INTERNATIONAL RIVER BASIN MANAGEMENT: A CASE STUDY OF THE OKAVANGO RIVER BASIN

MICHAEL JOHN CHASE

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Faculty of Science and Agriculture
University of Natal Pietermaritzburg

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ABSTRACT

This dissertation reviews the principles of International River Basin Management and their application by the governments of Angola, Botswana and Namibia. The dissertation deals with the issues popularised by governments, water planners and international agencies that the twenty-first century's conflicts will be fought over water. Increasingly this concern is being used to justify new water-supply dams and river diversion projects. This is especially so in arid Southern Africa, the focus of this dissertation, where numerous major international water transfers are underway and many more are being planned. While Namibia's growing thirst is a serious problem, the story is more complicated than just too many basin states putting their straws into one glass. The growing conflicts over the Okavango's water use raise broader questions about ownership of common resources, and equity of access to those resources.

Most southern African countries depend on primary natural resources to sustain economies and their people. The environmental issues are remarkably similar in countries within the region, and the economic, social and political fortunes of the individual countries are intertwined. Furthermore, the ways in which resources are being managed are similar and thus cause for common concern. In general, the ability of countries in the region to achieve sustainable development depends not on national policies but also on the commitment of neighbours to practice sound environmental management. This is because activities in one country can easily cause impacts on a neighbour and possibly result in "downstream" opportunity costs.

This case study of the Okavango River Basin, a river facing prospective developments from riparian states Angola, Botswana and Namibia, attempts to find sustainable solutions to solving international resource conflict. In addition to outlining the possible future threats to the Okavango River, this study proclaims a number of recommendations in the way of declaring alternatives to Namibia's plans to extract water from the Okavango River. One such recommendation is the encouragement of Water Demand Management as an alternative to water transfer by Namibia. This management strategy is aimed at optimising the use of available water rather than developing new or extended supplies and as a result it has a vital role to play since it contributes to sustainable development rather than over exploitation of limited natural resources.

The majority of large rivers in the Southern African Development Community (SADC) are shared by three or more countries, and as the region's water resources come under growing development pressure, the importance of establishing effective national and regional methods and institutions for sustainably managing these resources will increase greatly. From economic, ecological and human welfare perspectives, the Okavango River Basin is arguably one of the most important transboundary natural resources (TBNR) in the region. Owing to the basin's remoteness and history of conflict, the Okavango was spared much of the destructive developments that rivers in the region have suffered. As a result, the relatively pristine Okavango ecosystem continues to provide significant benefits to the region much as it has done for centuries. As we approach the new millennium, however, it is clear that the health of the Okavango River Basin is threatened as riparian states increasingly turn to the Okavango to support their growing populations and economies.

DECLARATION

This dissertation was carried out as part of the requirements for the degree of Master of Environment and Development in the School of Environment and Development, University of Natal, Pietermaritzburg, from June 1998 to October 2000 under the supervision of Professor R. J. Fincham and Professor C. M. Breen.

This dissertation is wholly the original work of the author and has not been submitted in any form for any degree or diploma to any University. Where use was made of the work of others, it is dully acknowledged in the text.

Signed .....

Michael John Chase

TABLE OF CONTENTS

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

CHAPTER SIX

CHAPTER SEVEN

LIST OF BOXES, FIGURES, MAPS, PHOTOS AND APPENDICES

LIST OF BOXES

LIST OF FIGURES

LIST OF MAPS

LIST OF TABLES

LIST OF APPENDICES

LIST OF PHOTOS

LIST OF ABBREVIATIONS

ADMADE	Administrative Management Designs
BDF	Botswana Defense Force
BNWMP	Botswana National Water Master Plan
BNDP	Botswana National Development Plan
CBNRM	Community Based Natural Resource Management
CI	Conservation International
DWA	Department of Water Affairs
EA	Environmental Assessment
EU	European Union
EIA	Environmental Impact Assessment
ENWC	Eastern National Water Carrier
FAO	Food and Agricultural Organisation
GEF	Global Environment Facility
GTZ	Deutsche Gesllschaft fur Technishce Zusammenarbeit
GHABIC	Angolan Authority of the Cunene River Basin
IA	Implementing Agency
IMP	Integrated Management Plan
IUCN	International Union for the Conservation of Nature
IW	International Waters
IMP	Integrated Management Programme
LEARN	Learning Exchange and Resource Network.
IRBM	International River Basin Management
ILA	International Law Association
ILC	International Law Committee
KCS	Kalahari Conservation Society
NSWC	North – South Water Carrier
NCU	National Co-ordination Unit
NGO's	Non Government Organisation's
NWRMR	Namibian Water Resources Management Review
OBSC	Okavango Basin Steering Committee
ORB	Okavango River Basin
OP	Operational Programme
OS	Operational Strategy
OKACOM	Permanent Okavango River Basin Commission
OLG	Okavango Liason Group
PIR	Project Implementation Review
PMC	Project Management Committee
PPER	Project Performance and Evaluation Review
PSC	Project Steering Committee
PMU	Project Management Unit
SADC	Southern African Development Community
SADC	Southern Africa Development Community
SAP	Strategic Action Programme
TDA	Transboundary Diagnostic Analysis
TPR	Tri-partite Review

UN DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UN	United Nations
USA	United States of America
WCED	World Commission on Environment and Development

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I am indebted to the staff of the Botswana University Library and Botswana National Archives who proved to be both helpful and courteous in allowing me to use their 'private collection' of papers on the Okavango River. Thanks are also due to all my interviewees.

I would particularly like to thank Conservation International Botswana, who provided me with much material on which to base my work; Elizabeth Soderstroom from the United States Agency for International Development (USAID) who supplied me with a number of splendid articles relating to International River Basin Management. Steve Rothert and Olive Sephuma of the Okavango Liasion Group met me with open arms, much thanks are due to them for all their encouragement and advice.

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CHAPTER ONE

The water management profession will face a complex challenge in the early part of the 21st century, the like of which has never been witnessed before in human history. Clearly water management practices have to become significantly more efficient in the future than they are at present. Furthermore, this change must occur within a short period, probably a decade or at most two.

(Habib N. El-Habr and Asit K. Biswas, 1993; pp. 23)

1.1 INTRODUCTION

1.2 The Study Area and Background

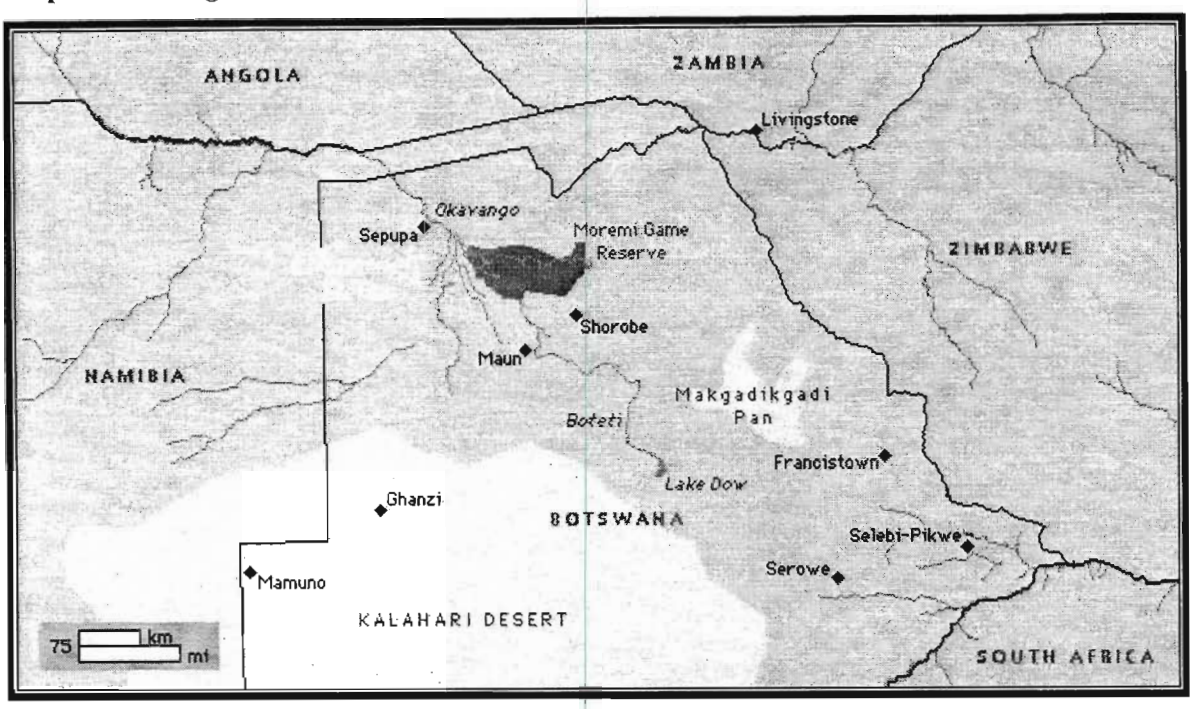
The Okavango is considered a unique river in terms of its size in the given area; it's seasonal flow variability and the fact that it does not flow into the sea but over a desert and therefore supports an extraordinary diversity of unique and possibly fragile ecosystems (Roodt, 1998). The Okavango Delta, the primary study area of this dissertation has been described as one of the world's "last great wildernesses" (Ross, 1997).

The Okavango River is seen as a *whole internally fluctuating system* which forms part of yet larger endlessly fluctuating systems, revolving around evapotranspiration and precipitation (Graham, 1991). Any point of entry into that system (i.e. water extraction) is not only technically significant but is influenced by the whole system, both up and down stream of that point (Heyns, 1995a). Thus, no matter how insignificant such entry into the system may seem even the slightest variations in initial starting conditions of systematically fluctuating systems (typically your entry point and time) can result in long term variations of patterns within that system. While it remains crucially important to continuously monitor the effect of entry into that system, it is questionable, from this approach, whether "predictions of insignificance" based on such data, can be used as justification for increased entry into that system (Heyns, 1995a).

From the stand point of this dissertation, the crucial issues are the extent to which the Okavango River as an integrated ecological system will be altered due to:

- Damming at the source (Angola)
- Extraction from the middle (Namibia) and
- Further development of a tourism industry as well as possible extraction at the delta (Botswana).

Map 1. Okavango River Basin



(Heyns, 1995a)

Keeping the uncertainty principle of Chaos theory in mind one cannot conclude at this stage that any planned use of the river by any of the countries will have a huge effect on the system. Certainly control of the flood at the source in Angola; for hydroelectricity or mining could have a huge effect on the whole system. Yet, environmentalists do not know whether this will happen, and even if/when it should, it must be executed in such a way as to have minimal impacts on the whole system.

Namibia's planned extraction does not seem to exceed more than 1,5 to 5,5 percent of the total flow, (these figures vary according to which country the document/report was written) depending on the season. Namibian hydrologist Heyns (1995) calculates the above figures "to a maximum influence on the flooded area and outflow of not more than 3,5 percent, compared to a natural variation, which is more than 20 percent". Namibian consultants though do not mention the impact of extraction on the river system during periods of prolonged drought, and whether the precedent set will allow for greater withdrawal requirements as Namibia's population and industry expand in the future. The above takeoff during such dry seasons could have significant effects on the down stream - Okavango Delta.

Botswana previously tried to dredge part of the Okavango's water for a water transfer scheme. This development was aborted due to opposition from strong regionally based (tribal) powers

(Botswana Society, 1992). Development of tourism has gone through many years of refinement and is mainly focused in photographic and ecotourism and thus is more concerned with the prevention of natural habitats than it's alteration. A growing tourist industry will, however, increase pressure for use of more water from the Okavango Delta. Given the above possible and proposed developments by the three countries it is crucial to foster a better understanding of the potential effects of these extraction projects. So providing a basis for strategies to mitigate negative impacts.

1.3 Water: A Fundamentally Important Resource

The end of the last decade of the twentieth century is a critically important time in the history of mankind. During the past few years there has been increasing realisation of the importance of water management in the continuing well-being and development of the developing countries, especially those located in the arid and semi-arid regions. Furthermore planners and decision-makers have started to realise the critical importance of efficient water management for the sustainable development of their countries. Water allocation is a major issue – certain areas in some countries have too much of it, while others have too little. In his forward to the book *Sharing Water in Southern Africa*, the Namibian Minister of Agriculture, Water and Rural Development, Nangolo Mbumba, suggests: "The first step is to recognise that water in southern Africa is limited, and the most important limiting resource for all development." This study focuses on sharing water resources, which is as much a moral principle as it is common sense if southern Africa is to ensure that crises and conflicts over water do not occur.

Water is abundant on the Earth in its various forms, liquid, frozen and gaseous states. Bodies of water cover much of the earth's surface and this substance is integral to many cycles in the atmosphere, lithosphere and biosphere (Kgathi & Mlotswa, 1998). Water is essential to almost all forms. Humans cannot survive for more than a few days without it. Indeed, we live on the "water planet", unique in our solar system and in all likelihood far beyond.

Although humans inhabit the "water planet", only a fraction of this resource is freshwater. While water covers some 70% of the planets' surface, less than 3% of this consists of freshwater (Samson & Charrier, 1997). Much of the world's freshwater resources are frozen in the polar ice caps or deep underground (Biswas, 1991). Surprisingly, in most parts of the world availability and quality of freshwater is taken for granted. Without being overly alarmist, figures and trends

appear to indicate otherwise. Serious questions relating to global freshwater quantity and quality are rapidly emerging – apparently unknown to the general public and authorities in general (Falkenmark, 1994).

New sources of water are becoming scarce, more expensive to develop, and requiring more expertise and technological know how for planing, design and implementation (Anderson, 1998). Accordingly, water can no longer be considered a cheap resource, which can be used, abused, or squandered without much consequence for mankind's future. Like oil some 20 years ago, the day when water could be considered a cheap and plentiful resource is now virtually past (Naff & Matson, 1984). During the coming decades, water will be considered a critical resource for the survival of the arid and semi-arid countries. Political tensions between certain neighboring countries over the use of international rivers, may escalate to the point of war during the early part of the twenty-first century (Biswas, 1991).

The water crisis, which some arid and semi-arid countries are already facing and which more and more other countries will encounter as the twenty-first century dawns, may be considered to be the direct result of four important but interrelated phenomena (Ohlsson, 1995).

- First, the amount of fresh water available to any country on a long-term basis is limited. Nearly all the easily available sources of water have now been developed, or are in the process of development.
- Second, world population is increasing steadily. Consequently, water requirements for domestic, agriculture, and industrial purposes and for hydroelectric generation will also increase. "This of course is not a new trend. For example, current estimates indicate that the total global water consumption during the present century (1900 – 2000) is likely to increase ten fold. The total agricultural water requirement is likely to increase 6.5 times this century. Industrial water use, which was about 6 per cent of the total water consumption at the beginning of the present century is likely to increase four-fold, to nearly 24 per cent by year 2000 " (Biswas, 1991; pp. 19). The general trend is likely to continue well into the twenty-first century because of the steady increase in world population. Present estimates indicate that the current world population is likely to double to 10.64 billion by the year 2050. Of these the less developed countries will contribute nearly 8 per cent or 9.29 billion (Huntley, *et al.* 1989). Biswas (1991) correctly declares that while there is no direct relationship

between population and water requirements, it is clear that with a substantial increase in world population, the total water requirements will increase as well. Further more, past experiences indicate that as the standard of living improves so does per capita water requirements. Hence, if the present poverty alleviation programmes succeed, both water requirements will increase further and the water management process will be considered by policy planners, both nationally and internationally (Asmal, 1995).

- Thirdly, as human activities increase, more and more waste products are contaminating available sources of water. Among the major contaminants are untreated or partially treated sewage, agricultural chemicals, and industrial effluents. These contaminants are seriously affecting the quality of water. "Since comprehensive water quality monitoring programmes in nearly all developing countries are either in their infancy or even non-existent, a clear picture of the status of water pollution and the extent to which water quality has been impaired for different potential uses is simply not available at present" (Biswas, 1993; pp. 4).
- The fourth major factor is the likelihood of increasing delays in the implementation of new water projects in the coming decades. Higher project costs and the lack of investment funds will be two major reasons for such delays. Equally, social and environmental reasons will significantly delay project initiation time, certainly much more than in the earlier decades (FAO, 1996).

1.4 Statement of the Problem

The quality, volume and course of the world's freshwater systems are in constant flux, and such changes have greatly influenced the direction of civilizations since time imemorable. Recently, however, human activities and population growth have significantly accelerated and altered natural hydrological processes (Stansbery, 1973). Today water issues relating to freshwater quantity and quality are becoming serious in many regions of the world. The potential for conflict over freshwater is enormous, given its importance for basic survival, industry, energy production and other fundamental components of society. A number of conflicts linked to freshwater are already apparent at various local and international levels, and the risk for more grows as population and degradation pressures accelerate (Saha & Barrow, 1980). In many cases, little preventive action is being taken. So far, only limited fact-finding and even less concrete planning has been systematically carried out to analyze this dangerous potential and propose integrated management solutions (Samson & Charrier, 1997).

It has been essential to mention these issues at the outset as they underlie all water crises and are imperative considerations in the Okavango River Basin. They are critical when considering the management of international rivers. Authors (Biswas, 1991; Ohlsson, 1995; Falkenmark, 1996) on International River Basin Management, state that the global magnitude of the problem has not been generally recognised thus far. Nearly 47 per cent of the area of the world (excluding Antarctica) falls within shared water basins. Expressed differently, there are 41 countries (20 in Africa) where at least 80 per cent of the total area lies within international basins.

Estimates made in 1976 indicate that there are 214 rivers and lake basins, which are shared by two or more countries, of which 57 are in Africa. Most of these 214 resources (156) are shared by two countries of which only two – Danube and Rhine – are in the developed world (Garretson, Hayton & Olmstead, 1997).

A very limited number of in-depth analyses on international water bodies in developing countries are available for arriving at conclusions on the way forward. Biswas (1991) declares that to a great extent, international organizations have deliberately stayed away from the development and management of international water bodies, mainly because such issues have been considered to be politically sensitive as shall be the case in the study area this dissertation considers. As the demand for water increases in the Third World, and the exclusively national sources of water are developed, the only major sources of water that remain to be developed in the twenty-first century are likely to be international in nature (Becker, 1998). Herein lies a major opportunity or a serious problem for the future.

Unless proper treaties (treaties on their own are insufficient, monitoring, auditing and dispute/conflict resolution systems are required) are negotiated between the co-basin countries, international rivers are likely to be a fertile area for emerging conflicts in the twenty-first century. Unilateral exploitation of shared water resources by one country, without the prior agreement of the other co-basin countries, could contribute to serious regional instabilities or even wars, during the latter part of this decade and beyond (Ohlsson, 1993). "The number of conflicts is likely to increase significantly during the next century, unless the seeds for their solutions are properly planted in the present decade." (Clarke, 1991; pp. 87).

1.5 Aim of the Study

There is a need for a new water ethic in southern Africa, one which takes into account the fact that we cannot continue to tap fresh water assets, dam rivers and channel water resources without due regard to the adverse impacts on communities downstream, ecosystems and ecological diversity (Kalapula, 1989). Due to the variability of water distribution across the region water transfers between regions and between countries will increase.

Against this background the overall aim of this study was to work towards an understanding of the nature and prevention of conflict in the Okavango River Basin through four main objectives:

- Awareness building – (elaborated on in Chapter Two)
- Multi-sectoral partnerships – by the adherence to the SADC protocol on Shared Watercourses and through the creation of Permanent River Basin Commissions (OKACOM) (Chapter Five)
- Integrated assessment / management and
- Project implementation.

These are issues the researcher will focus on rather than try to implement and then propose a framework which builds awareness on IRBM through data collection and analysis using the methodological design for assessing potential conflict intensity and models of cooperation, as described and outlined in Chapter Two. Creating multi-sectoral partnerships for such complex issues need to go beyond traditional technical studies and integrate to make a whole of the issues' various parts, including the physical constraints of water availability as well as the multiple socio-economic dimensions – in other words, proposing socio-technical options. Following these three steps, concrete progress can be made toward the implementation of appropriate mechanisms with a view to conflict prevention. The details of this approach are investigated in the next chapter.

The title of this research "International River Basin Management" is most relevant, since the need to focus on new innovative strategies has become inevitable, resulting from the lessons we have learned from the immediate past. The researchers ultimate concern has been to review the problems pertaining to IRBM and propose possible solutions to the sharing of the common resource.

What is needed now is a comprehensive review of the actions and strategies decision makers applied in the past decades and to reorient our approaches to safeguard and sustain the quality of life on this planet. The lessons learned from past decades ought to provide solutions that should enable acceleration of the development process and greatly enhance the management and utilization of water resources. "The development process and rational use of resources should not be contradictory. To develop today at the expense of the quality of life of future generations is not only shortsighted, it is suicidal. But neither can we halt development in order to safeguard the future. Such an approach would not be acceptable" (Biswas, 1991; pp.19).

The specific objectives of this study were to:

- Investigate approaches for sound and sustainable management of international rivers to the mutual benefit of all riparian states through the exchange of experiences among other countries that have witnessed the same tensions. During the course of this dissertation the author shall propose recommendations regarding three aspects of sharing international watercourse systems, namely the political, the operational / technical and the institutional / legal aspects;
- To review the literature on global experiences in developing international river basin management processes, and to determine which components of those experiences can serve as models of success or highlight stumbling blocks for the management of the Okavango River Basin;
- To prepare a model of best practices in international river basin management. To then apply this model to the discoveries about the existing situation in the Okavango region, and adjust the model so that it fits the challenges and opportunities presented in the Okavango basin. Essentially this would entail developing a conceptual framework, against which to structure and implement inquiry;
- To provide a comprehensive review of the water management situation in Botswana, Namibia and Angola. The author will restrict this focus primarily to a Botswana perspective due to time constraints. Through interviews with government officials, communities around the Okavango Delta, Non Government Organization's (NGO's) and academics, and through reviewing of consultancy reports and documents, the researcher will determine the legislative and government mechanisms that exist in Botswana for water supply and water

quality management and ascertain the political will, the public understanding, and the country capacity to approach managing international waters;

- Describe the perceptions of interested and affected parties, NGO's, politicians, Botswana Defence Force, the international community and communities relying on the Delta pertaining to Namibia's plans of water extraction from the Okavango river and whether this development has lead to deteriorating relations between Botswana and Namibia; and
- Questioning the credibility of regional co-operation (OKACOM) as a way forward to resolving conflict over shared resources.

1.6 Methodology of the Study

The aim of this section is to describe the data gathering methods, limitations and problems experienced during the data collection. Three methods were used during the course of this project. (The Okavango is a fluctuating seasonal system and any results obtained by a short-term study should not be seen as providing definitive conclusions. The researcher therefore, referred to secondary sources for quantifiable hydrological data).

(i) Secondary sources for quantifiable hydrological data

The quantitative approach is highly formalized, more explicitly controlled, is relatively close to the physical sciences and tends to the objective. In this case the author relied on reports pertaining to various aspects on the hydrology of the Okavango River. A time period of one to two years is required to obtain data relating to the functioning on the Okavango delta (water quality, sediment flow, and water velocity). These variables, due to fluctuations in water flow, differentiate throughout the year. Time was a luxury the researcher could not afford and therefore had to rely on available data.

(ii) Qualitative data derived from interviews

Informal interviews were conducted with communities and expert personnel from various departments in the field of water management (McCarthy & Ellery, Okavango Research Group). The achievement of the stated objectives required the adoption of a combination of quantitative and qualitative techniques. This triangulation technique (combination of the two) was effected to validate the difference in opinions.

1.6.1 Data Collection Methods and Field Research

The methods were largely qualitative as interviews formed the major method of gathering information. Primary data was collected from the study area (Maun and surrounding Okavango Delta communities) through structured interviews, questionnaires, group discussions (*Kgotla's*), key informants and personal observations (informal conversations and attending '*Kgotla*'-formal community meetings pertaining to the Okavango River and plans for extraction by Namibia). At these group discussions it is essential to note that Government personal, NGO's and representatives from Namibia and Angola were present. Thus, participatory techniques proved to be a valid form of interviewing people present at these meetings. This methodology proved to be viable considering the time limit of this dissertation, and the researcher applied a critical analysis as the methodology is not without criticism. The aim of these discussion meetings was to inform communities of the proposed Eastern National Water Carrier (ENWC) by Namibia and the implication this development might have on the Okavango Delta. It was a chance for interested communities to raise questions and voice their concerns.

Quantitative data was drawn from repots such as the Swedish Consulting Group Report on the Use, Extraction and Transfer of Okavango Water for the Development of the Okavango Corridor. Scientific information was also gathered from interviews with hydrologists form the University of Witwatersrand (McCarthey & Ellery of the Okavango Research Group) and the Water Utilities Corporation working in the Okavango delta.

Qualitative information was gathered via direct interviews with a number of people from various departments and organizations as well as community dwellers. Within the community of Maun were various categories and groups of people. Respondents therefore, varied from academics and intellectuals to indigenous rural folk with little or no education. The leadership structures within communities surrounding the delta are of traditional leadership (consisting of chiefs, headman and spirit medium) and the modern political leadership (consisting of government administrative structures). Before conducting the field study the headmen as the overall leaders of the communities were informed of the study. All communities shared the same sentiment toward the ENWC, rigorously opposing the tapping of the Okavango River for fear of not being able to rely on the river for sustenance.

The Okavango delta peoples consist of five ethnic groups, each with its own identity and language. The author being fluent in Setswana conversed with rural inhabitants through this medium. The groups consist of Hambukushu, Dxeriku, Wayeyi, Bugakwe and Xanekwe. They are all tribes who have traditionally engaged in mixed economies of millet/sorgum agriculture; fishing, hunting, and the collection of wild plant foods; and pastoralism. The Hambukushu, Dxeriku and Bugakwe are present along the Okavango River in Angola and the Caprivi Strip of Nimibia. These ethnic groups have inhabited the Panhandle and the area along the Boro River through the delta for over 150 years.

1.6.2 Limitations of the Study

Several limitations arose while conducting this research. The main limitation was the time constraint given that the field research had to be conducted within a month, as a result, this research project has been limited and there remains much to be expanded upon. A cut off date for gathering research material was the 31 October 1998 in order to provide time for the dissertation to be written and have elicited the views of supervisors.

Problems arose with appointments, these were made well in advance but only to be called off at the last minute or once reaching interviewees they were not present. Documentation was extremely hard to come by as this sort of study had never been completed in Botswana. When material was made available to the author it was vague, bearing no relevance to the topic of this dissertation and out dated. Government departments were reluctant to depart with reports and in many instances refused to allow any photocopying, or these machines were not available for use to the public. The researcher despite desperate attempts to locate the Environmental Impact Assessment (EIA) on the ENWC project failed to locate this important document. The Okavango Research Centre had lent this assessment to a research fellow from Austria. If time was available the researcher might have been able to locate a copy of the EIA and it was felt after numerous attempts that precious time was being wasted in trying to find the report. Despite these limitations a great number of people co-operated with the researcher.

1.7 Structure of the Dissertation

This dissertation has five subsequent chapters. Chapter Two is a literature review and develops a conceptual framework, against which to structure and implement inquiry on international river

basin management with special reference to the Okavango River. Chapter Three uses Botswana as a case study in highlighting policies for water resource management. The Fourth Chapter describes the study area, the Okavango River Basin and assesses international law and the sharing of rivers paying special attention to conflict resolution. Chapter Five, describes in detail, proposed development schemes by the three riparian countries on the Okavango River Basin (ORB). Chapter Six provides a detailed critique of The Permanent Okavango River Basin Commission (OKACOM) and recommending the development of a transboundary management plan that will enable the sustainable development of the Okavango River Basin. Chapter Seven, concludes the study by recommending alternatives to Namibia's water abstraction schemes from the ORB in the form a pipeline.

CHAPTER TWO

Water issues are going to become primary sources of conflict in regions like Africa and the Middle East, because people have failed to use the resource wisely.

(Secretary General of the United Nations; Strong, 1992,; pp. 12)

2.1 A REVIEW OF INTERNATIONAL RIVER BASIN MANAGEMENT

The over all aim of this chapter is to examine the potential for International River Basin Management using the Okavango River as an example. To achieve this aim the author has chosen to use the metaphor of a temple to incorporate three issues imperative to River Basin Management; political, legal and technical considerations. By adhering to these three principles the attitudes of people in the political, legal and technical sections to International River Basin Management will be highlighted.

There are several climatological differences, which stand out within the southern African Development Community (SADC). Southern Africa has distinct dry and wet seasons, and more importantly, its climate is characterised by high variation between relatively wet and dry years (Ohlsson, 1995). In addition overall evaporative demand is considerably high, in general southern Africa is a water scarce region. For SADC countries water is the key to sustainable development. Table One shows that many SADC countries are rapidly approaching situations of water stress (generally defined as less than $1700m^3$ per capita per year), if not absolute water scarcity (less than $1000m^3$ per capita per year). A major area of concern is that the per capita water availability in the SADC region, which is already low, is expected to reduce significantly. The rapid decline is to a large extent the result of population growth (Pallet, 1997).

Table 1: Per capita water availability (m^3 / capita/year)

SADC	**1990**	**2025**
Angola	17,185	5,936
Botswana	14,107	6,040
Lesotho	2,232	**959**
Malawi	**961**	**403**
Mauritius	2,081	*1,485*
Mozambique	4,088	*1,651*
Namibia	6,672	2,952
South Africa	*1,349*	**705**
Swaziland	9,355	4,226
Tanzania	2,969	*1,208*
Zambia	11,779	5,018
Zimbabwe	2,323	*1,172*

(Source: Engelman & Leroy, 1993; pp. 12)
Figures in *italics*: water stress<1700m^3/cap/yr
Figures in **bold**: water scarcity (<1000m^3/cap/yr)

Given the above stress of water in southern Africa, the sharing of water resources such as rivers between countries, is often a *zero sum* problem: its use by one country or sector implies another country is deprived (Kalapula, 1989). In contrast, in Europe the problem of water resources management converges around the maintenance of adequate environmental quality, which has a higher potential for *win-win* solutions (Clarke, 1991). The concerns therefore of shared river basins have different trajectories in Europe and Africa. This stems from the fact that Africa inherited its international boundaries from the European scramble for Africa in the 19th century, and thus 'the concept of keeping river basins within territorial boundaries simply never entered the issue' (Ellery & McCarthy, 1994). Second, whereas at present in the European Union (EU) water quality and flooding are the issues of great concern, the major concern for southern Africa is with water security. Third, people in the EU and in the SADC region have tended to view water differently. Their appreciation of the resource and the values attributed to the various functions of the water developed and changed as a result of cultural, climatic and economic circumstances (United Nations – Experiences in the Development and Management of International River and Lake Basins, 1983).

Thus whereas appreciable regional differences such as climate do exist, the problems besetting river basins around the world appear to be similar in terms of their seriousness and in terms of the methodology adopted to solve them (Perritt, 1998). Inter-regional cooperation and sharing of the experiences is therefore feasible and urgently needed. This study on the management of international river basins provides a platform where such inexperiences may be made known. "Beyond both the Cold War and Apartheid, policy makers are now able to view regional problems on their own merits, without first having to filter them through a series of ideological lenses" (Asmal, 1995; pp. 3). Southern Africa has experienced calamities related to water and rivers, examples being the Lesotho Highlands Water Project (the damming of the Orange River) and the ENWC project. Although some reports about inter-basin water transfer and water extraction from international rivers may be alarmist there is an increasing awareness that appropriate measures need to be taken and that sound management of international watersheds will prove to be crucial. Seen in this light, the general absence of open conflicts about water in our region is a remarkable fact and should be appreciated. Researchers seem to understand that as much as water may divide groups of people and pit countries against each other, water as the most basic human need appears to moiblise countries toward and a common agenda (David, 1998).

This common thinking has already materialised in the form of some agreements between SADC countries about water resources, regional treaties, and river basin organisations. One of the essential functions of these international arrangements is to reconcile and harmonize the interests of riparian countries. The main thrust of the management of shared river basins is thus to find ways of turning potential conflicts into constructive cooperation, and to turn what is often perceived as a zero-sum predicament – in which one party's gain is another's loss – into a win-win proposition (Davies & Day, 1986). Finding such propositions are, however, more difficult in water scarce regions, such as Botswana and Namibia, compared to humid regions on the rest of the continent.

2.2 General Principles and Critical Issues in International River Basin Management

At a national scale, governments appear to base their policy for resource management on a number of 'emerging' principles that have general validity. Such principles often also underlie international policies (McCaffery, 1993). Box 1 provides a brief description of six important management principles. In international law some more specific principles are used with regard

to international river basins. These are further discussed in Chapter Four using Botswana as a case study to assess the countries domestic policies relating to water management.

Box 1: Emerging principles on the management of international water resources

- ***Sovereignty principle:*** each nation has the right to develop its own policies, laws and institutions and their own strategies for natural resource development and utilization
- ***Transboundary principle:*** upstream water users have a responsibility towards downstream water users, and vise-versa; this principle is in a sense the extension of the equity and precautionary principles across national borders
- ***Equity principle:*** all people have basic rights of access to resources for their survival and development; no groups in society should be put at a serious disadvantage in this respect
- ***Intergenerational principle:*** future generations should not be deprived from access to an adequate resource base, although the resource base itself may change of composition (e.g. knowledge, technology, infrastructure)
- ***Water-as-an-economic-good principle:*** users should pay the economic value of the water used, provided that the price of water is affordable and that this principle does not conflict with the equity principle (which is higher on the ladder)
- ***Polluter-pays principle:*** he who inflicts damage on the natural resource system should pay for the damage
- ***Precautionary principle:*** governments should provide security to the people, including safety, food security, health care, protection against disasters, risk avoidance, conservation of natural resources, a healthy environment and good merits.

(McCaffery, 1993).

In the course of this chapter a number of critical issues emerge with respect to the sharing of international watercourse systems. These include:

- River basins do not respect village, district, provincial, and national boundaries. Too often, water has to fit into administrative and institutional boundaries, rather than to design institutions that fit the (physical, temporal and spatial characteristics of the) resource. As a consequence, there often is an administrative / institutional void when dealing with management of water resources (David, 1998).
- Management of water resources has generally concentrated on surface water, while insufficient attention has been given to groundwater, soil moisture and related aspects.
- Perhaps the greatest problem of sharing an international resource is its sheer scale and the opaqueness of system interactions over distances (upstream and downstream). For instance it is difficult to see, let alone quantify the consequences of upstream land use changes on downstream flood levels. This opaqueness may result in unforeseen negative consequences

of human interventions, which are difficult to correct and may give rise to tensions between riparian countries (WCED, 1987).

