at how the problems of sharing and distributing the water in a 'fair way' is discussed and how the content of this definition has changed. For example, if one country is allowed to use more water, how is then the others compensated? As I will show, the historical trajectories and political geography affects international agreements and implementation. South Africa has a stronger economy than Mozambique and a longer history of industrialization; therefore historically, South Africa has a high water outtake and a more developed water management and provisioning system. In Mozambique infrastructure both when it comes to industry and water systems, is generally lacking, much is also needed done to enhance flood control in Mozambique in order to better be able to prevent flooding's like the great flooding's of southern Mozambique in 2000 and 2011. Flood control is though also something Mozambique cannot manage on its own but where cooperation with upstream countries is crucial. Another issue I explore here is how the economic investments and costs are divided, and what are the compensations? Another relevant question in focus is how the treaties deal with power relations between the three countries? Are they moving closer towards cooperation and thereby equalizing the political and economic differences in the region and the neighboring states, in this case Mozambique and Swaziland, or is the richer country of South Africa gaining the most? What are the plans for the future?

As explained in chapter 1, I study the SADC protocols (agreements, treaties) within the vantage point of Maputo and its water supply need and flood control necessity, and from a Mozambican/Maputo economic perspective (specifically when it comes to trust issues, power relations, hierarchies, historic past, conflicts). My perspective then will be what are the Mozambican/Maputo's interests in the agreements and how well are they met in the treaties? How does treaties/agreements affect Maputo (Mozambique) being downstream of all the three rivers, are Mozambique's negotiation position affected by this dilemma?

## 2.3 Starting point

For my thesis I have chosen as already stated, to apply a holistic approach to the topic on the basis that I feel this is the best way to explore the full range of challenges for Maputo town and Mozambique in terms of water supply. Earlier research in the area has focused more broadly on international water law and water sharing, more practically on water engineering within the three river basins or have approached the matter historically but without including water law and international agreements. An important factor I also wanted to add was the power relations between the water sharing countries both in terms of upstream downstream and also economically, education level etc. In this endeavor I have found inspiration in the paper written by Salman (2007) *The Helsinki Rules, the UN Watercourses -Convention and the Berlin Rules: Perspectives on International Water Law* that analyze the international instruments of water law and discusses the basic areas of similarities and differences among them. Salman also examines the basic challenges facing international water law and describe the history and how and why they came to be created in the first place.

## 2.4 Field study

During this thesis work I have visited Mozambique on two occasions<sup>3</sup>, in total spending six months, mostly in Maputo but also visiting places around the southern parts of Mozambique, the eastern parts of South Africa, and Swaziland. In Maputo I spent many hours at the archive of Direcção Nacional de Águas (DNA) studying water reports and studies on water in Maputo and southern Mozambique, most of the text were authored by international consultants, but also maps of water pipe distributions of the city and material produced by DNA, for example information booklets concerning new water investments and projects that are planned in the area. The motives of conducting field study for this thesis are several, first I needed to be able to access archive material from the Direcção Nacional de Águas (DNA) that is not broadly available. I have also made field visits to parts of the rivers and the Pequenos Libombos dam on the Umbeluzi River, to do onsite observation - photo documentation and site descriptions. I also visited some of the unplanned settlements/informal neighborhoods in Maputo to have informal conversations with local residents who showed me their water taps in their homes and also showed me around the neighborhoods and for example discussed with me the problems with the storm water drainage that they feel are not being properly maintained. I also visited the water provisioning company in Maputo, Águas de Regiao de Maputo, where people pay their water bills.

The aim of these different field studies was for me to get a broad and contextualized understanding of the water provisioning system in Maputo. Beyond accessing written material, I wanted to collect local information and opinions from both staff working at Direcção Nacional de Águas (DNA) but also Maputo residents. Rather than using questionnaires or large scale semi-structured interviews, I felt that for my purpose smaller informal discussions on matters of water and water provision with officials and dwellers would be more useful. This approach was also taken due to time constraints and language barrier. The interviews are more to be regarded as conversations and were spontaneous and without a set of predefined questions, thus I adjusted my questions when being presented to a suitable situation. The unplanned neighborhoods in Maputo mentioned above where I was invited to see the household's water source was Xipamanine, where I had the opportunity to ask personal questions of what kind of problems they experienced with the water, the company providing it, billing and the procedure of how to connect to the water distribution system. Another very informative and interesting meeting was with a sociologist on Inhaca Island (March 2015) located just outside Maputo where I had the opportunity to discuss with him his point of view of the water management in the Maputo municipality. It would have been very valuable to also include interviews with government officials and town planners, but this was not possible within the time constraints I had.

---

<sup>3</sup> First time January to May 2014, second time February to April 2015.



## Chapter 3: Context

Southern Africa's climate variability and degree of water stress makes it one of the most vulnerable areas to climate change in Africa<sup>4</sup>.

### 3.1 Water in the Southern African region

Water resource availability in Southern Africa is entirely dependent upon its seasonal summer rainfall<sup>5</sup> feeding both rivers and ground water since there is not snow or glaciers storing water. Therefore if the summer rainfall does not come or is lesser than normal it has vast consequences for the whole year, especially for the small scale farmers in the region. The main freshwater resources are found in surface water bodies such as lakes, rivers and wetlands, as well as underground aquifers found in layers of rock, sand or gravel. (SARDC 2009: 14). Across most of the region, the year is thus divided into a dry season without rain, and a wet season when rain may occur. The length of each season varies with the geographical location of the country. The climate of southern Africa is highly shifting and rainfall is unevenly distributed across time and space both across Southern Africa but also within countries, especially studying the shorter term variations. Looking at longer terms, series of wet and dry periods are seen. During the last 100 years a nine year cyclicity of predominantly above average rainfall has been followed a period of below average rainfall (Tyson and Preston-Whyte 2000: 332–335). This pattern probably goes back millennia (Tyson et al. 2001: 97, 139-150; Lee Thorpe et al. 2001: 38, 4507-4510; Tyson et al. 2002: 52, 129-135; Scott and Lee-Thorpe 2005: 69-91). El Niño-Southern Oscillation account for approximately 25% of rainfall variation recurring with a cyclicity of 3–5 years (Hulme 1995). El Niño years are associated with dry conditions in the summer rainfall region of southern Africa, such as what we are experiencing in 2016 (one of the most extreme El Niño events measured) and has strong teleconnections over the world. La Niña events meanwhile are normally associated with higher rainfall than usual in this region. The dry periods sometimes last for a number of years at a time creating devastating droughts forcing people to relocate or needing outside help. Most affected by the absence of rain is the agricultural production. Historically trying to compensate for the loss of agriculture production people have focused more on trade, mining gold or hunt wild animals. The relocation sometimes meant that whole communities was searching for new grounds to settle down, sometimes leading to competition over land and water access. Long periods of drought and competition over natural resources therefore had the risk of leading to social instability, war, banditry, increase in slaving and epidemics. Recurring droughts led to cycles of violence and anarchy in the region and has recurred many times in the history of Mozambique. (Newitt 1995: 253-54, SARDC 2009: 13). Already in the mid-16<sup>th</sup> century Portuguese writers noted both that droughts was common and that the rivers sometimes swelled, causing settlements to be moved because of flooding (André Fernandez in Ekblom 2004: 55). Ekblom (2004: 57) has compiled drought and flood events mentioned in the written sources and based on other historians since the 16<sup>th</sup> century. Particularly sever was droughts in the 18<sup>th</sup> century and throughout the 19<sup>th</sup> century and beginning of the 20<sup>th</sup> century. For instance Newitt (1995: 254) writes about the drought in 1823:

---

<sup>4</sup> IPCC 1998, IPCC 201 b.

<sup>5</sup> October-April, e.g. southern hemisphere summer.

At first it affected the Natal area but its impact spread north and in 1823 it was reported as severely affecting the Zambesi valley. In the following years all the regions of Mozambique from Cabo Delgado<sup>6</sup> to Delagoa Bay<sup>7</sup> experienced what was apparently the severest drought ever recorded.

Apart from droughts, which as discussed above, occurs on a regular basis, in sub-Saharan Africa flooding is becoming the most common natural hazard and the effects on large cities are increasing. Paleo-flood events have been recorded since mid-1200 (Siteo et al. 2015) but flood events and more extreme flood events have probably become more common in the 20<sup>th</sup> century. The impact flooding has on a city, on the life of its inhabitants, and on assets and economical values are well appreciated, however the impact from flooding on a city's entire watershed from changing rainfall patterns is rarely assessed. Large floods result in large economic losses and destruction of infrastructure that can bring the economy to its knees. Building resilience against extreme events is therefore of high importance and it is also important to invest in storm water management, installing for example storm water drainage and synchronize openings of dams etc. trying to minimize the effect of heavy rains. A first step in trying to identify the risk of floods is risk mapping; risk mapping is also a means of identifying adaptation measures and priorities. However, in sub-Saharan Africa only one of the 11 largest cities most affected by floods has a detailed flood risk map (Tiepolo 2014: 19). There is also a general lack of long term studies of observed flood events and regularity of flood events.

The lack of studies is problematic for southern Africa, considering that temperatures in Southern Africa are expected to rise during the next three decades and global mean sea level is expected to rise from 18-59 cm over the next 100 years (IPCC 2007: 45). The IPCC Global Circulation Models prognoses and local projection models suggest an increase in extreme weather events for southern Africa and overall drier conditions (Christensen et al., 2007, Engelbrecht et al., 2009, 2012; Haensler et al. 2010, 2011). As discussed in the introduction, rainfall variability is expected to increase over southern Africa, with more extreme flood and drought events as a result. The majority of the large cities hit by flooding are located along the coasts of the continent and therefore being at risk for floods, at the same time also the sea level rise (Tiepolo 2014: 23). This will affect costal erosion and can become devastating, in particular for low lying areas in Maputo.

## 3.2 The country Mozambique

Located in southeast Africa Mozambique (officially the Republic of Mozambique) sits between latitudes 10° 20'S and 26° 50'S and border the Indian Ocean to the east, the coastal zone stretches some 2700 km. Mozambique are bordered in the north by Tanzania, inland by Malawi, Zambia, Zimbabwe, and in the south, Swaziland and South Africa. Almost half the country is less than 200 meters above sea level (Hall and Young 1997: 1). The surface area of Mozambique is 801,600 square kilometers, almost the double size of Sweden, and the country has a population of 28.6 million (worldpopulationreview.com). The official language is Portuguese and also several indigenous languages are spoken (around 20 in total). In Maputo Province the main languages are Rhonga and Shangaan, languages that are very closely related. The country has 25 rivers which all discharge of the Mozambican coast into the Indian Ocean. The biggest by far is the Zambesi River, located in the center of the country, discharging in the rainy season 15000 to 20000 cubic meters per second. The country has no less than nine international river

---

<sup>6</sup> Province in the northern part of the country.

<sup>7</sup> Today Maputo Bay.

basins and is the end user on eight of them, making Mozambique highly dependent on neighboring countries for water resources.

The climate is mostly tropical, characterized by two seasons as already discussed above. In the northern parts of the country, precipitation is strongly influenced by the southern end of the East African monsoon system. In the southern parts of the country the climate is instead influenced by the Indian Ocean sub-tropical Anticyclone System and the associated south-east trade wind zone (which brings dry weather for most of the year). The rainfall in the rainy season (November-February, southern hemisphere summer) emanates from convective clouds resulting from the seasonal southward movement of the Inter Tropical Convergence Zone. The rainfall distribution in Mozambique varies both from north to south and from west to east, where it is highest in the central section of the coast (1418 mm/year) and lowest along the southern sector (in Maputo it is 775 mm/year) (Sitoe 1999: 119-20). The coastal zone is under ever growing environmental pressure placing a risk on its ecosystems and the biodiversity. The coastline of Mozambique has a lower elevation in general than other coastal East African countries and 90% of the low coastal plain consists of sand and mud stabilized by mangrove and dunal vegetation. The physiological feature of the coastline makes Mozambique highly exposed to coastal erosion, affected by sea level rise due to climate change. In addition, if mangrove and other dunal forest/shrub is cut down, the risk of erosion increases and the ocean is literally eating up the coast (Sitoe 1999: 119; Chutumia 1999: 175). Mangroves, swamps and dunal forests/shrub, apart from being very important biological habitats, also protect against storm surges from the sea, which will be crucial with raising sea-levels. It is therefore noteworthy that some of the expansion of development of Maputo town in recent years has been located in low-lying areas that would otherwise support protective barriers of mangrove forests and swamps.

As Mozambique is a warm country and the majority of rain falls in the summer when the sun is the hottest evaporation is high. The water evaporation in the country ranges from 700 mm to 1400 mm, from the Incomati River and southwards (the area of this study) the evaporation varies between 1000 mm and 1200 mm. High water evaporation of course effects water availability and needs to be taken into account in planning and management, especially since climate change will increase the level of evaporation even further. The availability of surface water in Mozambique as a whole is estimated to be 217 billion cubic meters. The potential vulnerability of water supply can perhaps be appreciated in the fact that more than half (54%) of this amount of water is transported to the country through international rivers. Only 46 % of available national surface water is constituted through rainfall within the country borders of Mozambique, and this is mainly in the north and central parts of the country (Chutumia 1999: 175).

The dependence on international treaties is therefore very high in Mozambique in general, and in the south in particular because of the low total level of yearly rainfall. In Maputo the international rivers are the number one water provider. This precarious situation of a capital city was what first caught my attention when defining the subject area of this thesis. I wanted to look deeper into the fact that the city is so highly dependent on the cooperation and goodwill of country neighbors. To me it was of interest to study the conundrum of having functioning water sharing agreements in place for the basic water supply of the city, especially as the political situation between the three countries in question through the 20<sup>th</sup> century, at many times have been unstable.

### 3.3 A short history of Mozambique

Here I will present only a very short version of the history of Mozambique, focusing on the Portuguese entry and the economic relation with South Africa. The continent of Africa has, as we all know, many state borders that was drawn up by European colonial powers, which took little or no consideration to hydrologic integrity, typography or climatic characteristics (see discussion in Sadoff et al 2002: 55). The traces of the colonial past is to be found everywhere and of course especially in the dividing up of land, in decisions concerning use of natural resources and in what infrastructure projects that has been prioritized. In the case of Mozambique this is shown in the way that the rail way lines are planned and built, linking the interior with harbors along the coast to support the business of transporting natural resources for export (Newitt 1995: 461-463). There are no railway lines in Mozambique connecting the country from south to north. The lines were not built for the people of Mozambique but for the different companies operating in the area or other colonial powers with whom the colonial government had an agreement of some sort. This is one of the reasons to why Lourenço Marques, or Maputo city, became so important and later was chosen as capital (idem.: 382). The mines in Transvaal<sup>8</sup> needed a harbor, an outlet for its products to the world market, in exchange a part of the salary earned by Mozambican mine workers was paid in gold to the Portuguese colonial government. Therefore the railway line, and later the road to the interior west of Maputo was built. Not to benefit the development of Mozambique, but for international and economic reasons.

The land that is today Mozambique has been inhabited for at least 1.8 million years has seen both independent state development and agricultural development (Newitt 1995). March 2 1498 mark the day when the first European exploratory sea voyage was to reach the coast of what is today Mozambique. The voyage was conducted by the Portuguese explorer Vasco da Gama and him and his crew weighed anchor at Mozambique Island in the northern part of the country. The island became a Portuguese trading-post on the route to India and is now, since 1991, a UNESCO world heritage site. The Portuguese presence in Mozambique was from Vasco da Gama's arrival until the second half of the 19<sup>th</sup> century mostly limited to trading-posts and forts along the coast. The Portuguese Governor-General of Goa in India was the administrator of these forts and trading-posts until 1752 for practical reasons being closer than distant Portugal (Hall and Young 1997: 2). Mozambique had flourishing coastal settlements and a thriving domestic agricultural economy in the 15<sup>th</sup> century before the arrival of the Portuguese (Newitt 1995: 4-13). Even though there had been Portuguese presence in what is now Mozambique for centuries it was not until late in this history that Portugal started to settle in larger parts of the area. Up until then the Portuguese trading-posts had mainly been located along the coast alongside with Indian Muslim trading-posts and with African empires and regiments under local warlords (idem.).