- Within the same international river basin, national interests may differ; thus nations may develop diverging policies and plans which are not compatible (Engelman & Leroy, 1993). This is the sovereignty dilemma: to what extent may individual countries develop and use resources found within their territories and to what extent do they have to consider interests of riparian countries, and the 'common interest' of the river basin as a whole? (Fradkin, 1981) Upstream users commonly are reluctant to consider the problems of downstream users. One of the biggest challenges in sharing international rivers is to identify development strategies whereby all riparians eventually benefit from the equitable allocation of costs and benefits (WCED, 1987).
- The management of a river basin is further complicated by the fact that there are gaps between policies, plans and practices. New policies that innovatively deal with the complex nature of water resources management may be difficult to implement by sectoral institutions which therefore may have to be re-organized. Plans, when implemented often encounter a reality on the ground which was not anticipated; requiring the re-working of implementation strategies; or else local actors may circumvent or simply ignore new policies and new plans (CSE, undated). The above gives rise to an increasing importance of public participation and private commitments in the formulation of policies, plans, and in operational decision-making (McCaffrey, 1993).
- New developments may require entirely new legislation; new needs for information; new approaches to-and styles-of management; new technologies; and new procedures of weighing alternative operational scenarios for planning and decision making (Chenje & Johnson, 1996). Cases in point are water pollution, and the increasing demands for water coupled with a dwindling availability. Such developments necessitate a change in approach to the development of water resources: from a largely supply-orientated approach to demand management (Gieske & Gould, 1994). The increasing pressure on the water resources have led to the introduction of new technologies, requiring technologists with new skills, notably in the fields of planning, design, and operation (Ibid). With the major water resources having been committed already, there is a growing realisation of the importance of dryland agriculture relative to irrigated agriculture; of soil and water conservation measures; and of watershed management in general (Vision for the Future: Conference of SADC Ministers Responsible for Water Resource Management, 1995).

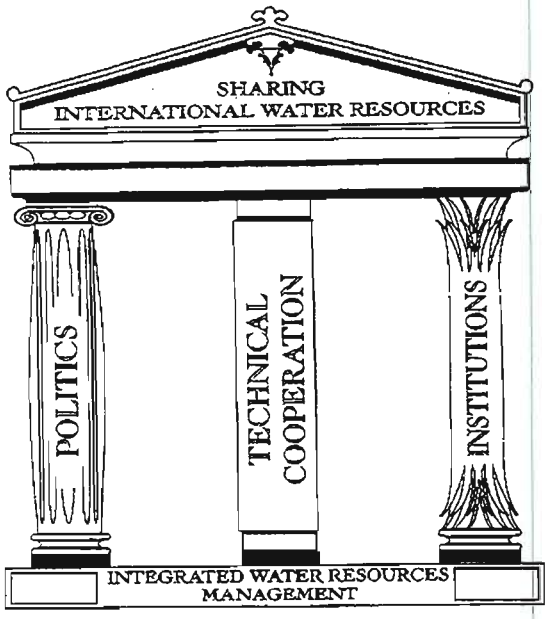
2.3 Conceptual Framework / Model for the Management of the Okavango River Basin

In this section the metaphor of a temple (figure 1) is used to propose a framework for the sharing of international rivers this also helps in the realisation that the management of water resources should be done in a fully integrated fashion (Dent, 1998). This is elaborated in the following section. Upon this foundation, three pillars support a 'roof' of the temple: the *equitable sharing of international waters*. The central pillar is that of a *technical cooperation* which may also be called the operational pillar. The two side pillars are the *political pillars*, responsible for an enabling environment, and the *institutional pillar* responsible for laws and institutions. All three pillars are necessary to arrive at a balanced and equitable sharing of international waters (Savenije & van der Zaag, 1997). If one of the side pillars is weak, meaning either a low political commitment or inadequate legal and institutional arrangements, the sharing of international river basins may not be firmly embedded and is prone to unbalanced management decisions (Example taken from: Savenije & van der Zaag, 1997)[1]. The metaphor further implies that the operational pillar is central to the success of the management of international river basins. It may support most of the load if one of the outer pillars is weak, cracked or in the process of repair or reconstruction. The three pillars as defined here are elaborated in sections 2.3, 2.4 and 2.5.

When dealing with the three pillars, reference will be made to the critical issues identified above. In the final section of the chapter the author will look at the roof of the temple and attempt to integrate the insights gained from the three supporting pillars. The integrative approach not only implies that each pillar is consistent in itself (regarding intersectoral policies, plans and practices), but also that the three are compatible with each other, i.e. are level (for instance that legal and institutional arrangements are consistent with, and reinforce, operational strategies, and vise-versa).

[1] The author after having consulted an array of documents pertaining to International River Basin Management found this example to be interesting and practical, in areas where it was felt that information could be elaborated on this was done by consolidating and incorporating viable points mentioned by other experts on the subject.

Figure 1. The Classical Temple: A Framework for the of Sharing International Water Resources



2.4 The Foundation for Integrated Water Resources Management

Integrated Water Resources Management (definition given in Box 3, page 26) should be the foundation supporting the management of the Okavango River Basin, taking as a starting point the principles of the Dublin and Rio Conference (Box 2). These principles that are key concepts to integrated water resources management are also the basis of the activities of the Global Water partnership, which was launched as a response to the human impacts of water scarcity and pollution world-wide (Dent, 1998).

The concept of integrated resources management has not been unequivocally defined; in fact it developed over time (Dent, 1998). Box 3 reflects some recent insights regarding the concept. Here an attempt is made to define the concept in relation to river basin management. It is useful to distinguish the 'physical' dimension of the water resource and its 'non-physical' dimension (Pearce, 1992). Subsequently, it is important to consider the resource in a time perspective (Gustafsson, 1989).

Box 2: Dublin principles and associated concepts

Dublin Principles

- Water is a finite, vulnerable and essential resource which should be managed in an integrated manner
- Water resources development and management should be based on a participatory approach, involving all relevant stakeholders
- Water has an economic value and should be recognised as an economic good, taking into account affordability and equity criteria.

Associated key concepts

- Integrated water resource management, implying:
  An intersectoral approach
  Representation of all stakeholders
  All physical aspects of the water resources
  Sustainability and environmental considerations
- Sustainable development: sound socio-economic development that safeguards the resource base for future generations
- Emphasis on demand driven and demand orientated approaches
- Decision making at the lowest appropriate level

(source: WCED, 1987).

(i) The physical dimension

The physical dimension refers to three important aspects of the resource, viz. location, type and quality (Gustafsson, 1989a). The location of the resource has to do with upstream-downstream interaction, basin-wide analysis, interbasin transfer, etc., determining to a large extent the quantity of water available. The type of the resource points to all relevant stages in the hydrological cycle and includes groundwater, surface water, rainfall harvesting etc., and the physical behavior of water in these different manifestations (Gustafsson, 1989b). It may also refer to how water, in these various manifestations, relates to the other natural resources. The quality of the resource, finally, deals with the physical, biological and chemical attributes; for instance, water of bad quality has lost its quality of a resource unless it is treated. These three physical aspects of water resources should not be considered in isolation. "The integration of location, type and quality is a necessary condition for water resource development" (Pearce, 1992; pp. 32.).

Box 3: Integrated Water Resource Management: some recent insights

The statement of the **Dublin Conference on Water and the Environment** equates the term 'integrated' to 'holistic', 'linking social and economic development with protection of natural ecosystems'. The holistic approach implies:

> Not only to look at the water cycle..., but also the inter-sectoral needs. It must also include an ecological approach,... and consider issues across the whole of a river basin or a groundwater aquifer and so also consider the interrelation with other natural resources.

Chapter 18 of Agenda 21, adopted during the **Earth Summit in Rio de Janeiro**, formulates the first of four objectives of integrated water resources management thus:

> To promote a dynamic, interactive, iterprative and multisectoral approach to water resources management... that integrates technological, socio-economic, environmental and human health considerations

(ii) The non-physical dimension

The non-physical dimension involves the various ways human beings and society at large attribute meaning and value to the resource, water (Gustaffson, 1989b). This may refer to the interests of different water users in all sectors of the national economy (including agriculture, water supply, hydropower, inland transportation, industry, fisheries, recreation, environment, and nature conservation) (Pearce, 1992). It also refers to the national objectives of the water resource, as laid down in government policies, action plans, the national budget, the laws of the nation. Furthermore, it points to the institutional framework, within which important decisions are made with regard to allocation, development and protection of the resource. This framework defines the roles of government and stakeholders at the various levels. (local, provincial, national and transboundary) (Gustafsson, 1989b).

(iii) Sustainability: incorporating the time perspective

The incorporation of the idea of 'sustainability' into the concept of 'Integrated Water Resources Management', requires a consideration of the time dimension since sustainability directly refers to levels of resource use that can be sustained over multiple generations. Strategies and action plans should therefore include a long-term view of development (Gustafsson, 1989).

In sum, integrated water resources management means that in managing the resource, both the physical and the non-physical aspects are considered simultaneously, while taking a long term perspective (Dent, 1998). Decision-making would then involve the integration of the different

objectives where possible, and trade-off or priority-setting between these objectives where necessary, by carefully weighing these in an informed transparent manner.

2.5 The Political Pillar: Creating an Enabling Environment

The countries sharing the Okavango river face a two-dimensional problematic: the first is to manage the water resource holistically; the second is to share the resource internationally. The management of the Okavango river thus requires the riparian countries to transcend both sectoral and geographical boundaries (Godana, 1988). It is the responsibility of Angola, Botswana and Namibia to create an enabling environment that makes inter-sectoral and international cooperation and planning possible. This will ensure that the waters are shared equitably and sustainably (Gleick, 1993). This responsibility is primarily a political one (Figure 1).

(i) Sectoral integration

A government structure is typically organized along sectoral lines whereby government bodies such as departments and ministries, are competent in specific policy area only (McCaffery, 1993). Often, departments represent diverging interests and define their policy objectives differently. There is a growing awareness that this situation requires a change in approach, triggered by, for instance, environmental aspects of water resources management (Golubev, 1993). To mention one example, planners have regarded annual floods (a resource that can be captured) as a waste and a threat. During the last two decades it is increasingly recognised that floods may be highly productive in agricultural and environmental terms; ensure the regular recharge of groundwater aquifers from which thousands of villagers draw their water; have valuable ecological functions and sometimes-important pay-offs for tourism (Ibid).

Integrated water resources management would thus require that the varieties of sectoral interests come together and are dealt with in conjunction; acknowledging all major aspects of the water system, while seeking to balance the various interests involved (Saha & Barrow, 1980). The challenge is to find appropriate structures and strategies so as to coordinate policy, planning and implementation in a truly integrated manner (Savenije & van der Zaag, 1997). Some of the emerging issues will be elaborated when dealing with institutional aspects (section 2.4). Suffice to mention here that many countries have or are in the process of adopting new scenarios for the integrated management of water resources, for instance as laid down in National Action Plans (South African Water Act). Such a shift in approach involves a tedious process of change

and therefore cannot be implemented over-night. Departmental bodies, who traditionally justified their existence on (mono-disciplinary) technical grounds, may not immediately accept the need for change. Sectoral integration, therefore requires political support and commitment at the highest Government levels (Davies & Day, 1986).

2.5.1 Cross-Border Integration and International Collaboration

Typically, the sectoral concerns of a country such as Angola in the upper reaches of the Okavango River basin differ from those of downstream neighbouring countries such as Botswana and Namibia. Agriculture in the well-watered upper reaches of the Okavango River - the Angolan Highlands - (Benguala Plateau) mainly rely on rain fed practices, soil and water conservation, whereas agriculture in the lower and drier plains of the Okavango Delta of Botswana for instance, may be orientated towards irrigation as the preferred solution to securing food production, sustaining a strong rural economy, and supporting agro-industry and exports (McCaffery, 1993).

Botswana tends to have a greater stake in cross-boundary planning and cooperation of the Okavango River Basin, as a consequence of the actions of upstream countries with respect to flood protection, water scarcity and water quality (McCaffery, 1989). The largest part of the Okavango River system's yield typically originate in the upper states, but downstream countries are more dependant on it.

In trying to bring the diverging interests together, one can think of the creation of mutual economic interdependence, which will enhance the interests in shared water resources management and mould more sustainable relations among riparians. Countries need to develop criteria, which would promote cross border (transboundary) cooperation. This could contribute towards achieving economic stability, social stability and environmental stability. Economic, social and environmental policies of the three basin countries (Angola, Botswana and Namibia) will be reviewed in the light of possible international collaboration. This will be accomplished in the next chapter.

In the absence of cross-boundary and cross-sectoral integration, the countries of the Okavango River Basin may easily get into conflicts over this shared resource. Indeed, the media brings to light that such conflicts do occur in the Middle East. In the majority of international rivers,

however, conflicting interests do not result in open conflict, but are dealt with in mutual respect and resolved amicably through negotiations. The following section reviews four aspects that may enhance international cooperation in water resources management (Biswas, 1991)

(i) Good neighbourliness

Most countries subscribe to international principles of good neighbourliness, recognize that riparian countries are mutually dependant, and have taken steps, signed agreements and instituted bodies through which emerging problems may be resolved (Le Roux, 1998). Often, binding elements between neighbouring countries, such as cultural and ethnic links, have helped to enhance communication and understanding in tense circumstances (Heyns, 1995). A review of current arrangements and strengthening of institutions are essential to alleviate future problems pertaining to water scarcity. Box 4 illustrates the important role politicians may play in fostering good neighbourliness.

Box 4: How politicians may curb prejudice

A survey among Dutch youngsters held in 1995 revealed that the majority considered their German neighbours as the least sympathetic of all Europeans. Suprisingly, the number of youngsters who actually knew Germans or had actually visited the country was very small. Their opinion appeared to be nothing more than a prejudice. For neighbouring countries the existence of such a prejudice is a bad thing, and the heads of government of Germany and the Netherlands started a short but intensive campaign to improve the image of each other's countries by visits, media events, exchanging writers and scholars and by addressing the underlying feelings openly. The campaign proved a success.

Source: (McCaffery, 1993).

(ii) Recognition of riparian interests

Once mutual respect exists, a worthwhile strategy is to urge each party to appreciate the different interest of all riparian countries. Thus attention shifts from a situation where riparian countries merely 'rehearse' their own parochial interests in the water resource, emphasizing competing interests, to a situation of basic respect for each other's perspectives (Barrett, 1993). Such an exercise may be worthwhile when parties realise that not all interests of riparians are incompatible. Concerns for flood protection in one country do not necessarily conflict with an interest in hydropower development in another riparian country. The lack of financial resources in one country with relatively large supplies of water that remain undeveloped, may not

necessarily clash with the richer neighbouring country where most of the available water has been put to economic use (Cuny, 1991). Such situations call for creative deals between parties that are fundamentally different, who have differing comparative advantages, but who are bound together by the same river in which they have a joint interest. Special negotiation techniques may facilitate the identification of possible deals.

(iii) Developing joint activities

A next step to creating a climate of cross-border collaboration is to formulate concrete and well-defined activities or projects that are mutually beneficial to riparian countries (McCaffery, 1993). For any collaboration to succeed it is necessary that the parties involved fully understand the complexities of the water resource processes in the entire basin. Further negotiations can be based on facts where subject matter specialists thus play a crucial role in the evolution of international collaboration (Barrett, 1991).

(iv) Turning a crisis into an opportunity

There are several examples of crises, natural or man-provoked, that have turned into opportunities for improved international cooperation. This man-provoked environmental disaster of Sandoz in 1986, could have easily developed into a political conflict, but formed the basis for the Rhine Action Programme of 1987 instead, and was instrumental in speeding up the cleaning of the Rhine (Savenije & van der Zaag, 1997). Similarly, the droughts that affected southern Africa during the last 15 years triggered the process of international coordination culminating in the Protocol of Shared Watercourse Systems, and the willingness of riparian countries to work towards solutions that are beneficial to all (Ibid).

2.6 The Legal-Institutional Pillar

Institutions dealing with the water sector, and the legal instruments pertaining to this resource circumscribe the way water resources are being managed. This is metaphorically described as the 'legal-institutional pillar' (see Figure 1). In this section, the importance of river basin organisations will be highlighted, but first a review of some legal aspects.

(i) Legal principles

In discussing legal and regulatory aspects of the management of international river basins, it is useful to distinguish international from national legal frameworks. Ideally, in a country specific

laws pertaining to the use of national waters should be consistent with those principles widely accepted to apply to international waters (United Nations, 1992).

(ii) International aspects

A wide consensus seems to exist among countries about the principles of the international cooperation concerning cross-border basins (Box 4). The importance of this observation is difficult to underestimate, for countries cannot begin to share a resource without first agreeing about some basic legal principles. The principles referred to have been written down ('codified') by three important institutions:

- The International Law Association, a non-government organization, who formulated the 'Helsinki Rules on the Uses of the Waters of International Rivers' in 1966;
- The International Law Commission, a commission of the United Nations who, formulated in 1991, and in 1994, the '33 Draft Articles on the Law of Non-Navigational Uses of International Watercourses'; and
- The Sixth Committee of the General Assembly of the United Nations, who on the basis of the ILC draft law finalized, in April 1997, the 'Convention of the Law of the Non-Navigational Uses of International Watercourses' (United Nations, 1997).

It is important to note that whereas in the Helsinki rules the central concept is 'international drainage basin', the ILC draft law and the UN convention use the term 'international watercourse' (Box 6). The global principles as defined by the above institutions have been translated into regional agreements, such as the SADC Protocol of Shared Watercourse Systems (1995).

Box 5: Some basic principles of the Convention on the Law of the Non-Navigational Uses of International Watercourses

Article 5 - Watercourse states shall utilize an international watercourse in an equitable and reasonable manner. Watercourse states have both the rights to utilize the watercourse and the duty to cooperate in the protection and development thereof.
Article 7 - Watercourse states shall, in utilizing an international watercourse, take all appropriate measures to prevent the causing of significant harm to other watercourse states.
Article 8 - Watercourse states shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse.
Article 21 - Watercourse states shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse.

(United Nations, 1997)

Box 6: 'International drainage basins' or 'international watercourses'?

Helsinki Rules: an *international drainage basin* is 'a geographical area extending over two or more States determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus' (Art.2).
ILC Draft Law and **UN Convention:** a *watercourse* is 'a system of surface water and groundwater's constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus'. An 'international watercourse' then is 'a watercourse, parts of which are situated in different states' (Art. 2).

(United Nations, 1997)

(iii) Operationalising the principles

Whereas the philosophies behind these rules are laudable and widely shared, problems begin when the general principles must be specified for a particular situation. In general, the problems arise when basin states take the interests of other riparians into account. Upstream basin states may emphasize the fact that they exercise 'absolute sovereignty' over their territory when pursing projects, while downstream countries may emphasize territorial integrity when challenging upstream developments (Skogerboe, 1985). The utilisation of shared water resources, therefore, requires riparian countries to acknowledge the principle of limited sovereignty, or, phrased positively, to accept the principle of community of interest (Pallet, 1997).

The definition of watercourses or drainage basins as being 'unitary wholes' may be interpreted differently depending on each country's perspective. In large river basins, upstream countries may consider a tributary to a main river as a river in its own right. It then becomes easy to ignore harmful effects of interventions on down stream users. Although such a way of thinking is understandable from the upstream country's point of view, it is certainly not the intention of the principles laid down by the ILA, ILC and the UN. It should therefore be emphasized that in practice a watercourse or a basin has as its downstream limit either sea, or, in some special cases, a desert. The correct way to refer to all other watercourses or basins should be as 'sub-basins' (United Nations, 1997).

The Helsinki Rules and the UN Convention is based on two principles:

The principle of equitable and reasonable use (article 5 in Box 6) and the principle not to cause significant harm (article 7). To establish what is an "equitable share", the UN Convention considers a wide variety of aspects such as the natural characteristics of the watercourse

(geography, hydrology, climate, and ecology), the social and economic needs of the states concerned, the population dependent on the watercourse in each state, the existing and potential users of the watercourse, the costs of the development and protection, the availability of alternatives, of comparable value, to a particular planned or existing use. However, these aspects are prone to subjective interpretations by the riparian states. 'Clearer criteria are needed by which to judge, for instance, what constitutes a reasonable level of per capita water use given the total amount of water available in a river system, and what constitutes a fair apportioning of water among nations sharing common resources' (Biswas, 1991).

Another question surrounding the legal aspects of international rivers is: which comes first, the right to equitable and reasonable use or the obligation not to cause significant harm. Those riparian states with a stake in the status quo stress the importance of the latter principle (which appears to recognize established uses however inequitable these may be), while those riparians who lagged behind in water development use the former principle to claim waters already used by 'more developed' riparians (Lundqvist & Falkenmark, 1996). This is, however, a false dilemma. Both principles apply concurrently and are two sides of the same coin. They convey the basic tenet that riparians have rights and duties in the uses of water resources, in line with the second principle of the Rio Declaration:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environment and development policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.

(iv) National legal frameworks

In general, countries have developed their own specific ways of solving the issues of planning, developing, allocating, distributing and protecting water resources. Countries also define water rights in various ways (Box 8). In many countries, the State is the owner of all or nearly all waters and allocates user rights or water permits; for a limited period of time (Ohlsson, 1995). In other countries, private persons may hold water rights that are very secure, as they are granted in perpetuity. These country-specific arrangements have far-reaching implications, for instance in the ways countries, attempt to charge the 'economic value of water' to users (Coase, 1960). In some countries water right holders may fundamentally object to the fact that the state charges for the water that is theirs, while in European countries where water is state controlled 'the only right that an individual has is the right to buy water' (Thema, 1997). Howsam observes that "This is a very much in line with many who advocate that water has an economic value and

therefore is a commodity that must be bought and sold – not a free right" (Howsam, 1987; pp. 34) implying that in other contexts such an approach may be much more difficult to follow.

Box 7. The three most important systems of water rights

Riparian rights link ownership of or reasonable use of water to ownership of the adjacent or overlying lands, and are derived from Common Law as developed in England. As a consequence, this principle is also found in countries that were under the influence of the British empire.
Public allocation involves administered distribution of water, and seems to occur mainly in so-called 'civil law' countries, i.e. that derive their legal system from the Napoleonic Code such as France, Italy, Spain, Portugal and the Netherlands. In these countries, the concept of waters common to everybody (*res communis omnium*) which existed under Roman law was eliminated from new legislation, contrary to what was retained in the common law of England.
Prior rights are based on the appropriation doctrine, under which the water right is acquired by actual use over time. This system developed in the western part of the USA, a typical (semi-) arid 'frontier zone'.

(Source: Rosegrant & Binswanger,1994; Caponera, 1992; Teerink, 1993)

The discussion on legal issues will be described in more detail with specific relevance to the Okavango River Basin. Countries, in consideration of regional and global arrangements and common law, should not lose sight of the principles relating to the use and sharing of water. Therefore, it will be essential to look at Botswana's local water practices as they have repercussions for international watercourses such as the Okavango River (Chapter Five).

2.6.1 Institutional Aspects

(i) Decentralising Institutions

An often-heard plea is that decisions concerning water resource management should be made at the lowest appropriate level. This is known as the principle of subsidiary, and is intimately related to the drive towards decentralization. The rationale behind decentralised water resources development and management is to change from a centralised, master planning (supply) type of management system to a decentralised, flexible, demand-driven way of doing things (Roberts, 1975).

Decentralisation may not be limited to devolution of responsibilities to lower levels only (leading to technical capacity-building and participation), but may simultaneously involve the delegation of negotiating rights and responsibility for broad policy formation to higher levels

(Savenije & van der Zaag, 1997). This is precisely what is aimed at when river basin organisations are established: certain decisions can only be effectively made at the basin level, while other decisions could be made most usefully at a much lower level such as the sub-catchment. Decentralisation should therefore be a dual process, as shown in the slogan 'think basinwide, act watershed specific' (Barret, 1995; pp. 65). If too much decision making power is delegated to lower levels, it may in fact threaten international cooperation concerning transboundary rivers (Heyns, 1995).

(ii) River Basin Institutions: Joint Commissions and River Organisations

Experience worldwide teaches that the policy-and strategy-level responsibilities should be clearly separated from the executive actions and implementation programme. Thus two types of organisations are needed: one is *regulatory* (policy-level) and the other *developmental* (implementation-level) (McCaffery, 1993). For example, a joint water commission (refer to Chapter Five for ORB examples, OKCOM and the Okavango Liaison Group) might be formed as the main policy body with a wide brief that may encompass one or more drainage basins shared by the member states. A river basin agency might then be established in the form of a corporation with a full legal status, and with specific responsibilities to execute, operate, and manage specific projects helping work towards an integrated approach. Normally, the executive river basin authority would be liable for policy direction to the joint water commission. Executive powers can be further delegated to lower levels of government at the sub-basin or river-board level (United Nations, 1983).

An effective river basin agency requires a strong political and financial commitment on the part of the member states, clear definition of tasks, well-defined procedures for interaction between the river basin organisation and the national agencies, and an organisational and incentive structure commensurate with its responsibilities and legal status (OKACOM leaflet, 1997). Acknowledged functions of international river basin organisations are given in Box 8. One of the obvious functions and first duties of any river basin organisation involves the sharing of relevant systems to incorporate models and data sets on rainfall, hydrology, dam operations and related aspects (Helsinki Rules article 29). If relations between riparian states are tense the countries tend to zealously guard data, as is the case with the Jordan, Ganges and Danude rivers (Glieck, 1993). One lesson stands out when reviewing experiences with transboundary organisations of international rivers: the time needed before effective and positive joint actions occur (Roberts, 1975). The Cunene River is one such example shared between Angola and

Namibia. There was a long time lag of 88 years between the signing of the first border and water use agreements, and the completion of the first joint infrastructure (Gove Dam, completed in 1973). ' This shows that basin states should start at the earliest possible time to enter into agreements to investigate the potential for sustainable future development of international water sources' (Pallet, 1997). The management of international river basins thus involves a long learning process; a process the participating countries have to go through. International assistance can only play a very modest role (Clarke, 1991).

Box 8: Important functions of international river organisations

- Reconciling and harmonizing the interests of riparian countries
- Technical cooperation
- Motoring water quantity and quality
- Development of concentrated action programmes
- Enforcing agreements
- Dispute resolution
- Exchange of hydrological and other information

Source: (Roberts, 1975)

2.7 The Operational Pillar For Technical Cooperation

Having established the wider political, legal and institutional aspects impinging on the management of shared river basins; this section 'descends' to a more concrete and practical level.

It is essential for the broader concepts to be translated into operational measures and actions, or else the management of shared rivers will not succeed. The third pillar is by no means the least important one and certainly not the last one to be constructed. On the contrary, a solid process of establishing international cooperation could well start with the operational pillar (Figure 1). Operational contacts establish trust, confidence and a reliable information base after which legal, institutional and political progress can be made. The basis for a legal document should be laid by the technical experts involved in operational activities, representing the sectoral spectrum. Legal experts, will, therefore review and structure it into a legal pillar.

At the same time an enabling political environment comes about after mutual trust and understanding has been created at the operational level. The operational pillar, then, is the centerpiece of the structure sustaining cross-boundary river management. In order to highlight

possibilities for operational alternatives, the case of flood management is developed as an example. Subsequently we turn to possibilities for technical cooperation.

(i) Technical cooperation

Relevant to the operational pillar is that technical cooperation between riparians is essential. Subject-matter specialists and technical staff, dealing with a variety of uses of the water resource, may play an important and often decisive role in ensuring continuity in international cooperation. Technicians from one riparian country may understand better than any other national the context in which another riparian country takes certain measures. This is not only because technical experts share the same disciplinary training and knowledge, and thus speak the same 'language'(it is important that they share and have confidence in each others data, management and interpretation issues), but also because they may have been involved in cross-border negotiations much longer than their superiors in (elected) political positions (Savenije & van der Zaag, 1997).

Technical cooperation (across the various sectors involved in water resources management) is imperative also for a more substantial reason: lack of appropriate information often gives rise to simplified assumptions held by riparians about each other. Yet, river management is such a complex field that it requires sound and precise knowledge of the hydrological, biological, chemical, etc. processes at play. Joint river initiatives will thus only be credible when based on accurate data and accurate assumptions as well as reasonable abilities to predict consequences of actions (Gustafsson, 1989). Moreover, technical cooperation will enhance the effectiveness of the mitigation of basin-wide or even regional disasters, such as floods and droughts (Savenije & van der Zaag, 1997).

The above opens up a wide field of cooperation between riparian countries. The Conference Paper on the Management of Shared River Basins (1997) presents six issues indicating an increasing level of cooperation:

- *Information.* Exchange hydrological and other relevant data on water use between the departments of Water, Hydrology, Agriculture etc. Update data series, calibrate data collection systems and agree on data formats. Establish joint databases and develop rules for swift information exchange in case of (implementing) crises such as floods, droughts, and

pollution. Finally, exchange relevant national water policy plans, basin action plans; and inform each other on revisions made to relevant laws and regulations.

- *Crises procedures.* Establish procedures to arrange crises, including monitoring, warning and evacuation plans in case of natural or man-provoked disasters such as floods, droughts, accidental pollution, etc.
- *Human resources development.* Let staff of one country follow relevant courses in a neighbouring country, and let experts give guest-lectures at educational institutions. In so doing strive for balancing the capacities to manage water resources among riparians. If a university in one riparian country has renowned expertise in, for instance hydrology, whereas another riparian is strong on water quality, exchange staff to follow (short) post graduate courses. Thus regional differences become an impetus for cooperation and exchange, not only between government departments but also between educational institutions.
- *Joint research.* Once educational linkages exist, a logical step would be to strengthen and stimulate regional research on a variety of topics related to river basin management (Box 13). This and the previous activity could be suitably embedded in a network of institutions consisting of universities, NGO's and relevant government departments.
- *Joint plans.* Prepare joint river basin plans, including compatible strategies for water conservation. Jointly prepare operational rules for large dams that impact on more than one riparian country. Jointly revise the legal systems so as to harmonize them. Prepare action plans for demand management, water pricing, for joint water use, for interbasin transfer.
- *Joint ventures.* When two or more countries develop joint ventures (such as the Lesotho Highlands Water Project and the Kariba dam), a large step has been made towards the 'community of interest' of individual countries in a shared resource.

Box 9: Technical topics for joint research on international river basin management

- *Development:* the assessment of potential for development and availability of land and water resources, which forms the basis of river basin development plans;
- *Economic:* cost-benefit analyses of projects developing the basin's water resources;
- *Efficiency:* the efficient use of water resources, with particular attention to demand management, the financial sustainable use of water resources, and the possibilities of, and the fair compensation for, inter-basin water transfers at all geographical levels;
- *Equity:* the equitable use of water resources within river basins, both at local, national, and international levels; this topic could include the development of new rules for dam operation that take into consideration trade-offs between e.g. environment and economic aspects, agriculture and industry, up- and down stream uses, etc.;

- *Sustainability:* the environmental sustainable use of land and water resources and productivity of the river basin; and environmental assessment studies;
- *Legal:* the harmonisation of legal and regulatory systems at local, national, basin and regional levels; implications of the UN Convention on environmental issues;
- *Disaster-management*: regional strategies of mitigation disasters, including droughts and floods;
- *Public participation:* new forms of water management, including ways in which public participation and community management should be incorporated in existing management approaches, and the managerial consequences of decentralisation policies.

2.8 Towards a Strategy for the Integrated Management of the Okavango River Basin

"The three basic tenets of sustainable resource use-Efficiency, equity, and ecological integrity".
(Gustafsson, pp. 42; 1989)

In this final section we look at the roof of the temple and attempt to integrate the insights gained from the three supporting pillars. The aim is to define a number of elements that would be part of a 'best' management strategy concerning the Okavango River Basin. This is an ambitious aim, since such a concentrated strategy would have to fulfil three basic requirements:

- The strategy should be consistent when it deals with political aspects, with legal institutional issues, and with technical questions. In other words the strategy should ensure that each pillar is structurally sound.
- The strategy should be comprehensive such that the three 'pillars' reinforce each other, and are wholly compatible; in short, the pillars should be 'level'.
- The strategy should be integrative in the sense that it gives adequate attention to all relevant economic, social and environmental interests of riparians and stakeholders.

There is probably no single 'best strategy' that would apply to the ORB. Local factors will influence the chosen strategy. The most suitable strategy would address the critical issues highlighted in the previous sections, relating to political, legal-institutional, and technical aspects in an integrated manner, while respecting three criteria which were frequently referred to, viz. efficiency, equity, and ecological integrity (Gustafsson, 1989).

In order to be more specific, this concluding section suggests, and emphasizes, three elements critical for any management strategy of the ORB: (1) the management of the river basin should be based on integrated demand-and-supply management; (2) the public should have an active voice in the management of the ORB, since it is the public who have a stake in their

development; (3) the management of river basins should explicitly recognise, and consciously exploit, the fact of spatial interdependencies among the entities making up the basin. At a higher level, one can even think of multi-basin interdependencies within a region. It is argued in this section that any concentrated strategy towards the integrated management of the shared Okavango River should seriously consider, and incorporate elements of, demand – and – supply management, public participation, and regional integration.

2.8.1 Exploiting Interdependencies

Having elaborated the part of strategy involving integrated demand-and-supply management and public participation one now turns to recognizing the existence of spatial interdependencies within a basin, or even between basins at a regional scale. The strategy consciously aims to exploit these interdependencies to the entire advantage of the basin or region.

It is first required to create transparency in the management of the river basin system. Interdependencies can then be made visible and quantified, both in technical and socio-economic terms. The dissemination of this knowledge and the creation of awareness among water users, politicians and the public at large, should lead to the realisation that it is in everybody's interests to share the resources in a sustainable manner (Daly & Cobb, 1989).