The most powerful Kingdom in what is now Mozambique was the Gaza Kingdom located in the south. The last Gaza king was sent in exile to the Portuguese island of Azores (Newitt 1995: 348-355, 376). The Portuguese attack on the Gaza state was in part a response to pressures from European competitors, as Portugal was obliged to show effective occupation of the Mozambique to maintain colonial supremacy (Hall and Young 1997: 2; Newitt: 348-355). Once the Portuguese had military control over an area, concession companies did run the administration, only Nampula Province in the north and Gaza, Inhambane and Maputo Provinces in the south was under direct administration of the colonial state (Newitt 1995: 357-378).

---

<sup>8</sup> Mining area in north-eastern part of South Africa.

The main income of colonial Mozambique was from transit fees and labor export and Mozambique was largely a support economy for South Africa. The labor export consisted mainly of people from the southern parts going to work in the mining industry in South Africa starting in the 19<sup>th</sup> century. All the way from 1875 to 1964 South Africa, as already stated, paid a part of the guest workers wages in gold direct to the colonial government. The numbers of Mozambicans working in the mines in the eastern parts called the Rand in South Africa peaked in the beginning of the 20<sup>th</sup> century when a 150 000, more than half of the workforce was from Mozambique (Hall and Young 1997: 2; Newitt 1995: 406-413). As part of the deal supplying South Africa with workers, South Africa agreed to use the Maputo harbor for part of its export traffic, creating jobs inside Mozambique and for Mozambique to earn income from transit fees.

Infrastructural development in Mozambique began in earnest in the 1940s. In 1937 the Portuguese state launched a development plan for Mozambique including irrigation schemes of the Limpopo and Umbeluzi Rivers, and rail and road developments. Interrupted by the World War II, this was followed by additional development plans and loans, including schemes for Portuguese immigration to Mozambique, roads, railways and dam constructions (Newitt 1995: 461-466). The first hydrological study in Mozambique was carried out in the 1920s then focusing on the Limpopo River valley, resulting in an irrigation scheme being implemented here. The next irrigation scheme was placed in the Incomati Valley and the last schemes were the Caborabassa in the Zambesi River valley in the 1960s and the Massingir dam in the Limpopo in the 1970s (Newitt 1995: 466). Development plans and a growing national economy led to increasing industrialization in Mozambique after World War II. Maputo became a center for oil refinery and continental tourism (Newitt 1995: 468-469). But despite the growing economy Mozambique remained a highly segregated and socially unequal state, with very high analphabetism and poverty and a low infrastructure of schools and hospitals were revenues continued to be based on migrant labour (idem: 474).

### 3.4 Mozambican political history in the late 20<sup>th</sup> century

Focusing on the events taking place in the southern parts of Mozambique, the international events in the region and the relation with neighboring countries, this short political history section does not aim to describe the whole Mozambican political history in the late 20<sup>th</sup> century but merely to describe the context I consider needed as a background for my discussion on water treaties.

During the 1950's different anti-colonial groups started to form and in 1962 the anti-colonial political groups formed FRELIMO, Frente de Libertação de Moçambique (Mozambique Liberation Front) and in September 1964 FRELIMO started an armed campaign against Portuguese colonial rule. After 11 years of armed struggle the Portuguese colonialism collapsed in 1974, and on the 25<sup>th</sup> of June 1975, Mozambique became an independent state. The first task Frelimo set out to accomplish was to nationalize all land. During the armed conflict between the anti-colonial movement and the Portuguese colonial government only the Soviet bloc countries and China had offered arms supply and after independence they also offered some protection against the potential local enemies such as Rhodesia (Zimbabwe) and the Apartheid regime of South Africa. They also offered advice and assistance in the pursuit of development, as also protection against "pressures from the West" (Hall and Young 1997: 62). Frelimo developed into a one-party rule, first running the country as a communist state (allied with Soviet) and later moving on to socialism.

By 1974 Rhodesia was still under white minority rule under Ian Smith and in an armed struggle against ZANLA, Zimbabwe African National Liberation Army and other liberation groups. The

Rhodesian counter-insurgency forces staged several attacks into Mozambique and also equipped and encouraged a Mozambique guerrilla force against Frelimo (Newitt 1995: 563-564; Lunstrum 2009: 884-892).

Just days before Mozambican independence the South African consul in Mozambique left the country. Right after that, a delegation from ANC arrived to set up an office in Maputo. Frelimo did however make a distinction between the Rhodesian and South African cases<sup>9</sup>, and was aware of Mozambique's considerable dependence on its economic links with South Africa (Hall and Young 1997: 121). Mozambique officially did not support the ANC attacks into South Africa, but the Frelimo government also did not stop ANC from crossing the border into South Africa or through to Swaziland. The Apartheid regime in South Africa had the ambition to be a regional power, but as more of the countries in the region became independent it became harder and harder for South Africa to find international allies. The independent states in the region instead showed their disapproval against the apartheid rule in South Africa using the Front-Line States grouping. The Front-Line States was created from the beginning to close out colonial Rhodesia, but when Rhodesia became independent Zimbabwe in 1979, Zimbabwe too joined in against the South African white minority rule, shutting South Africa out of the southern Africa community. The Front-Line States knew they had not the economic nor military means and therefore used isolation as their method to try and force South Africa to end apartheid.

National discontent, cold war politics and the independence struggle of Rhodesia and anti-apartheid struggle in South Africa conflated to create national instability in Mozambique. The armed rebel movement emanating from central Mozambique named RENAMO - Resistência Nacional Moçambicana (Mozambican National Resistance) was supported by both Rhodesia and Apartheid South Africa, and started to operate a guerrilla war challenging Frelimo (Neto and Dos Santos Monteiro 1999: 78; Lunstrum 2009). In December 1981 Renamo's main base was taken by Frelimo military, and documents found in the camp proved the close relationship between the South African military and Renamo (Hall and Young 1997: 126). The Renamo guerrilla was strongest in the central part of the country but later moved both north and then south resulting in civil war. Starting in 1977 the civil war lasted for 15 years. During this period severe droughts occurred and this in combination with the ongoing war led the country into an emergency situation. The war forced large people migration into the cities along the coast leading to depletion of water resources and other natural resources such as forest for firewood. The signing of the Rome Agreements in 1992 finally marked the peace (Neto and Dos Santos Monteiro 1999: 78). Frelimo has since then remained in power, though democratic elections, but recently there has been some increasing tension between Frelimo, the ruling party and Renamo as an opposition party which has resulted in armed conflicts, particularly in the central regions.

Frelimo from the time of independence was confronted with many problems of legitimization, one being the rural-urban divide, where an element of anti-urbanism was imbedded within Frelimo, seeing cities as dens of iniquity and colonial corruption (Hall and Young 1997: 84). This notion went along with the communist ideology and structure entailed grand ideas of rural development, with the creation of large state own farms and communal villages, and there was therefore less focus on urban development and city planning. This ideology met with considerable degree of resistance and frustration both in rural and urban areas (Lunstrum 2009). In addition, Mozambique suffered a state of war almost continuously for 28 years, in part upheld by neighboring states. Yet during this time international water negotiations were still taking place and these will be discussed in chapter 5 and 6. Mozambique's population has also risen

from being 1.6 million at the time of independence in 1975 to 28.6 million today in 2016 (worldpopulationreview.com). This of course means that more water is needed both in terms of increasing number of households and in need for irrigating agriculture to increase food production. The creation of Greater Maputo, the fact that the smaller surrounding towns are being integrated into one large entity is putting pressure on water management. The issue of competition over water access with the water basin sharing neighbor countries are being discussed in the next section below.

The water sector in Mozambique was undergoing a profound transformation as it changed from a highly concentrated and centralized water management system in place until 1990. In 1991 the government of Mozambique officially established a Water Law, which incorporated the basic principles and policies of water management. These new water management policies came in to existence as fundamental instruments for realization, with the aim to satisfy the interest of the Mozambican people. The water law of 1991 provides the basis for the modernization of the water sector establishing inland waters as public domain. Four years later, in 1995 the National Water Policy was approved. The National Water Policy defined and formulated the strategy to be followed by the water sector, including the main political objectives defined by the Water Law from 1991. The basic policy principles stated in the policy were equitable and sustainable distribution of water in a quality and quantity not destroying the water resource for future generations, and with a focus on provision for basic water needs. The wording, as described earlier, following the trend in international water documents.

### 3.5 The interrelated region

Mozambique has, because of its geographic location and the fact that the country is the downstream player on all its international rivers, been active in trying to make treaties with its neighboring countries. The rivers in the south has been the area of priority because of the semi-arid climate and the fact that South Africa is, and has been, more developed and have through history more intensely been using the common water resource. South African agriculture (sugar plantations) and mines have through history been using high levels of water. Making treaties have also been of interest for Swaziland, because of the fact that Umbeluzi River has been the river providing water to the capital city of Maputo, now also in company with Incomati River. Over the 20<sup>th</sup> century Swaziland has had, and still have, large irrigated state own sugar plantations, being the most intense water using sector in the country. During colonial times bilateral<sup>10</sup> and trilateral<sup>11</sup> technical commissions, were set up with South Africa and later Swaziland. These commissions where set up to discuss water-sharing issues concerning Incomati and Umbeluzi river basins. Mozambique was also taking part in other international transboundary river basin committees for example joining the Limpopo Basin Permanent Technical Committee in 1986.<sup>12</sup>

---

<sup>10</sup> Cooperation or agreements between two countries.

<sup>11</sup> Cooperation or agreements between three countries.

<sup>12</sup> The Limpopo River is located in Gaza Province, the province located just north of Maputo Province and is shared with Botswana, South Africa and Zimbabwe.



Fig. 1a and 1b: Large irrigated sugar cane plantations and a distillery with the name USA Distillers in Swaziland, photo taken by the author 10<sup>th</sup> of March 2015.

In 1960 the first Mozambique-South Africa Commission was established, Swaziland joined the commission seven years later (Chutumia 1999: 175). This was the starting point for continuing discussions between the three neighbors about their shared river basins. To reach the first agreement though took time; in 1971 an agreement was reached concerning the construction of the Massingir dam on the Elephants River, a tributary to the Limpopo River in Gaza Province just north of Maputo Province (Chutumia 1999: 176). This first regional water agreement was not specifically regarding water sharing, but still important as being the first agreement reached between the countries (Chutumia 1999: 176-177)<sup>13</sup>. The first agreement to be reached where the main question was water sharing was between Mozambique and Swaziland in 1976 over the Umbeluzi River. One of the biggest challenges during the first years of negotiations with South Africa and Swaziland was the fact that they were only conducted in English. Mozambique was represented not by their governmental representatives but by other parties, which led to a high level of distrust between the negotiating parties. South Africa and Swaziland's government representatives could understand each other both having English as one of their official languages leaving Mozambique out from the negotiations having Portuguese as their government language. The language barrier left Mozambique to feel left out of the negotiations, creating distrust not having control over what was actually said during the meetings and if contracts were translated properly, not trying to trick and take advantage of Mozambique. All this of course made it hard to cooperate between the three countries and led to many delays trying to constitute treaties. Portuguese was later made an official language within the SADC (Singer et. al.2010). Connected to the question of language barrier we also have the subject of education level. Official representatives may not always have had the necessary knowledge background to fully participate in negotiations, particularly as the number of university degree officials from Mozambique after independence was low because of the low level of schooling. The sense that experts are conducting the discussions without understanding the subject discussed also created distrust. Not feeling ownership of the questions and the negotiations, makes the implementation less of a priority.

The conflicts between the countries have of course affected the ability to cooperate in many ways, adding to the trust issues. These conflicts have been affecting also the ability to focus on water management planning, not investing enough in the water sector, in construction, maintenance, etc. Since the start of the liberation wars in Mozambique the whole southern region has been in a state of political uncertainty. Major political and social changes have

---

<sup>13</sup> The agreement concerned an area in the Kruger National Park in South Africa that would flood when the dam would be full which South Africa gave its consent to.



occurred, moving South Africa and Mozambique away from each other in political terms. South Africa was in alliance with Portugal and Rhodesia (today Zimbabwe) and therefore an enemy line was created between Mozambique and South Africa see chapter 3.4. The situation where South Africa took part in fueling civil war in Mozambique was of course not the best environment for neighborly discussion's and agreement creating for shared water resources. During this time no water-sharing agreements was reached.

One of the biggest challenges in international sharing of water is the different interests and competing demands. As the quote from SARDC (2009: 13) below shoes; the city of Maputo faces hard competition accessing water and the agricultural sector is by far the largest water consumer.

Agriculture alone uses as much as 80 percent of the region's water resources. Water also plays a vital role in industry, mining, hydropower generation, and tourism, as well as in commercial fishing. Urban areas are dependent on good management of water resources for the health and wellbeing of the inhabitants.

The fact that most irrigated agricultural land are found in South Africa and Swaziland and Maputo, means that both city and province is in need of more water for domestic and agricultural needs. This puts pressure on the river basins and agreements already now but the situation will be even more acute in the future. As long as more water is available for outtake, negotiating water sharing is easier, but when it comes to the point where if one area demand an increase in water supply on the cost of another area that then has to reduce water supply, this is when negotiating water gets hard. For example if Maputo Province wants to develop its irrigation system to increase food production in the region and the water is plentiful it is not to hard negotiating with the neighbors to increase the amount of water crossing in to Mozambique, but if every new irrigated field in Maputo Province has to mean one irrigated field less in Swaziland or eastern South Africa, the negotiations of course get much more complex. As discussed here (section 3.1.) overall water supply may also be decreasing in the future following the projections of the IPCC Global Circulation Models and regional models. Mozambique is in this case, not only the downstream user but also in a less favorable negotiation position economically in comparison with South Africa. In this light when discussing 'equitable use' of the water in the shared river basin, South Africa might suggest an equitable share of the economic value instead of the actual amount of water supply, offering to compensate Mozambique financially.

If Mozambique where to accept an offer like this it cannot be guaranteed that the users who would feel the strongest impact of reduced water supply would receive any parts of the financial compensation. In addition, on a national level, for Mozambique it would mean a higher national dependency on food import, (in part from South Africa) with the effect that Mozambique would not be able to increase its national food sovereignty and increase its dependency and inequality in relation to South Africa.

## Chapter 4: Water in Maputo

### 4.1 The history, location and ecology of the city

Delagoa Bay, today Maputo Bay, has a long history as a trading port. From the 16<sup>th</sup> century it served as a trading port for a huge hinterland extending west to the Transvaal and south to Zululand and Natal (Newitt 1995: 292-293). When the British in 1824 opened the trading port of Port Natal, now Durban, Lourenço Marques, now Maputo, was exposed to competition but was still a major port in the region. The first permanent settlement on the north bank of Maputo Bay and what is today Maputo city was founded by the Portuguese in the 1790s, Lourenço Marques was later made the capital of Mozambique by the Portuguese on the 1st of April 1898 (Historical Dictionary 2004: 27). Before Lourenço Marques in the south, Mozambique Island in the north served as capital city. Maputo city is situated on the west side of Maputo Bay, protected from the sea by Inhaca Island. The municipality of Maputo includes the city of Maputo, Catembe on the south bank of Maputo Bay and the Island of Inhaca to the east, making a total administrative area of 347 square kilometers where the cities built-up area counts for 182 square kilometers. Maputo is a relatively dry city with an average rainfall of 784.3 mm/year (1960-2006).<sup>14</sup> The city of Maputo is classified as equatorial with a dry winter, the rainy season in Maputo is relatively short, lasting from November to March with January being the wettest month. The rain distribution is highly variable, with a maximum of 1299 mm/year in 1966 and a minimum of 288 mm/year in 2003 (Bacci 2014). As discussed in the previous chapter, the probability of extreme events, including floods and drought, is high for the country of Mozambique and the Maputo municipality specifically.