How can one create the public support for measures that in the short run and at a small scale, seem less attractive to water users? The Conference on the Management of Shared River Basins (Lesotho, 1997), states that the EU countries would not think of letting a conflict over shared resources develop into a major conflict. The key word here is economic interdependence. The focus the EU, initiated shortly after the Second World War, has always been on economic co-operation and trade as well as on peace. In the course of the EU's development, member countries realised that sustainable and effective international relations require a "leveling of the playing field". Weaker members were supported by the stronger members to become more powerful "players". This approach, which might look foolish if one wants to achieve short-term gains, appears to be highly effective if one goes for the long term and more sustainable benefits. Botswana and Namibia are partners sharing a scarce resource they are at equal footing and share ties of common interest (such as trade links, economic, cultural and scientific cooperation). A conflict situation will hinder development in both countries.

Large differences in climate and in the availability of natural resources between the EU countries as well as economic cooperation has enabled countries to no longer strive for self-sufficiency in food, energy or production of essentials. The common market and the confidence in peaceful cooperation have made this possible.

SADC has made important steps in this direction. Sharing international rivers cannot be seen separately from economic cooperation, sharing a common identity and a political will to develop the region as a whole. The recent Trans Kalahari Highway (in line with the new African Renaissance) is a step in an appropriate direction as this creates trade corridors (economic imperialism) which will facilitate trade of products, and the development of a food market so that agricultural products are grown in those places where land and water resources are abundant and the climate is most favorable. In addition, this food market, which implies an increase of scale and consequent spreading of risk, could be an important instrument to mitigate drought within the region (Samson & Charrier, 1997).

Creating and exploiting interdependencies thus involves the search for creative deals between Okavango riparians, when they negotiate their diverging interest. Deals forged between riparians should contribute to the wider criteria of, first of all, equity, but also efficiency and ecological integrity. This becomes more important with the increasing scale of physical interventions in river basins, and particularly applies to interbasin transfer of water. In the past, SADC countries have transferred water from its original river basins without the consent of downstream countries. The SADC Protocol on Shared Watercourse Systems fortunately rules out similar interventions in the future.

In developing the three suggested elements for an integrated strategy towards the sharing of the Okavango's international waters, the three pillars of the temple really come together upon the foundation of integrated water management. In general one may say that through this integrated approach 'win-win' solutions may be more easily identified, thereby defusing potential conflict situations between riparian countries. One important strategy would be the recognition of the principle of 'unity in diversity': because of differences among riparian countries the task would be to look for a situation of cooperation whereby the countries complement each other to their mutual benefit. Finally one can observe that the process towards sharing of international rivers may be as important as the result, and that this process is one of continuous learning.

CHAPTER THREE

Management of the world's water resources is undergoing a momentous shift. New approaches to complex river development slowly are according greater recognition to its environmental limits and consequences. These approaches are departures from the preoccupation with single–purpose water development at the beginning of the twentieth century and are radical extensions of the concept of integrated or complex river development... Complex utilization means the integrated management of rivers flow and quality to serve multiple purposes.

(White, 1997; pp. 17).

3.1 Water Demand, Population and Sustainability in Botswana

Important elements to international river management are the policies at the national level. Therefore, it has been imperative to include a country perspective to integrated water resource management. National regulations do have a role to play in international river management, if national policies are inadequate these will result in searching for new water sources on an international scale. A study on Botswana is crucial to understanding the broader picture of international river basin management.

In Botswana, water is a scarce resource that undoubtedly needs good planning which should take into consideration both the short and the long-term effects of its use. The scarcity of water in Botswana is related to a number of factors such as rapid increase in human population associated with a sharp increase in the demand for water, low and variable rainfall, high rates of evaporation, and high costs of the exploitation of existing water resources (Krook, 1994). While the population is small in size it is increasing at a very fast rate such that it may double after a period of twenty years, implying that the demand for water may also double, as there is a very strong correlation between population and water demand. In addition, the demand for water may further be increased if the outputs of agriculture, industry and commerce are expanded in line with the development strategy of the Government. This suggests that there is a need for a carefully worked out water management strategy in Botswana. This is made even more necessary by the recurrent droughts which usually adversely affect the water sector as was the case in 1982/83 and in the mid 1990s. The issues of drought and water scarcity are of great significance, and they were recently seriously debated in Zimbabwe in the context of the Zambezi – Matabeleland Water Project which aimed at obtaining water by a pipeline from the Zambezi River to the region of Matabeleland (Campbell, 1997).

Using available literature and informal interviews held with senior officers in Government Ministries and parastatal bodies, this chapter addresses the discourse on water demand, population, and environmental sustainability in Botswana. The first part of the chapter starts by outlining the general characteristics and economic development of Botswana. The second section discusses the main sources of water in Botswana, and the institutions responsible for its supply. Section three addresses the magnitude of water demand in Botswana, and factors, which determine it. The fourth and fifth sections examine the future trends and the policy implications of the demand for water in Botswana, while the last section concludes the discussion. The domestic policies mentioned in this chapter are in line with the technical issues and institutions highlighted in chapter one (the Pillar of technical cooperation) as Botswana's policies of solving the issues of planning, developing, allocating distributing water are essential to the future of water resources international in character.

3.2 General Characteristics and Economic Development – Botswana

In this section, the background of Botswana is discussed with particular reference to general characteristics and economic development. This is essential in order to clearly understand the dynamics of the water sector in Botswana.

Botswana is a landlocked country with an area of 582,000 kilometres squared and a mean altitude of 1,000 meters. It shares boundaries with Zimbabwe, South Africa, Namibia and Zambia. The climate is semi-arid with an average rainfall, which ranges from 250 mm in the southwest to 650 mm in the northeast. The mean annual rainfall is 475 mm and is a high variability reflecting the unreliability of rainfall. Mean daily temperatures range from a minimum of 5 $^{\circ}$ C in winter to a maximum of 39 $^{\circ}$ C in summer (White, 1993).

The population density of Botswana was estimated at one person per square kilometre in 1971 and by 1981 and 1991, it was estimated at 1.6 and 2.3 per square kilometre, respectively (Botswana Government, 1997a). Although the aggregate population density is low, most of the population is concentrated in the eastern part of the country where most people live in towns and urban villages. In 1991, it was estimated that about 50 percent of the Botswana population lived within a radius of 100 kilometres from the city of Gaborone (Campbell 1995). Concentration of population in certain areas results in an increase in the demand for water in such areas. Water demand will increase as the population grows in the future. During the inter-censal decade 1971-

81, the national population growth rate was 4.7 percent, whereas between 1981 and 1991, the population grew at 3.5 percent (Botswana Government, 1995a) the decline in the rate of population between the two inter-censal periods is partly attributed to a decline in total fertility rate from 6.6 in 1981 to 5.2 in 1991.

3.3 Sources of Water Supply

(i) Surface Water

Most of the surface water resources are situated in the sparsely populated districts of Ngamiland and Chobe in the northern and northwestern part of the country where the perennial rivers of Chobe, Okavango, and Zambezi are found. These rivers are shared by a number of Southern African Development Community (SADC) states, and the modalities for the equitable sharing of the water resources from them is a key issue that needs to be clearly resolved. The Zambezi river is shared by the countries of Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe (Campbell, 1997).

In the eastern part of the country, where more than 80 percent of the population lives, all the rivers are ephemeral and are estimated to have a total annual yield of 1200 million cubic meters, and 19 percent of this amount is already stored in dams (Khupe 1994). The development of surface water in Botswana is constrained by a number of factors such as its low and erratic run-off, lack of the availability of suitable dam sites, and high rates of evaporation (Krook, 1994).

The Botswana National Water Master Plan revealed that 35 percent of the total water supply is from surface water, whereas the remainder (65%) is from groundwater (SMEC *et al.* 1991b). It is important to note that surface water accounts for 90 percent of water in urban areas such as Gaborone, Lobatse, Francistown and Selibe-Phikwe. In order to assist the Water Utilities Corporation to supply water to these urban centers, the Government of Botswana has constructed a number of dams on some of the ephemeral rivers such as Notwane, Shashe, Metsemotlhabe, Motloutse and Nnywane (Map 2, page 42 and Map 5 page 84). The Gaborone Dam is the largest with full capacity of 144 million cubic meters. In October 1997, the volume of the Gaborone Dam was estimated at 128.4 million cubic meters, suggesting that it was 91 percent full supply capacity. The Gaborone Dam is connected to the two dams of Bokaa and Molatedi through 600 mm diameter pipelines. The Molatedi Dam is situated in the Republic of South Africa. The agreement to use the water from this dam between Botswana and the

Republic of South Africa states that Botswana may extract up to 7.3 million cubic meters of water per annum when the dam is more than 26 percent full. The dam may therefore increase the yield of the Gaborone dam by 5.2 million cubic meters as 2.1 million cubic meters is lost through evaporation (National Development Plan 7 (1991-1997).

The Shashe Dam has a full supply capacity of 87.9 million cubic meters. In October 1997, it had a volume storage of 54.5 million cubic meters and this means it was 62 percent full. The dam supplies the urban centers of Francistown (Map 5) and Selibe-Phikwe with potable and non-potable water. The former is treated whereas the latter is untreated (or raw) water used in the mining industry. The Nnywane dam has a full supply capacity of 2.3 million cubic meters and it had a volume storage of 2 million cubic metres in October 1997 (Botswana Government 1996b).

Attempts are being made by the government to develop additional surface water resources, as such resources are renewable as opposed to finite ground-water resources. One such attempt is the development of the North South Water Carrier Project (Map 2, Page 42) which has led to the construction of the Letsibogo Dam near Mmadinare, 20 kilometres from Selibe-Phikwe. The other aspect of this project entails the construction of the 360 kilometres pipeline between the dam and the great Gaborone area. A total of 1.2 billion Pula plus an annual inflation adjustment of 10 percent per annum has been budgeted for the project (Botswana Government, 1996b). When completed, the project will supply urban centers and large villages, along and close to the pipeline, such as Selibe-Phikwe, Mahalapye, Palapye, Mochudi and Gaborone (Map 5) with water. The water Utilities Corporation does not usually supply water to rural villages, as the costs of water supply may not be recovered. While the denial of water to the small village communities living near the pipeline is consistent with the objective of allocative efficiency as stipulated by the Water Utilities Act of 1970, it militates against the objective of equity, and it is important to note that these communities are democratically entitled access to clean water.

(ii) Ground-water Resources

Ground-water resources are limited in Botswana with a recharge ranging from over 40 mm per annum in the extreme north to virtually zero in the central and western parts of the country. The average recharge is only 3 mm per annum (Botswana Government, 1996b). According to the Botswana National Water Master Plan, groundwater resources available in most parts of the country have accumulated over a very long period of time, and its conservation is of primary importance as some of the conditions which prevailed in the past may no longer be existing in

some of the areas, and this explains why some of the aquifers are receiving a recharge rate of almost zero.

Ground-water resources are the main source of water for most of the urban villages, rural villages and some of the mining towns. They are also the main source of water for livestock and wildlife. Ground water is supplied through boreholes, which are drilled from aquifers. It is estimated that there are 15 000 boreholes in Botswana, and they are scattered in various parts of the country. The quality sustainability of ground-water resources in Botswana is threatened by pollution; particularly in areas, which are densely, populated such as southeastern Botswana. An analysis of water samples from 2000 boreholes by the Water Affairs Department revealed that 34 (17%) of the boreholes had a nitrate pollution above the Government recommended level of mg/I, suggesting that the health risks are much higher when the Government of Botswana recommended level is exceeded.

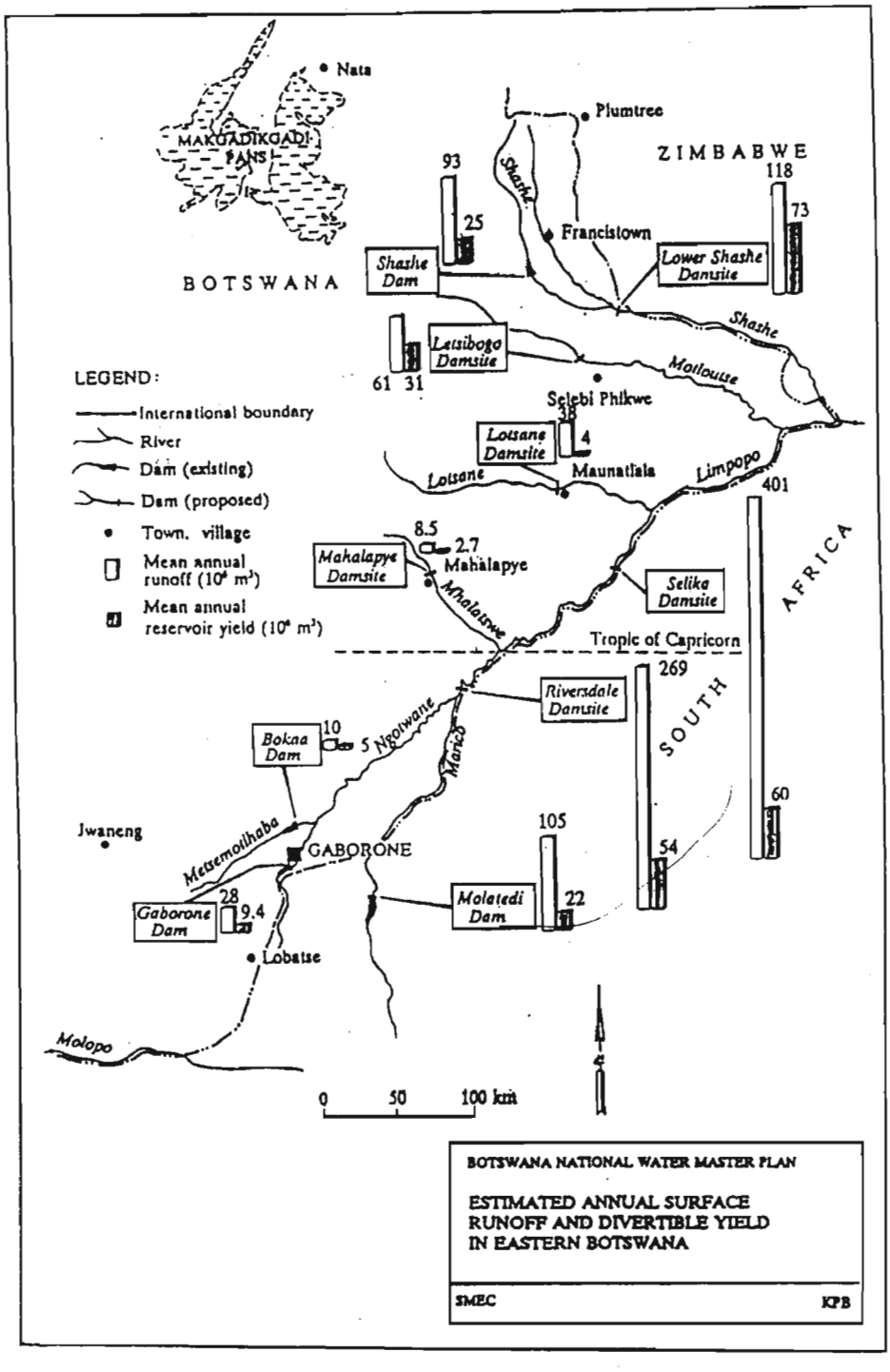
3.4 The Demand for Water

In economics demand refers to the amount of a commodity consumers are willing to purchase during a specific period of time (Lipsey, 1983). As a result of the existence of the informal sector in developing countries, resources such as water and energy are sometimes not purchased but instead collected (Arntzen, 1998; Kgathi & Mlotshwa 1997). The definition of demand in this paper will therefore be broader to incorporate non-purchased water consumption. In Botswana, 50 percent of the water demand is procured through a market, whereas the remainder is procured through a non–market, or simply put, it is just collected from boreholes and rivers (Arntzen, 1995). In the market sector, the Water Utilities Corporation, the Department of Water Affairs, and the District Councils supply water to urban areas and villages, whereas in the non-market sector in rural areas, water is usually obtained from boreholes and rivers. The suppliers of water in the market sector have been given the user rights, whereas in the non-market sector, water is an open access resource (Arntzen, 1995). The demand for water in Botswana can be broadly categorized as household and economic sector demands.

The total demand for water was estimated to be 116.9 million cubic meters in 1990. The agricultural sector had the highest demand, which constituted 46.4% of the total. Domestic, commercial/industrial, and institutional demand in settlements, which accounted for 28.9% of the total demand, followed the agricultural sector demand. The proportions of the demand for

other sectors were as follows: mining (17.7%), wildlife (5.1%), and energy (1.9%) (Botswana Government, 1996b).

Map 2: Eastern Botswana Dam Sites and estimated annual runoff



(Source: Botswana Government 1997b)

3.5 Determinants of Water Demand

A number of factors such as population, price, incomes, level of commercial and industrial activities, and weather conditions (Pearce & Werford 1993) generally determine the demand for water. As the subsequent sections will show, factors such as population, incomes, and level of commercial/industrial activities tend to have a direct relationship with water demand, whereas factors such as price and weather conditions (rainfall) tend to have an inverse relationship with water demand. This section discusses the various factors, which determine water demand in Botswana using available literature from various reports and from the limited information from analysis done by the researcher.

(i) Demographic Variables

Population growth and household size are some of the demographic variables, which tend to influence the demand for water in Botswana. As far as household size is concerned, the Botswana Government (1996b) revealed that household sizes of 1-2 had a per capita water demand of 325 litres/day, whereas households of 3-6 and 7+ persons had per capita water demands of 151 and 104 litres/day, respectively. Thus, per capita water demand is inversely related to household size in Botswana. Such an inverse relationship is also associated with the use of wood energy, and it suggests that larger households tend to be more efficient in using these resources when compared to smaller households. If, for instance, one or two people join the household, the use of water or energy does not necessarily increase in the same proportion as household size. This resource efficiency relationship could be viewed as a mathematical, economy of scale issue.

(ii) Tariffs

The pricing policy of water in Botswana is based on the principles of equity, efficiency and affordability. Equity implies that all citizens of Botswana should have access to safe water, as it is a basic need. Efficiency implies that an attempt should be made to ensure that consumers meet the economic cost of water supply whenever it is possible, and this is achieved by basing the prices of water on the long run marginal cost of water supply. Finally, affordability implies that those who do not have the ability to pay for water should not be denied access to it (Botswana Government, 1991).

The structure of water tariffs in urban areas is aimed at ensuring that affordability and equity are taken account of by a concessionary or lifeline tariff rate for low consumption, whereas efficiency is achieved by penalizing those who have a high consumption of water by charging higher tariffs. A tariff structure of this nature is known as an inverted tariff (or increasing block tariff), as opposed to the traditional decreasing block tariff .

It is worth noting that recent adjustments in urban tariff rates did not achieve full cost recovery (Botswana Government 1997b). The price of a natural resource such as water should not only be based on cost recovery of labor and capital, but it should also reflect the social opportunity cost which takes into account the external costs and user costs associated with the supply of water. Arguably, the failure to relate prices of water to the marginal private cost of its supply is one form of policy failure, whereas the failure to relate such prices of water to the social costs is another form market failure refers to a situation whereby a market fails to develop, or only develops partially such that the price of a resource remains zero or lower than the marginal social cost of production. Policy failure on the other hand, is the failure to intervene when necessary and beneficial, and the failure to refrain from intervention when unnecessary and detrimental. Policy and market failures are the root causes of the depletion of natural resources as there us a tendency for consumers to over-use natural resources when their prices are lower than market and social cost prices. This suggests that environmental sustainability will not be achieved if market and policy failures are common features in economic systems (Daly, 1992).

The structure of water tariff in urban villages has also been changing over time in order to achieve an efficient allocation of water resources. The Rural Water Supply Cost and Tariff Study of 1988 led to an increase in water tariffs in urban villages in 1990. The tariffs were structured such that they would achieve cost recovery and access to the water resources. These tariffs were increased during the period of National Development Plan Seven in 1993/94, by up to 45% (Botswana Government, 1997b).

What then are the effects of water tariffs on the demand for water in Botswana? In urban areas, a number of studies found no statistical significance between water consumption and the real price for water, suggesting that the price elasticity was zero (Thema, 1997). One reason why no significant relationship was found between water consumption and the real price of water could be that some of the consumers did not pay for water bills, and hence they had no incentive to reduce consumption when the price of water increased. Arup Economic Consultants *et al.* (1991)

found that households who pay for water tend to consume less water than those whose bills are paid by other people who have a water price of zero. Also, urban areas with low water tariffs such as Selibe-Phikwe and Jwaneng tend to have higher r consumption of water as compared to those with higher tariffs such as Gaborone and Lobatse. Arup Economic Consultants *et al.* (1991) estimated the domestic price elasticities for water demand in the urban areas of Botswana, using cross-sectional data and holding the town of Selibe-Phikwe as a datum as it has the lowest tariffs. The price fluctuations had negative signs, indicating that the cross sectional increase in the price of water was associated with a decrease in water consumption.

Although the rural tariffs were increased in 1994/95 by 45% in order to achieve cost recovery, they had a very small effect on water consumption in urban villages. This was mainly because the main consumers of water are public institutions, which use public funds to pay for their bills, suggesting that they have no incentive to reduce water demand when the price of water falls. In addition, some of the households still collect water from communal standpipes, and their water consumption pattern is therefore not affected by tariffs.

(iii) *Income*

Income is an important determinant of water demand in Botswana, like in other countries. According to a study undertaken by Arup Economic Consultants *et al.* (1991), the demand for water was found to be directly related to socio-economic status of households with private water connections in urban Gaborone. Households who lived in high income housing had a water demand of 258 litre/capita/day as compared to those who lived in medium and low cost housing who had water demands of 157 and 107 litres/capita/day, respectively. Thus, the water demand for households who lived in high-income housing was more than twice that of households who lived in low-income housing. In addition, the study revealed that households with a monthly income of more than P2000. 00 in Gaborone had per capita water demand of 210 litre/day, whereas those who had monthly incomes of P1000 – 2000 and less than P1000.00, had water demands of 155 and 108 litres/capita/day, respectively.

(iv) Weather Conditions

As stated earlier, average rainfall is very low and variable in Botswana, ranging from 250 mm in the southwest to 650 mm in the northeast. The temperatures are also very high, leading to very high evaporation rates. In this section an attempt will be made to examine the extent to which weather conditions affect water consumption in Botswana.

According to Arup Economic Consultants *et al.* (1991), a multiple linear regression analysis of Water Utilities Corporation time series data of 1985 – 1990 revealed a significant relationship between water consumption and weather variable of rainfall in the urban areas of Botswana. As rainfall increased, the demand for water decreased. The 1996 Annual Report of Water Utilities Corporation also revealed that the demand for water in the urban areas of Botswana reduced by 5% from P85.34 million to P82.03 million between 1994/95 and 1995/96. The decrease in water demand was mainly attributed to the high rainfall during this period as tariffs had not been changed.

3.6 Future Trends

The focus here will be an overview of the future demand for water, utilizing data assembled during the Botswana National Water Master Plan (BNWMP) exercise. The BNWMP made water demand projections for the period 1990-2020 on a sectoral basis. In the domestic sector, per capita water demands were forecast for each type of settlement, taking into consideration the various factors, which determine this variable, such as the type of supply connection. The projected population and per capita demands were used to project the water demands. The assumptions made in the projections for the water demand in the commercial/industrial and institutional sectors were based on "information obtained from the relevant authorities on likely new developments" (Botswana Government 1997b). In projecting water demands, three forecasts of low, medium and high were made. The medium forecast was considered the base case on which to base the planning for water development, whereas the low and high forecasts were meant to take account of the uncertainty, and were obtained by varying the medium demands by –10% and +20% respectively (Botswana Government, 1997b).

Table 2: Consolidated water demands estimates

CATEGORY	WATER DEMAND ($10^6 m^3$)			
	1990	2000	2010	2020
Urban centres	20.9	45.0	72.0	103.1
Major villages	8.2	21.5	35.4	51.9
Rural villages	5.3	9.2	12.7	16.5
Other settlements	1.9	2.3	2.7	3.0
Mining and Energy	22.5	35.7	56.5	63.7
Livestock	35.3	44.8	34.3	44.1
Irrigation & Forestry	18.9	28.9	38.5	46.9
Wildlife	6.0	6.0	6.0	6.0
TOTAL	119.0	193.4	258.1	335.2

Consumer	Demand in m^3/year	
	1990	2020
Urban Centres	21 (17.7)	103 (30.7)
Major Village	8 (6.7)	52 (15.5)
Rural Settlements	7 (5.9)	20 (5.9)
Mining and Energy	23 (19.3)	64 (19.0)
Irrigation	19 (16.0)	47 (14.0)
Livestock	35 (29.4)	44 (13.1)
Wildlife	6 (5.0)	6 (1.8)
	---	----
	119	336
	---	----

Note: Figures in brackets are percentages.

(Botswana Government, 1997b)

Table 2 shows the projected water demands for the different sectors for the period 1990 to 2020, which was the planning period for the Botswana National Water Master Plan. The most significant feature of Table Two is that the demand for water (medium forecast) in the settlements of Botswana will increase very rapidly so that it will account for 36%, 46% and 52% of the total water demand in 2000, 2010 and 2020, respectively, as compared to 29% in 1990. This will mainly be as a result of the rapid increase in population and the changing patterns in water supply connections resulting from increasing incomes. The urban centers are projected to account for as high as 62% and 64% of the total settlement water demand in the years 2010 and 2020, respectively, and a high proportion of this demand will be concentrated in the southeastern part of the country, particularly around Gaborone and Lobatse.

3.7 Government Policies on Water Resources

The previous section of this chapter has shown that the future demand for water will be concentrated in the southeastern part of the country, where there is a rapid increase in human population and the industrial/commercial activities. In some of these areas, there are indications that the rate of groundwater resources exceeds its recharge. In addition, the pollution of groundwater is common in areas of high population concentration such as urban villages. This section will critically evaluate the existing Government policies on the water resources.

Policies on water resources can be generally categorized as supply or demand-orientated. The former aim at developing water resources in order to meet the projected demand, whereas the latter aim at reducing the demand for water. In this section the researcher shall examine the various policy measure adopted in the water sector.

(i) Supply Orientated Policies

In addition to the North-South Water Carrier Project discussed earlier in this dissertation, an attempt will be made by the Government during the period of the National Development Plan 8 to construct a number of small to medium scale dams for conjunctive use with groundwater in the rapidly growing rural villages, particularly in the southeastern part of the country (the hardveld) where suitable dam sites can be found (Government of Botswana 1997). In sandveld Ghanzi and Kgalagadi Districts, where there are no suitable dam sites, an attempt will be made to identify suitable acquifers from which groundwater could be obtained. Attempt will be made by the Government to monitor groundwater resources in order to ensure that their use does not exceed their sustainable yields. Water supply will also be enhanced by a number of measures such as recycling of water and desalination. Desalination technology will be used to improve the quality of water in the sandveld region where groundwater sources usually become saline.

(ii) Demand Orientated Policies

Water development management strategies may be economic and non-economic in nature. Economic measures include the use of various measures such as pricing policy and allocation of property rights over the use of water. Non-economic measures include population control, the use of regulations to control water demand, promotion of public awareness about the importance of water, reduction of reticulation and other losses of water production, and the use of water efficient appliances (Government of Botswana, 1991).

Economic measures have been used in Botswana in order to promote the allocative efficiency of the use of water. For instance pricing policy has been vigorously applied in urban area and to a smaller extent in urban and rural villages. The reduction of the demand for water by tariffs is mainly constrained by the low elasticity of demand and adverse effects of equity. The adverse effects on equity are partly taken account of by a concessionary tariff rate. However, there are a number of households in urban rural villages who can afford to pay for water but who still obtain this resource freely from standpipes.

The National Development Plan 8 (1997/98 – 2002/3) shows more commitment to the use of non-economic measures of water demand management than the previous plans. For instance, it suggests that the use of water tariffs to reduce water demand must be complemented by educational campaigns on water conservation and the use of water saving technologies (Botswana Government, 1997). These policy statements, however, originate from the National Water Master Plan. Most of the non-economic measures mentioned in this thesis have not been included in National Development Plan 8 as policy statements. In addition, population policy is hardly mentioned as a strategy for water demand management in the official documents even though it is a primary cause of the increase in the demand for water.

It is important, however to note that the private sector is to some extent involved in a few water conservation activities such as water re-use and recycling. For instance the Golf Club uses the effluent from the Gaborone sewage ponds for watering its grounds, thus saving clean water. The mines also save water by re-using it, and also by utilizing water-saving technologies.

3.8 Policy Recommendations and Conclusions

The experience of the past has shown that the emphasis of water policy in Botswana has been more supply-orientated rather than demand – orientated. The former has high investment costs, as well as adverse environmental and social costs. Most of the countries of southern Africa have no national policy on water demand management, and their emphasis on water policy is also supply-orientated. Some of the countries in the sub-region have a tendency to attempt to utilize shared water resources before they fully explore the potential of their national water resources. There is a need to increasingly adopt a water demand management strategy in Botswana, as the narrow supply orientated approach is not sustainable in economic, social and environmental terms.

Water demand management is mainly limited to pricing, and non-economic measures are not sufficiently applied. The use of tariffs as a water demand management strategy had achieved some degree of success, though it is constrained by the low demand. This is attributed to the fact that the bills of some of the households are paid by others, implying that such households have no incentive to decrease water consumption when the price is increased. In addition, households who obtain water from standpipes do not pay for it in rural areas, and in urban areas they only pay a flat rate, as there are no controls to estimate water consumption. It is important to note that the price of water in Botswana only reflects the cost of labor and capital and not the wider social opportunity costs.

The Government of Botswana should continue to develop water resources in the country, more especially by introducing schemes aimed at supplying water to areas of high population and industrial concentration. The development of surface water resources will also reduce dependence on groundwater resources, hence reducing the extent to which groundwater resources are mined in Botswana. The monitoring of groundwater by the Government should be vigorously pursued in order to ensure that their use does not exceed their sustainable yields. In addition to the monitoring of groundwater resources, attempts should also be made to increasingly monitor the level of pollution in boreholes. It is likely that the promotion of sealed pit latrines will be recommended as a policy measure thereby alleviating the environmental externalities associated with the use of traditional pit latrines. In the long run, however, centralised sewage systems are the only permanent solution to such a problem.

There is also a need to increasingly adopt water demand management strategies in Botswana in order to reduce the demand for water. Constraints associated with the use of pricing policy to reduce water demand such as lack of water meters should be addressed in order to promote water conservation. The urban tariffs also need to be reviewed to reflect the wider social costs, and should not be based narrowly on the costs of labor and capital. In addition to utilizing economic measures in reducing the demand for water, attempts should be made to utilize non-economic and conservation measures such as the use of regulations, public campaigns on water conservation, water re-use, rain water collection, introduction of water conservation technologies, and adoption of policies on population stabilization. The population policy of Botswana seeks to integrate population in the overall development planning, and this will no doubt promote water demand management, as population is the main driving force behind the

growth of water demand in Botswana. Lastly, it is also necessary to ensure that water demand management is an integral part of the overall development planning in Botswana.

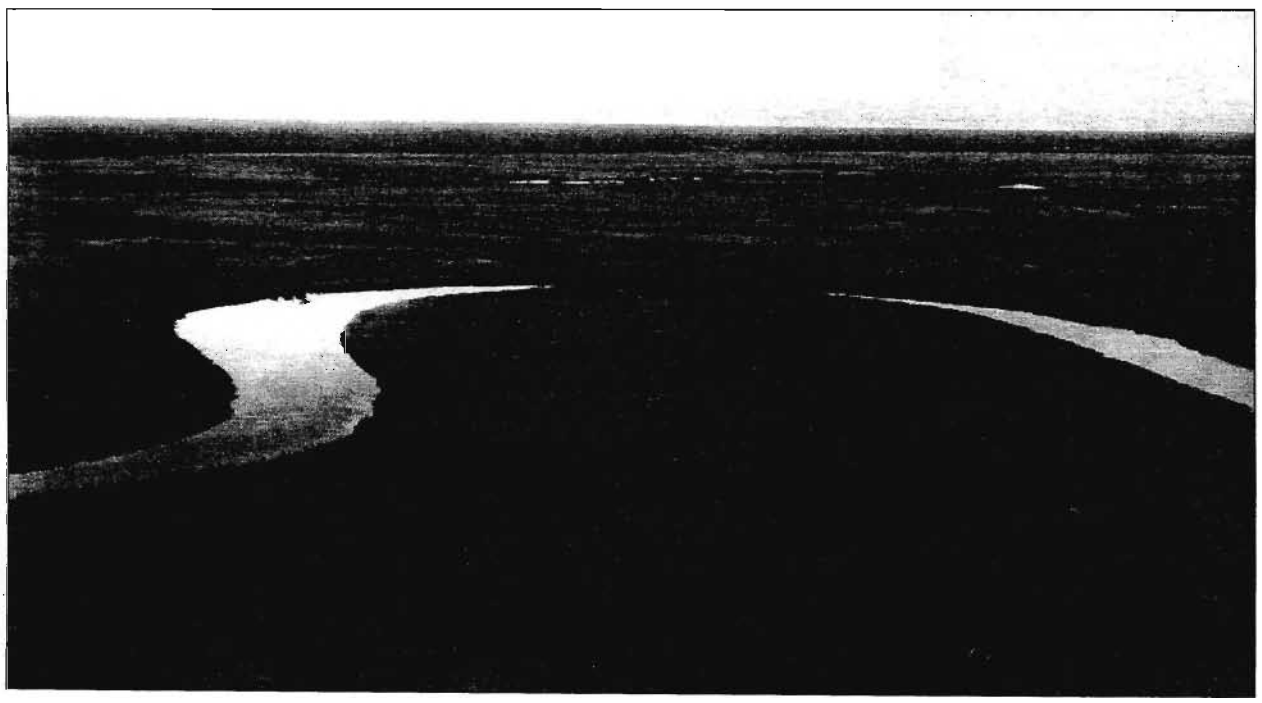
CHAPTER FOUR

It is easy to measure short-term gains that could result from water transfer. It is much more difficult to quantify the long-term losses that would result from the impairment or destruction of one of the world's greatest wildlife habitats.