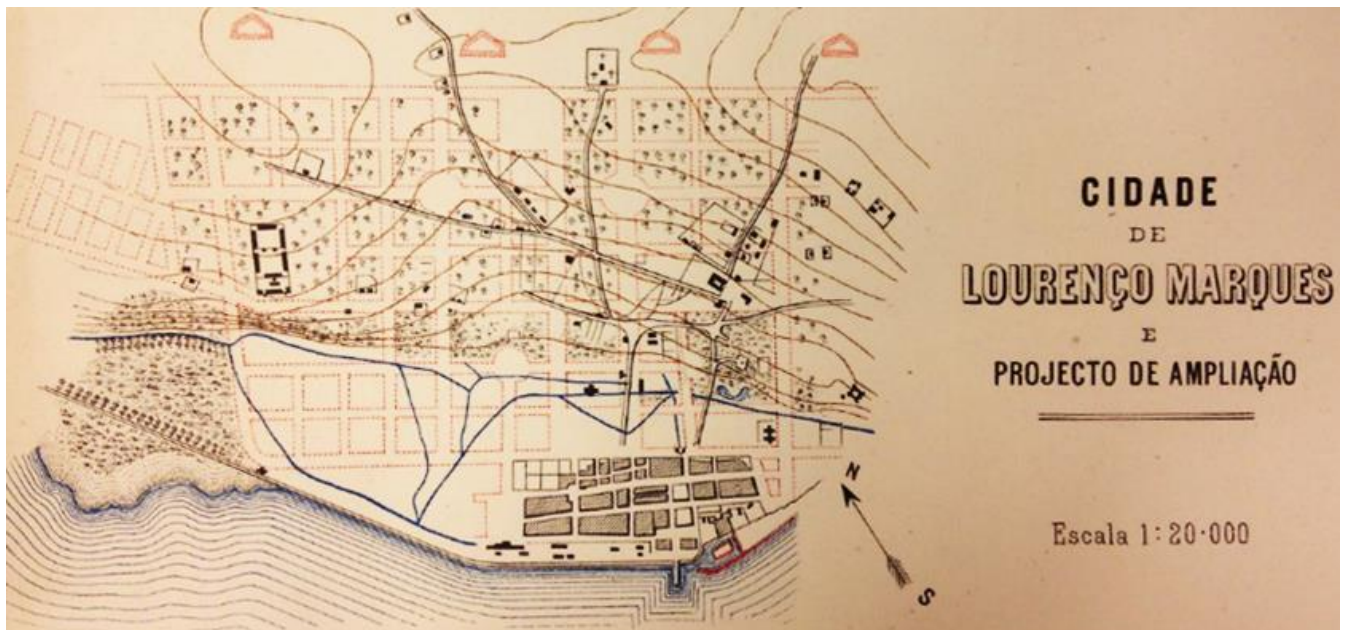


Fig. 2. Map showing Maputo in 1893, photographed at Carolina Rediviva map department February 2015.

<sup>14</sup> Instituto Nacional de Meteorologia (INAM), Maputo-Mavalane Station.

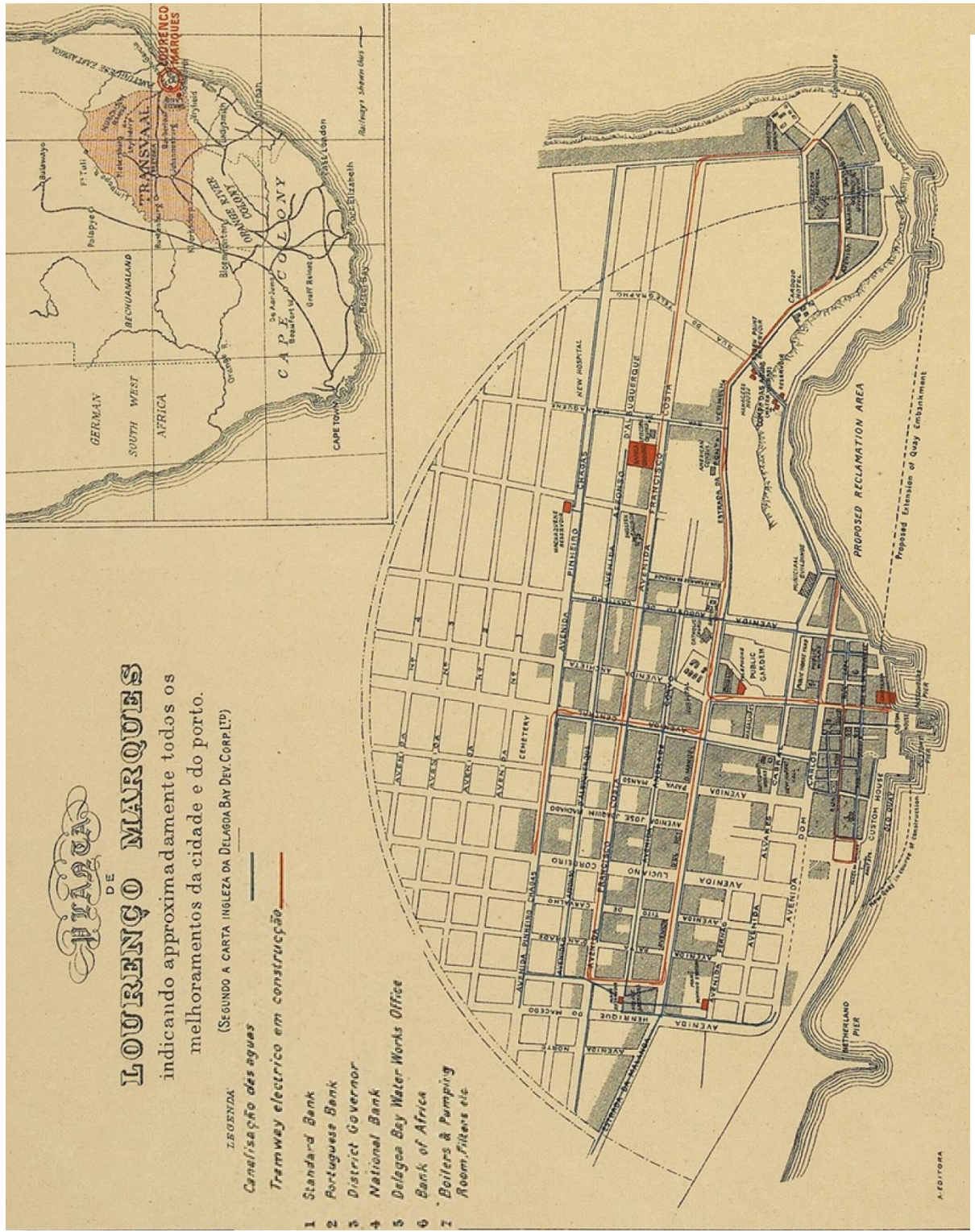


Fig. 3. Map from colonial era, water pipes and electricity lines, 1910. Map of Lourenço Marques in 1910, published by Delagoa Bay Development Company, a largely South African and British capital company in a way, for a while, almost "owners" of the city. (Modified from Delagoabayworld 2012).

## 4.2 Urban planning and water systems

The water use under the colonial period grew rapidly especially in the post World War II period, with new industries (Newitt 1995: 468-469), but also earlier with increased irrigation and water supply systems supplying the colonial neighborhoods and government area of the city.

From early in its history Maputo town was planned based on a grid plan, where streets meet each other at angles forming a gridlike pattern, a town planning common to many European colonial settlements and with old roots (Fig 2). A 1910 map of Maputo shows how the layout of water pipes and electrical lines followed the grid plan of Maputo town (Fig. 3). The 1910 map was published by Delagoa Bay Development Company, a largely South African and British capital company in a way, for a while, almost 'owners' of the city (Delagoabayworld 2012). Thus, a formalized water management system at least for surface water was in place by 1910. These formalised systems were focusing on the areas of European settlements. This early 20<sup>th</sup> century focus in water management planning and urban water supply systems are still to be seen in the city today. The phenomenon was widespread in the urban water planning in the colonized world with separate areas of the city devoted to Europeans and Africans. One of the main things that eventually made the authorities in the colonial cities of Africa to increase the water supply to the African neighborhoods was the notion that if sanitation was not improved generally in the whole city the spread of disease would never be under control (see discussion in Mulwafu 2005: 5).

Today Maputo has large informal settlements where access to the municipal water system is absent in many cases. However, it has not always been this way, during the 1980s the programme *Strategic Action Planning* controlled the increased urbanization by land redistribution. In this way the new independent local government, by providing thousands of plots regardless of income, created desirable and equitable urban form for the city of Maputo (Eskemose Andersen and Jankins 2011: 1). Civil war then increased urbanization when fleeing people sought protection in the city, at the same time as political attention was directed away from urban planning because of the unstable political situation. The war also heavily constrained the economy and therefore not much was invested in the city's infrastructure including new water supply systems. The economic situation is and has been one of the major factors in water management in Maputo in need of large investment both in maintenance and in extending the water system. For the period that the programme was ongoing 12 000 much needed plots was provided through the *Strategic Action Planning* programme which resulted in neighborhoods where room was made for roads, schools and health care stations, this work was implemented between 1981 to 1987. When this programme came in to force an estimated 300 000 people lived in unplanned settlements around the formal central urban core. The problem though was that the 12 000 plots provided by the municipal authorities only served 60 000 people out of the 300 000 (Eskemose Andersen and Jankins 2011: 2). As the municipal authorities tried to organize the growth of the city through the *Strategic Action Planning* programme they were constantly faced with the fact that they were one step behind the fast urbanization and that the budget was not big enough to cover the constant need of upgrading of the programme. The programme therefore ended after 1987, many of the unplanned settlements had then been upgraded and new areas had at the same time been built without any formal planning. Today plots in Maputo are most of the time being sold by private developers resulting in the fact that room is not given to public open spaces such as parks and a limited number to schools, health care stations or other public services (Andersen and Jankins 2011: 2). Around the world today the private sector is a huge actor in the property market and Maputo is no exception, resulting in violations of the rights of inhabitants in the informal settlements, making

the situation for the unplanned settlements even more insecure and the question of getting water systems in place uncertain.

So what would be a good way forward for the continued expansion of the city and the needed upgrading of the already in place unplanned settlements? Eskemose Andersen and Jankins (2011) argues that the situation in Maputo calls for a bottoms-up approach, based on the citizens needs instead of grand plans:

In light of the continued relative weakness of the state and private sector in the face of rapid urbanization and widespread low income levels, what is needed most now is a professional openness to alternative modernity's and forms of urban development that are based on contextual demand. (Eskemose Andersen and Jankins 2011: 2-3)

The *Strategic Action Planning* programme from the 80s is a good example of low-cost and hands-on approach that would be worth going back to, and there are some settlements being formalized but still not in the pace as new ones are being built. Instead the government have for the last decade chosen the opposite path where private real estate companies have bought large pieces of land to build modern skyscrapers or hotels forcing people to leave their homes. The government wants to see a modern city and in that plan the informal neighborhoods are not a priority. There are different NGO project taken part but the scale and timespan of these projects are often too small and too short to create a sustainable long term solution. What is needed is a locally based long term municipal plan where the informal neighborhoods are made a priority not looked at as a problem because it is here that the majority of the cities inhabitants live and the numbers will not decrease rather they will increase. The United Nations Population Fund (UNFPA) estimates that more than half of the world's population now lives in towns and cities and this number will increase to about 5 billion by 2030. Much of this urbanization will unfold here on the African continent. In Mozambique both the urbanization and demographics are on a steady upward curve. The next section will look more into the present water situation in the city and what the future may hold.

Maputo has today together with Matola 2.5 million (2011 numbers) inhabitants and is projected to be more than 4 million by 2035. Greater Maputo is one of the 15 largest urban areas in sub-Saharan Africa. The city is growing beyond its formal boundaries and the population is expected to be higher than the official figures. The unplanned and informal settlements inhabits a large part of the city's population. These unplanned neighborhoods are often located in areas prone to floods, because of their low location the water take a long time to disappear, causing damage on housing and spreading disease (Eskemose Andersen and Jankins 2011: 1). The migration to Maputo city started to increase after independents in 1975. Historically, urbanization in Mozambique has been low and when the increasing housing demand by the new settlers was not met and the new government did not/could not take control of the urbanization and informal settlements increased. Even though urban development was not a priority at the time, within the Greater Maputo council a development team was created in the 1980s (Eskemose Andersen and Jankins 2011: 1). Most of the urban expansion in Maputo today takes place outside the city's official boundaries. The fast urbanization started in the 1990s and is ongoing, international agencies like UN-HABITAT are today not focusing on trying to stop the expansion of unplanned settlements but instead on programmes upgrading the worlds slums (Eskemose Andersen and Jankins 2011: 2). Today pipes in Maputo are very old and so much as 30 percent of the water is being lost when transported through bad or broken pipes. Pipes spring open on a weekly basis even in the downtown area leaving big water filled holes in the street or sidewalk for days. As already stated there is a huge pressure on the water management in the city both in providing new pipes and treatment plants for the expansion and maintenance of the old pipes. The maintenance of drainage is also a problem throughout the whole city, where the downtown area are being flooded during every heavy rainfall because if its location

downhill. Many of the unplanned neighborhoods are located in slumps or close to waterways or in other ways more vulnerable to floods, here storm water ditches been built but in some areas they are not maintained properly and are there for over grassed or filled with trash, see picture on page 38. Maintenance have not been a priority during colonial time or after. During colonial time it was the area where the colonial residents had their houses and the area where the colonial government's buildings were located that was prioritized. Today still it is the city center that are prioritized when it comes to having piped water inside the house. There are no overall plan for the whole city. The unplanned neighborhoods are more or less being built without the government support. The plots are being bought from local self-proclaimed owners of the land and then the housebuilder have to apply from the water company to get a pipe drawn to the house. The pipes that are drawn and used in the households in the unplanned settlements are so called single taps, and the households are called single tap households in the literature. Single tap households means that there are only one tap in the house where you collect the water for all different uses, filling containers and carry the water to where you need to use it.

### 4.3 Hydro-politics of urbanization

Water is of course central and necessary to the life of a city. Therefore, the politics of water is central in a city's development. If water cannot be provided the city cannot function. Urban water history "explores how colonial and postcolonial governments attempted to provide the water urban residents demanded" (Hoag 2013: 210). What challenges did planners and engineers face? What concerns drove these efforts? A city's water history is a crucial link between a city and its surrounding often including also neighboring countries. A city can never be an isolated island though it is always dependent on its surroundings. Urban and industrial pollution is a major problem for the bay of Maputo. The rivers discharging its water into the bay also bring with them pollution from the neighboring countries that through history has been more developed using more agrochemicals and having more industry pollution. Also when the stream flow is too low it makes the concentration of pollution higher and the level of saltwater intrusion rising from Maputo Bay. The low stream flow do not only affect the river water but also the water in the bay being more salt, affecting the environment for fish and other animals and organisms. There is also not enough sludge being brought down to the bay when the water flow is low. All this together is changing the ecology in the bay and the estuary. Municipal waste is also a growing problem, Maputo has a water treatment plant that processes waste water but it does not operate as efficient as it could. Poor usage and maintenance of the water system and lack of finance is two of the main hindrance to having a well-functioning water system in the city of Maputo, the latter is of course affecting the first. Also, the rising population pressure and demand in access are a growing problem for the city. The population of Mozambique and of Maputo is growing at a very high rate, and urbanization is fast as in most developing countries, leading to an increase in numbers of households wanting to connect to the city's water network. Water loss is a huge problem in Maputo, the water being lost on its way through the pipes is estimated at astoundingly 30 % because of leaking water pipes due to the lack in maintenance. Lack of drainage systems in the suburbs contribute to the contamination of the urban environment, heavy rains also stagnate in these areas creating problems for the residents and spreading disease, malaria for example. A large part of the people living in the unplanned settlements in Greater Maputo do not have access to toilets and therefore have to use the surrounding nature. This is then causing a risk at contaminating the water that are then used for domestic use. As written by Ferraz and Munslow (1999: 105) when discussing the challenges of urban development in Maputo, the:

Main problems include inadequate maintenance of the existing system and a failure to expand the provisioning system, tariff receipts are very low, there is weak financial management and a low level of technical capacity amongst the human resource base. A fundamental cause of these problems is a lack of autonomy and failure to integrate these water companies in local government (Ferraz and Munslow 1999: 105)

## 4.4 Water authorities

### 4.4.1 Mozambican Water Law

The legislative framework in Mozambique consists of the 1990 Constitution and the Water Law developed in 1991 (Law 16/91, of August 3, 1991) and is based on a river basin approach to water management ([www.limpopo.riverawarenesskit.org](http://www.limpopo.riverawarenesskit.org)). The water sector in Mozambique was undergoing a profound transformation as it changed from a highly concentrated and centralized water management system in place until 1990. In 1991 the government of Mozambique officially established a Water Law, which incorporated the basic principles and policies of water management. These new water management policies came in to existence as fundamental instruments for realization, with the aim to satisfy the interest of the Mozambican people. The water law of 1991 provides the basis for the modernization of the water sector establishing inland waters as public domain. Four years later, in 1995 the National Water Policy was approved. The National Water Policy defined and formulated the strategy to be followed by the water sector, including the main political objectives defined by the Water Law from 1991. The basic policy principles stated in the policy were equitable and sustainable distribution of water in a quality and quantity not destroying the water resource for future generations, and with a focus on provision for basic water needs. The wording, as described earlier, following the trend in international water documents.

### 4.4.2 The National Directorate of Water

The National Directorate of Water, in Portuguese; Direcção Nacional de Águas (DNA), is the water institution of the central Mozambican government and is responsible for development and management of policies and strategies. DNA is also in charge of leveraging investments for water supply and sanitation in rural and urban areas, resource management of water, plumbing and planning management, and last but not least, issues concerning sharing water resources in transboundary basins agreements. The DNA is a subordinate institution under the Ministry of Public Works and Housing (Ministério das Obras Públicas, Habitação e Recursos Hídricos –MOPH) ([www.dnaguas.gov.mz/](http://www.dnaguas.gov.mz/)). As already mentioned I have spent a lot of time at their archive in downtown Maputo, studying water documents and evaluations. I also interviewed two members of the staff asking their view on what challenges Maputo have had and what they foresee for the future situation. My two interviewees were both placed at the Water and Sanitation Department; Manuela Siteo being a sociologist and Renato F. Solomone a civil engineer (21 April 2014). Drought will according to them be an overall bigger problem than flood for Maputo Province and Maputo city. The IPCC Global Circulation Models prognosis and local projection models suggest an increase in extreme weather events for southern Africa and overall drier conditions (Christensen et al., 2007, Engelbrecht et al., 2009, 2012; Haensler et al. 2010, 2011). This gives support for focusing on droughts but we also know that when the floods will come they will be more extreme, still stressing the need of planning for both droughts and floods.

The second subject we discussed was the recurring flooding's in Maputo, flooding's in downtown and in the unplanned settlement in low laying areas. The flooding of the down town area during rainy season is tough not that severe according to Solomone, explaining that it would be hard doing anything to change the situation because of the water pressure from the bay stopping water in the drainage to empty into the bay. This problem will probably only increase with climate change, sea level rise will mean that the water pressure from the bay on the drainage system will only increase. It is predicted that the area over all will be dryer but at the same time when the floods will come they will be more extreme. The combination of unsatisfying drainage systems combined with higher sea level and more extreme floods will most probably result in more severe floods, even though the overall picture of the situation is increased water stress. The third subject discussed in the interview was the issue of treatment plants in the city. At the time of the interview (2014) 50-60 percent of the water in the city was being treated with the goal that by 2025 100 percent of the water should be treated. On their webpage the DNA states their vision for water management in Maputo:

The desired future in relation to water is one where water is available in adequate quantity and quality for present and future generations, serving for sustainable development, poverty reduction and promotion of the welfare and peace and where minimizing its negative effects of floods and droughts. ([www.dnaguas.gov.mz/](http://www.dnaguas.gov.mz/))

The DNA presents its objectives as being to meet basic needs of human water consumption, where access to safe and reliable water is offered to the public, meeting the UN convention. They also state that improved sanitation is essential for prevention of waterborne diseases with the goal that this should improve quality of life and increase environmental conservation. Moreover, DNA also states that they have an aim to reduce vulnerability to floods and droughts through better coordination and planning using structural a non-structural consultation and preparation of the inhabitants, the communities and the institutions in cyclically affected areas. Last but not least DNA set out to promote peace a regional integration to secure water resources for the development of Mozambique and this by joint water management of shared river basins which need comprehensive agreements, effective implementation and coordinated management.

#### 4.4.3 Ara-Sul

The Water Law established in 1993 the National Water Council with the task of coordinating the inter-sectoral coordination of five regional water authorities. The one relevant for this study is the authority operating the southern region called ARA-Sul, Administração regional de Águas Regional (Southern Regional Water Authority). The ARA-Sul administration is placed under the supervision of the Ministry of Public works and Housing, via the National Directorate of Waters. The ARA-Sul administrates the Incomati basin management unit (UGBI) and is responsible for the operational management of the Incomati Basin Committee, made up of water users and is a consultative body of the UGBI.

One of the responsibilities of the ARA-Sul is to see to the sustainable management of the Umbeluzi water resources. To work toward an improved understanding of the behavior of the river basin in relation to water demand in the region (Droogers, Peter et. al. 2014: 6).

### 4.5 The water sector over time

A short summary will follow of the different actors within the Mozambican water sector through time. Águas de Portugal, was the first water company established in Mozambique, later



transformed to Águas de Lisboa, both being established during colonial rule and state owned. In 1998 an independent regulatory agency called CRA was created in independent post-civil war Mozambique. The Mozambican water sector went in to a new face when Águas de Moçambique (AdeM) was established, being a public-private partnership (PPP) and not only state owned. In August 2011 AdeM changed its name to Águas de Regiao de Maputo. Mozambique's urban water supply reform was initiated in the same year as the CRA, in 1998. It encountered serious problems in its early years when the lead private partner in Águas de Moçambique withdrew because of financial losses. Because of the financial problems Águas de Regiao de Maputo instead was created. In Maputo today it is Águas de Regiao de Maputo



Fig 4. The office of Águas de Regiao de Maputo, photo taken by the author.

and FIPAG, a private asset-holding company, serving the city: providing water, maintenance, construction development, administration etc. (Fig 4).

#### 4.6 Maputo's water supply

In a report from 1979 consultants from Danika (a Danish governmental consultant) state that the at the time, existing water resource supplying for the city of Maputo, the Umbeluzi River, was being exploited both in Swaziland and Mozambique to an extent which sooner or later would interfere with the Maputo water supply demand. Through a study of the available 17 years of run off record from Boane station, it was found that the smallest monthly run off, according to the consultants, recorded had been 4,800 m<sup>3</sup>/h. This figure of run off was valid for the river in its "natural" flow regime, i.e. before the Fairview Dam was erected on the Black Umbeluzi in Swaziland. At the time of the bilateral agreement between Mozambique and Swaziland in 1976 on the sharing of Umbeluzi's water recourses showed a decrease of 20% during low flow periods accrued. Such decrease in flow would have led to a smallest monthly

run off of approximately 3,800 m<sup>3</sup>/h. It should be noted that this flow rate was only slightly above the present day intake rate at the treatment plant (Danika 1979).

When the 1981 *Maputo Water Supply Study* was carried out, again by Danika consultants, Maputo city had a central water supply system based on surface water intake from the Umbeluzi River. The water was led into four large central reservoirs, from which it supplied water to the residents in the apartment houses and the few family houses in the city between hours 08:00-20:00. A great number of private houses and official and industry buildings in and around the city center had their own tanks in order to ensure water supply 24 hours (Danika 1981: 33). Water from the central reservoirs was also led to a number of fountains in the poor quarters of the city. The distance between the houses in these quarters and a fountain was however in some instances 500 meters or more; on an average it was 200-300 meters. The average water consumption per person/day was between 10-20 liters, based on a general household consumption of three-four barrels (20 liter) a day. The water was almost exclusively collected by women and children. In some areas water was supplied from private or public wells during periods of drought or when the public water supply was out of service. Some owners of private wells then sold water to the inhabitants in the surrounding area (Danika 1981: 36).

#### 4.7 The mission of supplying Maputo with freshwater – planning for a mega town

Maputo is as already said, a rapidly growing city with an ever growing demand for freshwater. Being located at the end of three transboundary water systems, Maputo is highly depended on its neighboring countries and affective and equitable water agreements. In a booklet presenting the construction of Moamba-Major Dam National Director of Water Resources (DNA), Suzana Saranga Loforte (in a pamphlet n.d, see below) states that;

We are a still-growing country, with significant external dependence and the fact that we remain highly vulnerable to extreme cyclical phenomena, such as droughts and floods, is both cause and consequence of our poverty. Mozambique's vulnerability with regards to water resources is tied to the reality that most of its major rivers originate outside its territory, thus suffering from the influence of abstractions in upstream countries, the Incomati River being the one most exploited.

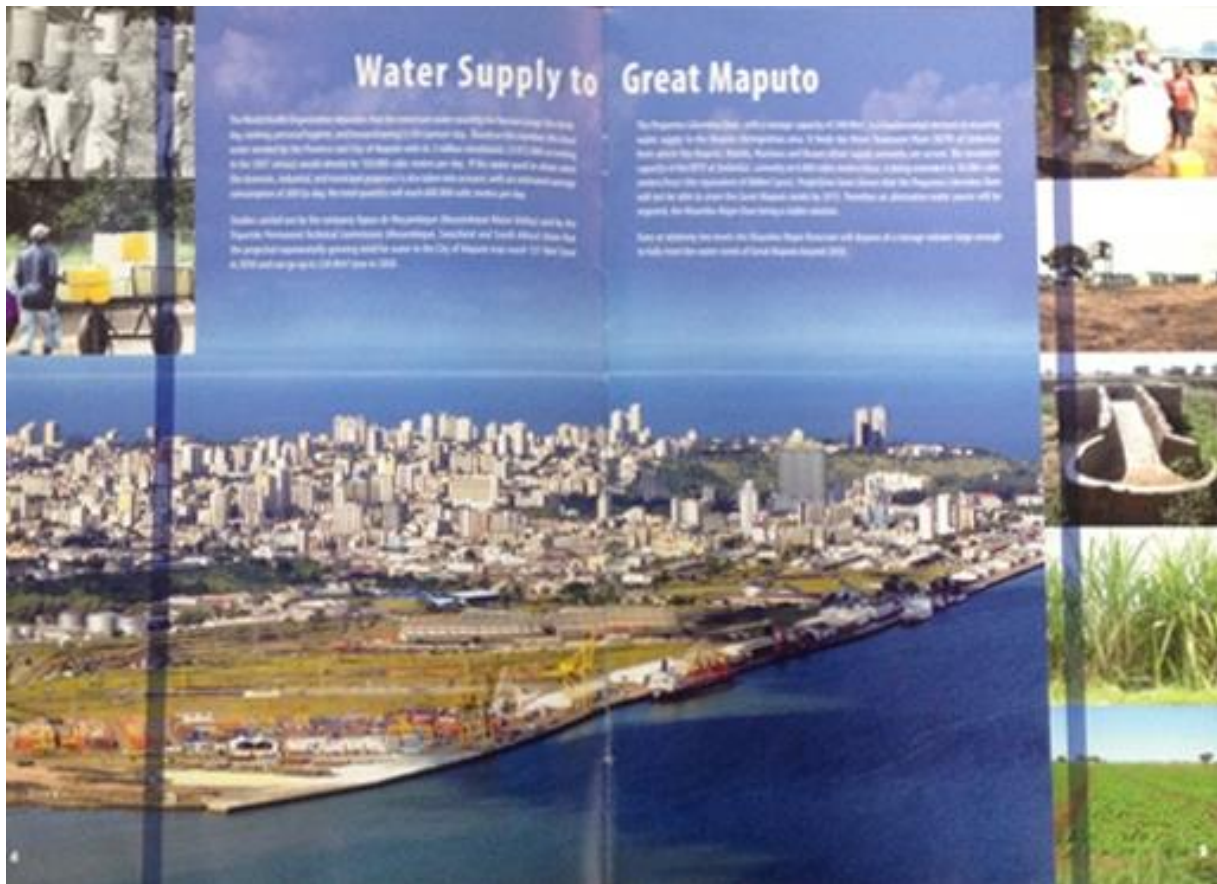


Fig 5. Pamphlet (n.d) describing the water supply situation in Greater Maputo, photo taken by the author.

The figure above (fig. 5) shows a pamphlet describing the water supply situation in Greater Maputo and presents information about the new dam construction plan that is carried out to increase the amount of freshwater available to the city (published by DNA). As stipulated by the World Health Organization (WHO) the minimum water quantity for human usage (for drinking, cooking, personal hygiene, and housecleaning) is 50 l/person per day (WHO). The booklet *Moamba-Major Dam* (fig. 2) states that based on this number the clean water needed for consumption alone in the Province and City of Maputo with its three million inhabitants (2.972.000 according to the 2007 census) would be 150.000 cubic meter per day. If the water used in urban areas for other purposes (for domestic, industrial, and municipal) is also taken into account, with an estimated average consumption of 200 l/person per day, the total quantity will reach 600.000 cubic meters per day. Studies made by Mozambique Water Utility (Águas de Moçambique) and the Tripartite Permanent Technical Commission show that the projected need for water in the City of Maputo is growing exponentially and may reach 157 Mm<sup>3</sup>/year in 2030 and 230Mm<sup>3</sup>/year by 2050 (Moamba-Major Dam booklet n.d). The Piquenos Libombos Dam, completed in 1988, with a storage capacity of 390 Mm<sup>3</sup> was constructed to ensure water supply to Great Maputo, and was predicted to be able to do so until 2015. The plans for the Moamba-Major Dam was to be able to secure the water supply after 2015, and is, when it is finished (the work started in 2014 and construction is expected to take five years), predicted to be able to do so beyond the year 2050 (Moamba-Major Dam booklet n.d).

The three biggest rivers in Maputo Province is Incomati, Umbeluzi and Maputo River. The Incomati and Maputo River basins are both placed in the same three countries; South Africa, Swaziland and Mozambique and are therefore managed as one entity through the Tripartite Interim Agreement of 2002 agreed on by the three countries until comprehensive agreements can be reached for both basins. The Incomati River is the more developed one of the two, with

more dams and irrigation infrastructure, and the second most important river in Mozambique after the Limpopo. The Incomati/Maputo basin is the smallest river basin in South Africa but highly important to Mozambique and also very important to Swaziland. Therefore an uneven dependence exist, where South Africa is not as dependent on that particular water basin as the other two countries. Integrated river basin management, in which a single hydrological unit is proposed as a basis for the management of the Incomati/Maputo basin. The South African approach has up till now relied, instead, on inter basin transfers of waters, water has been moved between rivers on the South African side of the border to meet demand from dams and hydroelectric power stations.

#### 4.7.1 Water data

The lack of data is an ongoing problem, both in terms of not collecting enough data to be able to get the full picture of the present situation when it comes to water flow and rain. Collecting and having access to data is of course much needed in the water management planning. Not having access to enough collected data from today or the past makes it very challenging to make the much needed estimations and predictions for the future and how for example climate change will affect the region. The lack of data has also and still do pose a problem when it comes to tracking the amount of water crossing the border from South Africa into Mozambique, something stated by South Africa as being Mozambique's task to monitor, and if the flow is lower than agreed it is Mozambique's responsibility demanding South Africa to release more water. South Africa monitored the water flow on their side of the boarder and knows therefore when the flow is lower than agreed but states that it is Mozambique's responsibility to monitored the flow on its own side of the boarder and to demand South Africa to release more water when the flow is too low.

### 4.8 Experience from the field

I will below present two different parts of my fieldwork, firs when visiting a neighborhood in Maputo and secondly the Island of Inhaca. No names will be presented and it is as described earlier very informal situations in which I have had the opportunity to speak to these people sharing with me information and opinions on the present water situation in their two respectively areas of Maputo municipality.

#### 4.8.1 Xipamanine neighborhood

When visiting the Xipamanine neighborhood in the western part of the city I had the opportunity to be invited into the home of the woman on the picture below. The house was equipped with a single tap, being a so called single tap household. To have the tap installed she had applied at the water company. The houses in the area are supplied with water from many different coexisting systems for example by having water tanks as you can see in the picture on the next page. A third alternative is to collect water from public standpipes but this is not as common any more in this specific neighborhood but are still in others.