(Dasmann, 1989; pp. 2)

4.1 THE OKAVANGO RIVER BASIN

During the course of this chapter the study area, the Okavango River Basin (Map One), will be described with special reference to the hydrology, environment (social and natural) and economy of the three basin countries. It must be noted that the researcher has had to limit this insight due to the fact that these issues alone could be the subject of a major project. The international character of the Okavango River (Photo One) and the inter-state and intra-sector competing demands for the water resources of the basin present a contentious situation, these geographic traits, however, also present opportunities for regional cooperation and win-win solutions in the management of a scarce resource. During the course of this chapter attention will be drawn to the 'political and technical pillars' which are essential in cross-boundary collaboration, and the implications of downplaying these negotiating requirements.



(Photo M.Chase, 2000)

Photo 1: The meandering Okavango River in Botswana (Shakawe).

Water spreading out over otherwise dry land is of interest to all people and an almost irresistible attraction to engineers and developers (Ross, 1987). All of Africa's great swamps from the Nile Sudd to the Okavango have received attention from those who want to do something different with the land or water. Wetlands are usually highly productive ecosystems. The productivity, however, is not expressed simply in some readily harvested crop, but in a myriad of ways (Dasmann, 1989). The species of plants and animals that partake of and contribute to this productivity may defy any easy analysis. Primitive peoples have learned to adapt, to live in harmony with, and thrive on this complexity of life (Roodt, 1998). The technicians of the modern world are less patient, less willing to understand diversity, to use what the natural world can of itself produce. Instead, where diversity occurs in rainforest or swampland we find efforts to simplify, to narrow the range, and force the system into directions determined by mankind (Dasmann, 1989). Thus swamps are drained; their waters channeled elsewhere, their life destroyed. Perhaps it did not matter when people were few and wild nature was in the ascendant (Botswana Society, 1982). This has occurred too often in too many places. Wilderness areas on a global scale are threatened, and such losses are less tolerable.

In Angola, Botswana and Namibia, water is scarce and precious. Its presence determines how well people survive; its absence leaves large areas uninhabitable. The three countries have one of the world's greatest rivers, where the abundance of water limits human occupancy. The contradiction brings temptation to change the pattern, to direct water elsewhere. Anderson (1998; pp. 13) sheds light on the senseless developments of such projects by proclaiming that "the antidote for short-sightedness is careful consideration both of environmental history and the need for sustainability in the future. The antidote for a non-integrated approach is consideration of the many facets of the ecosystem, including the fact that humans cannot control every aspect of it, since massive actions always have massive unintended effects, nor can humans exceed the limits of the ecosystem without catastrophic results for themselves".

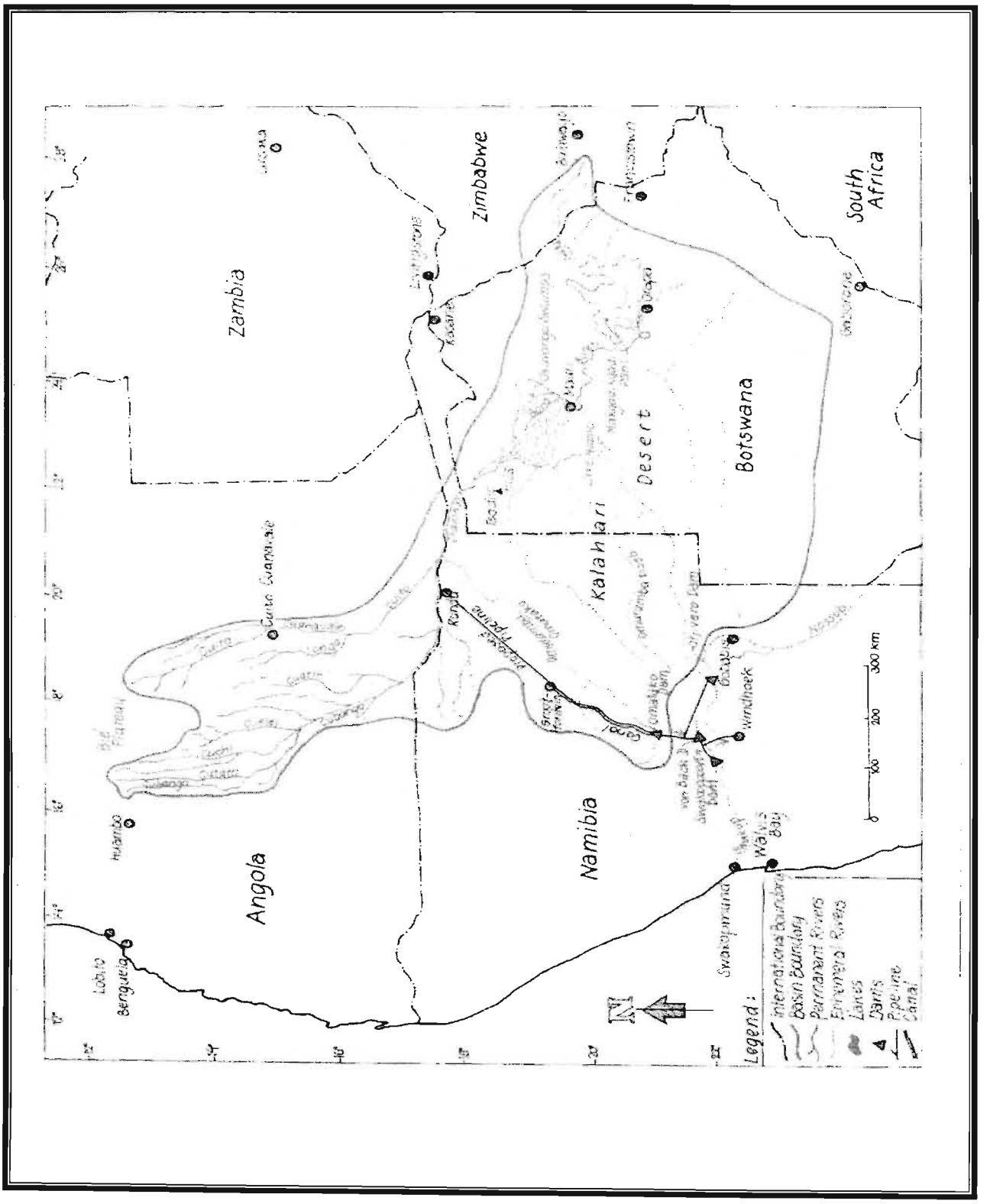
The Okavango River Basin (ORB) remains one of the least human impacted basins on the African continent. Mounting socio-economic pressures on the basin in the riparian countries, Angola, Botswana and Namibia, threaten to change its present character. It is anticipated that in the long term this may result in irretrievable environmental breakdown and consequent loss of domestic and global benefits. Maintaining these benefits requires agreement over the sharing of both the benefits and associated liabilities (to include those of an environmental and ecological nature) through joint management of the basin's water resources. The 1994 OKACOM

Agreement, 1995 SADC Protocol on Shared Watercourse Systems and the 1997 UN Convention on the law of the non-navigational uses of international watercourses provide a framework for such an agreement. Under the OKACOM Agreement, the riparian countries are working toward the implementation of an Integrated Management Plan (IMP) for the basin.

Table 2: Conventions ratified by Angola, Botswana and Namibia

Conventions/UN Resolutions/Regional Protocols	**Angola**	**Botswana**	**Namibia**
Bio-diversity	Ratified	Ratified	Ratified
Climate Change	Pending	Ratified	Ratified
Desertification	Ratified	Ratified	Ratified
Ozone Depletion	Pending	Ratified	Ratified
RAMSAR		Ratified	Ratified
UN General Assembly Resolution 51/229: Convention on the law of the non-navigational uses of international watercourses	Signed	Signed	Signed
SADC Protocol on Shared Watercourse Systems	Signed	Ratified	Ratified

Map 3: The Okavango River Basin



(Pallet, 1997)

4.2 General Context

The Okavango River Basin (ORB) is shared by three nations, Angola, Botswana, and Namibia. (A map of the basin is presented on page 56). The basin straddles sub-humid climatic zones in Angola through semi-arid to arid climatic zones in northern Namibia and Botswana where freshwater sources are scarce. The basin's source in the Angolan Province of Cuando Cubango is relatively undeveloped with few wholesale water demands made upon the watercourses of the source sub-basins, the Cubango and Cuito. As the main tributaries converge on and run along the border with northern Namibia, human development alongside the trunk water course intensifies. In Botswana, the Okavango River drains into the Kalahari desert as an alluvial fan, commonly known as the Okavango Delta which forms part of a large national wetland reserve. Periodic outflows from the apex of the fan to the Chobe channel linked to the Zambezi basin occur but the bulk of the flow drains to the distal margin of fan which is bounded by geological faults across which flood flows intermittently drain and flow into the Boteti River to evaporate in the Makgadikagadi basin (Arup Economic Consultants, 1991).

4.3 The Hydrological Context

The ORB has a topographic catchment of approximately 704,000 km^2 and a length from basin divide in Angola to the distal margin of its terminal fan of approximately 1,100 km. The economic and ecological vitality of the ORB and its associated wetlands depends upon the detailed character (timing, volumes, duration) and quality of the annual flow regime generated in the source catchments of Angola. Over the Angolan portion of the basin, from the mean annual rainfall of approximately 800 mm, only 58 mm appears as flow at Rundu (Cubango sub-basin) and 74mm at Dirico (Cuito sub-basin). At the head of the Delta, at Mohembo, the combined annual yield of both these sub-basins is reduced to 44 mm. By the time flow has traversed the Delta, despite the addition of a further 4-500 mm in direct rainfall over the area of the fan itself, outflows from the fan are negligible in most years. The bulk of the loss over the area of the Delta is through evaporation and evapotranspiration from surface and shallow groundwater. Potential rates of evaporation over the fan are in the order of 2,000 $mmyr^{-1}$. All transmission and evaporative losses along the course of the ORB are essentially non-negotiable if the basin is to retain its present hydrological and ecological character. In addition, the evaporation component of the hydrological cycle is a key element of the basin's micro-climate which supports specific aquatic habitats. As a low gradient hydrological "sink" in an arid quarter of southern Africa, the

fan is highly sensitive to variations in tectonic and climatic regime, but is equally sensitive to man-induced threats and there is now preliminary evidence that the hydro-environmental integrity of both the source and the sink of the ORB is under threat from such activities.

4.4 Environmental Context

Freshwater is the prime environmental and socio-economic resource and agent in the ORB directly supporting all human activity, vegetation and wildlife habitats and their associated productivity. Freshwater sources are also the natural resource component most at risk since there is no economic substitute for the basin's watercourses and associated aquifers while they are also the final repository of anthropogenic waste. The status of the sources and the characteristics of the freshwater balance in the basin as a whole is therefore key not only as a critical resource for development, but also as an irreplaceable global environmental asset. The Okavango Delta has been designated a RAMSAR site on the basis of its wetland values and also contains the globally important Moremi Protected Area. The flood and baseflow to the fan sustain a unique wetland environment which supports significant regionally and globally significant biodiversity with a large number of endangered and threatened species (Botswana Government, 1991).

4.5 Socio-economic Context

The pressures on the water resource base and associated environments of the ORB are driven by population growth and shifts in consumption patterns. While the population within the ORB is currently estimated at approximately 580,000 (250,000 in Angola, 140,000 in Botswana, and 190,000 in Namibia), the pent-up demands for raw water from population centres outside the basin in Namibia and Botswana are now significant. The intra-basin population comprises predominantly mixed agro-pastoral low income communities who are highly dependent upon the freshwater resources of the basin for their basic subsistence and income generation. By contrast, the extra-basin population creating pressure for inter-basin transfer is largely urban with associated industrial demands. The productivity associated with freshwater use and its related aquatic ecosystems is estimated at approximately 25% of GDP in the basin as a whole although there is considerable inter-country variability. In Angola, civil war has resulted in a decline of population, commerce, and trade, so that current use of the basin's water resources are limited to water supplies to small regional centres and some small scale floodplain irrigation. In contrast, Botswana's mineral led growth is putting pressure on its vital freshwater resource base as urban centres on the fringe of the Delta expand. There is also significant demand for amenity use of

the Delta largely from international tourists. Namibia is attempting to manage demand for water but is also facing unprecedented levels of demand for municipal and industrial water, particularly in its central area which lies outside the topographic and hydrologically active system boundaries of the ORB. The ORB is the only perennial river system that lies within Namibia and is therefore the first candidate in Namibia's search for new water. These disparate levels of dependence upon the basin's natural resource base in each country create barriers to harmonised development of the basin as a whole. In addition there is concern in both Botswana and Namibia that current national patterns of development are not sustainable (Comrie, 1987).

4.6 Policy Context

Recognising the significant regional and global values of the Okavango River Basin, the Governments of Angola, Botswana and Namibia convened the first meeting of the riparian States in Windhoek in 1993. The Permanent Okavango River Basin Commission (OKACOM) was subsequently established in September 1994. The countries are committed to the negotiation of all transboundary water issues through OKACOM where they place high level inter-ministerial representation to advise on all technical and policy issues to do with the water resources of the basin. The countries have made it clear that they intend to continue this reliance on OKACOM to address technical and policy issues regarding water resources in the basin. Under the Helsinki Rules (Article XXIX) invoked in the 1994 OKACOM Agreement, riparian countries are required to give prior notification of planned and unplanned measures affecting the ORB. Thus, at regional level, the 1994 OKACOM Agreement, the 1995 SADC Protocol on Shared Watercourse Systems and the 1997 UN Convention on the law of the non-navigational uses of international watercourses provide a framework for national policy initiatives to converge on an agreed programme of joint management (United Nations, 1983).

Commissioners of OKACOM are appointed by the respective cabinet offices and the Commission reports at cabinet level in all three countries through the respective Ministers. In Angola this is the Ministério da Energia e Águas , in Botswana the Minister of Mineral Resources and Water Affairs and in Namibia, the Minister of Agriculture, Water and Rural Development. Meetings are held in rotation at national capitals and the Departments of Water Affairs in Botswana and Namibia and GABHIC (The Cunene River Basin Authority) in Angola service the secretariat function within OKACOM. Prior to the establishment of OKACOM, Botswana had been supporting research in ORB system in collaboration with donors and had cancelled a major water development project for the southern margin of the Delta on the basis of

an independent IUCN review in 1992. Namibia had included the option of abstraction from the Okavango in its Central Area Water Master Plan published in 1995 (Heyns, 1995).

The national development policies of all three countries are centred on maintaining or increasing rates of growth while also addressing poverty alleviation and sustainable livelihoods. Freshwater resources are critical to pursue these national interests. The relevant national policies in Angola are associated primarily with the development priorities in Cuando Cubango Province as peace becomes re-established and with the commitment to co-ordinate basin level activities through GABHIC, under the Deputy Minister for Water. The relevant national policies in Botswana are linked very much to wildlife and nature conservation in the Delta where the Government is promoting eco-tourism and wildlife management. Botswana is also in the process of developing a Wetlands Policy and Strategy which will facilitate proper utilisation and management of resources in the Okavango Delta and other wetlands in the country. At the same time, Botswana is developing groundwater on the margins of the fan to serve urban expansion and mining activities. Caught between these two riparians, Namibia's policies are conditioned by an imperative to increase water supply for the central area of the country and an active policy of devolution of natural resource planning and management to the regions. These policy directions need to be co-ordinated if the ORB resources are to be managed in a sustainable fashion.

4.7 Institutional Context

The countries are committed, through their presence in OKACOM, to involve the appropriate ministries and government and non-governmental organisations (NGOs) necessary for the completion of a TDA and the formulation and implementation of a SAP. There are several dozen NGOs in the basin that are active in monitoring & research, policy, habitat conservation, institutional strengthening, public awareness and education programmes dealing with critical environmental problems in the ORB. This commitment to stakeholder participation will also strengthen the engagement of key ministries with the process and thus help ensure country commitment to implementation. Despite the urgent need to co-ordinate at regional level, national co-ordination between lead agencies involved in water and environment needs to be strengthened and for a clearer separation of policy and operational (user) functions to emerge. In Angola, the Direcção Naçional de Águas (DNA) of the Ministry of Energy and Water and Ministries of Environment and Planning play strong roles at the national and international levels for all Angola's shared river basins through the Authority of the Cunene River Basin

(GABHIC). In Botswana, the Department of Water Affairs under the Ministry of Minerals, Energy and Water Affairs is the lead agency in water resources and provides support to the National Conservation Strategy (Coordinating) Agency in the implementation of the National Conservation Strategy (Kalapula, 1989). In Namibia, the key institutions are the Department of Water Affairs under the Ministry of Agriculture, Water and Rural Development and the Environmental Directorate in the Ministry of Environment and Tourism. This institutional setting at national level is reflected in OKACOM where cross-sectoral co-ordination and cross-disciplinary collaboration is not yet effective. While OKACOM has the mandate to convene all relevant agencies and institutions, in practice this has been difficult to effect since governments' professional resources are severely stretched. Effective consultation and co-ordination at national and regional level is therefore an essential pre-condition for the successful formulation and implementation of an integrated management plan (Heyns, 1995).

OKACOM is thus the key inter-governmental institution in co-ordinating integrated approaches to the development and protection of the basin. Accordingly, the mandates, functions, commitments and resources invested within OKACOM need to be reviewed during formulation of any programme of joint management to assure countries that it will be able to discharge its role effectively during subsequent implementation (Krook,1994).

4.8 Threats to the ORB

(i) Environmental Threats

The chief threats to the ORB arise from patterns of development that cannot be effectively co-ordinated. It is apparent from the draft TDA findings that the natural resources of the basin are already subject to demands for water and land from agriculture, urban and industrial development both within and outside the basin. The externalities generated by these demands are already resulting in modified quantity, quality and sediment flows. There are also minimum requirements for the basin to be met if it is to continue to furnish its flow of environmental benefits and maintain a critical stock of freshwater assets. However, the national institutional and policy responses to date has been one of supply management. In financial, economic and environmental terms this approach is not sustainable. Regional demands for raw water have to be managed in a co-ordinated fashion and an integrated joint management plan with a comprehensive approach to demand management is therefore essential. If these threats are not addressed through such management, irreversible changes in the basin's water balance, and

hydrochemical and hydrogeomorphological responses are anticipated. Such changes will impact the productivity and environmental integrity of the basin as a whole (Fradkin, 1981).

The proximate cause of environmental degradation is three fold; continuation of unplanned abstraction from watercourses and aquifers; growth of effluent disposal and non-point pollution sources; and the accelerated erosion of land hydro-geomorphologically linked to the basin. But the root causes lie with patterns of socio-economic development – population growth, urbanisation and industrialisation. Key factors in these trends are; over-grazing which is already resulting in accelerated land and soil degradation in Namibia and Botswana; unplanned development in Angola along de-mined transport corridors in the Cubango and Cuito sub-basins as post civil-war re-settlement occurs; and pressure for new and increased abstraction of raw water to service urban expansion and irrigated agriculture. It is anticipated that these factors will continue to accelerate new demand for raw surface and groundwater in the basin, and its immediate region, and accelerate the process of land use conversion for subsistence agriculture. But it is equally apparent that the trends are outpacing policy and institutional response in the riparian countries and it is to address these intermediate causes where co-ordination is necessary and where improved understanding can drive the required policy shifts (Gleick, 1993).

Angola: Since independence in 1975, there has been no appreciable inward investment to the basin. A proposed regional re-habilitation programme for Cuando Cubango Province formulated in 1995 will supply a considerable amount of infrastructure related to water supply, sanitation, agriculture and transport. However, under present circumstances these activities cannot be verified. In 1997 World Bank has proposed an Agricultural Sector Investment Programme part of which may be expected to assist smallholder and commercial farmers in the Province. The World Bank is also preparing a national Water Sector Development Project which is be expected to channel resources for water supply and sanitation to major provincial capitals, Cabinda, Lubango, Lobito-Benguela, Luanda and Namibe. None of them is in Cuando-Cubango province. A separate World Bank technical assistance project is under preparation which will encompass national programme of water policy institutional development and transboundary water resources. A pilot river basin management component on the Cunene basin, adjacent to the ORB is also being considered. This work will complement Norwegian Government assistance to national hydrometric services and water resource assessment for other priority basins, but not including the Cubango or Cuito sub-basins.

Botswana: The Government of Botswana is committed to the implementation of their 8th National Development Plan for the period 1997/8-2002/03. In this period, the Plan anticipates various capital development projects and studies, elements of which are related to water management in the vicinity of the Okavango Delta. These national plans include; Major Village Water/Sanitation Development; Groundwater Studies and Protection; Hydrological Support including updating of the Okavango Forecasting Model; and International Water Planning and Development (Gould,1994).

Namibia: Under its First National Development Plan (NDP1) for the period 1995/6-1999/2000, the Government of Namibia's support to the Okavango region and Caprivi Strip focuses on health and education sectors with a programme of rural water supply and sanitation supported by GTZ. Additional community development activities are carried out by Namibian and international NGOs. A World Bank/GTZ/UNDP Water Resource Management Review (NWRMR) was launched in early 1998 with total resources of US$ 1,100,000. Elements of this exercise will be directly related to transboundary water issues, including the Okavango. Despite this, the Government of Namibia has made provision for feasibility studies for the construction of an emergency pipeline from Grootfontein to the Okavango at Rundu. The preliminary feasibility work carried out in 1997 amounted to approximately US$ 1,500,000 (Ohlsson,1995).

(ii) Hydrological analysis

Current detailed hydrological, hydrogeological and hydrochemical information for the ORB is fragmented and, in the case of Angola, entirely absent. The basin has no regulatory or control structures at which flows can be determined accurately. Validation and verification of resource development options (both in terms of quantity and quality) is therefore dependant upon high quality continuous stage/discharge information at key natural channel reaches in the basin, particularly in relation to the relative contribution of the Cubango and Cuito sub-basins and their associated catchments in Angola. At present, the water resource records from Angola are limited to variable sets of level readings and gaugings for the period 1963/4 to 1969/70 in the Cubango and Cuito sub-basins, principally in the upper catchments. There is no systematic measure of the relative yields of the sub-basins before they cross the Namibian border. The former gauging locations in Angola are known to have been selected on the basis of ease of access, not reach stability so that their stage/discharge relationships are suspect. The only permanent cable-way from which an accurate stage/discharge relationships has been determined is at Mukwe in Namibia. The gauged flows at Mukwe are routinely compared with the level readings at an

unsuitable section at Mohembo in Botswana to establish an agreed inflow to the 'panhandle' in Botswana. The hydrometric network described above is not sufficient to determine and monitor the amount of water, its quality, timing and availability throughout the system that is needed to sustain the various consumptive and non-consumptive uses for water, and for the Okavango Delta in particular, nor does it provide a system to verify compliance with a basin-wide joint management plan. The riparian countries have no specific national plans for the improvement of hydrometric monitoring on the ORB (Pallet, 1997).

(iii) Information availability

Government departmental libraries, national research institutes, and universities all maintain indexed hardcopies of relevant reports and maps and some digital data, but in a variety of formats. Access to these sources in the ORB region is therefore limited. Hydrological and hydrogeological information for the Angolan portion of the basin was taken out of the country at Independence in 1975 and is believed to reside in Lisbon, Portugal. Since 1975 there has been no additional hydrometric data gathered for the Cuito and Cubango sub-basins. Equally, much original research on the Okavango Delta resides with research groups, institutions and at universities ouside the basin. Much of the collected data and subsequent analysis is either sector based, academic or focused on the Delta.

Consequences. The national policy focus and institutional arrangements are not sufficiently co-ordinated at national or regional level to address threats to the basin's freshwater resources. The consequences are two-fold. First, the primacy of national interests is resulting in the imposition of transboundary externalities; these include: quality and quantity losses of water supplies for urban centres in the basin (Rundu, Maun); reduced supplies for irrigated agriculture (Caprivi and fringes of the Delta); degraded stock watering (Caprivi, Ngamiland); reduced supplies for mining (Orapa); loss of biodiversity; and compromised nature tourism (Caprivi, Panhandle, Delta,). Second, the costs of co-operation are high where barriers to communication and understanding persist.

Required actions. Barriers to transboundary management and the achievement of global benefits are manifest under the baseline. To overcome these barriers, understanding of environmental issues, consultation and commitment to alternative course for sustainable development needs to be addressed. The principal barriers and constraints include:

- Policy, Institutions and Co-ordination - there is no basin-wide policy perspective. The current policy focus on national issues will not result in the sustainable development of basin and OKACOM lacks expertise and the capacity to co-ordinate effectively. OKACOM therefore needs to be in a position to establish this perspective and drive a programme of joint management with the appropriate political and financial support.
- Awareness, Consultation and Communication – there is a lack of cross sectoral and stakeholder consultation and communication which is inhibiting participation, commitment, and investor buy-in. To address this issue, national and regional consultative fora need to be scaled up, particularly during the intensive planning stages.
- Information and Analysis – there is a fundamental lack of understanding of the threats and opportunities of the hydro-environmental and socio-economic systems of the basin as a whole. This is particularly the case for the Angolan portion of the basin. Alternatives cannot be evaluated and transboundary economic assessments made. Knowledge based planning frameworks (with distributed modelling and scenario development capabilities) need to be assembled and multi-objective decisions made.
- Criteria, Guidelines – There exist no basin-wide technical criteria or guidelines for resource assessment and valuation to inform allocation decisions. This gap needs to be filled through basin wide hydro-environmental and socio-economic analyses.
- Indicators, Monitoring and Evaluation – there is no basin-wide system of hydro-environmental and socio-economic monitoring procedures that can be used to evaluate the impact of the joint management plan. Key indicators and benchmark monitoring arrangements need to be agreed.
- Training – All levels of technical and professional level staff in water, environmental and community development agencies will require training in specific aspects of SAP implementation.
- Political agreement on and commitment to SAP implementation – the role of OKACOM in brokering political agreement and commitment needs to be strengthened through the inter-ministerial and cross-sectoral advisory mandate that it possesses. Here the role OKACOM can play in convening the technical dialogue between ministries, sectors and disciplines in all three countries will be pivotal.
- Sustainable Financing – The generation of financial resource flows for implementation of the management plan has not been addressed. Specialist training in investment analysis and

resource mobilisation is required to service stakeholder participation and donor consultations.

4.9 The Okavango Delta

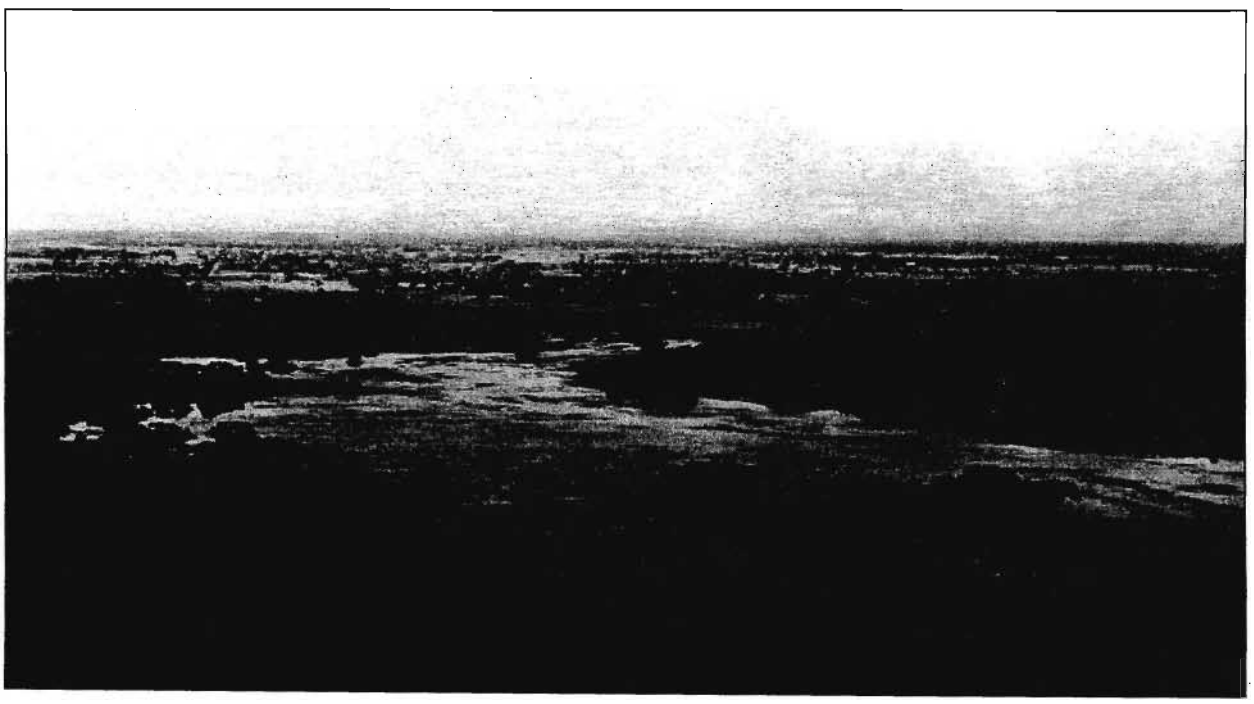
The Okavango Delta (Photo Two), in the midst of the Kalahari sands, is Africa's largest and most beautiful oasis. The Okavango River originates in the Benguela plateau in Angola. The two major tributaries of the Okavango River, the Cubango and Cuito/Cuanavale, flow south for some 700 and 750km respectively, before the Cubango enters and drains through the Namibian Caprivi Strip into the northern part of land-locked Botswana, which plays host to large parts of the Kalahari desert (Roodt, 1998). In Botswana, the Okavango's waters never reach the sea and turn what would otherwise be an extension of the Kalahari into one of the worlds largest inland wetlands, long prized as Africa's greatest natural paradise (Ross, 1987). Having taken six months to reach Botswana, the floodwaters reach their peak in July. The slow movement of water in the Okavango Delta, together with a low sediment load, results in the water being crystal clear (Botswana Society, 1979).

(Photo M. Chase, 2000)

Photo 2: The Okavango Delta

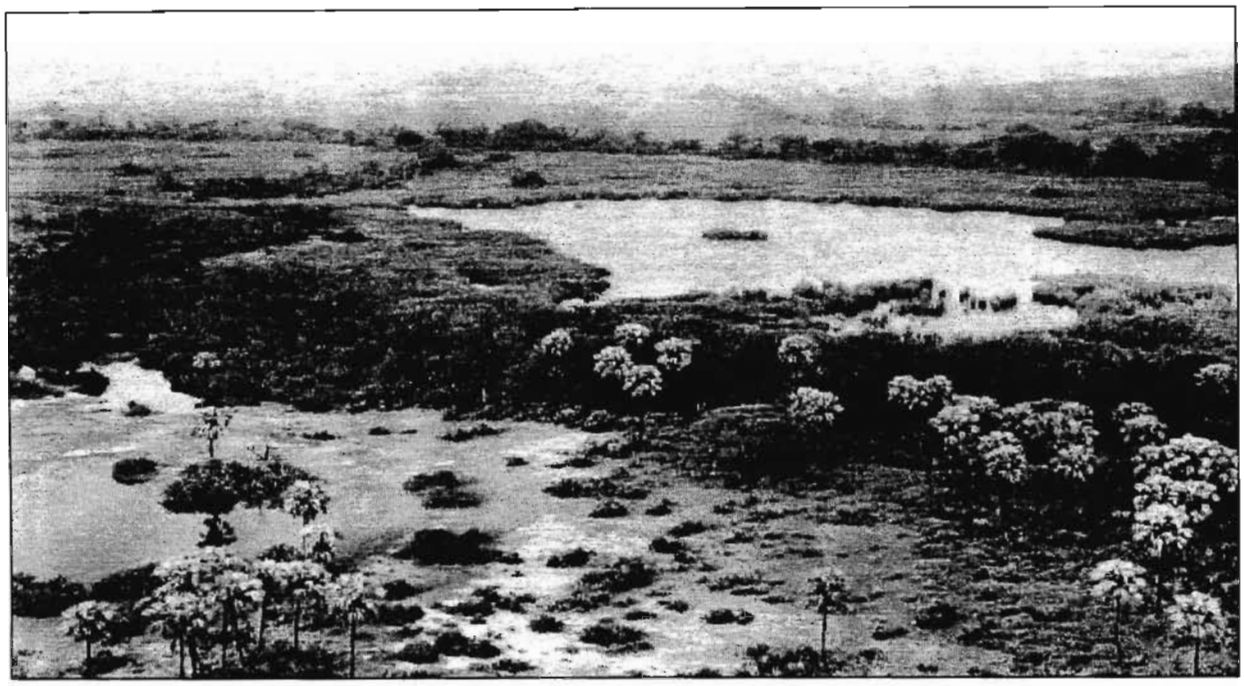
(Photo M. Chase, 2000)

Photo 3: Aerial view of a portion of the permanently inundated swamp within the Okavango delta.



(Photo M. Chase, 2000)

Photo 4: Aerial view of a portion of the permanently inundated swamp in the Okavango Delta, showing typical pools and lagoons.