Figure 6. Single tap household in the Xipamanine neighbourhood, photo taken by the author.



Figure 7. Water tanks, Xipamanine neighbourhood, photo taken by the author.

#### 4.8.2 Inhaca Island

Talking to people living on Inhaca, located in the eastern part of Maputo Bay and included in Maputo municipality they describe a situation where the access to fresh water is an increasing problem on the island. This because of salinization, creating problems for agriculture but also for domestic water use. The problem for agriculture is twofold, the fact that the drilled wells on the island are getting more saline hindering irrigation but also that the ground itself are starting to get too saline for many crops to grow. This is causing a major problem to the island residents that are already experiencing smaller catches from fishing, which have traditionally been the main occupation, food provider and source of income. In losing the secure access to enough food coming from fishing, agriculture has become more important as a source of food for the island population. If the island population cannot grow enough food because of the increasing salinization they will have to rely more and more on food having to be transported out to the island, where the residents because of the decline in fish stock do not have a secure income to pay for food. This is a sad situation where the island population is starting to talk about the fact that they might all have leave the island because of the worsening conditions. It is also a very typical example of the effect of overexploitation of natural resources and of climate change, both of which the island population has no fault, nor no possibility to influence the situation. As one teacher (Inhaca resident March 2015) said; the municipality and city of Maputo have forgotten the people on this island, the people here are left to their destiny. The teacher himself

grew up on the island but then left to study. Being a sociologist and originating from the island he felt that he had to go back and try to make a difference, both in training the local teachers and also to try to demand accountability from the municipality. Language has in many cases been a factor throughout this thesis work and especially when trying to conduct field studies talking to people. I visited Inhaca Island both in 2014 and 2015 and to come across this English speaking sociologist explaining the local situation at the second visit to the island was a very happy and fruitful incidence.

## 4.9 Floods and droughts

As already mentioned Mozambique is prone to both droughts and floods. Flood-prone areas are prone to flooding because of their position at the bottom of several of secondary watersheds. They receive water not just from rainfall but also from rainfall runoff on the surface off each secondary watershed (Braccio 2014: 181). One of the most severe floods in Mozambique occurred in 1977 when the Limpopo and Incomati rivers flooded, making 400 000 people flee their homes and causing material loss of 34 million dollar. The next year, in 1978 the Zambezi River also flooded damaging some of the country's most fertile zones and resulting in 60 million dollar worth of material damage (Hall and Young 1997: 106). In 1980 instead Mozambique and especially Inhambane Province, located in the southern parts of the country, was stuck by severe drought forcing the government so seek for international food aid. Before the year was over more than 1.5 million people was affected, spread over six of the ten provinces (Hall and Young 1997: 106). The coordination of dam openings are crucial in case of flood minimizing the effects in the whole river basin. If this is not done one part of the basin, one country, will take the bigger hit. In this case most likely Mozambique being downstream.

### 4.9.1 Responding to floods

From the perspective of state and urban planning, responding to flood and building up resilience to water variations means that authorities need to be able to predict what is going to happen in the future, they need to know what has happened in the past, and they also need to know what areas in the country/city that are most vulnerable and in need for extra support. In trying to predict future floods and droughts you need enough data to be able to see patterns. Maputo city has only one weather station which makes it hard to collect enough data needed to present local variability. There are different methods used to identify flood-prone areas in large cities, Maputo uses the method of mapping wet areas after heavy rains, this gives the information of where in the city the water ends up after heavy rains but no information of where the rain fell (Tiepolo 2014: 27). Another challenge is the combination of heavy rain over the city and rising water levels in the rivers and Maputo Bay, hindering the runoff. The sea level in Maputo Bay highly fluctuates, causing floods when rainwater are hindered to leave the streets because the sea is high and pushing the water back.

In a city like Maputo, with large informal areas, making calculations and predictions is hard due to constant change and insufficient storm water canals which can for example be blocked with garbage or hindered by construction. Modelling informal areas is therefore hard due to the very different outcomes from one flood to the next. The most important two things in responding to floods in Maputo is functioning rainwater drainage system in all lower parts of the city, especially the most flood-prone areas the other thing is more data collection. In the case of trying to stop, or milder, floods before they even happen, the inter river basin cooperation's have the most important role to play both in the long and short term. In the short

term, authorities can try and stop floods and droughts by jointly planning for example how much water should be stored in the different dams along the rivers when a storm is approaching. Even more important, not creating floods or droughts by mismanagement. In the long term, a greater holistic view of the river basin ecosystem is required aimed at creating management plans that are sustainable over long term. One of the top priorities within the SADC is therefore the sharing of data and information helping the region to have better data when taking decisions concerning the river basins.



Figure 8: Storm water drainage in the Xipamanine neighbourhood, photo taken by the author 21<sup>st</sup> of March 2015.



## Chapter 5: The Three River Basins

The region in which the basins are located has a political history characterized by violent disputes over peoples and land. Even though droughts and floods are recurring events putting pressure on the region, open conflict related to water has not occurred. Instead the establishment of the Southern African Development Community (SADC) have made the countries work closer together, developing treaties on the sharing of the river basins. One factor that might have been in favour for successful negotiations is the number of states negotiating. The fact that there is three countries sharing the Incomati and Maputo basins, Swaziland have many times acted as the moderator, approved by the other two, which have helped the negotiating processes not to lock up (Carmo Vas and van der Zaag 2003: 1). The three river basins all drains into the Indian Ocean adjacent to Maputo Bay, Incomati from the north, Umbeluzi from the west and Maputo from the south. The Incomati and Maputo river basins are both placed within the same three countries; South Africa, Swaziland and Mozambique and are until separate treaties are in place managed as one entity. The rivers streamflow varies seasonally depending on the level of rainfall in the catchment basin. Because Mozambique is the end receiver on the three rivers, floods are most of the time more severe and lasts longer on the Mozambique side of the border than in the other two countries. All three rivers flow from east to west, from the inland highland mountains in South Africa and Swaziland to the Indian Ocean. Before emptying into the Ocean the rivers pass through an estuary or a delta where the rivers freshwater are mixed with the incoming saltwater. The use of the river for irrigation is therefore limited at the river mouth because of the in-flow of sea water. The level of intrusion of sea water rises when the river flow decreases. The water in Maputo River for example is unsuitable for irrigation 30 km up the river from the mouth during high tide, in a dry year the saline water reaches as far as 40 km up the river. The dominant irrigated crop in all three countries within the three river basins is sugar cane (Carmo Vas and Van der Zaag 2003). Sugar cane production, which requires irrigation and that can be water exhaustive, has a long history in the region and has been grown by both state and private companies but it is also a relatively water intensive crop.

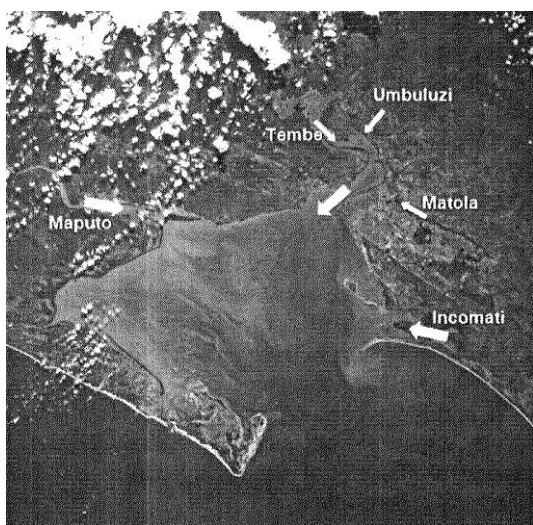


Figure 9. The rivers emptying into Maputo Bay (Carmo Vas & Van der Zaag 2003: 2)

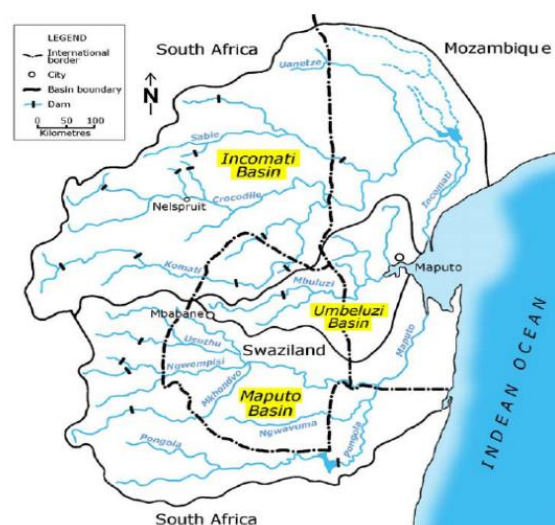


Figure 10. The three river basins (Carmo Vas & Van der Zaag 2003: 2)



Figure 11. Incomati and Maputo river basins, the white in the middle being Umbeluzi river basin (Van der Zaag 2003: 2)



Fig 12a,b. Incomati River 10<sup>th</sup> of February 2015, photo taken by the author.

## 5.1 Incomati River Basin

The Incomati river basin covers an area of 46,700 km<sup>2</sup> (15,600 km<sup>2</sup> in Mozambique, 2,500 km<sup>2</sup> in Swaziland, and 28,600 km<sup>2</sup> in South Africa) The river rises in the mountains 2,000 meters above sea level in the west of the basin and drops to the coastal plain in Mozambique. An interesting characteristic of the Incomati basin is that Swaziland and South Africa are intermittently upstream of each other, while Mozambique is the end user (Van der Schans 2003: 10). The basin is characterized by a broad variety of natural vegetation types; from beaches, recent dunes, tropical bush and forest to different types of savannah and grassveld. The general

climate in the Incomati river basin varies from a warm to hot humid climate in Mozambique to a cooler dry climate in South Africa in the west. The mean annual precipitation of about 740 mm/year falls entirely during the summer months (Hilders 2003: 24-25). And as already mentioned rainfall is the number one water provider to the basin. On both the South African and Swaziland side surface water is being exported from the Incomati basin to neighboring basins. Water transfers represent the third largest water user in the basin, after irrigation and exotic tree plantations (Australian eucalyptus). Two bulk water transfers exist in the Incomati river basin. South Africa transfers water from the upper Komati river catchment for power generation in the adjacent Olifants catchment and Swaziland exports 136 square kilometers per year from the Komati River in to the Umbeluzi catchment. Some of the dams in the basin generate hydropower, but all dams have as a primary purpose to provide water for irrigation. Electricity production is a secondary benefit derived from water releases made for other use. Consumptive use of surface water amounts to 51% of the average amount of surface water generated in the basin, which is considered relatively high (Van der Zaag and Carmo Vaz 2002). Other (marginal) water uses include domestic, municipal and industrial use as well as water for livestock and wild animals. Due to the high water use certain parts of the basin are subject to severe water stress during certain periods of the year, and during years with below normal rainfall and runoff (ibid.). Therefore water allocation is the most important issue in international water management (Hilders 2003: 25). As pointed out above, more than 50 percent of the basin water is being withdrawn (Van der Zaag 2003). The Komati and Crocodile rivers meet at the border to Mozambique, at Ressano Garcia, and joining together forming the Incomati. KOBWA –Komati Basin Water Authority. SKPE –Swaziland Komati project Enterprise. JIBS – Joint Inkomati Basin Study 2001. The foundation stone for the construction of the Moamba-Major Dam on the Incomati River and related works was laid Friday 31<sup>st</sup> of October 2014 at a ceremony attended by the president of Mozambique (macauhub.com.mo). The store capacity will be 760 million cubic meter and are built to meet the increasing water demand from the capital (idem.).



Fig 13. Umbeluzi River 10<sup>th</sup> of March 2015, photo taken by the author.

## 5.2 Umbeluzi River Basin

Umbeluzi is one of the main rivers of Swaziland (where it is called the White Umbeluzi or Imbuluzane) and are made up of two sources; one coming from the Highveld and the other one from the Middleveld near the city of Manzini. The river flows through Hlane Royal National Park and Shewula Nature Reserve. The main dam fed by the river in Swaziland Mnjoli dam which is located not far from the sugar plantations of Mhlume (Droogers et. al 2014: 6-7). Coming from Swaziland Umbeluzi passes the towns of Goba and Boane before reaching Maputo Bay. Umbeluzi river basin is managed by the Umbeluzi river basin authority (UGBU). The Umbeluzi runs up into the Pequenos Libombos dam. The dam is built on the Umbeluzi River located east of the city of Maputo, close to the Swaziland border. The Pequenos Libombos Dam has a storage capacity of 390 Mm<sup>3</sup> and is the major water supplier to Maputo Metropolitan area. It feeds the Water Treatment Plant (WTP) of Umbeluzi from where Maputo, Matola, Boane, and Machava urban supply networks are served.



Fig 14. Piquenos Libombos Dam visited 19<sup>th</sup> of February 2015, photo taken by the author.



Fig 15a and 15b: Bridge over Maputo River south of Catembe on the south side of Maputo Bay, photos taken by the author.

### 5.3 Maputo River Basin

The Maputo river basin is covering 29,800 km<sup>2</sup> (1,507 km<sup>2</sup> in Mozambique). The catchment area of Maputo river basin is 29 030 square kilometers where 94% is located outside

Mozambique (Vasco Langa 2005: 10). The two major principal tributaries to Maputo River are the Pangola and the Usutsu. Most of the area drained by the Pangola is situated in South Africa and the area drained by Usutu mainly in Swaziland. After crossing the border into Mozambique Maputo River passes through the Libombos mountain range following a northerly course until it discharges into Maputo Bay (DNA 1982). The mean annual rainfall in the basin ranges from 1054 mm near the coast to 388 mm inland (1982 report). Within Mozambican borders there are no dams on the Maputo, though there are seven small earth dams (all less than 6 m high) within the basin (DNA 1982, Vasco Langa 2005: 11). These small earth dams have a total storage capacity of about 133.000 m<sup>3</sup> and are used for the watering of livestock. Measurements of run-off have been taken at Madabula station since 1952/53; however, the results of this station may be incorrect at very high flows. Studies have correlated flows at Madabula with both rainfall and flows in the Usutu, Pongola and other tributaries. The correlations is restricted by the small quantity of flow-data available for the two major tributaries (1958/9-1964/65). Given the low storage capacity on the river, the main limitation to water use is during the dry season when flow is at a minimum. On average, the minimum flow occurs in October but low flows can also occur at any time between April and November. In a dry year, the mean monthly flow, with probability of 80%, is only 12m<sup>3</sup>/sec (DNA 1982). Maputo river commission for Maputo river basin was established in 2003. Within Swaziland four considerable dams are located in the larger Higher Usuthu catchment<sup>15</sup> area; Westoe Dam, Moorgenstond Dam, Jericho Dam and Heyshope Dam. Heyshope Dam is used for inter basin transfer to the Vaal catchment and about 60 million cubic metres of water are stansfered annually (Vasco Langa 2005: 13). There is also a hydropower dam located on the Little Usuthu River in the Usuthu catchment, the Lumphohlo Dam. The Pongolopoort dam which takes possession of the water of the Pongolo River in KwaZulu Natal in South Africa was built in the 1970s to provide water for irregation. The dam is licated where the river flows through a narrow gorge between the Lebombo and Ubombo mountain ranges close to the Swaziland border. The dam was planned and constructed by what was the predeccessor of Water Affairs and Forestry. The Pongolopoort dam was built during the apartheid period in South Africa to provide water for white farmer mobilization through sugar cane irrigation. The South African attention was to stabilize and limit the water flow bordering Mozambique and Swaziland through the creation of 40 000-50 000 hectare of irrigation schemes on the Makatini Flats, the drop in sugar price though changed the situation and in the end only 3 000 hectare of irrigation was created (Vasco Langa 2005: 12-13).

There are as already mentioned no existing water resource infrastructure located in the Maputo River Basin in Mozambique, except for the three towns within the basin (Belavista, Salamanga and Catuane) that has smaller water systems, also supplying Salamanga and Catuane with domestic water (National Water Recourse Plan for the Maputo River Basin 2003). In Mozambique the Maputo basin is located in one of the poorest districts, where the many years of war and political instability show long term effect on economic and social development within the basin and still today economic activity is limited (see Vasco Langa 2005: 14). The socio-economic situation in the part of the Maputo basin located in South Africa are more mixed, with substantial economic activity in some areas (commercial forestry and irrigated cash crop production) and subsistence rural economies in others. The Maputo basin and its sub-catchments cover more than half the land area of Swaziland, where the northern and western parts are characterized by agricultural development (forest and sugar production) in rural areas and industrial in urban areas. There is lower activity in the eastern part of the basin and hence poorer conditions (National Water Resource Plan for the Maputo Basin 2003; Vasco Langa 2005: 15). Rapid sugar plantation and land development in South Africa and Swaziland

---

<sup>15</sup> Consiting of Usuthu, Ngwempisa and Mkhondvo catchements.

combined with population increase throughout the last few decades have caused rapid increase in water demand. More water is therefore being diverted from the Maputo basin resulting in less water crossing the border into Mozambique, and also affecting the environmental flow and the quality of the water. Mozambique has become worried that neighbors, particularly South Africa are contributing to their difficulty in development and maintaining even minimal flow in the shared rivers. Environmental flow problems have been improving during the past two decades, but future development demand might reverse this tendency. Appropriate management of water resources of Maputo basin is thus needed to guarantee that water abstracted for different water uses and environment is sustainable and that the quality of the water is adequate. The main activities contributing to the total water use within South Africa is irrigation, forestry and water transfers from the upper portion of the basin to the Upper Vaal River catchments where it is used for electric generation and irrigation (Vasco Langa 2005: 48). Within the Maputo basin Swaziland is the main irrigational water user followed by South Africa, Mozambique in comparison with the other two only uses 10 and 17 percent respectively (Vasco Langa 2005: 67). This means that if Mozambique were to increase its irrigated agricultural land to the levels of the two neighbors the water demand in the basin would drastically increase. Water demand is increasing constantly in the basin, particularly as stated above, in the upstream countries. But also Mozambique's demand is and will continue to grow due to the growth of the necessities in irrigation and as already mentioned; future plans to use water from Maputo River to supply the growing city of Maputo (Water Resources Development Plan).

## Chapter 6: Sharing water

The development of the Incomati/Maputo regime has gone through tumultuous process. Mozambique sabotaged the apartheid regime in South Africa and this affected its interbasin relationship with South Africa, an upstream state with control of the water flow downstream. By contrast, Swaziland has benefited from its friendly relationship with South Africa. (Louka 2006)

Around the world, more than 200 major rivers are shared by two or more countries. The importance of transnational treaties and regulations can be estimated on the basis of the fact that these 200 rivers put together, covers 47 percent of the planets land area. In the case of the African continent 80 rivers are shared by two or more countries, covering as much as 60 percent of the land area. Terms often used in discussions concerning water resources and the subject of water sharing is “integrated management of water resources” and “regional sustainable development of water resources”. Other terms used in more recent water documents by international bodies are “fair”, “just” and “equitable” use and sharing of water resources. One of the major problem in international river basin management is the so-called “Lowest common denominator” (see also discussion in Vasco Langa 2005: 4), obligations cannot be imposed on the basin sharing countries without their consent and therefore many international agreements basically reflect the commonalities in the national policies of the states concerned.

Mozambique shares, as already said, its main rivers with a number of upstream countries. These rivers are in order from north to south: the Ruvuma, the Zambezi, the Pungwe, the Save, the Limpopo, the Incomati, the Umbeluzi and the Maputo. This study focuses on the three rivers furthest south in the country, located in Maputo Province and part of the two river basins supplying the city of Maputo and its residents with water. Mozambique as a whole is because of its high number of international rivers highly dependent on its neighboring countries to have a secure access to water both in terms of volume and quality. The fact that Mozambique is placed downstream on all its rivers make Mozambique dependent on the other countries willingness to share equitably. Access to natural resources, in this case water is the subject of discussion, is one of the most important factors in development for a country and its inhabitants. Development plans therefore have to take issues of water resources into account and also the subject of Mozambique’s interdependence with its upstream neighbors. It is clear that the interests of Maputo’s access to water are unavoidably dependent on external factors (Ferraz and Munslow 1999: 176).

### 6.1 Cooperative management of international rivers

To a greater extent in Africa than anywhere else in the world, international rivers have the potential to join countries economically and politically— or, conversely, to cause economic and political tensions between them. (World Bank : 55)

There is more rivers that are shared by three or more countries in Africa, than any of the world’s continents. Because of the many shared river basins the importance of cooperation is immense. Adding to the importance of cooperation is the challenge of extreme inter- and intrayear rainfall variability in the region, causing drought and flood which can only be dealt with looking at the shared river basins as one unit, where decisions made by one part, both the positive and negative, always effects the other riparian states (World Bank p. 55). An example is the floods



of 2000 where Mozambique suffered enormous destruction. The fact that Mozambique is the end receiver on all the three rivers in this study (and all the international rivers in the country except one) will be discussed in the section concerning the consequence of upstream-downstream position. One way used in negotiating shared river basins within the SADC is that of benefit sharing and “equitable utilization, which emphasizes equity for all riparian’s, and no significant harm, which emphasizes protection for all riparian interests” (World Bank : 57).

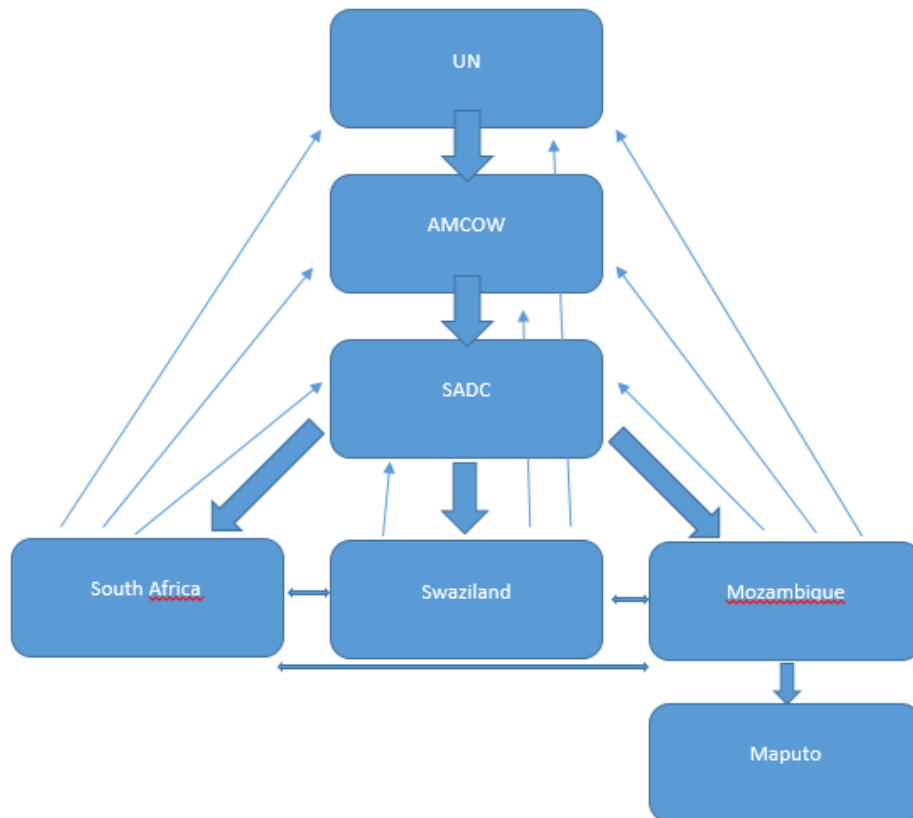


Fig 16. Map showing the hierarchy system and the connecting net between the protocols, the water sharing countries and the city of Maputo (produced by the author).

## 6.2 Negotiating water with other countries

Politics play the most important role in creating agreements and for cooperative management of shared water resources, politics meaning local, governmental and international. Stakeholders on all levels have to be a part and be recognized if agreements are to be successful. A very important point is put forward by Sadoff et al. (2002) in the case of how important the historical past is to negotiations and in reaching agreements, they state that:

Historical precedents and alliances may affect negotiations by influencing states’ initial bargaining positions and the propensities for riparian’s to form coalitions. Relative wealth may also be a factor, particularly with regard to the credibility of unilateral threats and promises that would require significant investment or financial outlays. (Sadoff et al. 2002: 56)

*The SADC Regional Water Policy and Strategy:*

- *Recognises water as an instrument for peace, cooperation and regional integration;*
- *Promotes effective public consultation and involvement of users at all levels;*
- *Promotes integrated people-centred development;*
- *Promotes joint planning and development of strategic regional infrastructure; and*
- *Promotes the efficient use of available water resources through application of best practices such as demand management and the “polluter pays” principle. (SARDC 2014: 67)*

In *Africa’s International Rivers: An Economic Perspective* Sadoff et al. states that there are up until today “no international consensus on the criteria for equitable allocations though numerous principles for benefit sharing exist” (Sadoff et al. 2002: 45). There are criteria that can be found in international water law dealing with allocation of water and its benefits, what is causing discussion and dilemmas is the way these are formulated, which is believed not to be helpful when priorities are to be decided and different actors view the principles of “reasonable and equitable” different from each other. There is one exception though, there is one clause in the UN Convention (1997) stating that “special regard” should be given to “the requirements of vital human needs” (Sadoff et al. 2002: 45).

### 6.3 International water law

International law concerning water is divided into two categories – navigational and non-navigational uses. The reason for the divide is to be found in the history of international water law. Whereas water for navigational uses has been regulated since the early 19<sup>th</sup> century, water for non-navigational uses still did not have a universal treaty in force for international watercourses until 17 August 2014 (treaties.un.org). There has though been international rules for both categories, but the rules has emerged separately and are therefore still left separated to much extent. When regulations around navigational uses of water started to emerge, navigational uses was seen as more important, it was also easier to reach agreements on rules concerning such use (Salman 2007: 625). There has been many customary rules and declaration on the use of non-navigational water, both prior to, and after the UN treaty of 1997, complementing and adding to the treaty. The rules and resolutions though, differing from laws, have no formal standing or legally binding effect. However, the Helsinki Rules remained the single most authoritative and widely quoted set of rules for regulating the use and protection of international watercourses until the UN Convention was developed in 1997 (Salman 2007: 629-30). The reason to why law concerning water for navigational uses started to emerge in the beginning of the 1800-hundreds was the industrial revolution taking place in Europe. The need for transportation of goods and materials was great and the number one choice of transportation mode was the rivers, laws and rules where therefore needed. Whereas the navigational waters where subject to pressure, demanding rules to be established, non-navigational water use for example irrigation and hydropower, were not fought over, therefore not in need for regulation at the time. The major powers of Europe signed a treaty on the use of navigational waters in 1815 - the Act of the Congress of Vienna. “The Act established the principle of freedom of navigation for all riparian states on the rivers they share, on a reciprocal basis, as well as its priority over other uses” (Salman 2007: 626). In this section I will go through international and regional water law, rules and regulations affecting the transboundary river basins concerned by this study.

### 6.3.1 UN Convention on Law of the Non-navigable Uses of International Watercourses

The treaty came in to force in 2014 after being adopted by the United Nations General Assembly in 1997<sup>16</sup>. When UN adopted the treaty in 1997 it had already been under preparation for 23 years. The UN Convention is “a framework convention that aims at ensuring the utilization, development, conservation, management and protection of international watercourses, and promoting optimal and sustainable utilization thereof for present and future generations” (Salman 2007: 632). Like the Helsinki Rules, the UN Convention stresses the importance of equitable and reasonable utilization, but this treaty is a framework convention leaving the riparian states to complement the details.

### 6.3.2 Helsinki Rules on the Use of the Waters of International Rivers

The Helsinki Rules on the Use of the Waters on International Rivers published by the Association of Human Rights in 1966 is one of two important rules contributed by non-governmental organization (the other one being Berlin Rules) (Salman 2007: 626). Being the first, Helsinki Rules as an international legal instrument, includes both navigational and non-navigational uses of international rivers (Salman 2007: 629). The main principle established by the treaty was that of “reasonable and equitable utilization” of the waters of an international drainage basin among the riparian states as the basic principle of international water law” (Salman 2007: 629). Focusing on the principle on “reasonable and equitable utilization”, the treaty specifies factors for sharing. In article five, one of many stated, is one concerning the degree to which the needs of a basin state may be satisfied, without causing substantial injury to a co-basin state (Salman 2007: 629). One that of course is very important when negotiating the water extraction levels for states sharing river basins, within the SADC countries and the three specific basins concerned by this study, and elsewhere. Included in the treaty is also a section dealing with prevention of conflicts and disputes among the riparian countries. The rule quickly became widely accepted and a number of countries and organizations adopted the Helsinki Rules, one of the organizations being the Southern African Development Community (SADC) and the SADC protocol of 1995 is largely based on the treaty (Salman 2007: 630).

### 6.3.3 Berlin Rules on Water Recourses

The Berlin Rules from 2004 is a revised version of the Helsinki Rules from 1966 and consists of 73 Articles. The much needed updated version, 40 years after the last, complements the Rules with the development of important bodies of international environmental law, international human rights law and the humanitarian law relating to the war and armed conflict” (Salman 2007: 635). The Helsinki Rules and the UN Convention emphasized “the right of each of the riparian states to a reasonable and equitable share” the Berlin Rules instead emphasize “the obligation to manage the shared watercourse in an equitable and reasonable manner” (Salman 2007: 635).

---

<sup>16</sup> From when the Convention was completed it took 17 years for it to come in to force, having enough countries ratified the treaty.

### 6.3.4 SADC Shared Watercourse System Protocol

The first protocol on shared watercourses was signed by the member states in 1995, and came into force in 1998. The treaty is largely based on the 1997 UN Convention and the 1966 Helsinki Rules. From the Helsinki Rules the Protocol adopted the somewhat older “principle of territorial sovereignty of a watercourse state” and according to that principle “upstream state has the right to use water resources within its territory with no regard to any effects such use may have on the downstream state” (SARDC 2014: 68). Mozambique was not satisfied with this principle and was not willing to sign the treaty unless it was changed to take greater responsibility of the end riparian of the river basin. The Protocol was later revised to “ensure that rivers are managed in such a way as to benefit all those countries and people who share a river basin” and came into force in 1998 (SARDC 2014: 68).

### 6.3.5 The SADC Protocol on Shared Watercourses

The SADC Protocol on Shared Watercourse Systems in force since 1998, and revised as the Protocol on Shared Watercourses in 2000. The Revised Protocol on Shared Watercourses was signed by SADC Heads of State on 7 August 2000 in Windhoek, Namibia, and entered into force on 22 September 2003 upon ratification by the required two-thirds majority of Member States (SARDC 2014: 69). The new SADC protocol on shared watercourses, the Protocol on Shared Watercourses from 2000 complies of 16 articles and the main goal is to foster closer cooperation for judicious, sustainable, and co-coordinated management, protection, and utilization of shared watercourses (Carmo Vaz and van der Zaag 2003: 30-31).