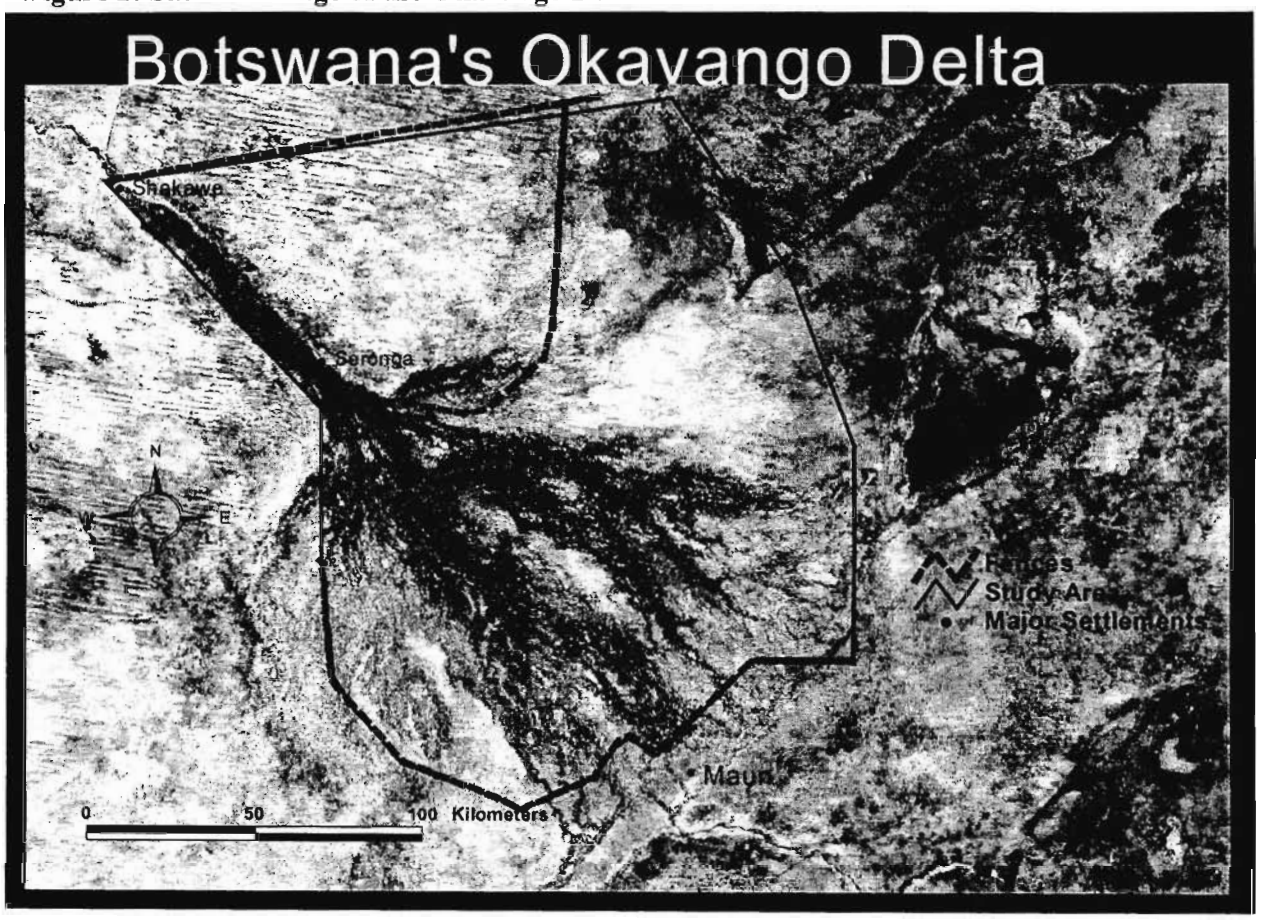
(Photo M. Chase, 2000)

Photo 5: Aerial view of the interface between seasonal and permanent swamp in the Okavango delta, showing typical island formations.

A robust and resilient ecosystem, the Okavango Delta is home to over 140 000 people, who depend on it for their livelihood. "A desert mirage come true, in a parched land it is a miracle of water and life – a 10 000 square – kilometre network of shimmering channels, reed beds, hippo pools, and flood plains. It is home to thousands of plant species, 540 species of birds, 164 of mammals, 157 of reptiles, 80 fish, 5000 insects, and countless microorganisms" (Alhiet, 1997; pp.; 67). But the Okavango is so much more than 'just another' repository of priceless biodiversity fighting for an audience on the sadly over-crowded stage of threatened world ecosystems (Ross, 1998). It seems to meet all contemporary criteria to justify its existence: It has a proven ability to pay its way (the Delta supports a valuable tourist industry which in turn provides employment as well as an all important foreign exchange) and, in addition, the panhandle and adjacent flood plains are traditional homes of people whose very livelihood depends on the bounty of the swamp and its environs.

Three southern African countries, Angola, Namibia and Botswana, with diverse histories and different future needs share a common water resource, economically important to all. The potential for conflict is real. New ways of peaceful cooperation around a common goal are called for. The following section identifies the three countries requirements for water extraction from the Okavango River.

Figure 2: Satellite Image of the Okavango Delta – Botswana



(Adapted by Chase, 2000 from Land Sat Image)

CHAPTER FIVE

5.1 RIPARIAN COUNTRIES DEVELOPMENT PLANS FOR THE OKAVANGO

5.2 Angola: Damming at the Source

"Angola is a battle-scarred land, where major powers pushed their ideologies, regional powers honed their fighting skills and more than a million lives were lost in a thirty year war" (Alheit, 1997; pp. 56). Now clinging to a tenuous peace, a window of opportunity is opening, to go in search of the source of water. The Okavango River has been targeted as this window of opportunity, a river that crosses an arid land to the south, thirsty for its water. The Okavango, an unexplored river and the focal point of a new conflict in southern Africa; the fight for water.

Angola, like most African countries approached independence with an uneven and weak infrastructure. Set off against two strong regionally segmented elite sets and combined with prospects of substantial government revenues in oil and diamonds, this proved to be a recipe for conflict, exacerbated by a series of foreign interests (Alhiet, 1997). The ideological concerns of the United States of America, Portugal's economic interest, France's search for oil, South Africa's destabilisation techniques, the USSR's socialist expansion and Cuba's promotion of world revolution all led to interventions which soon escalated from the political and diplomatic to the military (GOB, 1996b).

The result of thirty years of war is total devastation. Rough reconstruction cost estimates range between 25 and 40 000 million dollars. In human cost, apart from some 1 million deaths, current estimates place only 4 million of the country's 10 million people above the absolute poverty line (Ross, 1987). Given lasting peace, the massive reconstruction task at hand in Angola will be facilitated by the fact that its petroleum sector is still in good condition, with about 1000 million dollars in present oil revenues divertable from war import bills (Ibid). Most of the basic dam structures, but not the transmission systems, are still structurally sound. "While the case for moral economy – that no nation can be great and prosperous if a majority of its peoples are poor – is relevant, it is also currently out of fashion, with large scale safety nets having a high profile in world bank work" (Alhiet, 1997; pp. 11). It is likely that Angola will first concentrate on increasing export revenue, then build Gross Domestic Product and therefore develop the rural sector.

The petroleum sector is the main focus of potential revenue but it is known that Angola also seeks to become an exporter of hydroelectricity through joining a regional grid. The main export units for this regional grid are at Stieglers Gorge (Tanzania), Kariba (Zambia), Cabhora Bassa (Mozambique), Kunene (Namibia) and the Angolan Plateau – the source of the Okavango. According to the Namibian Department of Water Affairs, "not much is known about the Angolan water requirements and there are no identified positions for dams in that country, is cause for concern" (Alhiet, 1997; pp. 34).

5.3 Namibia: The Proposed Eastern National Water Carrier

While Angola's reconstruction task will, in all probability, be focused on grand scale foreign earning, Namibia's development goals (apart from it's quest for economic infrustructural independence) are likely to lean towards the 'moral economy' aimed at a more equitable distribution of such wealth (Alheit, 1997). In terms of rural community this can be achieved in two ways. Their government may 'take over' some commercially successful farming land and assist subsistence farmers through resettling, or marginal farming land may be enhanced with artificial water supply. To this effect the development of a massive water transfer scheme from the Okavango River is required.

Namibia is sub-Saharan Africa's driest country, with approximately 80 percent of its 842,000 square kilometres consisting of desert, arid and semi-arid land. Rainfall averages roughly 320mm/yr, but ranges from less than 50mm to more than 700mm a year. What meagre precipitation that does fall is most often quickly evaporated; it is estimated that only 1 percent of annual rainfall recharges groundwater and only 2 percent runs off and becomes available for storage in dams (DWA, 1991). Droughts are a common occurrence, and not surprisingly, water is considered the most significant constraint to development.

In an average year, water supplies can meet demand comfortably, but as the years of drought that ended in 1997 showed, precipitation can fall far short of average. By the beginning of the 1996-97 rainy season, the Central Area's water supply situation was precarious: dams stood at or below 25 percent capacity; the City of Windhoek had increased water tariffs and instituted water rationing; and aquifers were being pumped at rates beyond sustainable levels. Absent significant rainfall in the 1996-97 season, Windhoek would have run out of water in less than two years (Heyns, *pers. comm*).

Such was the climate in June 1996, when the Namibian government announced they would accelerate the 1973 plan to divert water from the Okavango River to Windhoek and the rest of the Central Area. At that time, the Okavango River appeared to be the only potential water source that could meet Namibia's emergency water supply criteria: a capacity of at least 18 Mm^3/yr to meet the Central Area's needs; construction time of 18 months or less; and the least cost option.

The Eastern National Water Carrier (ENWC) was conceived in 1973 after a study had been conducted to determine water scarcity in the central area of Namibia and possible alleviation of the problem. The unanticipated growth of the central areas of Namibia has delayed the completion of the project, originally scheduled for 1992.

After some 25 years have elapsed, a full re-evaluation of the project was done between 1991 and 1993. The results of the study showed that the need to complete the final link to Rundu on the Okavango river would only be required by the year 2003, or even as late as the year 2008, depending on the future development scenario within the central area of Namibia (Bonyongo, 1997). Excellent results have been achieved with water conservation measures and water demand management in the central area of Namibia since 1980 (Heyns, 1995). In spite of the fact that the population in the city of Windhoek grew from 120 000 to nearly 200 000 since Namibia gained independence in 1989, the water demand remained fairly constant at 1990 levels, at about 17 million cubic meters per annum (Bonyongo, 1997).

The 95 per cent safe yield of the existing water resources already developed in the central area of Namibia is about $25Mm^3$ /a which can satisfy the national demand. The persistent drought of 1991 / 1992 resulted in virtually no surface runoff in the state dams supplying the central areas of Namibia. (Ibid). The situation despite water conservation measures has now reached critical proportions and the Department of Water Affairs in the Ministry of Agriculture, Water and Rural Development was instructed to embark upon a detailed feasibility study and the design of the Rundu – Grootfontein Pipeline in anticipation of a possible failure of the 1996 / 1997 rainy season (Legget, *pers. comm*). Forecasters were expecting searing droughts only to experience good rains. If El Nino theorists were accurate, immediate steps would have had to be taken to construct the pipeline on an emergency basis.

Hydrologists and engineers employed by South West Africa's Department of Water Affairs came up with part of the answer in the form of the Eastern National Water Carrier. This is the name applied to a grand scheme to transport water by canal and pipeline from the Okavango River on the north-eastern border of the country, overland past Grootfontein to storage dams north of Windhoek. Described as a "bold engineering concept" the scheme has caused some concern, not just to environmentalists who are automatically (and justifiably) suspicious whenever a "bold engineering concept" rears its ugly head, but also to officials of Namibia's eastern neighbour, Botswana (Comrie, 1987). The latter are only too aware that 95 per cent of their country's surface water resources come to Botswana from Angola via the Okavango River and they are sensitive to Namibia's plans to divert some of this water before it reaches Botswana's borders.

Rumours concerning the ENWC were rife and, like most, were negative. Sources in Botswana indicated that the ENWC would cause the Okavango delta to dry up either completely or temporarily, depending upon the degree of cynicism from various interviewees; at any rate, it is maintained that the character of this wildlife paradise will be altered forever. The canalised section of the ENWC has been dubbed the "killer canal" by Windhoek journalists because of the numerous wild creatures which have tumbled into it and died. What are the facts? Is the ENWC an environmental disaster in the making? Before the researcher looks at the project from an environmental point of view, however, one must first examine the details of this bold engineering concept.

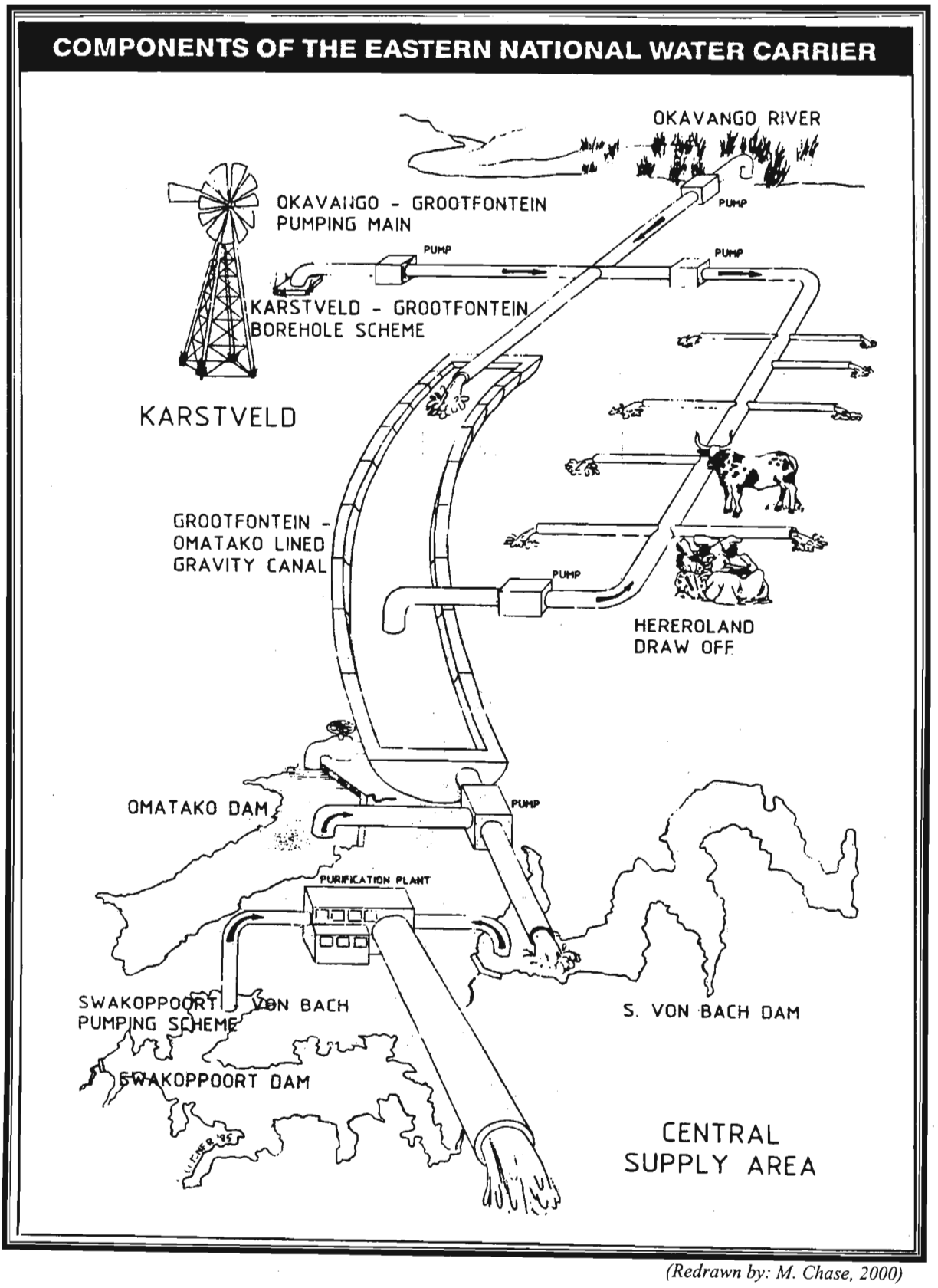
The ENWC scheme is a four-phase project, which will ultimately transport water from the Okavango River southwestwards to Windhoek, a distance of 750 kilometers (Map Four, page 74). The first phase of the project, consisting of the Von Bach and Swartkoppoort River north of Windhoek and a purification plant at Von Bach was completed in 1978. The water is transported to Windhoek by pipeline.

The second phase of the project was completed in 1983. It consists of the Omatako Dam north of the Von Bach Dam and a pumping scheme to carry its water to the Von Bach Dam. The Omatako Dam and pumping scheme received the regional award for Namibia from the South African Institution of Civil Engineers for excellence in civil engineering in 1983; the pumping scheme itself received the 1985 Projects and Systems Award of the South African Institute of Mechanical Engineers (Comrie-Grieg, 1987).

Phase three of the ENWC was completed in 1987. It carries the project still further north towards Grootfontein, some 300 kilometers from the Omatako Dam. This area known as the "Karstfeld" is noted for its extensive dolomitic limestone formations, which have substantial reserves of groundwater. "Investigations have indicated that a surplus yield of at least 20 million cubic meters per annum can safely be abstracted in this area without disrupting stockfarming activities" (Ravenscroft, pp. 26; 1985). Seventy boreholes were sunk in the aquifer and electric pumps abstracted the water for transfer through pipes to the Grootfontein / Omatako Canal. This 263 kilometer long system runs from the Grootfontein boreholes south-westwards to the Omatako Dam. Sixty kilometers of its length is an underground pipeline, with 203 kilometers being completely open parabolic-shaped concrete canal (Leggett, 1998).

The fourth and final phase of the ENWC scheme is the link between the Okavango River and the Grootfontein / Omatako canal. Water will be pumped out of the river near Rundu and transported by pipeline for 250 kilometers to the canal at Grootfontein. The quantity of water to be pumped from the river varies between sources but is expected to be in the order of two to three cubic meters per second (3000 l/s). (Refer to Map 4, page 74, illustrating the various phases of the ENWC).

Map 4: Various Components of Namibia's Eastern National Water Carrier



(Redrawn by: M. Chase, 2000)

At a public meeting held in Namibia on 9 September 1996 it was stressed that if the drought continued, a decision to build the pipeline (phase four) would be made in February 1997, as it would take a year to construct the 250 kilometer long pipeline (Bonyongo, 1997). Feasibility studies regarding the social and environmental impact would have to be carried out before that date. During the meeting those present were informed that due to the urgency of the matter impact studies would not assess downstream impact on the Botswana section of the Okavango River System – the Okavango Delta and Boteti River (Leggett, 1998).

(i) Window Before Next Water Shortage

Fortunately, the rains of early 1997 replenished many surface supplies and recharged aquifers, providing a respite for Namibia and diffusing the growing tension surrounding the project's potential downstream impacts on the Okavango Delta. Although the 1997 rains averted a serious crisis, the episode illustrated Namibia's vulnerability to drought and highlighted the need for significant planning and action before the next shortage.

(ii) Next Time, Pipeline Not Best Option

By the time the next water supply crisis could possibly occur, the Central Area's ability to meet its normal water needs and weather a drought will be significantly enhanced. Indeed, a combination of smaller measures, some of which are already near completion, could obviate the need to even consider constructing the costly pipeline to the Okavango River. At least two new sources will be added to the system by the end of 1999, including a sustainable yield of 2 Mm^3/yr from the Berg Aukas Mine and 1.5 Mm^3/yr from the expanded Windhoek reclamation system. Recent data from pumping tests of undeveloped groundwater sites look promising, and new tests of other potential sources are planned. Water demand management measures show potential for limiting growth in water use, thereby delaying the need for expanding the supply system and/or stretching existing supplies further (van der Merwe, 1998). Finally, initial tests of artificially recharging known aquifers to minimise evaporation losses from dams could yield an additional 10 Mm^3/yr (van der Merwe, *pers.comm.*).

If Namibia faces another drought in the near future, the Okavango pipeline (sometimes called the Rundu-Grootfontein pipeline) likely would not represent the only, or even best, alternative for the Central Area's emergency supply. Incremental development of new groundwater sources, implementing demand management and artificial recharge could meet growing demand

and enable the Central Area to weather another severe drought. Developing these three sources offers significant benefits to Namibia over the Okavango pipeline option. New supplies would become available as each stage of development was completed, as opposed to having to wait at least 18 months before the entire Okavango River pipeline is completed before water is delivered. The total capital cost would be significantly less than the pipeline, and funding could be phased with the developments, thereby reducing the challenges of financing. In addition, delaying the construction of the Okavango pipeline would provide sufficient time to adequately understand and address the pipeline's potential impacts on the delta.

Water Planning and Development in Namibia

Namibia does not have a contemporary national water master plan (Becker, 1998). Water resources development in Namibia has been based on the 1973 Water Master Plan, which generally directed development efforts first toward Namibia's ephemeral rivers, then to its groundwater resources and finally to border perennial rivers. All three phases have to some extent progressed simultaneously, but the general approach was followed (P. Heyns, *pers. comm*). Instead of revising the 1973 Plan, Namibia has, until recently, adopted the approach of developing more detailed water plans on a regional basis. Recognising the need to update the country's national water planning, however, the Namibian government committed to developing a new comprehensive water plan as part of National Development Plan 1 (Rothert, *pers. comm.*)

(i) The Central Area's Water Demand

Until a successful water demand management program was initiated in the mid 1990s, water consumption had grown rapidly over the past three decades, increasing almost 300 percent between 1970 and 1995 (Ashley *et al.*, 1995). By 1996, demand in the Central Area exceeded 41 Mm^3/yr, and countrywide demand reached 280 Mm^3/yr, and (Table 3). Windhoek is the largest water consumer in the Central Area, using almost 17 Mm^3/yr. The Central Area's second largest consumer category is agriculture (livestock and irrigation), at 8.3 Mm^3/yr, followed by the mining sector which consumed approximately 6.3 Mm^3/yr in 1996 (Lange, 1997). If demand grows at the expected rate of 2.5 percent per annum, by 2012 demand will reach 60 Mm^3 per year in the Central Area and 423 Mm^3 countrywide (Becker, 1998). By 2020, country wide

demand could exceed 500 Mm^3 per year, the estimated total sustainable yield of domestic[1] surface and groundwater resources.

Table 3. Water demand in the Central Area and Countrywide

Water Demand Mm3/year				
Category	**In Central Area**		**Countrywide**	
	1996	**2012**	**1996**	**2012**
Wildlife and Tourism	0.15	0.21	0.74	1.62
Urban (all inclusive)	26.26	41.25	67.90	108.96
Rural domestic	0.17	0.28	13.10	21.02
Mines	6.53	7.74	20.00	30.00
Livestock	3.41	3.68	42.18	49.46
Irrigation	4.91	6.45	137.03	212.03
Demand TOTAL	**41**	**60**	**281**	**423**

Sources: in Central Area, WTC (1997); and Countrywide, DWA (1997). After Becker (1998).

(ii) Windhoek Water Demand

Water consumption in Windhoek grew by 6.6 percent annually until 1980, and between 1982 and 1991 demand grew by nearly 8.8 percent (Water Transfer Consultants, 1993). With the initiation of a water demand management program in the early 1990s, water demand began to level off, despite a continued rise in population. Total water use (*i.e.,* including the use of reclaimed waste water) in 1997 was roughly equivalent to the amount used in 1990, despite a 45 percent increase in population. However, when considering the only consumption of new water, *i.e.,* without reclaimed water mixed in, Windhoek's 1997 use was equivalent to 1987 use, despite nearly a *doubling* of population from 105,000 to 202,000 (van der Merwe, 1998). If Windhoek continues to successfully implement

Managing Water Demand in Windhoek

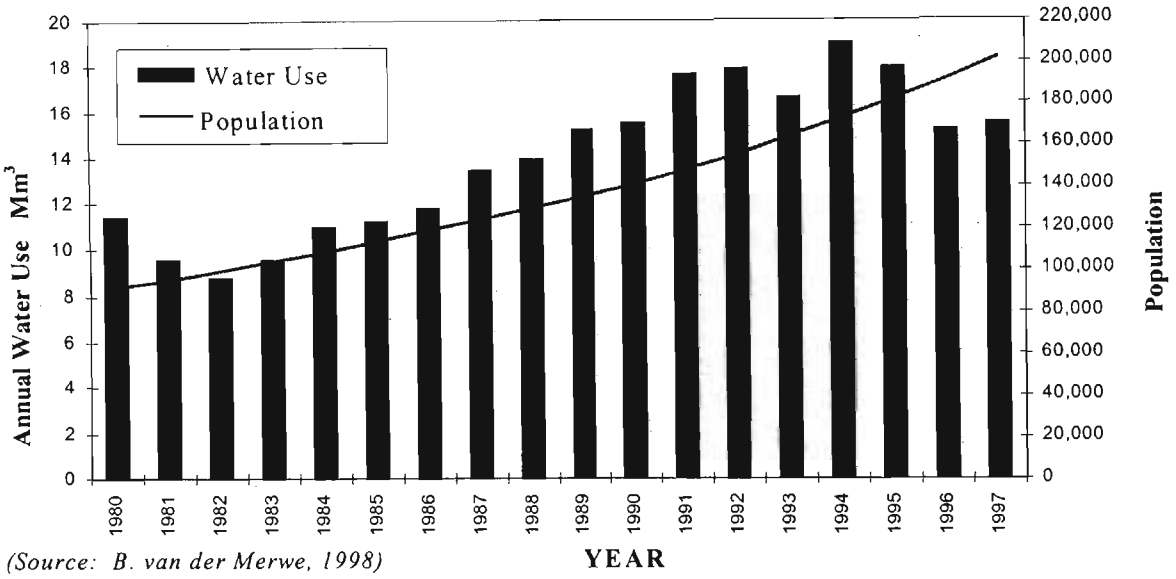
The city's demand management programme includes:

- block tariff system,
- maximising reuse of water,
- improved urban zoning,
- water conservation guidelines for businesses
- water metering taps in hotels
- penalties for wasting water on private properties,
- prohibiting watering gardens during mid-day
- promoting dual flush toilet cisterns
- requiring pools to be covered.

[1] In this dissertation, "domestic" means surface water (rivers) originating wholly in Namibia, and groundwater underlying Namibian soil.

water demand management strategies, demand in 2005 should be more than 30 percent below what unrestricted demand would be (Heyns et al, 1998; van der Merwe, 1999).

Figure 3. Water Consumption and Population in Windhoek



(Source: B. van der Merwe, 1998)

(iii) Water Supply

Namibia's water is supplied from three natural sources: groundwater, ephemeral surface water and perennial surface water (Lange, 1997). Wastewater reclamation in Windhoek represents another "source" of water, providing roughly 3.5 Mm^3/yr of Windhoek's annual supply. Namibia's total potential safe yield[2] of domestic water sources is estimated to be 500 Mm^3 per year, made up of 200 Mm^3 of surface water and 300 Mm^3 per year of groundwater. The portion of the annual water supply coming from each source varies from year to year depending on rainfall. Groundwater is found throughout the country and commonly accounts for about half of Namibia's annual water use. Perennial[3] rivers, which form the northern and southern borders of Namibia, account for about 27 percent of annual use, while ephemeral[4] rivers typically provide approximately 22 percent (Figure 4, page 79).

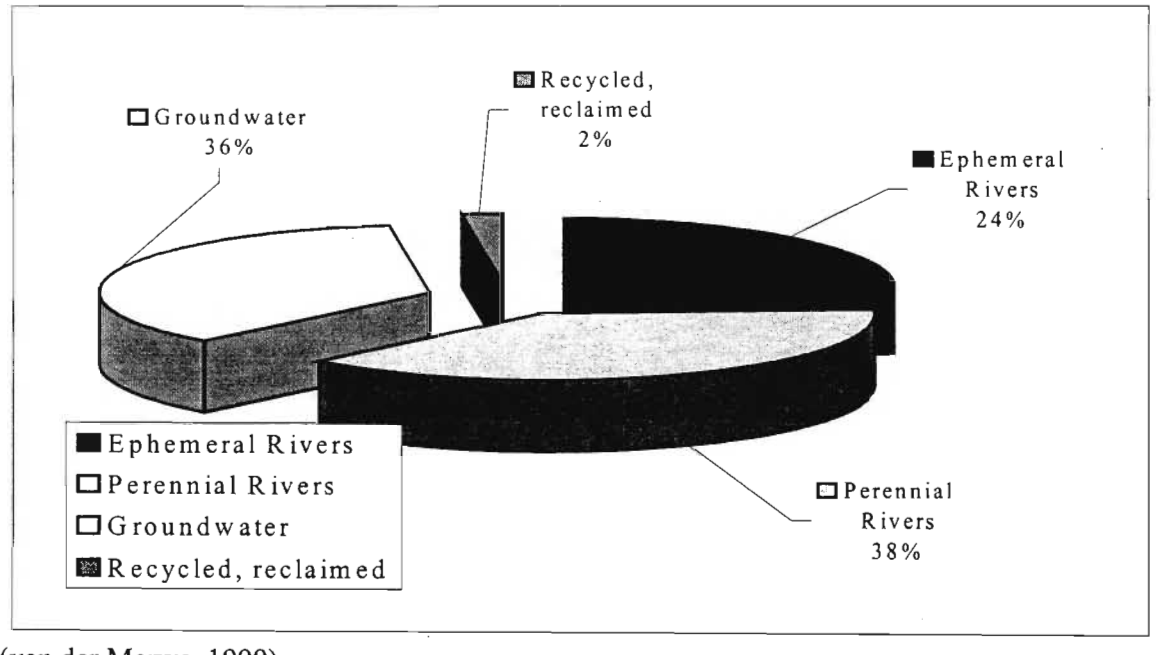
[2] Safe yield in this case refers to the amount of water that Namibia can depend on from surface and groundwater sources in 19 out of 20 years. In the strict groundwater context, safe yield is usually defined as the average annual amount of water that seeps into an aquifer that can be withdrawn without producing some undesirable result, such as lowering the water table, reducing the total amount of water available or allowing the ingress of low-quality water into the aquifer.

[3] Perennial rivers are those that continue to flow all year long, from year to year.

[4] Ephemeral rivers are those whose flow is naturally interrupted for a period each year, or up to many years at once.

The total water supply in 1996 was made up of 36 percent groundwater, 38 percent perennial surface water and 24 percent from ephemeral rivers (Figure 4). The Okavango River currently supplies approximately 22 Mm^3/yr to Namibians living along the river, which represents about 2 percent of the countrywide demand (Becker, 1998; Hatutale, 1994).

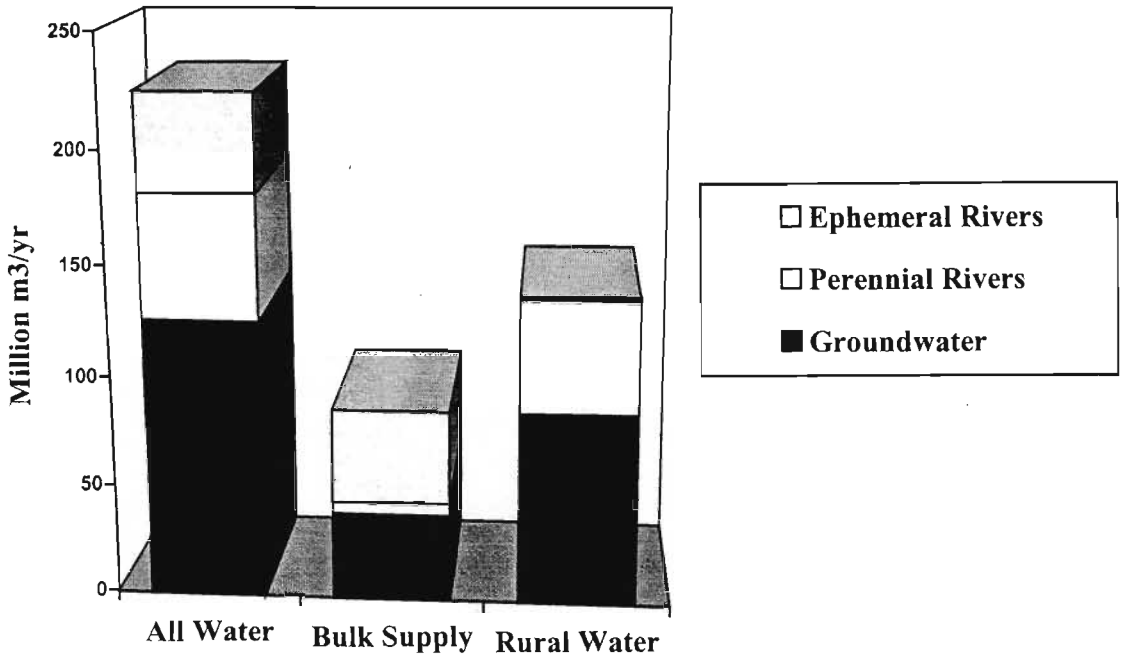
Figure 4. Water Sources Used in Namibia in 1996



(van der Merwe, 1999)

The source of water depends on whether it is used for rural supply or bulk supply intended for urban centres and certain industrial and agricultural enterprises. For example in 1993, 45 percent of the bulk water supply came from groundwater, while ephemeral rivers provided almost 50 percent and perennial surface water about 5 percent. Groundwater made up about 63 percent of rural water supply in 1993, perennial surface water over 35 percent and ephemeral surface water about 1 percent.

Figure 5. Water Supply in Namibia by Natural Source



(Lange, 1997)

The mix of water sources supplying any given area of Namibia varies by location. Figure 5, depicts the general distribution of water sources and supply systems in Namibia, and shows the Central Area supply coming from a combination of surface and groundwater; reclaimed water from the Windhoek reticulation system also contributes a significant amount. The Eastern National Water Carrier system distributes water to the majority of people living in the Central Area.

(iv) Central Area Water Supply

The ten major dams in Namibia can yield 87 Mm^3/yr at 95 percent assurance[5] - which is nearly half of Namibia's estimated total potential assured surface water yield - but only 14.05 Mm^3/yr of this volume is currently available to the Central Area through the existing supply system.[6] Approximately 29 Mm^3/yr of groundwater compliments surface water supplies, in addition to approximately 3.5 Mm^3/yr of reclaimed water from the Windhoek municipal system, totalling 46 Mm^3/yr in the Central Area.

[5] This means that there is a 95% probability each year that precipitation will produce sufficient runoff to provide 87Mm3 of water from dams after accounting for evaporation.

[6] Only four reservoirs service the Central Area: Omatako, Von Bach, Swakopport and Goreangab.

Table Four below lists the various sources of water for the Central Area. From 1996 to 1998, dams supplied approximately 30 percent of total supply, groundwater provided 62 percent and reclamation provided roughly 8 percent.

Table 4. Existing Surface and Groundwater Resources in the Central Area

Source	Ave. Annual Supply 1996-98 (Mm3/yr)	Sustainable Yield (Mm3/yr)
Surface water		
Dams	13.9	14.05
Reclamation/Recycling	3.5	5
Groundwater		
Windhoek	2.3	2
Otjiwarongo	2.7	2.7
Platveld	0	5
Tsumeb: Carbonate	11.5	20
Unconfined	0.44	12
Confined Kalahari	2	2
Grootfontein Karst Aquifers		
Area I	4.5	4.5
Area II	5.1	5.5
Area III	0.07	3
Area IV	0.06	1.5
TOTAL	**46.07**	**77.25**

Notes: Average Annual Supply figures based on unpublished NamWater data for water use between March 1996 and May 1998. "Sustainable yield" means 95% assured yield in the case of dams. In the case of the Tsumeb Aquifers include undeveloped potential in addition to existing capacity.
Sources: Sustainable Yield figures are taken from WTC, 1997; Becker, 1998; Kirchner, 1997.

5.4 Worst Case Scenario: Another Water Supply Crisis in 2001?

In September 1998, NamWater announced that the Central Area had adequate water supplies for the next three years, *i.e.,* until September 2001, even if no rain falls in that time. What if Namibia receives no significant rainfall or runoff in the coming rainy season, and the country is faced with a situation similar to that in 1996 that prompted the acceleration of the Okavango pipeline plan? Would the Okavango River be the best water supply option? It is becoming increasingly clear that the answer is "No" (refer to conclusion for recommendations). If NamWater and the government continue (and expand) the development of new groundwater sources, demand management strategies, artificial aquifer recharge and other smaller measures, the Okavango pipeline would be rendered unnecessary for the foreseeable future.

It is possible to quantify a hypothetical water supply shortfall in the Central Area if Namibia receives no significant rainfall before September 2001. A key assumption is that Central Area dams have no remaining supply available. Thus, from the planning perspective, the required emergency volume would equal the difference between the Central Area's projected water demand in 2001 and the Central Area's groundwater supply.

The analysis starts with Windhoek demand (21.1 Mm^3/yr), taking into account the supply of reclaimed and recycled water, and proceeds upstream through the Central Area supply system to the Grootfontein area, including demands and available groundwater supplies along the way.

This estimate is less than that used for the 1997 pipeline feasibility study for three reasons: 1) the closure of the Tsumeb Mine, reducing total demand by 3.4 Mm^3/yr, 2) increasing supply by 4.0 Mm^3/yr through the expanded Windhoek water reclamation system, and 3) the addition of 1.5 Mm^3/yr from the Berg Aukas mine. No additional water supply sources are assumed to be operational by June 2002 for this exercise.

The total estimated water demand in 2001 for the Central Area is approximately 51 Mm^3/yr, which is approximately a 4 percent annual increase. If the Central Area receives no runoff during the next two rainy seasons, and no steps are taken to expand the supply other than the three listed above, the total supply would be approximately 35.5 Mm^3/yr, leaving a deficit of approximately 15 Mm^3/yr in 2002. Thus, an additional supply of 15.5 Mm^3/yr must be identified or developed by 2002 in order to avoid a hypothetical water supply crisis[7].

5.5 Botswana: History of Water Extraction from the Okavango Delta

The social and economic climate of the country will be reviewed in detail in the case study section on Botswana in chapter five. The primary purpose in this section is to highlight Botswana's plans for water extraction from the Okavango Delta.

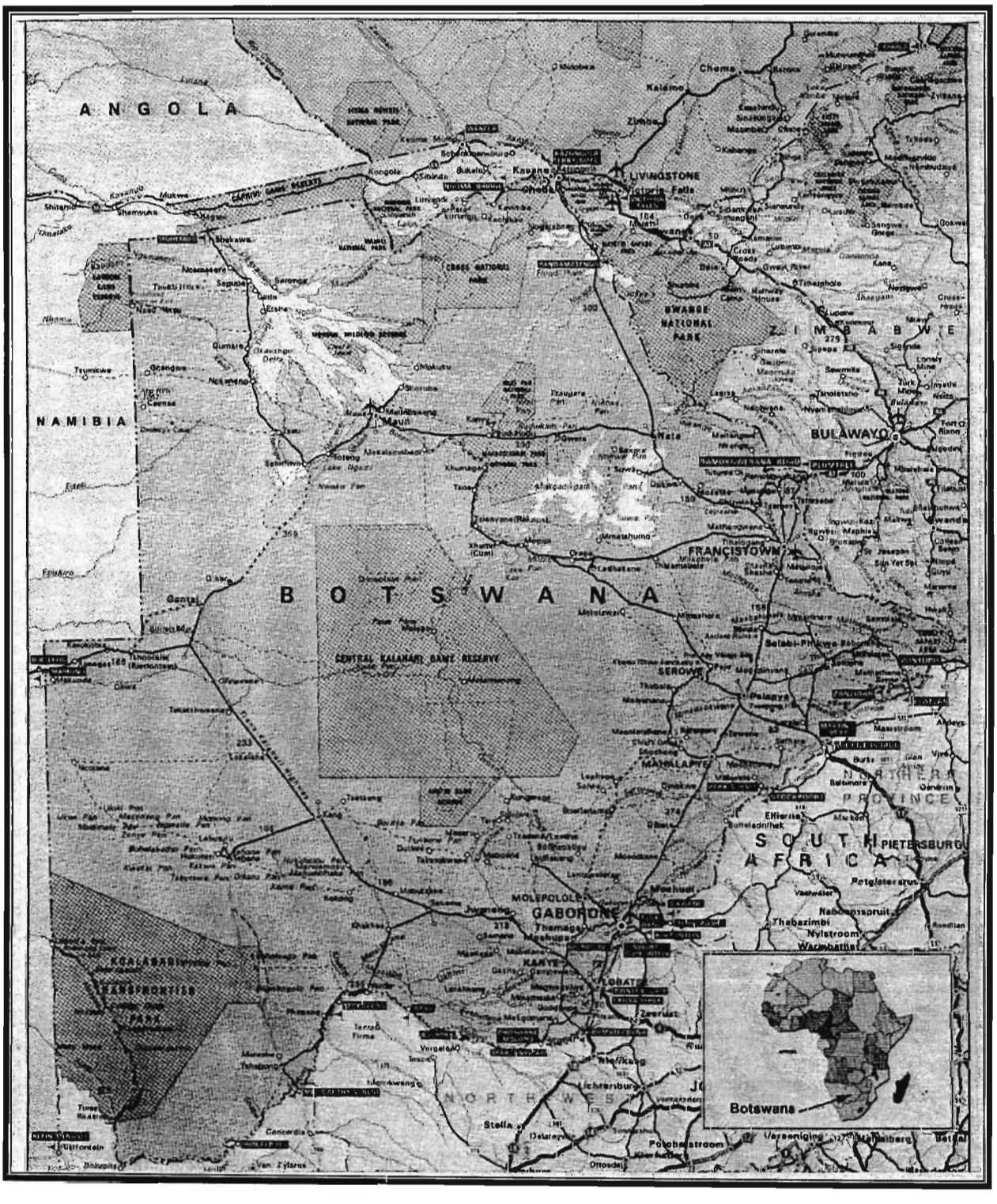
The last of the Okavango's waters flow along the Boteti River. Snaking across the Kalahari, they flow towards the edges of the Makgadikadi Pans (see Map Five, page 84). Here, deep beneath

[7] The 1997 feasibility study estimated that the Central Area could face a shortfall of 18 Mm^3/yr by 1998. The possible shortfall in 2002 would be less than this because of the additional supplies listed above and because of the Tsumeb Mines closing down.

the sands, not far from the Okavango Delta is Orapa, the second largest diamond pipe in the world. For, some ninety million years, it lay hidden in the vast flatness of the Kalahari's sandvelt, unmarked by any striking features or change in topography (Ross, 1987). Diamonds require great quantities of water to be extracted from the earth. It is perhaps a bitter irony that such a massive diamond pipe should be located in the arid Kalahari. Although Orapa lies within 280 kilometers from the delta, only a small fraction of the Okavango's cast resources of water reach it via the Boteti River (Walker, 1991).

In the 1970's a large reservoir was developed from a natural pan to store the Boteti's floodwaters after their journey from the Angolan highlands through the Okavango Delta. The flow of one of the Okavango's Rivers, the Boro, was increased by dredging a stretch of its riverbed and blocking some of its outlets with earthen dams. For several years the Mopipi reservoir was full, but the drought years of the 1980's reduced the floods to such an extent that the waters of the Boteti never reached Mopipi reservoir (Walker, 1991). The diamond mine turned to boreholes. Extensive explorations on the groundwater reserves in the region were carried out, prior to a decision being made on whether Orapa would need additional surface water (Ross, 1987). There were widespread fears that extraction of water from the Okavango Delta would upset the areas delicate natural balance of a complex system, in turn this led to heated public rejection and the Mine had to seek alternative measures.

Map 5: The Republic of Botswana



(Botswana Government, 1997d)

The extraction of Boro water from the lower delta would inevitably drain large areas of seasonal swamps. This would reduce the amount of land flooded and would therefore seriously affect the way the whole system revitalised each year by the coming of the nutrient-rich floodwaters (Gray, 1971). The environmental impact study associated with the project estimated that seventy square kilometers of floodplain would be drained, including the feeding grounds of water birds, notably endangered species such as wattled cranes and slaty egrets. The breeding and movement of fish in the Delta are also closely adapted to the annual floods The floods enrich the lower waters and create vast shallow inundated areas, which are used by fish for feeding and breeding. The floods also provide for a way of distributing fish throughout the Delta The dredging of the Boro would have inevitably disrupted the fish population, and the breeding grounds of those fish that populate the southerly waters of the Thalamakane and the Boteti (Graham, 1991).

People would have also been affected, "particularly those inhabiting the areas that would be drained. Hunters would lose animals, 'molapo' (river) farmers their waters, and all inhabitants would loose access to reeds and leaves for building and weaving" (Ross, 1998). Roads would have opened up previously inaccessible areas of the Delta to heavy works machinery for construction work and maintenance. The Boro River is important to tourism, giving people access into the Delta from Maun, and is used for boat trips and fishing. Channeling the river would have destroyed the beauty and wilderness that attracts so many people to the area.

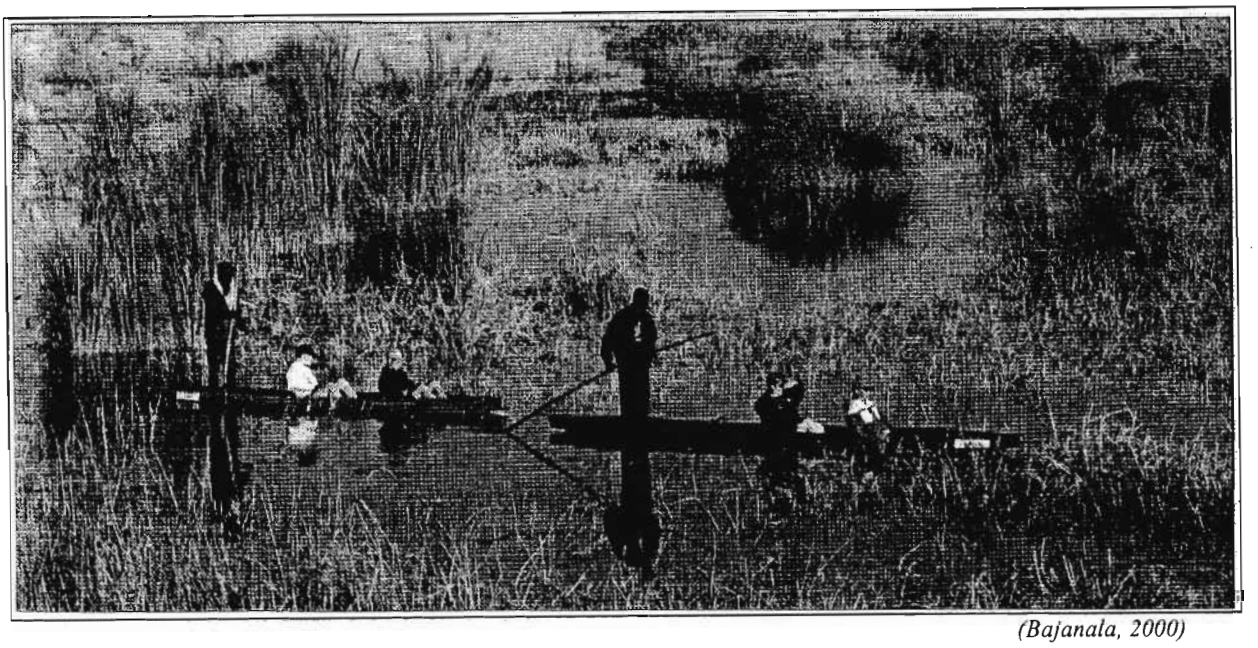
Ross (1987) states that "water extraction schemes must take into account the fact that the average life of a river before it changes course may be as little as one hundred years; this means that, because of the changeable nature of the Delta's water flow, many proposals are simply not practical". The Department of Water Affairs committed itself, not to interfere with the perennial swamps, following the findings of the environmental impact team and it was agreed to abandon alternative water extraction projects deep in the Delta.

In the past there have been many attempts to influence the flow of the Delta's water, and in hindsight most of them have been remarkably misguided. Hydrologists, government officials, hunters, explorers and researches have all attempted to cut their way through channels blocked by papyrus, or to open up new channels as they tried to tame the swamps. Small earthen dams (called 'bunds') have been built to improve the water supply to areas of flood irrigation. In the 1970's, large areas of floodplain were drained when the Boro River was dredged to improve the

flow of water down the Boteti River to Orapa. The unflooded land reverted quickly to its arid origins (Ross, 1987).

Other grandiose schemes for using the Okavango's waters have included a proposal for an aqueduct to take water from the delta to Pretoria in South Africa (Ross, 1987). Another suggested a 1000 kilometer canal, large enough to be navigable, from the panhandle to the capital city, Gaborone, in the south; the route would be across the Kalahari sand face. A particularly wild proposal was that the Okavango and Chobe rivers be diverted into the Magadikgadi Pans, thus creating a huge lake. The idea was that the lake would increase evaporation, thus resulting in heavier rainfall, which in turn would increase the flow of the rivers. In this way vast quantities of water would be available for irrigation, changing the Kalahari into "the most fertile region in the world" (Gray, 1971). As one economist noted, these ideas "were based on complete ignorance of topographic levels, very unsound meteorological theory and at times very dubious arithmetic" (Botswana Society: The Okavango Delta and its Future Utilization, 1982; pp. 31).

How important is it that the Okavango should survive? There appears to be no argument that the Delta is a valuable and unique area to Botswana. The Okavango Delta and its associated areas provide a sanctuary to many rare and endangered animals. It is one of the most important wetlands in Africa, providing a breeding area for many rare birds. The Panhandle is one of three breeding areas in southern Africa for pink-backed pelicans, while the Delta is the only area in the world where the slaty egret breeds. The area attracts visitors from all over the world, who come to enjoy the wilderness and to see these rare creatures. Thus tourism is becoming one of Botswana's largest income earners, and in the north it provides more work than any other economic sector (photos one and two). The Delta provides the livelihood of many people scattered around its edges, through hunting, fishing and flood irrigation. More than half of Ngamiland's cattle depends on the Okavango for water. Ross (1998), indicated that "the Okavango is Botswana's water heritage, a resource more precious than diamonds. Indeed, without it the country's largest diamond mine would cease production as soon as its groundwater's dry up". Margret Nasha (Minister of Minerals, Energy and Water Affairs) indicated the importance of the Delta by declaring that "the way in which the Okavango Delta is utilized is of crucial importance, for it is a fragile system and interference by man could damage and change it for ever". Beneath the shallow water lies Kalahari sand, ready to be burnt by the sun and blown away by the wind should that protective cloak of water disappear (Ross, 1987).



(Bajanala, 2000)

Photo 6: Tourists in traditional dug-out canoes know as '*Mokoros*'.

(Marung, 2000)

Photo 7: Elephant back safaris in the Okavango delta

5.6 Regional Cooperation ... Sharing a Common Water Resource

Given the ecological sensitivity of the Okavango River System and it's known socio-political and economic importance in the region, the question is: Can the three countries concerned harmoniously share it as a resource and cooperatively manage it as a whole? It has been said that if a war should erupt in southern Africa it would be sparked by competition for natural resources, the most crucial of which is water. Certainly the potential for conflict is huge.

Tawana Moremi, the Delta's paramount chief has been quoted as saying about Namibia's planned extraction: "I do not like this pipeline very much, we should buy more planes and bomb it" (Mail and Guardian, 1997). Political cooperation is evaluated in this section as an agent towards conflict resolution.

Both Botswana and Namibia need and rely on the river as a resource with immediate effect. These needs can be interpreted as conflicting. In fact, it is hard to interpret them otherwise. Current mediating factors in this potential conflict lie in Namibia's insistence that the small quantity of water they aim to extract will not affect the major system, and that it is their moral duty towards their people and International Law to do so. While no one can argue the moral point that if your people are thirsty you should lead the water to them (Taking them to water raises the social issues embedded with redistribution of people), the International Law implications of shared rivers are more complex (as discussed in Chapter One).

Botswana and Namibia share more than just a border. The two countries have a great deal in common. They have cultural similarities, their populations are almost equal in size. They share between themselves one of the harshest deserts in the region as well as some of the biggest rivers such as the Okavango and Chobe Rivers. In addition, they cooperated in the construction of major projects such as the Trans-Kalahari Highway, the cross-Caprivi road and several other projects under the auspices of SADC. Despite the commonality and intimate cooperation the two appear to find no peace. They are constantly jostling. If not over the tiny, sub-mersible Sedudu Island, it is over the abstraction of water from the Okavango River. M. Nasha stressed that the main reason why the Government did not publicly denounce the extraction of water by Namibia was that to do so imediately after rejecting Namibia's claim to Sedudu would be pushing their neighbor to a point of conflict. The government placed huge emphasis on NGO's within Botswana to solve the volatile issue (Ross, 1998).

Of late, another new source of conflict has been found in a virtual marshland in the Linyanti River. Farmers from one side of the border cross whether inadvertently or otherwise to plough. They are told that they have crossed over into another country and asked to desist from embarking on such acts. Ministers from the two countries have met to discuss the issue, and decided on a joint technical committee to resolve the matter. On the other hand President Sam Nujoma consults Robert Mugabe, then President Nelson Mandela to ask them to intervene and help him against the "aggressive, war –mongering" Botswana (Mmegi Newspaper, 1997).

NGO's and environmentalists fear the precedent that was set by the Sedudu problem where the technical committees could not reach a decision as none of the two parties accepted each other's proposals. Experience from Sedudu has shown that when the technical commission fails, and the mediation efforts, which Nujoma tried to solicit fail, the only other option is the International Court of Justice. This means paying adjudication fees - huge amounts of money that could go a long way to improve the lives of both the peoples of Namibia and Botswana. If the two countries fail to find a solution to the Rundu Pipeline it is hoped that they will be able to resolve this conflict out amongst themselves, at least they should seek resource through SADC. Evidently Namibia has halted the course for water extraction after a brave fight put up by NGO's surrounding the Okavango Delta in Botswana.

There is no good reason why the Sedudu Island case, presently before the International Court of Justice, could not have been amicably solved with-in the SADC region. This represents a serious undermining of meditative power in an organisation of such magnitude in the region. "With regards to the Rundu Pipeline extreme caution was be called for, tolerance and restraint by both countries" (Mmegi Newpaper, 1998).

5.7 Parallels between Botswana and other countries... Lessons Learned

To incorporate a case study from other parts of the world is important, for example a parallel can be drawn from the Nile and lessons applied to the basin countries of the Okavango River. Perhaps the most striking of resemblance's between Middle Eastern states and Botswana is that the Nile and Okavango are rivers, which bring imported water originating from rainfall over upstream parts of the river basin. Several countries in fact, receive most of their waters through rivers, which originate in other upstream countries. Botswana, Bulgaria, the Congo, Egypt, the Gambia, Hungry, Luxembourg, Mauritania, the Netherlands, Romania, the Sudan and the Syrian Arab Republic all receive 75 percent or more of their water resources from upstream countries (FAO, 1993).

The role that such 'imported runoff' may play in a country or region's water management depends on many factors. A key question is whether or not the imported water is easily accessible. Differences in this respect may be illustrated by comparing Botswana and Egypt. The

basic similarity is that some 5 percent of the overall 'blue water' [4] availability is endogenous, whereas 95 percent is exogenous. Egypt's whole socioeconomic development has been based on the water imported by the Nile, which passes right through the inhabited strip of the country and is therefore extremely easily accessible (McCaffrey, 1993). In the case of Botswana, on the other hand, the exogenous water is brought by three main international rivers: the Limpopo, entering from South Africa; the Okavango, entering from Angola/Namibia; and the Zambezi, bringing water from Zaire, Angola, Namibia and Zambia. Although Botswana is extremely water rich in relation to overall blue-water availability, its self-image is that of a country with a chronic water scarcity (Ohlsson, 1995). The reason is that the entering rivers are not seen as accessible for use: the Limpopo has already been exploited in South Africa; the Okavango is seen as 'untouchable' in view of the extremely well respected aquatic ecology of the delta; and the Zambezi has to be shared with six other states upstream and downstream.

There may be different types of constraints on imported river water:

- Physical constraints, related to the geographic position of the entering rivers in relation to the country (passing right through as opposed to passing along the periphery as the two extremes);
- Political constraints, related to the difficulties of reaching agreement on the shared use of international rivers with the other river basin countries; and
- Ideological constraints related to different alternative uses of the river water (the rivers function as valuable habitat versus water source for purposes of societal production).

In the case of the Nile, the physical constraints are very low; and political constraints have been manageable in the past – as long as the interests in water withdrawals from upstream countries have remained limited. In the case of Botswana, physical constraints are active for all three rivers. Political constraints complicate the use of the Zambesi's water, and ideological constraints limit the use potential of the Okavango water (Ohlsson, 1995)

There is also another problem involved: imported water is a much less reliable resource than the water originating from rainfall over a country (Pallet, 1997). There is a risk that intensified biomass production upstream within forestry or agriculture will send more water back to the

[4] Surplus water left to recharge the forms of groundwater and river runoff – this water Falkenmark and Lundqvist (1997) define as *blue water* that which is available for human use in society.

atmosphere, leaving less blue water to feed the river (Ibid). This is the predicament of Egypt, which is in fact the victim of the upstream countries in the sense that socioeconomic development there may very well involve more water consumption in the real sense, depleting Egypt of part of the resources which has hitherto constituted the very lifeline of the country (Falkenmark, 1997).

Studies of international rivers have shown that conflicts over the rains funneled by shared water courses, have already been a major contributing cause of war and annexation of territories: the 1967 war when Israel occupied the West Bank, the Golan Heights and the Gaza Strip. In 1975 Iraq, Syria and Turkey almost went to war over waters of the Euphrates (Naff & Matson, 1984). What countries have here is a classic riparian problem. A river knows no boundaries. What happens at its source will reverberate all through its course until it reaches the ocean. Problems at the mouth may be unsolved if you cannot control what happens at the source, and developments on the upper part should not be made without considering effects further downstream. Almost none of the world's major rivers, however, is contained within the borders of a single state (Pallet, 1997). The India-Bangladesh Joint Rivers Commission has identified more than 140 water systems common to both countries. The disruption of, for example, the former Soviet Union has created an as yet uncharted number of new internationally shared watercourses. These examples alone will add up to more than the often-quoted total figure of 214 international rivers (which stems from a highly misleading 1978 UN desk study, made from maps on a very small scale, and unfortunately referred to ever since); obviously the correct figure is much larger (Biswas, 1991).

The potential for conflict over water seems to be large. As certain case studies show, however, so is the potential for conflict resolution and peace. Conflict over and violent annexation of common water resources is a viable strategy only so long as more water in the hands of one country is perceived by another as a loss of the same amount (Ravenscroft, 1975). Soften that notion, and the first ground for cooperation, leading to more water for all, is laid. Storing the Nile's water at the springs of the Blue Nile, in the deep mountain gorges would lead to less evaporation loss, and more water, than dams on the desert plains of Sudan and Egypt (Pearce, 1992; Clarke, 1991). There are, however, many complications, however. Egypt fears that Ethiopia will not just store the water, but withdraw a sizeable portion of the present Egyptian share for internal Ethiopian use (Naff & Matson, 1984). Present FAO plans for Uganda on the White Nile would similarly imply less water for downstream Sudan and Egypt. Ethiopia, on the

other hand, may rightly fear that the decrease of evaporation caused by the Jongeli project will lead to less rain over the Ethiopian Mountains. (The main reason for the present deadlock over the Jonglei Canal, however, is the civil war in Sudan, which is largely unrelated to the Jonglei issue.)

The degree of justification for the persistence with which many governments continue to regard international water bodies as the ultimate zero-sum game is therefore difficult to determine (Ohlsson, 1997). Only one thing is clear: it is an old age habit. The English words river and rival in fact have the same root, *rivus*, meaning in Latin, from which is derived *rivalis*, which means sharing the same stream (Biswas, 1993). Even if it were possible to show that common management of a shared water resource would in some cases lead to more water for all, it is very difficult to build up the confidence in a long standing adversary necessary to embark on that road. Living along the same river can, very often, give rise to reasons for conflict other than the primary issue i.e. scarcity of water. It is quite possible therefore, that the inherent conflict potential of shared rivers might not be so much the very real contemporary scarcity of and competition for the waters of the river, but, rather, the ease with which today's water conflicts along rivers seem also to become pervaded by controversies of unrelated, often old-age origin, now invested with the very physical presence of the river (Biswas, 1993).

Conversely, and in the light of what has been said so far, the equally real peace potential of water issues would seem to be that since water is such an essential necessity for which there is no substitution, countries perceiving an increased scarcity of water will opt for a negotiated solution of differences over water allocation rather than unilateral annexation. While negotiations would in most cases lead to more of a scarce resource for all; and a successful peaceful resolution of the differences should initiate a positive spiral whereby a number of other ingrained conflict patterns could start to dissolve (Stansbery, 1973).

Far from being a mere idealistic dream, this is exactly what has happened in some places. A more than century old conflict between the provinces of Sind and Punjab in Pakistan over the allotment of water from the Indus was finally resolved in 1990 – a feat which neither British colonialism nor later authoritarian regimes were able to achieve. In the wake of the agreement, several other conflicts between the provinces were resolved (*Far Eastern Economic Review,* 1991). Although the massive floods in 1992 seem to have rekindled conflicts over water

management, the 1990 conflict resolution process still seems to have worked as a catalyst for unraveling a whole complex of conflicts.

Obviously behind a breakthrough like this lies a great deal of patient work, often initiated on a low-key, technical and administrative level. From the report of such a closed meeting of the Middle East water managers, the impressions given are those of constructive talks, relatively unhindered by political barriers (El-Habar, 1993), monitoring the perhaps paradoxical fact that the best chances of realizing the peace potential of shared water resources will be where the conflicts are most acute – if all countries involved perceive a shortage, the stakes of developing the common resource by cooperation become very high. What is clear is that such talks will generally have to take as their point of departure the only natural unit for river management, a river basin or an aquifer in its entirety, and would thus entail regional cooperation of some sort.

It has been estimated that Botswana's current defence budget represents about 68 per cent of the country's total budget (Rothert, *pers .comm*). These sharp increases in the Botswana budget and the country's desire to increase the size of its defence force (BDF) from its current 7 500 to about 10 000 men have raised more questions than supplied answers, especially if viewed against the background of earlier developments such as the construction of a highly secret military air-base at Molepolele, the growing tension over Namibia's claims to the Sedudu Island in the Chobe River and the recent decision by Namibia to draw water from the Okavango River on a permanent basis. The aim of the next section is to briefly examine these developments and to determine their contribution, if any, to the deteriorating relations between Botswana and Namibia and to Botswana's decision to increase its defence capabilities through the purchase of sophisticated heavy armour and fighter aircraft.

5.8 Security threats to Namibia's decision to divert water from the Okavango River

It was reported in the Mail and Guardian of 29 November 1996 that plans by the Namibian government to go ahead with a project to draw water per pipeline from the Okavango River were adding to the tension between the two states for the scheme holds the potential of turning the Okavango Delta into a desert. The Batswana are extremely concerned about the Namibian plans and have warned that any unilateral interference with the river could have grave consequences for the country and its people. The world's third largest oasis the Okavango Delta is responsible

for a third of Botswana's foreign currency earnings. The river and the delta it supports are thus of vital importance to Botswana's economic and political stability.

It has been pointed out that while concerned white business people in Botswana can always move elsewhere, this is not an option for many blacks who make a living off the river and the delta. The mood and concern of these people is volatile. Tawana Moremi's threats of bombing the pipeline may seem a rather drastic solution, but, for many Batswana who are concerned about the effect that Namibian interference may have in their livelihood and their future, this may be a legitimate solution in the end. Since the Namibian plan became known the idea of military action against Namibia is something that is now raised and Botswana's recent attempts to purchase heavy battle tanks from Europe and military aircraft from Canada are seen by many as a precautionary move by the government to safeguard its natural resources (Le Roux, 1998). According to Heyns (1998), a senior Namibian water engineer, "it has been suggested that the Batswana wants to buy tanks to shoot at the Namibian's because they want to steal water from the Okavango".

Although Botswana recognizes the fact that Namibia has a serious water shortage problem and that a mechanism in the form of OKACOM, is available to deal with the issue, the Namibians appeared determined to unilaterally go ahead with their plans to pipe water from the Okavango River. Representatives from an American company, Owens Corning, that also has strong businesses connections in South Africa, had already visited Windhoek in connection with the construction of the proposed pipeline. The pipeline was expected to cost some one billion Pula, is designed to draw 700 liters of water per second or an estimated 20 million cubic meters of water a year from the Okavango River (Cashman, 1994).

Since then, Namibian government has denied that it would go ahead with the project to pump water from the Okavango River without the approval and cooperation of the Botswana Government. According to Namibia's Deputy Secretary of Water Affairs, no international donor would fund the project if Botswana was adamantly opposed to the feasibility study. Fry, a Namibian geologist and consultant on the ENWC believes that in the end the Batswana government will see Namibia's water crisis "in the light of humanitarian need and will ultimately respond to the pipeline project sympathetically" (The Mail and Guardian, 6-10 December 1996). Although Fry (*pers. comm*) was reluctant to say about Namibia's actions

against Botswana's rejection of the feasibility study, he did point out that Namibia has few alternatives to pursue in order to solve the country's pressing water needs.

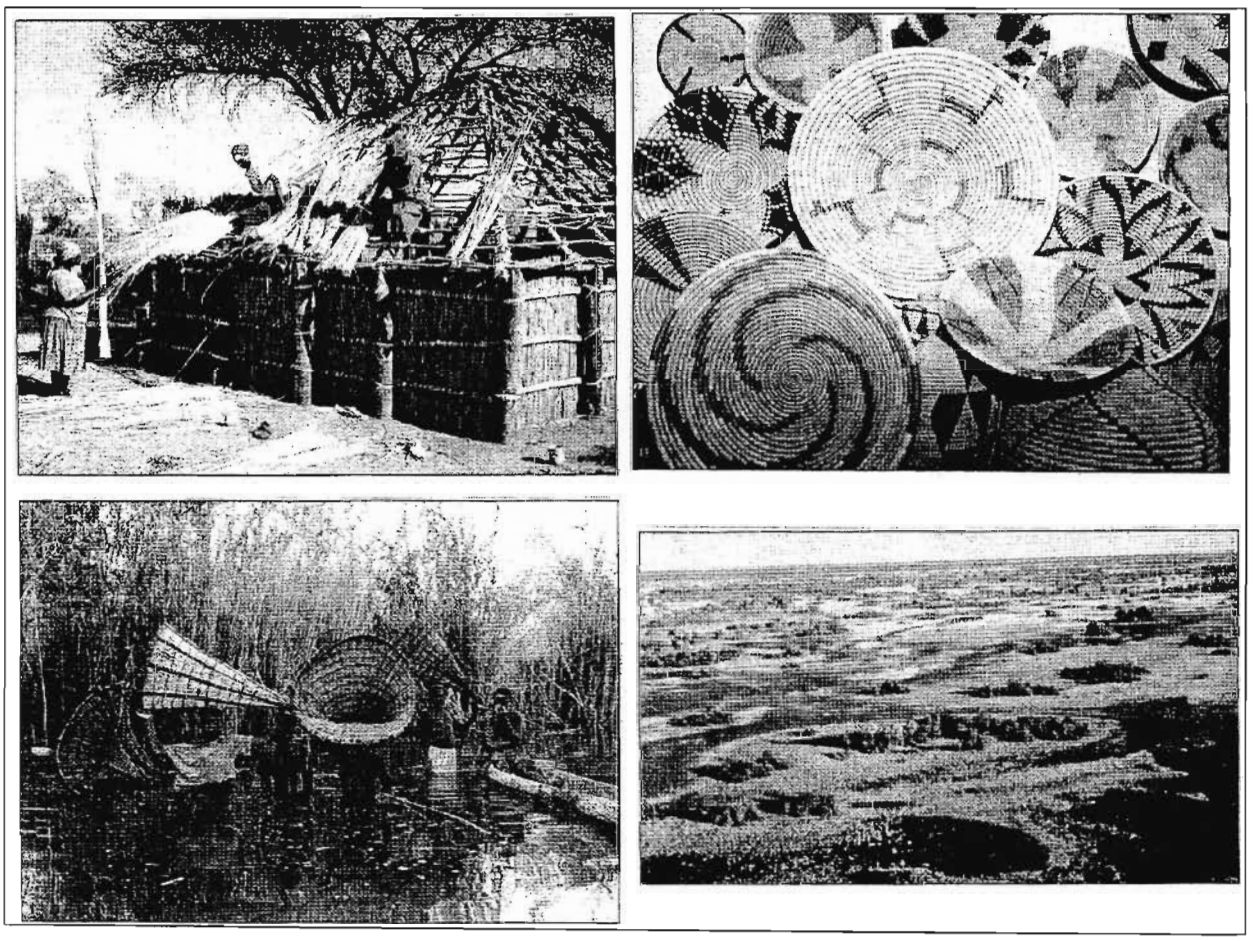
There can be no doubt that Botswana's socio-economic and political future is closely tied up with the Okavango River. Any attempt by either the Angolans or the Namibian's to interfere with the river's flow is bound to have a serious effect on Botswana's economic and political stability in particular, as well as on the future of southern Africa in general. In the same way as Egypt, to a large degree, depends on the Nile for its economic security and prosperity, Botswana depends on the water of the Okavango for its economic and political well-being. Besides diamonds, which account for close to 80 per cent of the country's exports, Botswana is also rich in other base minerals but it needs a secure and constant supply of sufficient water to develop these and other resources in order to meet the demands that are currently being made on the country by its rapidly increasing population. In order to make the country's economy more secure, it needs to make it less dependent on diamond exports which have shown a steady decline over the last few years. Botswana's revenue from diamonds declined from more than $1,06 billion in 1992 to $850 million in 1993 (Botswana government 1997b). These figures were, however, reversed in 1994 when revenue from diamond sales was reported to be US$ 1,74 billion.