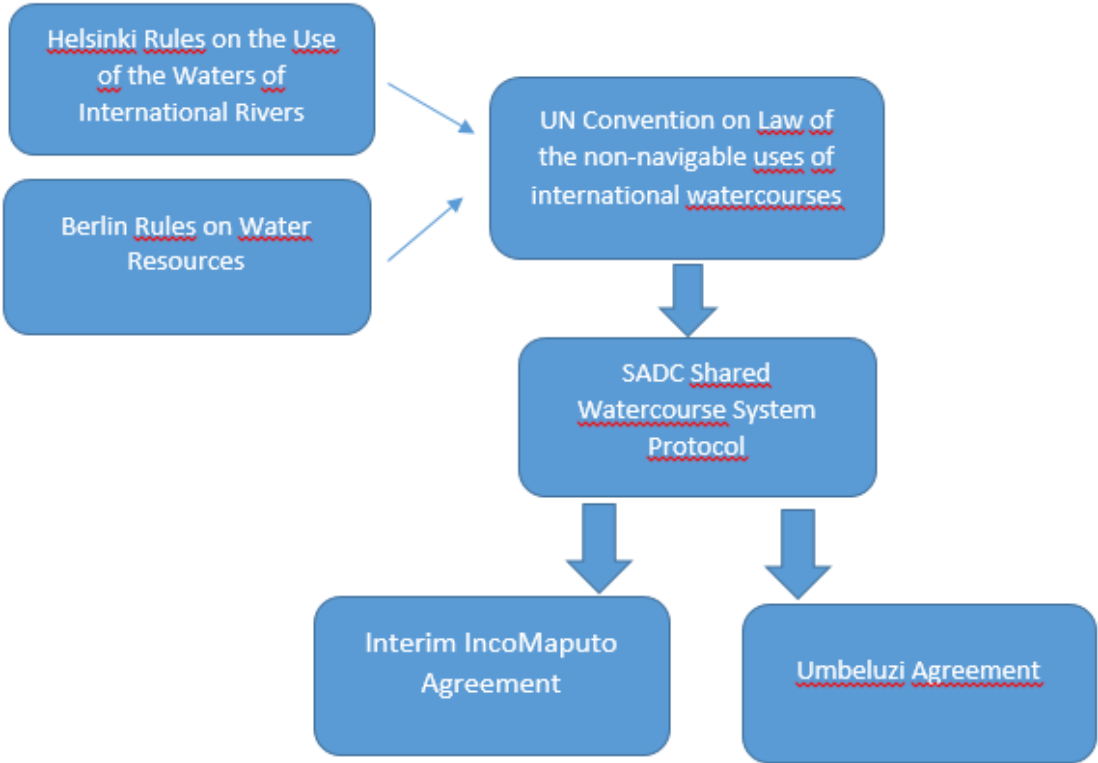


Fig 17. Map showing the historical and hierarchical background of water management, and in particular water sharing management in which the agreements concerning the three rivers have been created in (made by the author).

## 6.4 Water sharing management

Water is, as said earlier, a basic human right and every person are to have access to minimum 20 litres of clean, safe, affordable water a day (World Health Organisation, WHO). The world population is growing and therefore the need for water is increasing. This in combination with climate change and pore and uneven distribution needs changes in water management. When the stress on the water supply increases, it cannot be managed without taking into account the inter-dependence between agencies, jurisdictions, sectors and geographical areas, or otherwise it will never be effective. But despite a need of integration in water management, the water management sector has often have little social participation and local communities have often been left out of the decision making process. Sadly, the common way of managing water and other natural recourses has been the top-down approach. At the moment the Southern African Development Community (SADC), and most other organizations and countries approach to water resource management is the focus on solving the water shortage or water stress by trying to increase the supply rather than trying to find a better way of managing the demand, this is in no way sustainable.

The Southern Africa Research and Documentation Centre (SARDC) pinpoints a general problem when it comes to water management in their report: *Reporting Water in Southern Africa (2014)* that “management of water resources is often portrayed as an engineering profession, with a main focus on technical and financial solutions for problems faced by users in the domestic, industrial and agricultural sectors” (SARDC 2014: 31). This quote is important as it stresses a need for a more interdisciplinary approach to water management, especially in the field of trying to understand what chain off reactions one decision sets off, how, and what it effects on all levels. Examples of the different levels that needs to be assessed are for instance, to see what is best today but also for the future, seeing and understanding what effect one decision has on the urban population and at the same time the rural, because they interact – people migrate in search for better conditions. A holistic view on water basins is hard to work with, it demands extreme amount of information and analysis, but is at the same time the most effective and fair way to manage a shared river basin, and for this to be possible engineers cannot be left alone to solve the question of water and benefit sharing. Another problem in the same area is sectoral fragmentation where agricultural, industrial or domestic water consumption are seen as separate with little coordination between the sectors (see discussion in SARDC 2014: 31). By this approach, you miss where these sectors meet and integrate, different uses of water impact on other uses, which can in its worst cause conflict. The different uses of water impact on other uses is especially evident for the downstream user in a shared river basin, the relationship between upstream and downstream water users are to be discusses in a later section. Sectoral approaches fail in the same way as when relying on one single area of profession, one misses to recognize the larger picture and fail to see the inter-linkages between different users and uses of water. In changing water management the concept of Integrated Water Resources Management (IWRM) has emerged, moving towards more holistic management of water, away from the sectoral approach, hopefully taking the people and the environment in to account more (SARDC 2014: 31).

## 6.5 Agreements and river basin commissions

As already mentioned in the beginning of this chapter, bilateral and trilateral technical commissions were set up between South Africa and later Swaziland and the colonial

government of Mozambique. These commissions were set up to discuss water-sharing issues concerning Incomati and Umbeluzi river basins. In 1960 the first Mozambique-South Africa Commission was established, Swaziland joining seven years later. The first agreement to be reached in 1976 revolved around the main question of water sharing of the Umbeluzi River, between Mozambique and Swaziland. In the agreement Swaziland agrees to ensure that 40% of the annual flow of the Umbeluzi River and its tributary the White Umbeluzi are to flow across the border into Mozambique. The Umbeluzi agreement is based on the Helsinki Rules which is presented above. Two weaknesses are to be found in the agreement, the first one is that there are nothing written about the yearly distribution of the *actual flow* of water coming into Mozambique, only a percentage of the total yearly amount. In an area characterized by recurring drought and flood, the *actual flow* is of course of huge importance, and the goal (seeing it from Mozambique's point of view) is to have as steady flow as possible crossing the border. If a flood occurs, Swaziland has no obligation to try and constrain the water in any way, trying to alleviate or regulate the effect of the flood for Mozambique, unless Swaziland does so voluntarily. The second weakness of the 1976 agreement is the absence of any water quality guarantee, which would have been good since Umbeluzi is the main water provider for the city of Maputo where a large part of the water are used for domestic use. The fact that Mozambique did sign this agreement with Swaziland have more to do with the political situation than the quality of the actual agreement. Newly independent Mozambique wanted to have close bonds with other black-ruled nations in the region having taken a stand against apartheid in South Africa and the white rule in Rhodesia (see discussion in Ferraz and Munslow 1999: 177). When it comes to the Incomati river basin, the requirement from the Mozambican side has always been to meet the ecological needs of the river, not destroying the system. In February 2002 the Interim IncoMaputo (IIMA) agreement between Mozambique, South Africa and Swaziland was agreed. The signing took place on August 29 during the World Summit for Sustainable Development in Johannesburg, South Africa. The agreement from 2002 includes a technical committee (TIA). Later, in 2006, TPTC – Joint body for cooperation between the countries was formed to implement the TIA agreement.

## 6.6 Upstream-Downstream

The country of Mozambique and the province and city of Maputo is as stated earlier, the downstream recipient on all the three water basins concerned by this study and are therefore dependent on the two riparian states: Swaziland and South Africa to be able to obtain enough water to supply Greater Maputo and its inhabitants. Regulation on how much water that are to cross the border into Mozambique from each river is regulated by the treaties on respective river basin. Below; after flows from South Africa to Mozambique NAT: 8.53. Water flows from Swaziland to Mozambique NAT: 3.4.

## 6.7 Mozambican Water Law and Urban Water Supply Reform Process

In 1991 Mozambique officially established a national water law. The Water Law of 1991 provides the basis for the modernization of the water sector – establishing inland waters as public domain. Two years later, in 1993 ARA-Sul (Administração Regional de Águas Sul, Regional Water Administration South) was established, placed under the supervision of the Ministry of Public Works and Housing, via the National Directorate of Waters. ARA-Sul and its Incomati Basin Management Unit (UGBI) is responsible for the operational management of the Incomati Basin. The Incomati Basin Committee, made up of water users, is a consultative

body of the UGBI. The national Water Policy was approved in 1995 and later revised in 2007. The water policy for Mozambique was developed with a focus on provision for basic water needs and to establish principles for private sector partnership (PSP). Through the Decentralization Law of 1997, which created municipal governments with elected leaders, and the Law of Local State Organs of 2003 the 129 district and 11 provincial governments of Mozambique are supposed to gradually take over more responsibilities in various fields including water supply.

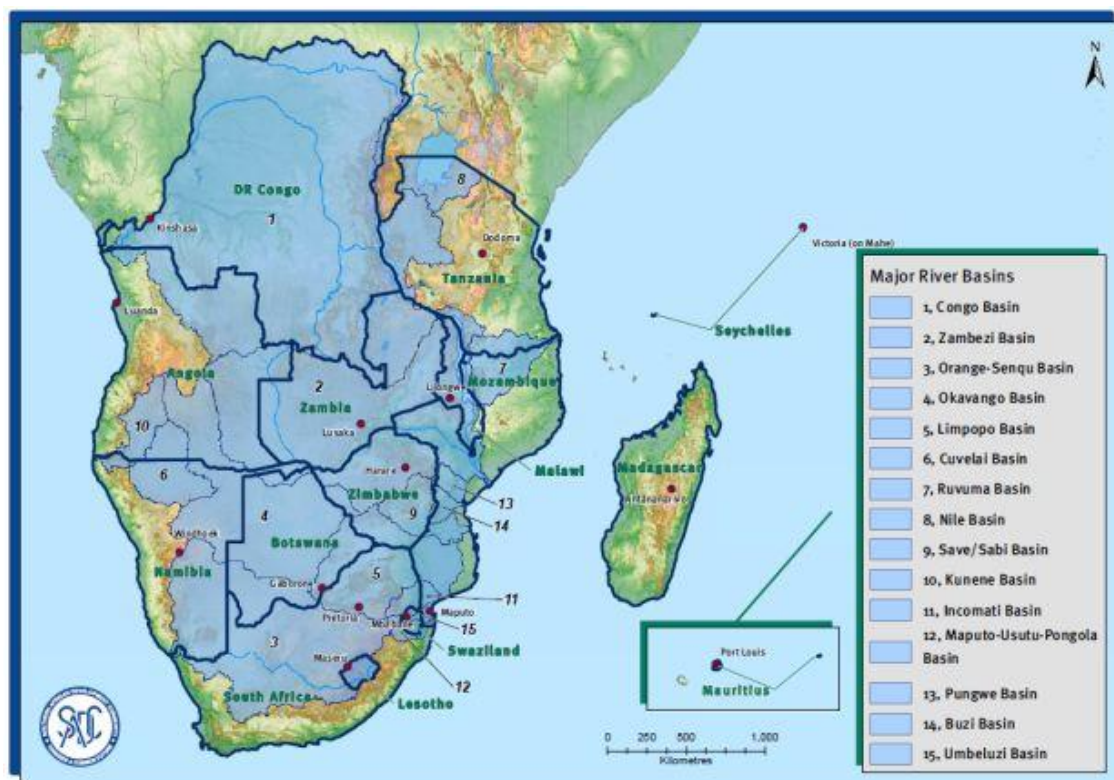


Fig. 18. Major river basins within the SADC.

## 6.8 SADC

The Southern African Development Community (SADC) was established 17 August 1992. Before the SADC there was the Southern African Development Co-ordination Conference (SADCC), established in 1980 by the Front Line States (FLS). The reason for the creation of the organization was to promote regional cooperation in southern Africa and to oppose the apartheid regime in South Africa. “One of the important actions taken by the SADC countries is without doubt reaching agreement for a protocol to govern the use of water resources in common rivers in the region” (1999: 177). The main objectives, stated by the of SADC are to

“Achieve economic development, peace and security, and growth, alleviate poverty, enhance the standard and quality of life of the peoples of Southern Africa, and support the socially disadvantaged through Regional Integration. These objectives are to be achieved through increased Regional Integration, built on democratic principles, and equitable and sustainable development” (www.sadc.int).

The SADC covers all shared water courses in the region including the three river basins in this study. The SADC contains of 15 member states, which are Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. Written environmental policy with a holistic point of view was almost non-existing up until the beginning of the 1960s. This situation was a fact everywhere in the world, also in the southern part of Africa and the states that are today members of the Southern African Development Community (SADC) (Environmental information & organizations). Mozambique and Swaziland was two of the original 10 member states when the treaty was signed in 92 while South Africa was one of the last country to become a member in 1995. The first year as a member South Africa hosted both the SADC summit in August the SADC conference of water ministers in November (Van der Zaag UNESCO).

Article five, paragraph one, in the treaty of 1992 states that the objectives of SADC shall be to “achieve sustainable utilization of natural resources and effective protection of the environment” (SADC 1992: 5) and “strengthen and consolidate the long standing historical, social and cultural affinities and links among the peoples of the region” (SADC 1992: 5). In chapter seven, article 21, the summit states that “Member states shall cooperate in all areas necessary to foster regional development and integration on the basis of balance, equity and mutual benefit.” (SADC 1992: 9). The new updated version of the protocol -the SADC Shared Watercourse System Protocol came in to force in 1995.



## Chapter 7: Conclusions

When looking at the subject of supplying Maputo with freshwater the choice of location of the city can seem strange, the city is though placed where it is because of the perfect natural harbor. The harbor has been fought over multiple times for access to transportation. The region was through history tightened together by the rivers and the shared desire to control the bay. Through history Mozambique has depended on South Africa for water investments and South Africa has been dependent on Mozambique for labor to the mines, and the Transvaal in the early days was dependent on the harbor to get the ships out. Maputo Bay and its connecting rivers into the hinterland is the reason to why the Portuguese choose to move the capital down to the bay in the first place. The bay is also what has been connecting the region of South Africa, Transvaal, Swaziland and Mozambique. Maputo has been and still is very much a part of the southern region, the city being more linked with its neighboring states than the northern part of Mozambique. The history of Transvaal is especially important to the Maputo history and development as also the South African gold mines and the work migration. Today still many Mozambicans work in South Africa, but as we have seen there is tension and conflict concerning migrant workers in South Africa, especially during 2015.

Much of the infrastructure that has been built in the region has been in the purpose of transporting goods down to the harbor in Maputo. The colonial past and the market for ivory, gold and other natural resources has had a huge impact in forming the net of infrastructure. Development investments has most of the time not been made in local industry or to connect different parts of the country with roads or railway lines. Dams have for example been built inside Mozambique to generate hydropower for mining companies in South Africa. Other large infrastructure projects in the region has been made for the irrigation for sugar plantations in Swaziland. Both the mines and the sugar plantations have tough been in the purpose of extracting natural resources or raw materials to be sold on the world market, not benefiting local development – not for the purpose of supplying the region and its population with electricity or water. Understanding the impact of climate change in the region is key in understanding and being able to plan for water management today and for the future. The interplay between human and nature is as present as ever. Present and future problems for the region when it comes to freshwater is; overuse, crossing ecological boundaries and in some parts increasing salinization. It is though important to point out, that even if conflict has occurred over the rivers and the bay, wanting to control access to transportation, there has never been any armed conflicts over the water itself. The people in this region have for a long time been sharing a common space and a common history, and because of the need of cooperative management of the three shared river basins, are inevitably sharing a common future.

### The biggest challenges of providing water to all inhabitants

Now, moving on to answer my main research question -*What has through history up until today been the biggest challenges of accessing enough water to supply the city of Maputo and all its inhabitants?* I will here conclude the different aspects that has, or still do hinder all the people in Maputo to have access to safe, clean and affordable water that is stated by the UN as a basic human right. With the challenging fast urbanization, and climate change disturbing

weather patterns making droughts and floods in the area harder to predict. These two factors makes water management one of the hardest but also one of the most important tasks in the continuing development of the city. Below I will list some of the historical factors that have impeded water negotiations from the perspective of Mozambique and Maputo water sharing.

**Not speaking the same language** -As presented in section 3.5 one of the biggest challenges during the first years of water negotiations with South Africa and Swaziland was the fact that they were only conducted in English. Mozambique was represented not by their governmental representatives but by others. This led to a high level of distrust between the parties. South Africa and Swaziland's government representatives could understand each other both having English as one of their official languages leaving Mozambique to feel left out from the negotiations having Portuguese as their government language. The language barrier made Mozambique to feel left out of the negotiations creating distrust not having control over what was actually said during the meetings and if contracts where translated properly not trying to trick and take advantage of Mozambique. All this of course made it hard to cooperate between the three countries and led to many delays trying to constitute treaties. Portuguese was later made an official language within the SADC. Closely connected to the question of language barrier we also have the subject of education level that is and has been higher in South Africa and therefore many of the water experts for example doing evaluations have been South African, adding to the feeling of an uneven relationship and not having ownership of the process, taken up in section 3.5.