The Botswana government is well aware of the fact that any interference with the flow and volume of the Okavango River will have a detrimental effect on the country's economic prosperity. Although figures for the current unemployment situation in Botswana are not available, figures for 1992 have shown a sharp increase from 27 per cent in 1991 to 29 per cent in 1992. These figures will no doubt be higher now due to a sharp increase in Botswana's population since the end of the 1980s. The situation has deteriorated to such an extent that even graduates are now reportedly having difficulty in finding employment (Mahende, 1996).

The growing tension between Botswana and Namibia over the formers increased arms purchases was one of the aspects highlighted at a SADC meeting in Zimbabwe in August 1996 (Ohlsson, 1995). It was pointed out that while the end to apartheid has removed the greatest destabilizing factor in southern Africa, other factors such as the growing tension between Namibia and Botswana have the potential to create instability in the region (Fall, 1997). Only time will tell whether the two countries will be able to find an amicable solution to their dispute over Sedudu Island and the waters of the Okavango River.

5.9 Okavango Delta Communities Formally Oppose Namibian Pipeline

Okavango Delta communities have sent a joint letter to the government of Namibia urging it to find alternatives to the proposed pipeline. Citing their dependence on the fragile delta ecosystem for water, food and livelihood, Delta communities fear the proposed pipeline would spell the beginning of the end of their lifestyles. Mr. Wanga Moremi, one of the 2500 signatories to the letter and a resident of a small village overlooking the delta, said, "Why do the Namibians want to take our only source of water when they could get desalinated water from the Atlantic ocean, or fresh water from the Cunene River? We depend on the delta for almost everything (photos page 98). Without it, we would have to move or die" (Rothert, 1998).



(Photos M. Chase, 2000)

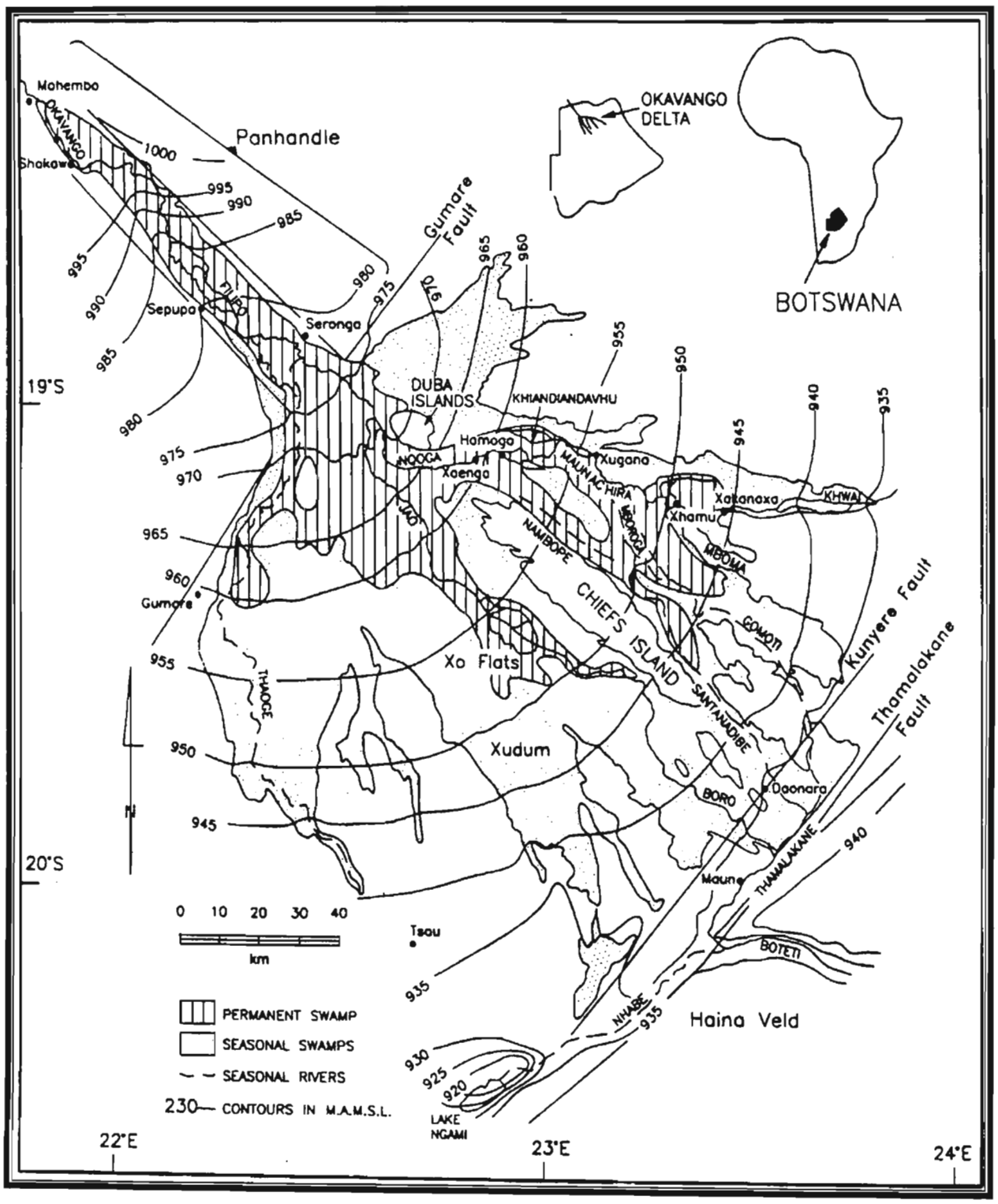
Photos 8,9,10&11 *from top left*: Women using reeds from the Okavango delta for thatching; baskets from the Okavango delta; fisherman using traditional reed baskets and the an Aerial view of the Okavango delta.

Doctor Samora Gaborone, spokesperson for the Okavango Liaison Group, (OLG) which facilitated the community letter, said, "The communities hope this letter will encourage the Namibian government to search for alternative sources for water. We understand Namibia needs water, but we hope they will search for other ways to meet their needs, such as conservation, or desalinization, rather than this pipeline which could harm the 100 000 people and world renowned ecosystem the Delta supports".

While Namibia currently proposes to extract only a small percentage of the Okavango River's total flow, communities fear that even a relatively small extraction could result in serious impacts at the edge of the Delta. Access to water has become difficult over the last two decades. Several communities that used to lie on the edge of water now have to walk several kilometers or dig deep wells to collect water (MaBeki p*ers. comm.* 1998). Given the already decreasing flows, and the natural tendency of Delta channels to shift locations, the communities wonder how Namibia can know with certainty what impact any diversion will have on the ecosystem and the communities. According to Du Plessis (*pers. comm*, a De Beers geologist), there is a great deal of geological activity in the Okavango region and he expects the area to continue tilting to the northeast. "Normally we don't see the effect of this tectonic plate movement since it happens very slowly, but in the Okavango you only need a plate movement of a couple of centimeters for the water to change course and the delta to dry up" (Du Plessis, 1989) (Refer to Map 6 page 98).

Another fear of Delta communities is that this will be only the first of ever-larger extractions. Namibia's water demand is expected to more than double from the 1990 level of 250 million cubic meters per year to 600 million cubic meters per year by 2020 (Cashman, 1994). If Namibia turns to the Okavango now for its next 100 million cubic meters of annual supply, what is to keep them from coming back for the next 250 million cubic meters per year to meet demand until 2020? Pipeline proponent's point out that flows into the delta can naturally vary by nearly 10 billion cubic maters from year to year, and so adapted to hydrological variation (Du Plessis, 1998). Project opponents note that the pipeline would take water from the river when the Delta needs it most: during drought years. As proposed last year, the pipeline would divert between 20 and 120 million cubic meters only during "crisis years". Environmentalists point out that crisis years for Namibia will most likely correspond to crisis years for the Delta as well, thereby compounding the impact on the Delta's ecology.

Map 6: Sketch map showing the major fault lines and distributary channels of the Okavango River in the panhandle and the Okavango delta, together with the extent of seasonal and permanent swamps, in relation to local elevation.



(McCarthy & Ellery, 1993)

The community letter, which was also sent to the governments of Angola and Botswana, and to the Okavango River Basin Commission (OKACOM is dealt with detail in the following chapter), requests communities be included in the ongoing process begun by OKACOM to assess the entire Okavango River Basin and develop a long term management plan for the river and Delta. The communities feel that with out their presence in the planning process, their concerns will be misunderstood or overlooked (Rothert, 1998).

More than 50 chiefs and community leaders also from the Okavango delta recently called on non-governmental organisations and the government of Botswana to help them stop the proposed Namibian water pipeline project. An EIA on the project was recently completed and approved by the Namibian cabinet for public release. At press time, it had not yet been publicly released or made available to the Botswana government. In Maun, the district centre of the Okavango Delta, a meeting was organised by a coalition called the Okavango Liaison Group (OLG), which was formed earlier last year to counteract new threats to the Delta such as the pipeline proposal. OLG includes representatives from the Kalahari Conservation Society, Conservation International, IUCN, the University of Botswana, the Hotel and Tourism Association of Botswana and Someraleng Tikologo / Environment Watch Botswana (Samora, 1998).

Since November 1996, when a Namibian government delegation first introduced the pipeline proposal in Botswana, discussions about the project have been limited primarily to senior government officials and a small number of NGO's. Okavango delta communities who will bear the brunt of upstream water developments have not been included in the process by either country's governments. Exclusion from such a decision making process is an effort in Botswana, where the culture places great importance on consulting those who will be affected by a decision, traditionally through community meetings called "Kgotlas" (Rothert, *pers. com.*).

Environmentalists throughout the region have urged Namibia to wait on its plans until the OKACOM completes an integrated management plan for the river. The study will address the question of ecological needs of the Okavango. Environmentalists in the region maintain the first step in setting management priorities for the Okavango and other shared rivers should be to determine what the river needs to sustain healthy aquatic ecosystems and the people, plants and animals that depend on them. The perceived link between environmental management and

sustainable development in this region remains tenuous, often subordinating environmental values to the goal of rapid economic development.

The concepts of instream flows and ecological needs have only recently found their way into discussions of water resource management in southern Africa. In 1998 South Africa adopted a new Water Act that establishes as the nation's top priority providing water for basic human needs (25 liters per day, millions of South Africans are without a safe water supply) and, once those needs are met, maintaining the quantity and quality of water needed to protect aquatic ecosystems. Only then is water allocated to industrial and agricultural uses (Engelman & Leroy, 1993).

Windhoek is a case study in how water needs are spiraling in many parts of this arid region. According to the US State Department, although the city's growth is around six percent a year, its water use is expected to quadruple from current levels in the next 25 years (Rothert *pers. Comm*). To sustain such growth, Namibia is also reportedly considering building a 1000-kilometer pipeline to pump water from the Congo River to supply Windhoek. In June 1998, President Sam Nujoma told *The Namibian,* "My vision for the future 15-30-year period is that we should make use of the Congo River for our future water needs". He added that the SADC regional trade bloc should manage this project so that it can also benefit Botswana.

5.10 Emergency Status for the ENWC Ends

The Namibian government advanced the Okavango pipeline proposal in 1996 as an "emergency" project – to be completed by 1998 – when the nations reservoirs dropped to less than 10 percent of capacity following several years of drought. Plentiful rains fell in Namibia last year, filling reservoirs to capacity and recharging many groundwater aquifers. The Namibian government now estimates that Central Area has sufficient water for at least four years, even if little rain falls. As a result, the government confirmed recently that it no longer regards the Okavango pipeline as an emergency project, and extended its completion date to 2003 (Business in Africa, June-July 1998).

The Namibian Cabinet stressed, however, that it still considers the pipeline a "future emergency" project that should proceed nonetheless, and announced that a full study will soon begin (Heyns, 1995a). The non-emergency status of the pipeline and the extension of the

completion date will give NGO's and the Botswana government a chance to thoroughly evaluate the potential impacts of the pipeline, and will allow OKACOM to incorporate the project into its river basin management plan. Also, Namibia can now explore alternatives to the pipeline without the acute threat of a water shortage. Finally, the delay opens a window for Okavango Delta Communities to organize and participate in the process.

Many in Botswana question whether Namibia has thoroughly considered all of its options before turning to international waters. The Okavango River Pipeline was first conceived in the 1970s, before much investigation into groundwater reserves or other water sources had been done. Namibia still has not conducted a thorough assessment of groundwater supplies, suggesting the decision to build the pipeline is not fully informed (Rothert, *pers. comm*). The government's 1993 Water Plan projects that water demand in the Central Area could rise from approximately 55 million cubic meters today to between 150 and 240 million cubic meters by 2020, possibly exceeding supplies by 2003 (Heyns, 1995a).

The study indicates that the Central Area has a number of undeveloped water sources that could meet demands for at least 10 years and forestall the need to tap the Okavango. Together, the various sources identified could supply a 95 percent safe yield of approximately 80 million cubic meters per year (Heyns, 1995b). The water plan's list of potential sources does not address relative costs or environmental impacts of the various sources, but it does indicate that there are other options that could meet demand for some time (Ibid).

The elimination of inefficiencies from the existing ENWC system, and using the Windhoek Aquifer as an underground reservoir to reduce evaporation (a serious problem for open water bodies of water in hot, dry climates) would yield more than 8 million cubic meters per year, which is more than half of what the proposed emergency pipeline would extract (Rothert, *pers. comm*). Perhaps the most appealing alternative on the list is desalination, which offers a virtually unlimited supply and relatively few environmental constraints. The problem at this time is the cost. According to government assessments, the cost of desalinating seawater is approximately $N5/cubic meter – at the coast – compared to an estimate of $N10/cubic meter of Okavango water delivered to Windhoek (The Namibian, 1997).

The cost of pumping desalinated water over 350 kilometers and up 1600 meters to Windhoek reportedly raises the cost to at least $N12/cubic meter. Until the cost of water in Namibia

increases significantly or the cost of the technology decreases, desalination will not offer an economically competitive alternative for Windhoek water supply. However, recent advances in the technology being developed in South Africa and elsewhere could make this an economically competitive alternative in the near future (Heyns, 1995a).

The consideration of alternatives to the Okavango pipeline leads to a broader question that has been raised in discussions of water resources in Southern Africa: should countries have to meet certain standards before tapping international waters and adversely impacting their neighbours? Such standards might include recycling a certain percentage of water consumed, implementing effective conservation and demand control measures, and full utilisation of economically feasible domestic sources. This approach would certainly go beyond any current international river basin agreements, but would help southern African countries stretch their limited water supplies over the long road to economic development.

The Okavango River Basin has unique qualities in terms of its geomorphology, hydrology, and biodiversity, qualities which remain relatively pristine with little discernible human impact on the hydrology and aquatic ecology of the basin. The significance of the basin has been highlighted by the international interest in the hydro-ecological state of the Delta and the bio-diversity it supports. In addition, by virtue of its remoteness and the continuing political instability, the Angolan portion of the basin remains one of the least developed regions in the savannah belt that traverses Angola, the Republic of Congo and Zambia. The complex arrangement of linear tributaries, dambos and broad seepage zones in the upper and middle Cuito and Cubango sub-basins make road access difficult and it is probable that this relatively undisturbed environment exhibits largely unmodified hydrological responses. The incipient degradation under the baseline conditions will threaten aquatic flora and their associate fauna both in the source sub-basins in Angola and the Delta in Botswana.

If left unchecked, the direct and indirect threats to this international water body will result in the breakdown of the hydrological and ecological integrity causing the global community to forfeit sizeable conservation benefits (including direct and indirect use values, and existence and option values). The threats are real and imminent – as evidenced by the recent unilateral initiative by Namibia to abstract water from the system under emergency drought conditions. This was avoided following a period of rainfall that re-established reservoir levels in the central area of the country. It is expected that the opportunity to protect this relatively pristine system will not

appear again and that the costs of remedial action will exceed current conservation costs by several orders of magnitude.

CHAPTER SIX

Countries need to establish links allowing for discussion and the exchange of views, and mutual beneficial cooperation in order to achieve better management of shared water resources.

(Pallet, 1997; pp. 65)

6.1 RIVER BASIN ORGANISATIONS

In the SADC region there are fifteen international drainage basins (Pallet, 1997), with great potential for the socio-economic development of the states that share them. Increased efforts at international regulation of these immense resources, using a basin-wide approach, should receive serious attention. Basin states should not allow poorly planned development and deterioration of the environment to ruin the chances of beneficial use of the natural resources for future generations. Similarly, the full development and optimal use of the water resources will be hampered if they are unilaterly developed in each country as a purely national matter, without considering the interests of the other basin states.

Countries therefore need to establish links allowing for discussion, exchange of views, the establishment of trust and mutual beneficial cooperation in order to achieve better management of shared water resources. Each state normally has its own projects of harnessing water resources (chapter five on Botswana). The challenge facing water users in international river basins can only be met in a multi-disciplinary way (Chapter Two).

One method of achieving integrated management of an international river is to establish a permanent River Basin Organization (ORB), with adequate terms of reference and sufficient power to meet its commitments. The Permanent Okavango River Basin Commission (OKACOM) aims towards the agreement of equitable and beneficial use of the waters of the Okavango.

6.2 A Critique of OKACOM: The Way Forward

In response to the perceived threats, the three Okavango Basin states signed an agreement in 1994 that formed the Permanent Okavango River Basin Commission (OKACOM). In addition to committing the riparian states to managing the Okavango River based on the principles of

equity, sustainability and openness, the 1994 OKACOM agreement requires OKACOM to develop an integrated basin-wide management plan[8]. (See Appendix One for details about OKACOM and the planning process). Because the Okavango is the first international river basin in southern Africa that has a functioning river basin commission that includes all riparian states, the importance of OKACOM establishing a regional precedent for managing the river in a participatory and sustainable manner cannot be overstated.

A possible long-term resolution to the potential conflict over the Okavango's waters may lie in the introduction of OKACOM (See Appendix One OKACOM Leaflet). It is clear that, in a worst case scenario there may soon be three dogs fighting for one bone. A fourth dog is needed. The numbers are not the issue. Finding a common concern, creating a common goal, which all parties strive to achieve together – that is the issue. Internationally attempts have been made to use Environment Development Plans as common goals to solve conflict. Walter Lowdermilk's ambitious efforts to ease Arab-Israeli tensions by joint development of the Jordan River were one. Will it be possible to turn the very bone of contention into a common goal – the preservation of shared ecosystems?

Not many years ago in the 'old' South Africa, by using the very result of their conflict, Professor H. W. van der Merwe managed to start negotiations between two warring factions in Natal. Knowing that it was useless, he did not try to persuade the groups to discuss their differences. Instead he used the rising death toll as the proverbial third dog: the common enemy. Finding it possible to discuss this common problem, suggesting for example restrictions in the use of lethal weapons, the two groups managed to reach consensus on other issues. Such is the magic that can still take place on this sub-continent (United Nations, 1992).

The objective of the Commission is "to act as technical advisor on matters relating to the conservation, development and utilization of water resource of common interest" (Okacom leaflet, undated) Within the scope of OKACOM, an Environmental Impact Assessment of the impact of Namibia's planned water extraction is already in progress.

[8] The OKACOM basinwide management plan is to be developed in four phases: 1) a Diagnostic Assessment which will assemble all relevant information about the basin; 2) a Strategic Action Plan which will establish a framework for completing the final phase; 3) an Environmental Assessment; and 4) the Integrated Basinwide Management Plan. The Diagnostic Assessment was completed and presented to OKACOM in November 2000, and the Strategic Action Plan is expected to commence in mid-2002.

The most effective means of minimizing international conflicts is to establish positive attitudes between groups. In addition to OKACOM's technical and scientific input it is crucial that ways are found whereby this political conflict situation can be turned into an example of international cooperation. Attention must be shifted from national gain towards universal sustainable management of a shared resource. One realistic way of achieving this aim lies in creative collaboration between OKACOM, concerned NGO's – thereby using the media to create positive public attitudes.

The relation between governments and the scientists they employ on the one hand and NGO's and the media on the other, has always been a strained one (Roberts, 1975). Government and scientists must however, realise that the NGO's and mass media survive on the strength of public interest and will therefore always tend to sensationalize issues. Still, it is the same public and their perceptions, as influenced by the media that will or will not keep the government officials and scientists in their decision-making positions.

The onus rests with the government and scientists to prevent damaging reporting. Articles like the one in a recent "Mail and Guardian" which under a heading "Plan could turn Okavango to Dust" quoted Tawana Moremi as wanting to bomb the pipeline and then continued to state: "Botswana recently tried to buy tanks from Europe but the deal was scotched, most think by a plea from Namibia" not only confuse the facts of an already complex issue, but creates a damaging and confrontational climate.

It is up to OKACOM to understand and appreciate the power (which may be negative or positive) of public perceptions in final decision-making. OKACOM's task, therefore, in addition to collecting and interpreting the necessary facts and figures, is that of communication, so that a culture of caring and sharing of a common natural heritage can prevail over a culture of conflicting demands.

Ensuring the sustainable management of the Okavango River Basin will require more than simply signing a treaty among basin governments proscribing how to share water and other resources. Management of the resource is made up of millions of discrete decisions and actions, from international treaties to a farmer's daily decision of where to take his or her cattle grazing. Both levels of action have the independent or collective capacity to impact on the river basin

significantly. Effective management of the river basin, therefore, will require all those who utilise it to share the responsibility of managing the Okavango (Roodt, 1998).

In 1995 OKACOM declared its commitment to the implementation of an Environmental Assessment (EA) and an Integrated Management Plan (IMP) for the basin The proposal for the EA and IMP recognised the threats to the basin and the need for joint management to protect national interests.

A draft Transboundary Diagnostic Analysis (TDA) has been compiled. The draft TDA has initiated a consultative process with basin stakeholders, established the current status of the basin as a whole, identified causes of degradation, and imminent threats, and indicated critical gaps in information, policy and institutional arrangements This is the first attempt of its kind to analyse the hydro-environmental and socio-economic information available in all three riparian countries. The draft TDA will be expanded as gaps in the analysis are filled and the TDA will include a thorough review of the competencies and comparative advantages of OKACOM as a basin organisation in preparation for SAP implementation. This analysis of the effectiveness of existing mechanisms and clear recommendations for improvement of both OKACOM and all the related policy, legal and institutional arrangements at national and regional level is an important test.

The long-term success of this initiative (OKACOM) depends primarily on the political willingness of the riparian countries to co-operate not only on regional transboundary issues, but also to collaborate positively across the linked sectors within their national administrations and socio-economic systems. The success of OKACOM as the co-ordinating agency is the key to maintaining the initiative and any undermining of OKACOM's position as the prime technical adviser to all three governments on the ORB will pose a serious risk to SAP implementation. This political will is necessary to the creation of specific institutional arrangements and strategies that are consistent with the SAP process. An ongoing concern is the ability of OKACOM and related institutions in the riparian countries to implement progressive natural resource policy. While OKACOM has a mandate as an inclusive body, sectoral interests may crowd out key partners across environmental, agricultural, financial and planning departments and agencies. To prevent this from occurring, the consultation and communication components have been designed to address this risk from the inception of the project.

The current uncertainty over peace in Angola and the Democratic Republic of Congo poses risks to project implementation if unrest in the region spills over into the ORB. In particular, if access to the catchments and the risks of land-mines inhibit direct data collection more emphasis will be placed on remote sensing and detailed interpretation of multi-temporal imagery. While a period of unrest may disrupt consultations, water will remain a key issue for any government. In the case of major unrest which threatens project implementation, UNDP will suspend operations in accordance with standard UNDP rules and procedures. The risk of international water disputes through lack of communication and understanding over water as the ORB is progressively re-settled and developed in Angola is minimised by the effective dialogue that takes place within OKACOM. Generally there is strong interest in co-operation and co-ordination among the three countries, particularly since all countries belong to SADC and OKACOM and can be expected to respect the SADC Protocol on Shared Water Resources.

Time is of the essence in this initiative. SAP formulation needs to proceed as quickly as possible to establish a meaningful framework for riparian co-operation and avoid unilateral action on the basis of drought conditions or other national imperatives such as dealing with the emergency re-settlement of refugees in the ORB. Prevention on this basis will be much cheaper than cure and needs to occur while close co-operation amongst the riparians can be assured.

(i) Sustainability of OKACOM

Government Commitment. The governments of the three countries of the Okavango have already demonstrated strong commitment to strengthening international co-operation in the regional basin management and this commitment has been confirmed among other things by their readiness to appoint OBSC as the co-ordinator of the PDF work on the TDA. The draft TDA further illustrates the governments' commitment to the development of enhanced transboundary environmental co-operation under the GEF International Waters Operational Strategy.

Economic Sustainability. This will establish the economic rationale for investing in integrated management of the ORB, conserving the stock of environmental assets, and optimising the flow of benefits from the basin's natural resource base. Positive and negative externalities associated with a set of water resource development options in the ORB will be evaluated and policy

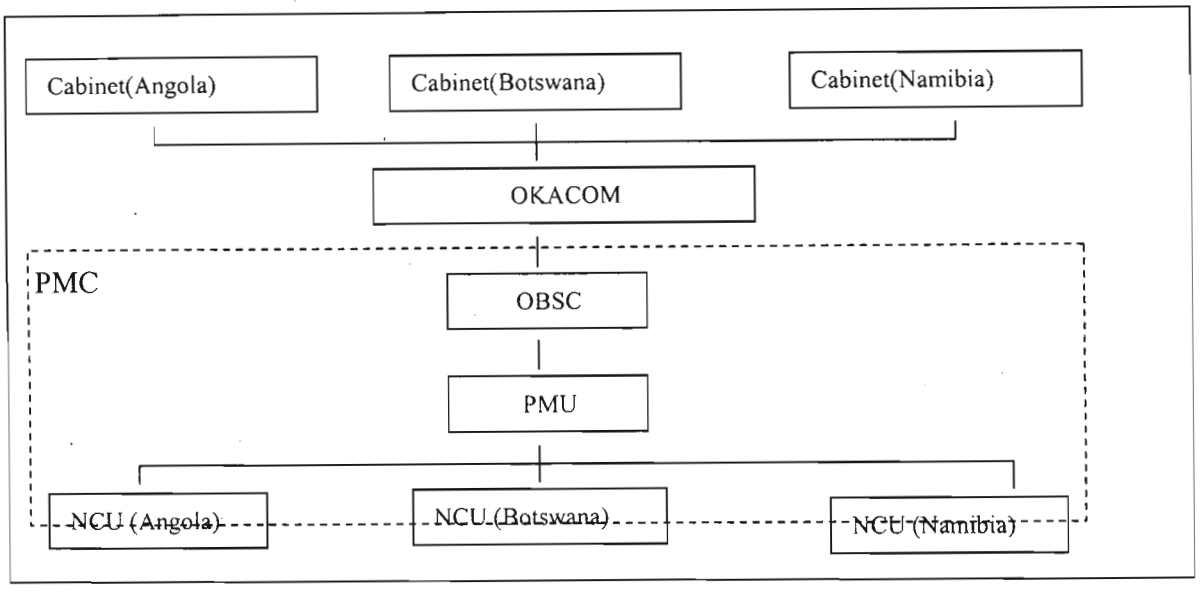
initiatives put in place to minimise transaction costs and work toward internalisation of negative externalities

Institutional Sustainability. OKACOM must be designed specifically to mainstream hydro-environmental and ecological concerns for the ORB within processes of decision making occurring within communities, local government, interest groups and NGOs operating within the basin - the stewards of the basin's landscapes. It must do this in two ways. First by driving policy changes and institutional adaptation at national levels and second, by active engagement of the basin stewards in research, analysis, and monitoring of programme components. Schools, colleges, universities, and research institutions will be key partners in building this capacity. In addition, the penetration of these sustainability concerns into national policies, regulatory, and institutional frameworks will be driven by the engagement of national professional interest groups in carrying out awareness raising, research, analysis, and monitoring. OKACOM should promote this penetration by use of their communication and networking capabilities, a feature of the PDF work that had positive resonance within the basin communities.

(ii) OKACOM Implementation and Institutional Framework

Institutional Framework. The institutional framework of OKACOM is set out below. OKACOM derives its authority from the respective cabinets of the riparian countries. The Governments of Angola, Botswana, and Namibia have nominated national experts as country delegates to OKACOM. These delegates are drawn from the respective Departments/Directorates for Water Affairs, Ministries of Environment, Planning, and Attorney General's Offices. OBSC is responsible for overseeing the day to day implementation of studies related to the ORB.

Figure 6: General Framework for OKACOM



Promising signs for a sustainable future of the river basin have also emerged with the formation of the Okavango Liaison Group. The Okavango Liaison Group (OLG) is a growing regional network of NGOs managed by the Kalahari Conservation Society, it proposes to implement *Every River Has Its People: Promoting Co-Management of the Okavango River Basin* ("Every River"). 'Every River' will be a coordinated set of activities over an 18-month period aimed at promoting the sustainable co-management of the Okavango River Basin.

6.3 The Okavango Liaison Group

Co-management involves the shared management of natural resources by those who have the official obligation to do so, i.e. government, and those who live with and use the resources, such as communities and the private sector (Rothert, *pers. comm*). The goals of the proposed activities are two-fold: One, to increase the capacity of the region's institutions and stakeholders to participate in co-management of the Okavango; two, to create a protocol by which co-managers of the resource may participate in sustainable management of the Okavango River Basin.

(i) Co-management

Co-management is a concept that primarily evolved out of natural resources conflicts in North-America, often related to rivers. A staggering variety of "watershed initiatives" have sprung up across the United States and Canada in recent years that seek participatory and consensus-based solutions to the modern difficulties of resource management, including decision-making grid-lock, ineffective and fragmented management programmes, the frequently unmet desire of local stakeholders to play a meaningful role in the process, and the need for more integrated, cooperative and effective problem-solving strategies (McCaffery, 1989). The form such cooperative management initiatives take vary greatly, but are based on the idea of shared management opportunities and responsibilities. This activity (Every Rivers Programme) aims to apply this emerging concept of co-management to the Okavango River Basin.

There are four levels of management related activities ongoing in the Okavango River Basin: on the highest regional level, OKACOM is conducting the basin wide management planning process; on the next level, governments are engaged in national level planning activities (e.g. Namibia is conducting a water sector analysis and Botswana has launched planning efforts for Ramsar and a National Wetlands Policy); on the provincial level, regional institutions are undertaking water projects (e.g. Ngamiland district Council is constructing water supply pipelines along the Okavango delta); and on the local level, riparian towns and villages are busy securing water for residents' daily use. With these multiple layers of management, there is one interwoven element – the people who live in the basin – and one theme that could tie the levels of effort together, participation.

Unfortunately, although many in the Okavango River Basin recognise the importance of participatory management, efforts in the basin remain largely non-participatory. Two significant obstacles block the way to successful co-management of the basin. First, many riparian communities and other stakeholders lack the capacity to effectively participate in the management of the resource, and second, there is no defined system to facilitate non-governmental stakeholders to play their role.

(ii) Technical Approach

The activity "Every River Has Its People: Promoting Co-Management of the Okavango River Basin" has three elements: a) Stepping up capacity building for Okavango River Basin Stakeholders; b) Promoting a participatory protocol; and c) Okavango watch (Rothert, 1998).

Over an 18-month period, the OLG proposes to implement a coordinated set of activity elements aimed at two goals:

- Increase the region's institutional and stakeholder capacity to participate in managing the Okavango River Basin,
- Develop a protocol by which stakeholders may participate effectively in the management process;

The OLG will achieve these goals through several integrated elements, including:

- Educating riparian communities and other stakeholders on issues important to the management of the Okavango, through an educational book and video;
- Developing stakeholder participation protocol that incorporates regional and international best practices;
- Assessing the feasibility of "Okavango watch", a programme to involve schools and the private sector in monitoring the health of the Okavango River and Delta (Rothert, Ross, and Shupema, *pers. comm*).

6.4 A Regional Approach to Environmental Assessment

As another solution to ensure the sustainable future utilisation of the shared waters of the Okavango, the author proposes that the establishment of a Regional Environmental Assessment Policy should be proclaimed. Environmental Assessment (EA) is a useful tool in planning for sustainable development and since the threats to the Okavango are development incentives EA would prove a viable tool to assessing these developments and ensuring that they are sustainable. Unfortunately though, Botswana and Angola have not made significant progress in adopting EA as a strategic planning tool, and thus (Southern Africa) has not made a collective effort to apply EA at the regional level (Tarr, 1998).

Most southern African countries depend on primary resources to sustain economies and their people. The environmental issues are remarkably similar in countries within the region, and the economic, social and political fortunes of the individual countries are intertwined. Furthermore, the ways in which resources are being managed are similar and thus cause for common concern (Tarr, 1998). In general, the ability of countries in the region to achieve sustainable development

depends not on national policies but also on the commitment of neighbours to practice sound environmental management. This is because activities in one country, can easily cause impacts on a neighbour and possibly result in downstream opportunity costs (a classic case being the Okavango River).

In order for the Okavango River to be conserved and ensure that its natural capital is continued, governments in the three basin countries need to apply collectively, an EA policy. This will also ensure that activities do not negatively affect the development potential of downstream neighbours. The Rundu Pipeline Environmental Impact Assessment was carried out wholly by Namibian consultants, and this was a cause for contention in Angola and Botswana. In order to avoid this 'bias', cooperation on development activities must be planned (Roodt, 1997).

There is the possibility that investors will play one country up against another when negotiating new projects. Using a hypothetical example, a company wishing to establish a sugar plantation in the Caprivi (Namibia) may indicate that they will only do so if environmental requirements (e.g. efficient water use, waste management, land clearing) are relaxed. They could argue that Namibia's Laws are too strict and that adhering to them is too expensive. Thus, they would threaten to pursue an option in Angola instead, where (hypothetically) environmental laws are more relaxed. If they did this, the impacts they would cause (e.g. pollution) would still enter Namibia via the Okavango River and ultimately concentrate in Botswana's Okavango Delta. In this hypothetical example, Angola would receive the benefits of the project (jobs, taxes and foreign exchange) while Namibia and Botswana would pay the price of environmental degradation.