**Conflict and war** -The conflicts between the countries, described in chapter 3, sections 3.4 and 3.5 have of course affected the ability to cooperate in many ways, adding to the trust issues. Also affecting ability to focus on water management planning, money was spent elsewhere, not into the water sector, construction and maintenance therefore was not being performed.

**Neglected maintenance** -In section 4.2 the subject of neglected maintenance is discussed as it is also one of the biggest challenges found when it comes to water sharing. Maintenance have not been a priority during colonial time because of other priorities, then war and the economic situation has been affecting the level of maintenance performed. Thus neglected maintenance continues to be a crucial problem in water negotiations and will continue to be so for the future as the old system continues to be used.

**Economic issues** -The economic development as stated in section 4.2 is and has been one of the biggest challenges when it comes to supply all households in Maputo with freshwater. The situation during colonial time had to a large part to do with prioritization but the colonial government also suffered from economic problems. The liberation war and later the civil war up to 1992 also negatively affected Mozambique's economy and very limited investments where made in the water supply sector. Corruption is also a factor in the state of the economy and the investment possible in the water supply sector, as said about the colonial government prioritization is also part of the equation today. The subject of corruption and how large part that would play in the economy concerning water management in Maputo is a whole other thesis in itself, , I therefore suggest exploration of this issue as further research of water management in the present and future.

**No priority supplying local population during colonial rule** – In the colonial time the focus was not to reach all citizens with water systems as presented in section 4.2 and 4.6. During colonial rule there supplying the local population in Maputo with water was not a concern, therefore the whole city was designed with a water system that was not well thought out. Later, the fast growth of the city has resulted in unplanned neighborhoods and a planner water supply system that has not been expanding at the same pace as the city has grown. This in part historical

situation but also a matter of lack of urban planning continues to be a problem for Maputo and will continue to be so in the future. This combines with another and related problem which is that: **Governance not living up to responsibility** -The municipal government is in charge of meeting the needs of the citizens but fails to accomplish these goals in various ways. I have brought up the example here of on the Inhaca Island where the municipal government does not fulfill its duties in terms of supplying water to its citizens , (see sections 4.2 and 4.8.2). This is just one of many possible examples, a larger scale example is the passiveness of authorities when it comes to planning for the fast urbanization that is now happening in Maputo. Thus, the **Lack of urban planning, unplanned settlement** makes future supply of water difficult as building water systems after the neighborhoods are already in place makes the job harder. Another problem is the **Demographics and fast urbanization** -Mozambique's population has risen from being 10.6 million at the time of independence in 1975 to 28.6 million today in 2016. This of course means that more water is needed both in terms of increasing number of households and need for irrigating agriculture to increase food production. The creation of Greater Maputo, the fact that the smaller surrounding towns are being integrated into one large entity puts pressure on the water supply systems and accessing enough water. The fast urbanization puts constant pressure on the water system constantly needing to expand when it at the same time is in need of repair and upgrading (see chapter 3 and 4 section 3.4).

Apart from these social and political issues (that are partly historical) there is also the problem of **Lack of data** -The lack of data is an ongoing problem, both in terms of not collecting enough data to be able to get a full picture of the present situation when it comes to water flows and rain which is much needed in the water management planning, not having access to enough collected data from today or the past makes it very challenging to make very much needed estimations and predictions for the future and how for example climate change will affect the region. In addition there is **Lack of adequate monitoring supervision of water flows, not enough water crossing the border into Mozambique** -The lack of data has also and still do pose a problem when it comes to tracking the amount of water crossing the border from South Africa into Mozambique, something stated by South Africa as being Mozambique's task to monitor and if the flow is lower than agreed than demand South Africa to release more water. South Africa do monitored the water flow on their side of the boarder and knows therefore when the flow is lower than agreed but states that it is Mozambique's responsibility to monitored the flow on its side of the boarder and to demand South Africa to release more water when the flow is too low. Also here historical process largely affects water sharing today. There is currently an **Uneven distribution between the three water sharing countries**. Industry is more built out in South Africa than Mozambique and has been so since the early 20<sup>th</sup> century. Sugar plantations and mines in South Africa and Swaziland using large amount of water. Water treaties, despite the philosophy of equal sharing does weigh in existing infrastructure which leaves less room for the potential of building out infrastructure (and increasing water use) in countries with low infrastructure in the present. Practically **Being downstream** remains a disadvantage:-This is especially true for river basins where upstream water and land practices impact directly on the quantity and quality of water downstream (SARDC 2014: 31; see section 3.5). The **Different interests and competing demands** – are putting pressure on the negotiations as the countries water use increases (section 3.5). As **The limit of outtake is reached** (or near being reached) - fairness in negotiations on the sharing of water are becoming acute. When the countries will not be able to increase the outtake of water one country's expansion of for example irrigated agriculture stands against another's. In addition, **Ecology, weather, climate** also affects the sharing of water - South Africa is not as dependent on the three river basins as Mozambique (supplying the capital) and Swaziland (covers the whole country) because of other large rivers in the area. Most of the rain falls where the rivers spring, Maputo province being dryer (see sections 3.1 and 3.2). In addition **Increased evaporation is**

**a problem** -Evaporation is estimated to increase with global warming and this will result in the loss of more surface water and therefore also increases the evaporation even further (section 3.2).

## Conclusion

As discussed above the historic process of differential industrial and agricultural development lies at the core of the **Power relations** between the countries as discussed in Chapter 3, for example; South Africa being more developed than Mozambique puts the countries at different starting positions and also makes Mozambique the weaker party in the negotiations. In addition to all these factors **The political history** itself has affected water negotiations -The fact that the countries relations at times have been strained have affected ability and willingness to cooperate. And also in agreeing to make bonds even though the agreements was not satisfying as the case of the first agreement between independent Mozambique and Swaziland. On a local level in Maputo political history also effects the equal sharing of water, colonial authorities did not build the city to provide secure water for all its inhabitants which still affects water provisioning systems today, Meanwhile the rapid urban growth exasperates the problem, as informal settlements are growing very quickly, whereas water provision systems are not growing at the same pace. **Climate change** - Climate change will affect the amount of water available (as discussed in section 3.2). Higher degree of predictability and greater extremes of climate events are likely to increase problems of equity in water sharing both between countries and within the city itself.

# Bibliography

## Archives and Libraries

Arquivi Historico de Moçambique (Mozambique Historical Archive)  
Biblioteca Central (Central Library), Eduardo Mondlane University, Maputo, Mozambique  
Carolina Redeviva, Map department, Uppsala, Sweden  
National Directorate of Water (NDW) (Direcção Nacional de Águas (DNA) Archive/Library, Maputo, Mozambique  
Nordic African Institute (Nordiska Afrika Institutet) Library, Uppsala, Sweden

## References

- Adonis, Shaheeda 2007. THE HYDROCHEMICAL CHARACTERISTICS OF GROUNDWATER IN THE INCOMATI ESTUARY. University of the Western Cape.
- Bacci, Maurizio 2014. Climate Change Hazard Identification in the Maputo Area. In: Macchi, Silvia & Tiepolo, Maurizio (eds.) *Climate Change Vulnerability in Southern African Cities*. Springer International Publishing, Switzerland.
- Braccio, Sarah 2014. Flood-Prone Areas Due to Heavy Rains and Sea Level Rise in the Municipality of Maputo In: Macchi, Silvia & Tiepolo, Maurizio (eds.) *Climate Change Vulnerability in Southern African Cities*. Springer International Publishing, Switzerland.
- Chenje, Munyaradzi 1996. Directory of Environmental Information & Organisations in Southern Africa Vol. 1, Harare, Zimbabwe, Southern African Research & Documentation Centre ; IUCN Regional Office for Southern Africa.
- Carmo Vaz, Álvaro & van der Zaag, Pieter 2003. Sharing the Incomati Waters: Cooperation and Competition in the Balance. UNESCO-IHP.
- Chutumia, Issufo 1999. Managing Water Resources in the South. In: *Sustainable Development in Mozambique*, Africa World Press, Trenton, USA.
- Danika 1979. Water resource evaluation for Maputo. Danika, Denmark.
- Danika 1981. Technical evaluation plan. Danika, Denmark.
- Delagoabayworld 2012. <https://delagoabayworld.wordpress.com/category/lugares/lm-mapa-1910-delagoa-bay-dev-company/>. Published 2012. Accessed 2016-09-25.
- DNA (Direcção Nacional de Águas) 1982. Maputo River Basin – Present and Potential Future Development in the People’s Republic of Mozambique. Maputo, Ministério das Obras Publicas e Habitaco, Mozambique.
- Droogers, Peter, de Boer, Froukje & Terink, Wilco 2014. Water Allocation Models for the Umbeluzi River Basin, Mozambique. Wetterskip Fryslan & ARA-Sul, FutureWater, The Netherlands,
- Eklblom, Anneli 2004. Changing landscapes, an environmental history of Chibuene, southern Mozambique, c AD 400-present. Uppsala. Department of Archaeology and Ancient History, African and Comparative Archaeology.
- Eskemose Andersen, Jørgen & Jenkins, Paul 2011. Cities, Health and Well-Being: Urban development in Maputo: strategic action planning on a tight budget. *Environment &*

- Urbanization 2014. vol. 26 no. 2, Conflict and violence in 21<sup>st</sup> century cities.* Urban Age, Hong Kong.
- Engelbrecht, F. A., McGregor, J. L.; Engelbrecht, C. J. 2009. Dynamics of the Conformal-Cubic Atmospheric Model projected climate-change signal over southern Africa. In: *International Journal of Climatology, vol. 29, issue 7.* Wiley-Blackwell, Boston, USA.
- Ferraz, Bernardo & Munslow, Barry ed. 1999 Sustainable Development in Mozambique. African World Press, Trenton, USA.
- Global Atlas of Excreta 2008. Wastewater Sludge, and Biosolids Management: Moving Forward the Sustainable and Welcome Uses of a Global Resource. Edited by: Ronald J. LeBlanc, Peter Matthews, Roland P. Richard, United Nations Human Settlements Programme (UN-HABITAT) UN-HABITAT, Nairobi, Kenya  
[https://esa.un.org/iys/docs/san\\_lib\\_docs/habitat2008.pdf](https://esa.un.org/iys/docs/san_lib_docs/habitat2008.pdf)
- Hall, Margaret & Young, Tom 1997. Confronting Leviathan Mozambique since Independence. Hurst and Company, London, UK.
- Hilders, Marianne 2003. Sharing a river -An analysis of international decision-making on the Incomati river basin South Africa, Swaziland and Mozambique, MSc. Thesis, University of Technology Delft, The Netherlands.
- Hoag, Heather J. 2013. Developing the Rivers of East and West Africa – An Environmental History. Bloomsbury Academic, Bloomsbury Publishing, New York, USA.
- Hulme M. (1995) Climate change within the period of meteorological records. In: *The physical geography of Africa*, Goudie A.S. (ed.), 88–102. Oxford: Oxford University press.
- IPCC 1998. The Regional Impacts of Climate Change, Chapter 2 Africa.
- IPCC 2007. Fourth assessment report (AR4), IPCC.
- Louka, Elli 2006. International Environmental Law: Fairness, Effectiveness, and World Order
- Latour, Bruno 1996, On actor-network theory. A few clarifications plus more than a few complications, <http://www.bruno-latour.fr/sites/default/files/P-67%20ACTOR-NETWORK.pdf>
- Lee-Thorp, J.A., Holmgren, K., Lauritzen, S., Linge, H., Moberg, A., Partridge, T.C., Stevenson, C., Tyson, P.D., 2001. Rapid climate shifts in the southern African interior throughout the mid to late Holocene. *Geophysical Research Letters*.
- Limpopo River Awareness Kit, Governance. [http://www.limpopo.riverawarenesskit.org/LIMPOPORAK\\_COM/EN/GOVERNANCE/WATER\\_GOVERNANCE\\_IN\\_THE\\_LIMPOPO/NATIONAL\\_POLICIES\\_AND\\_LAWS/MOZAMBIQUE.HTM](http://www.limpopo.riverawarenesskit.org/LIMPOPORAK_COM/EN/GOVERNANCE/WATER_GOVERNANCE_IN_THE_LIMPOPO/NATIONAL_POLICIES_AND_LAWS/MOZAMBIQUE.HTM) Accessed 2016-12-10
- Lunstrum, E. (2009). Terror, territory, and deterritorialization: Landscapes of terror and the unmaking of state power in the Mozambican “civil” war. *Annals of the Association of American Geographers* 99(5)
- Ministerio das Obras Publicas, Republica de Mocambique, FIPAG 2013. Water supply and Institutional Support, Environmental and Social Studies for Greater Maputo Water Supply Scheme. FIPAG, Maputo, Mozambique.
- Mulwafu, O. Wapulumuka 2005. Does water have a history? Water use and management in Malawi. In: *African Water Histories Transdisciplinary Discourses*, Vaal Triangle Faculty, North-West University, Guateng, South Africa.
- Newitt, Malyn 2009. A History of Mozambique. Hurst & Company, London.
- Radkau, Joachim 2008. Nature and Power: A Global History of the Environment. Publications of the German Historical Institute Series. Cambridge University Press, New York, USA.
- SADC 1992. Treaty of the Southern Africa Development Community. SADC, Harare, Zimbabwe.
- SADC <http://www.sadc.int/> Accessed 2015-05-04
- SADC <http://www.sadc.int/about-sadc/overview/sadc-objectiv/> Accessed 2015-05-04

- Sadoff, Claudia W., Dale Whittington, David Grey 2002. *Africa's International Rivers: An Economic Perspective*, The World Bank, Washington D.C, USA
- Salman, Salman M. A., 2007. 'The Helsinki Rules, the UN
- Salman M.A. Salman 2007. The Helsinki Rules, the UN Watercourses Convention and the Berlin Rules: Perspectives on International Water Law. In: *Water Resource Development, Vol. 23, No. 4, 625-640, December 2007*, The World Bank, Routledge, Washington, USA.
- Scott, L., Lee-Thorp, J., 2005. Holocene climatic trends and rhythms in southern Africa. In: Battarbee, R.W., Gasse, F., Stickley, C.E. (Eds.), *Past Climate Variability Through Europe and Africa*. Springer, Dordrecht.
- Tempelhoff, JWN ed. 2005, African Water Histories Transdisciplinary Discourses Watercourses Convention and the Berlin Rules: Perspectives on International Water Law', *International Journal of Water Resources Development*, 23: 4, 625 – 640 SARDC, Southern Africa Research and D Centre 2014
- Tiepolo, Maurizio 2014. Flood Risk Reduction and Climate Change in Large Cities South of the Sahara. In: Macchi, Silvia & Tiepolo, Maurizio (eds.) *Climate Change Vulnerability in Southern African Cities*. Springer International Publishing, Switzerland.
- Tyson, P.D., Preston Whyte, R.A., 2000. *The Weather and Climate of Southern Africa*. Oxford University Press, Oxford
- Tyson, P.D., Odada, E.O., Partridge, T.C., 2001. Late Quaternary environmental change in southern Africa. *South African Journal of Science*.
- Tyson, P.D., Lee-Thorp, J., Holmgren, K., Thackeray, J.F., 2002. Changing gradients of climate in southern Africa during the past millenium: implications for population movements. *Climate Change*.
- Van der Schans, Martin L. 2003. *Just Add Water? Negotiating Water Security in the Incomati River Basin*, MSc. Theses Report, IWMI International Water Management Institute, Wageningen University, South Africa
- UN, [https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg\\_no=XXVII-12&chapter=27&lang=en](https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-12&chapter=27&lang=en) Accessed 2015-05-17
- UN, [http://legal.un.org/ilc/texts/instruments/english/conventions/8\\_3\\_1997.pdf](http://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf) Accessed 2015-05-17
- World Bank, [http://siteresources.worldbank.org/MOZAMBIQUEEXTN/Resources/water\\_supply\\_CaseStEngl.pdf](http://siteresources.worldbank.org/MOZAMBIQUEEXTN/Resources/water_supply_CaseStEngl.pdf) Accessed 2015-05-10