Thus, it is the view of the researcher that one way of reducing conflict over the Okavango River is by the application of EA at the strategic level, and the harmonisation of countries EA policies and legislation, could help to minimise future opportunity costs and conflicts. While regional or subregional level environmental legislation is necessary in order to address environmental issues that cross frontiers and that involve common management, there is still insufficient progress in regional cooperation in the fields of environmental management, political direction or economic development (Tarr, 1998).

As people realise that water is a finite resource the move for cooperative management is growing world wide. Southern African countries are beginning to establish management

agreements and structures for shared water-bodies, the most notably being SADC' Zambezi River Action Plan (ZACPLAN), which involves eight countries, and focuses on ways to guarantee the quality and quantity of water crossing borders.

In spite of the clear need for regional cooperation on river management, the efforts to achieve this are fragmented and inadequate. Where joint decision making exists, the results have been positive. SADC has been created to facilitate integration and its policies reflect this mandate. Similarly, it has established the necessary institutional structures to fulfil this mandate. The next step should be the development and implementation of a SADC protocol on Environmental Assessment, which binds its members to assessing the impacts of all their major policies and development activities, including those that may affect neighbours. In this way, countries in the region could move closer to achieving the elusive goal of sustainable development.

CHAPTER SEVEN

The potential for violence is always present...when next it comes, as it will, the areas being fought over will demonstrate that the stated cause of conflict may not be the only one. Although the battles may appear to be about land, or autonomy, or human rights, or protecting borders, every confrontation in the future will be affected by the hydrology of the region. Water wars are on the way.

(J. Bulloch & A. Darwish, pp; 46, 1993).

7.1 CONCLUSION

7.2 Namibia's Okavango Pipeline: Avoiding the Next Water Crisis

Even under the worst case scenario described above, Namibia has a three-year window of opportunity to get far enough ahead of the drought cycle that emergency planning is unnecessary. If Namibia continues to expand three water supply measures it is currently pursuing, *i.e.,* water demand management, artificial recharge, reclamation/recycling and new groundwater sources, the water supply system could be resilient enough to meet demand and weather droughts – without going to the Okavango River for the foreseeable future. It is a case where long-term objectives can meet short-term threats. While all those concerned would prefer a longer period of water security with which to plan, if public and private sectors act with urgency, an emergency such as that experienced in 1996 likely will not occur again. The following sections evaluate a number of potential strategies and new sources to supply a possible shortfall in 2002. Schemes such as extracting water from the Kunene and Orange rivers are not considered here because their costs and time to develop are prohibitive (Rothert, *pers comm.).*

i) Demand Management

Despite rapid urban growth rates in the 1990s – more than 5 percent annually in Windhoek – Namibia is still a relatively un-urbanised country. Approximately 32 percent of the population lives in urban centres, which is low compared to 80 percent in many developed countries and an estimated 58 percent in South Africa (Heyns *et al.* 1998). Because the cities, especially Windhoek, continue to dominate the country's economic, legislative, administrative and financial activities, Namibians will continue to flock to urban areas in coming years. In fact, the

rate of urbanisation in Namibia is expected to increase significantly before growth levels off (van der Merwe, 1999).

Because urban services can be provided more efficiently and *managed* more effectively than rural services, higher urbanisation rates can be beneficial to water demand management efforts. The City of Windhoek initiated a demand management programme in 1992, and by 1996, the city's aggressive conservation and pricing measures succeeded in reducing demand to 1989 levels, despite a 35 percent population increase since that time.

7.3 Artificial Recharge of the Windhoek Aquifer and Water "Banking"

Namibia experiences tremendously high rates of evaporation. During 1997, for example, the volume of water supplied by Windhoek's three dams totaled 15.7 Mm^3, while evaporation losses from the dams exceeded 35 Mm^3. As a result, Namibian water planners have historically relied more heavily on surface supplies than groundwater during rainy periods and vice versa[9]. There is incentive to utilise surface supplies quickly before they are evaporated. Another strategy to minimise evaporation losses is to store surface water underground until its needed at a later date. Windhoek has recently begun exploring the effectiveness of this technique, known as artificial recharge. In August 1998, the city began injecting treated water supplied by NamWater into the Windhoek Aquifer and found that water levels at surrounding boreholes were rising at four times the natural recovery rate (Ashley, *et al.,* 1995).

If the recharge tests continue to prove successful, the large-scale application of this technique has the potential to save significant amounts of water, which could substantially increase the sustainable yield of the Windhoek Aquifer, as well as the aquifer's capacity to sustain the Windhoek during a drought. It is estimated that for every 1 Mm^3 of water temporarily stored underground, 0.4 Mm^3 is spared from evaporation. Thus, if Windhoek injected 5 Mm^3/yr into its aquifers, it would have an extra 2 Mm^3/yr for use that would have been lost to evaporation had it remained in one of it's dams (van der Merwe, 1999).

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[10] For example, in 1996 the Windhoek Aquifer provided the city with more than 3.6 Mm^3/yr – almost double it's sustainable yield – because surface supplies were nearly depleted. When the rains fell in 1997, the city reverted to surface supplies and allowed the Windhoek Aquifer to recharge by only using 0.9 Mm^3/yr, less than half it's sustainable yield (NamWater unpublished data).

Similarly, water could be injected underground and reserved from normal consumption, thereby "banking" water for use during a drought. The total capacity of the Windhoek aquifer is estimated to be between 15-25 Mm^3. The annual sustainable yield is considered to be 2 Mm^3/yr, and emergency yield is considered 4 Mm^3/yr. This means that not even half of the aquifers capacity is being utilised. Therefore, it could be possible to inject and maintain a certain volume of water and set it aside for drought use only. This is in effect what is already done, in that over a two year emergency period 8 Mm^3 not 4 Mm^3 can be pumped for two years. Assuming the artificial recharge proves feasible on a large scale, Windhoek could inject 6 Mm^3, for example, that could supply an additional of 3 Mm^3/yr for two years during a drought (Ibid).

(i) Short-term emergency pumping of aquifers

The Central Area has occasionally been forced to pump water from aquifers at rates exceeding their long-term sustainable yield. The general policy of the Department of Water Affairs holds that aquifers should not be pumped at greater than sustainable rates for more than 24 months to avoid causing permanent damage to the resource (Heyns *et al.* 1998). WTC (1997) compiled DWA's proven or estimated emergency and long-term sustainable pumping rates for the Central Area's aquifers. Studies have revealed that if the Central Area's aquifers are pumped with existing boreholes at emergency rates, an additional 13.4 Mm^3/yr would be available for up to two years in a drought situation. The net potential emergency yield would increase to 26.9 if the Abenab and Tsumeb mines were developed (Comrie, 1987).

(i) Development of "New" Ground Water Sources

The abandoned mines in the Grootfontein-Tsumeb area, and the Tsumeb and Platveld aquifers represent important untapped groundwater resources that could play a significant role in meeting growing demand and emergency supply needs (WTC, 1997; NamWater , 1998). In addition to the economic and technical issues surrounding these potential sources, water quality is a potential problem that would have to be addressed in some cases, such as the Tsumeb Mines and other areas of the Tsumeb aquifer (van der Merwe, *pers. comm.).*

(iii) Abandoned Mines in Grootfontein -Tsumeb Area

Information from past pumping practices and recent studies suggest the three abandoned mines in the Grootfontein-Tsumeb area, namely the Berg Aukas, Abenab and Tsumeb mines, represent a significant potential contribution to the Central Area water supply. More on-site investigations need to be carried out to confirm estimated sustainable and emergency yield rates, which DWA

and NamWater plan to continue in 1999 (M. Harris, pers. comm.). Available information suggests the combined sustainable yield is more than 5 Mm^3/yr, while the emergency yield likely exceeds 15 Mm^3/yr (WTC, 1997; NamWater, 1998).

(iv) Summary of Water Supplies in Worst Case Scenario

Should the coming rainy seasons fail, surface supplies would be exhausted by 2001, which would result in a potential supply shortfall. The total Central Area demand in 2001 would be approximately 51 Mm^3/year. All sources excluding surface dams would produce approximately 35.5 Mm^3/year, leaving a potential deficit of approximately 15.5 Mm^3/year. If the Namibian government continues to develop water demand management, artificial aquifer recharge, and new groundwater resources, sufficient water would be available to meet demand for at least two years at a much lower cost than the Okavango Pipeline.

Research (Namibian Water Plan, 1993) shows that if the government implements an effective demand management program, applies artificial recharge on a large scale, and utilises aquifers at emergency rates, these measures would produce between 18-20 Mm^3/year for at least two years – enough to satisfy worst case scenario conditions. If the abandoned mines or Tsumeb aquifers were developed as well, the water supply would be even more secure (Ibid).

Systems modeling conducted for the 1997 Okavango pipeline feasibility study (Water Transfer Consultants, 1997) indicates that the amount of "emergency" water that would likely be required during the next 15 years to supplement existing supplies in the ENWC system will vary, but will average between only 2.0 - 2.5 Mm^3/yr. Thus, based on this modeling, demand management, artificial recharge and groundwater sources could safely meet the water needs of the Central Area projected growth in demand for many years to come as well as in an emergency situation.

(v) Comparison of Okavango Pipeline and Alternatives

Planners would likely judge emergency supply alternatives using the three criteria applied in the 1997 feasibility study: adequacy of capacity, required construction time and capital costs. There are certainly other criteria to consider in addition to these, such as environmental impacts and operating costs, which would need to be studied in greater detail. As chapter five shows, the option of using existing aquifers and the abandoned mines would likely surpass the Okavango pipeline alternative in terms of project capital costs and timing.

Clearly the Okavango River pipeline project is not the only option to meet the emergency water supply needs of the Central Area. Existing aquifers, developing abandoned mines, water demand management and the conjunctive use of the Windhoek aquifer appear to offer more than adequate resources to meet Central Area demand for at least two years in an emergency situation. The lower cost and more rapid time to delivery make alternatives to the pipeline more attractive (Pallet, 1997).

7.4 Beyond the Next Crisis: Long-term Water Supply and Planning Issues

Water resources planning and management in Namibia has until recently concentrated on the technical side of supplying water, rather than managing demand (Ashley, *et al.*, 1995). This approach allowed water demand to increase rapidly, burdening Namibia's economy, infrastructure and aquatic systems. The drought in the early 1990s sent a clear message to water suppliers and consumers across southern Africa that it's time to come to grips with the region's limited and unreliable water resources. Namibia was among the surprisingly few countries that responded affirmatively to that message. Many new ideas and programs emerged that set a course toward the sustainable management of this important resource, but more can still be done.

(i) Food Security vs. Food Self-Sufficiency[10]

Ashley et al (1998) argue that it is more efficient and cheaper for Namibia to import certain foods using revenues earned from its export sector (*i.e.,* "food security"), than for the country to grow all of its food at an unaffordably high cost (*i.e.,* "food self-sufficiency"). Namibian farmers provide between 20 and 50 percent of the country's grain requirements each year, depending on annual rainfall, and imports the balance. It borders one of the largest producers of white maize (whose costs of production are significantly lower than in Namibia), and has ready access to the world grain markets. Namibia can import grain quickly and efficiently from a variety of sources using foreign currency generated from its strong export sector. The recent shift away from a focus on food self-sufficiency towards food security has been a noticeable feature in the agricultural policies of many countries in the southern Africa region, including Botswana. Poverty reduction forms the core of any effort to achieve food security and the

11 Food security refers to a nation whose residents are sufficiently well fed to lead a healthy and active life. Food self-sufficiency refers to a nation that produces enough food to feed its members and does not need to import any. No country is self-sufficient in all foods and each country imports food to some degree (Ashley et al, 1998).

principle way this can be done is through the creation of employment opportunities. The production of food grains has lower labour requirements and generates lower incomes per cubic meter of water than other crops. Thus, pursing food security rather than food self-sufficiency is a less expensive and more efficient option for Namibia (Ellery & McCarthy, 1994).

(ii) Updating and Revising Water Policy and Law

As Bethune et al (1998) argue, Namibia's National Water Act requires updating and extensive revision to achieve sustainable water management. Article 95 of the Namibian Constitution states: "*the State shall actively promote and maintain the welfare of he people by adopting ... policies aimed at ... maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilisation of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future ....*" This articulates the guiding principle and basis for developing suitable legislation to achieve Namibia's goals.

Several policy and legal instruments govern the use of Namibia's water resources. The principle one is the Water Act, No. 54 of 1956, which covers a range of issues relating to the protection of surface and subsurface waters from pollution and misappropriation, and sets out the State's interest in protecting the resource. A major limitation of the act, and one that puts it in conflict with Namibia's Constitution, is that it does not stipulate the sustainable use of water resources in terms of social, economic or environmental sustainability. Moreover, it does not recognise the natural environment as a user of water nor as a provider of essential processes and services. The Water Supply and Sanitation Sector Policy (WASP), has effected wide ranging changes in water management in Namibia, including the establishment of the Directorate of Rural Water Supply, the Namibia Water Corporation (Namwater), and the Water Supply and Sanitation Co-ordinating Committee. However, WASP has certain limitations that need to be addressed. The shortcomings found in the Water Act, WASP and other laws and policies could be rectified in a White Paper on water sector policy that would become the new water law.

(iii) Demand Management and System Efficiency Strategies

The population of Namibia is doubling every 23 years, and as the country continues to develop, a greater percentage of the population will expect to have water continuously available their various needs. Effective demand management will be the only way to assure that water continues to be available for at least basic needs. For example, if water demand grows at four percent annually, by the time the population has doubled in 2023, the countrywide demand will

grow from approximately 240 Mm^3/yr to 591 Mm^3/yr . If, on the other hand, demand is limited to only three percent annually, by 2023 countrywide demand will be 473 Mm^3/yr, a reduction of 118 Mm^3/yr – which is more than six times Windhoek's current demand. The City of Windhoek has already demonstrated the effectiveness water demand management can achieve. The challenge lies with government now to continue to expand the demand management programme without the incentive provided by a countrywide drought (Ashley, *et al.* 1998).

On a system-wide basis, opportunities exist to increase the assured safe yield through operational innovations. Windhoek's supply comes from numerous sources such as local boreholes, a dam nearby town, a water reclamation plant, re-use of purified effluent, three major dams a distance from town and links to groundwater some 300 km north of the city. For example, by linking the dams to Windhoek's groundwater through artificial recharge as discussed above, the city could make significant gains in its safe yield.

7.5 Emerging Technologies

Several water supply strategies have been proposed that utilise non-traditional technologies, most notably desalination coupled with solar powered pumping stations to transfer water from the coast. Supplying the Central Area with desalinated water from the coast has been considered in two studies, and found to be currently more expensive than other sources of water (WTC, 1997; Joint Venture Consultants, 1993). Similarly, solar power has been investigated recently and found to be more expensive than other power sources at this time (Nampower, 1997). However, considerable resources are being committed to developing these types of renewable technologies that could produce significant advances that would make them competitive with traditional sources of water and power.

Another technology that has been proposed as a partial solution is wave-powered desalination. Wave-powered desalination involves a series of buoys connected to pumps, which are in turn connected by high-pressure sub-sea piping to the shore. On shore, the pipes would lead to a desalination plant equipped with reverse osmosis membranes and turbine generators. As the buoys rise and fall with wave action, seawater is pumped through the membranes and generators, producing both fresh water and electricity for pumping the water inland. It is estimated that a system consisting of 400 buoys along four kilometers of coastline would have a fresh water production capacity of 21,800 cubic meters per day (8 million per year), and an

electrical output of 4 megawatts. The estimated cost of water produced by this system is US $2.00/m^3, whereas Okavango River water is estimated to cost US $1.80/m^3 (Hagerman, 1997).

Moreover, there could be funding or subsidisation strategies to reduce the cost of sustainable approaches enough to competitive levels. For example, multi-lateral donors such as the World Bank have expressed goals of supporting sustainable water and energy projects. In addition, some have proposed a cost-sharing arrangement with Botswana, levying a tax on tourists visiting the Okavango Delta, or establishing a regional environmental mitigation bank. While sustainable technologies and creative financing strategies are definitely for the future, opportunities available today should not be overlooked.

7.6 Solutions and Recommendations

Having noted the overall factors, issues, theoretical considerations and dynamics that prevail in the Okavango Basin, it now becomes possible to suggest four over all solutions to the problems.

Solution number 1: Because one of the underlying features of the overall Okavango problem is related to competition over ever decreasing resources, it becomes abundantly clear that an effective multilateral structure needs to exist. There are two aspects that are relevant. These are mutually supportive of one another.

There is already a multilateral structure in the form of SADC. In terms of SADC, there is the SADC Protocol on Shared Watercourse Systems, which already exists. In terms of Article 3 of this instrument, River Basin Commissions are required to be set up between member states. OKACOM already exists but is not functioning well. Clearly it makes the most sense to revitalize OKACOM and to further legitimize it by means of the SADC Protocol.

The best way to reestablish OKACOM is probably by means of diplomatic interchange at a level higher than the technical working group in the opinion of the reseracher. It cannot only be left to technical commissions as preliminary research that has been conducted by the researcher suggests that "there is an underlying fear that River Basin Commissions may eventually erode the sovereignty of the state, so officials do not allow cooperation to develop to a level beyond the minimum that is absolutely necessary" (Turton, 1999b). As already noted, communication will play an important role in this regard, creating the right climate for the diplomatic

interchange by empowering the decision-makers with the relevant knowledge that they will need in order to be effective.

Solution number 2: As has been noted above, there is a prevailing zero-sum paradigm in existence. Because this is inherently conflicting in nature, there is a need to change this to a cooperative approach based on the benefits of win-win principles. This takes time as it is based at least in part on prevailing human attitudes. Attitudes can be changed if communication is effectively used. The purpose of this communication must be to inform the decision-makers of the costs of the prevailing zero-sum paradigm and the benefits of a cooperative paradigm. The inherent benefits of diplomatic interchange can also be brought to bear. In this regard, political allies can be used to also raise the issue in the appropriate international political fora. This also illustrates the relative advantage of raising the issue of the revitalization of OKACOM at the political level rather than at the technical level. The long-term objective of this whole series of interactions is to change the prevailing paradigm to a cooperative one. This has lower conflict potential and increases the regional security by offering guarantees to all of the participants. While each actor may not get exactly what they feel they want, in the final analysis they can probably get what they effectively need for survival in the process.

Solution number 3: There is an overarching need to begin to balance the developmental aspirations of each state against the realistic developmental potential of those states. The operative word in this regard is "balance". This is needed between the following:

By introducing the notion of the water landscape at the policy-making level, the issue is no longer one of man versus the environment as already noted. In terms of this concept, man is an integral part of his environment, and the water landscape becomes the life-support system that is needed for continued survival. Part of this solution is then linked to the revenue that is generated by tourism. It could be argued that wildlife is a far more efficient means of harnessing the natural environment and converting it to an economic asset than farming is in arid regions. Critical to this whole balancing act is the need to expand the policy-making support system available to states. Unquestionably, the major driving force behind all of the development-related problems that have been highlighted in this dissertation, is uncontrolled population growth. Therefore, as long as this population-factor is not being dealt with at the policy-making level, the final result will almost always be unsustainability.

Previous research that has been done by water researchers (Turnton, Heyns, McCaffrey, Naff and Falkenmark) shows that water scarcity is not the actual problem, but is rather the manifestation of the interaction between three specific root causes (Turton, 1998a). These root causes are environmental change, population growth and the allocation of water within an economy to specific sectoral uses. In this regard, the researcher has suggested the linkage of policy to effectively deal with this expanded view of water-scarcity in arid regions.

An important component of the need to balance the developmental aspirations of each role-player is linked to the national interest of each state. At present, each state seems to be viewing their own national interest from a very narrow perspective. This is what is essentially driving the zero-sum dynamics within the Okavango Basin. There are really three important components to this that need to be specifically highlighted.

1. A key component of national interest is the perception that the individual policy-maker has of what this interest is or should be. Because perceptions play such an important role, the importance of communication again comes to the fore. This communication should be designed to change the perception of the national interest over time.
2. Another key component is the fact that the policy-maker is not necessarily a water specialist. In fact, the policy-maker tends to be a politician who is elected to office for a period of time and then departs. While this is not true in all cases (Asmal, 1998), it certainly is the case much of the time.

3. The people that provide continuity are usually the technical staff from the respective Departments of Water Affairs. They also have an extremely narrow focus, being guided by the engineering related dimensions of their normal work. The proposed panhandle pipelines (Botswana) are an example of this. There is thus a need to expand this technical staff to include specialists that can adopt a multidisciplinary approach. This is necessary once a critical threshold has been crossed - that of the politicization of water at the international level – as has been the recent case with the Okavango Delta.

Solution number 4: Capacity building is an obvious solution. Leif Ohlsson (1998; 1999) has done some pioneering work in this regard. It is the inability of developing states to innovate in the face of complex challenges, which causes them to fail (Barbier & Homer-Dixon, 1996). It has been shown that there are many aspects to the capacity of states, which manifests when that

state tries to deal with water scarcity (Turton, 1999d). This is relevant for most of the states in the Okavango Basin, albeit in varying degrees. There is a critical shortage of intellectual capacity in the Southern African water sector, specifically regarding the social sciences. This lack of capacity is what Ohlsson refers to as a social resource scarcity or lack of social adaptive capacity (1998:8). It is precisely the existence of this lack of adaptive capacity within the Southern African water sector that makes cooperation between all role-players so vital (Turton, 1999b). The development of this intellectual capacity should be focussed on incorporating indigenous knowledge systems and understanding the unique problems that confront developing states in arid regions. This means that intellectual capacity that originates from the wetter parts of the developed world is not necessarily entirely relevant to the unique problems that exist in the arid, under developed regions of the world (Turton, 1998c). The Okavango Research Centre in Maun can play a pivotal role in this regard and deserves to be encouraged in their current scientific endeavors.

Article 5 of the SADC Protocol on Shared Watercourse Systems provides for the collection, storage, analysis and dissemination of data relevant to the integrated development of the resource, along with the design of relevant research programs. At present, each state is trying to develop this intellectual capacity themselves, almost in competition with one another. This is self-defeating in the opinion of the researcher. What intellectual capacity exists, should be shared for the common good. This will clearly have to involve a paradigm shift towards a more cooperative basis of interaction. If not, then the shortage of intellectual capacity will become a definite element of social resource scarcity as conceptualized by Ohlsson. There is also a critical lack of institutional capacity within the Southern African water sector. This will have to be specifically addressed.

There is a maldistribution of institutional capacity within the Southern African region. Within the Okavango Basin, Botswana probably has the most highly developed institutional capacity, although Namibia is probably not far behind. Even then, the capacity of both of these states is really limited when compared with other parts of the world. Angola has very limited institutional capacity indeed. The SADC Protocol on Shared watercourse Systems calls for the establishment of institutional capacity, but leaves it up to the individual states concerned to establish, staff and fund these institutions. For this reason, institutional capacity at a regional level is somewhat stunted, being limited at this stage to the SADC Environment and Land Management Sector (ELMS). All capacity building efforts are highly dependent on the availability of financial

capacity. Without sufficient financial capacity, other aspects of capacity building are rendered ineffective (Turton, 1999d). As with the other forms of capacity, this is also seriously limited at present. Article six of the SADC Protocol on Shared Watercourse Systems notes that the financial framework for the various River Basin Management Institutions shall be annexed to the Protocol once it has been finalized. This hampers the implementation of the Protocol, as without a budgetary base, the institutional structures cannot be effectively established (Turton, 1998a).

7.7 Research Needs

From the preceding discussion it becomes evident that there is a pressing need for well-coordinated applied research. The whole academic discipline of hydropolitics is in its infantile stage. There is thus a pressing need to develop this discipline further as a matter of some priority. What is needed is an emphasis on the following:

1. There is a need to define key concepts that are the critical components of any scientific endeavor.
2. Once the concepts have been defined, there is a need to develop an understanding of the relationships that these concepts have with one another in terms of being either independent or dependent variables.
3. Once the variables have been isolated and their relationships determined, then there is a need to develop hydropolitical models by understanding how these variables (and other sets of variables) relate to each other.
4. Finally, there is a need to study the models that are derived from different regional settings in order to determine whether there are commonalties or universal truths that exist. In other words, a paradigm needs to be developed over time. It is possible that the hydropolitical dynamics that exist within a given regional setting are highly dependent on specific local conditions or variables. In this case universality may not be attainable. Where universal truths have been isolated, they may be found to be so vague as to be almost meaningless. This needs to be explored further. The study of hydropolitics shows how interconnected the problems are. There is thus a need to encourage interdisciplinary research. The danger of a multidisciplinary approach is that the final study can be treated with suspicion or disdain by the intellectual purists. The need still remains for such an approach however.

There are a number of types of thresholds that will probably be relevant to a profound understanding of hydropolitics. These are likely to be:

1. Political thresholds are subtle but pertinent. The Okavango case study shows that engineers chose to consider the development of a pipeline system along the panhandle. Under normal conditions this would probably be acceptable. The planning is certainly within acceptable engineering parameters. Once the Government of Namibia chose to develop their new Okavango pipeline a political threshold was crossed. The researcher would argue that this took place when the Government of Botswana chose to register the Okavango Delta as a Ramsar Site. The issue at hand was thus elevated from the status of a normal engineering problem, to one with the status of an international political issue. It therefore fell beyond the competence of engineers alone to make the decision concerning the pipeline project, probably for the first time in their living memory.

2. Population thresholds are also relevant and possibly easier to quantify. Both Falkenmark, (1989) Naff and Matson , (1984) note that Gustafsson has determined that a country would have the capacity to be self-sufficient in food production at the subsistence level based on rainfed agriculture if there is a minimum of 1 250 m/ p / yr. Of significance however, this figure does not make any allowance for water availability for either industrial or irrigation demands (Evans, 1995). After studying the most successful traditional cultivation systems that history had recorded - those of eastern Asia, the Nile River basin and the Netherlands - Vaclav Smil concluded that a threshold level of 0,07 hectares of arable land per person was incapable of feeding their population on a sustainable basis without intensive use of synthetic nitrogen, phosphorous and other technological improvements. This threshold signals the transition to the vulnerability of dependence on extensive modern inputs. The crossing of this threshold is seen as a permanent event without subsequent expansions in land availability or considerable decrease in population size. Ohlsson (1999) gives a detailed and chilling account of what can happen when this threshold is crossed, as in the recent case of Rwanda.

3. Ecological thresholds are known to exist between different phases of ecosystem degradation or reconstruction. Critical thresholds that are hydropolitically relevant relate to ecosystem collapse or possible revitalization. Given the existence of tensions between stakeholders, it is necessary to begin to develop a deeper understanding of conflict resolution and conflict management.

As previously noted, the field of water demand management is conducive to a multidisciplinary approach. It is also probably one of the most significant issues currently emerging from the water sector in Southern Africa. The importance of this is likely to grow in direct proportion to the increase in water-scarcity. This field of research covers diverse disciplines such as

economics, psychology, communications, anthropology, political science and sociology amongst others. Given the relevance of population growth within the overall water-scarcity debate, specific research should be targeted at quantifying and mapping out the current and future migration patterns of "ecological" or "environmental refugees". Attention in this regard should be given to identifying any thresholds that may suddenly be crossed due to this presumably unplanned, probably drought-induced migration.

7.8 Conclusion

This dissertation has been an attempt to produce a comprehensive study that illustrates the relevance of water within the context of a developing state in an arid region. Suggestions have been made for additional research and the development of relevant intellectual capacity. The material that has been presented suggests that if the ecosystem fails, then it is catastrophic for all of those people that depend on the ecosystem for survival. A valuable lesson can be learned from the Aral Sea in this regard. Botswana has been a highly successful state within an African context. Yet this success could be short-lived unless some really critical strategic issues are adequately addressed. This will require decision-makers that are farsighted and visionary. They will have to be empowered to make the correct decisions by scientists and specialists, probably working in multidisciplinary teams. Crucial to the success of this, will be the fact that a paradigm shift needs to be made away from the existing national interest base towards a more cooperative regional approach. The important aspect to note however is the fact that sustainability means, in its most basic form, that development must take place within the constraints that the environment has posed. This can be achieved once man realizes that he cannot stand alone from the environment, and accepts that he is an integral part of the overall water landscape. In short, it involves a fundamental shift away from the "wild-west" notion of ever expanding boundaries (Wilson, 1998), to the new political economy of the spaceship earth with its life-support provider, the water planet.

Securing an adequate and reliable water supply is among the most important issues facing Namibia today. Managing the Okavango Delta is of utmost importance to the people, wildlife and economic activities that depend on it. Many people have considered these two goals mutually exclusive, even though the impact on the delta of an emergency water supply for Namibia's Central Area is uncertain. This dissertation shows that the perceived tradeoff between water security for Namibia and an untapped Okavango River is a non-issue for the foreseeable future.

While Namibia's water situation today looks fairly secure, drought is a recurring feature of the lansdscape and must be planned for. Even in the worst case scenario, *i.e.,* that it stops raining in Namibia today and surface supplies are exhausted by 2002, Namibia has the infrastructure and technology to withstand another drought without taking the momentous and costly step of building the Okavango pipeline. With effective demand management, large-scale artificial recharge, emergency pumping of aquifers, an expanded reclamation system, a connection to the Berg Aukas mine, and possibly new aquifers developed by that time, a possible supply deficit as a result of drought could be managed smoothly.

Given the country's existing ability to handle a possible crisis, the country has an opportunity to focus on the long-term planning goal of sustainable water resources management. Relative to many of its neighbours, Namibia has already made significant advances toward this goal; *e.g.*, an exemplary water conservation program in Windhoek, a comprehensive water sector review nearly complete, and a national demand management assessment completed. More needs to be done, however. The Water Act and water policies need to be updated and revised, artificial recharge should be further explored, demand management should be instituted nation-wide, economics should be applied more effectively, and emerging technologies need to be monitored for eventual inclusion in the central supply system.

With effective planning and continued commitment to sustainable water management by all Namibians, the country can continue to grow and prosper without having to consider building an expensive pipeline to the Okavango River for a very long time.

One of the main questions at the heart of this study has been whether states could use water to impose their will, and whether countries affected would decide that military means were an effective way of resorting the balance. Can an upstream state like Namibia 'turn off the taps'?

the message delivered by the Turks when they filled the Ataturk Dam seemed to be: yes, it is possible to deprive a neighbour of a flow of water usually received. Can a downstream state, which is more powerful, impose its will on a neighbour that controls the water resources? The lessons from Israel seem to show that this, too, is possible. But there is an alternative way of looking at it, as such politicians as the late King Hussein of Jordan, President Ozal of Turkey, President Sadat of Egypt and previous UN Secretary General Boutros-Ghali have all recognised: they all noted that while water could be a cause of war it could also be an excellent focus for inter-state cooperation (Ravenscroft, 1985). Equally, political rhetoric often does not affect technical cooperation, which may well continue quietly while the politicians rant, although water management has been politicized. Apart from local tensions, one reason for this, which could be overcome, is that the consultative process is inadequate and there is no satisfactory body of international law to deal with the issue of shared water courses. This absence of multilateral or comprehensive bilateral agreements between southern African states and their neighbours is again linked to political mistrust i.e. civil war in the case of Angola.

What no one knows is the degree of provocation that a state would consider insupportable, and that might force it to resort to military action. In the modern world, economics come into it: when would a war be the most cost-effective means of safeguarding the vital interests of a state? Botswana and South Africa's recent intervention in Lesotho has been said not only to be as a SADC peace keeping force but to guard and protect the recent Lesotho Highlands Water Project (Katse Dam) in the Maluti Mountains. Given the huge sums involved, and the likely losses, the answer must be that warfare in southern Africa would very rarely be economically practical. Low-intensity operations seem to be a likelier option: installations such as dams, diversion tunnels, pipelines and desalinization plants are usually vulnerable to sabotage. There are lessons from the past to show when interference with a natural resource becomes intolerable, action has to be taken[11].

During the course of this dissertation the researcher has also drawn some ideas and recommendations concerning sustainable development of the Okavango River based upon various documents pertaining to International River Basin Management and from personnel who's expertise lie with the Okavango River. Authors who have written on International River Basin Management have focused most of their attention to the Middle East. Where there was no

[11] A prime example being the Arab – Israeli dispute over the Jordan, which was one of the causes of the 1967 War.

previous political and environmental threat as has been the case in southern Africa, authors on the subject have hardly written anything at all, therefore, research material relating to the Okavango has been thin. Despite its title, it has not been possible in this study to concentrate exclusively and focus on – International River Basin Management – but of necessity on several issues which are inextricably linked to the subject. The study of the Okavango River has also been placed within the context of the political environment of southern Africa and the world at large. The necessity to do so is reinforced by the special character of the case study, which has had a great deal in common with the other major rivers of the world.

The researcher has learned that the most important ultimate element in water resource decision-making is not planning processes, analytical procedures, or sophisticated arguments. It is the attitudes and feelings of decision-makers, water planners, water and river engineers, politicians, landowners, and others. Their attitudes and feelings about particular water resource decisions depend upon what these people know, their confidence levels, their cultural context, the benefit and costs of the decisions to themselves and others, and the attitudes of the people they respect.

In the last two decades there has been growing recognition by such decision-makers throughout the world that natural resources are limited and that development must consider the needs of our children and our children's children. "Sustainable" development has, at least in concept, been broadly endorsed. What I have learnt is that considering the future with regards to the Okavango River Basin is not so easy when a politician, engineer, or other decision–makers throughout the riparian countries must decide upon specific actions in the present in a specific context.
Interviewees in Government Departments responded to a considerable extent, that voter's demands - immediate, were their main consideration, not long term benefits. To a politician, water resource planner or river engineer, a water resources development plan, which brings direct and quite immediate benefits to those funding efforts, will often bring job approval, even if there are long-term costs. In addition, pursuing "new", sustainable approaches may be considered risky. Planners tended to shy away from new innovative ideas proposed to them, traditional approaches to water resources and river planning was considered safer.

If planners and decision-makers are to take more sustainable approaches, they need practical "how to" information and guidance concerning such approaches. Therefore, it has been the object of this paper to present such information based on work and experience elsewhere. It is

hoped that the alternatives suggested will provide both short-term benefits and long-term sustainability of the Okavango River by adhering to the framework outlined in Chapter One.

It is hoped that this study of the Okavango River Basin will contribute to a small, though not insignificant chapter to the Management of International Rivers and in so doing it is hoped that the future of this unique oasis may not be left "hanging in the balance".

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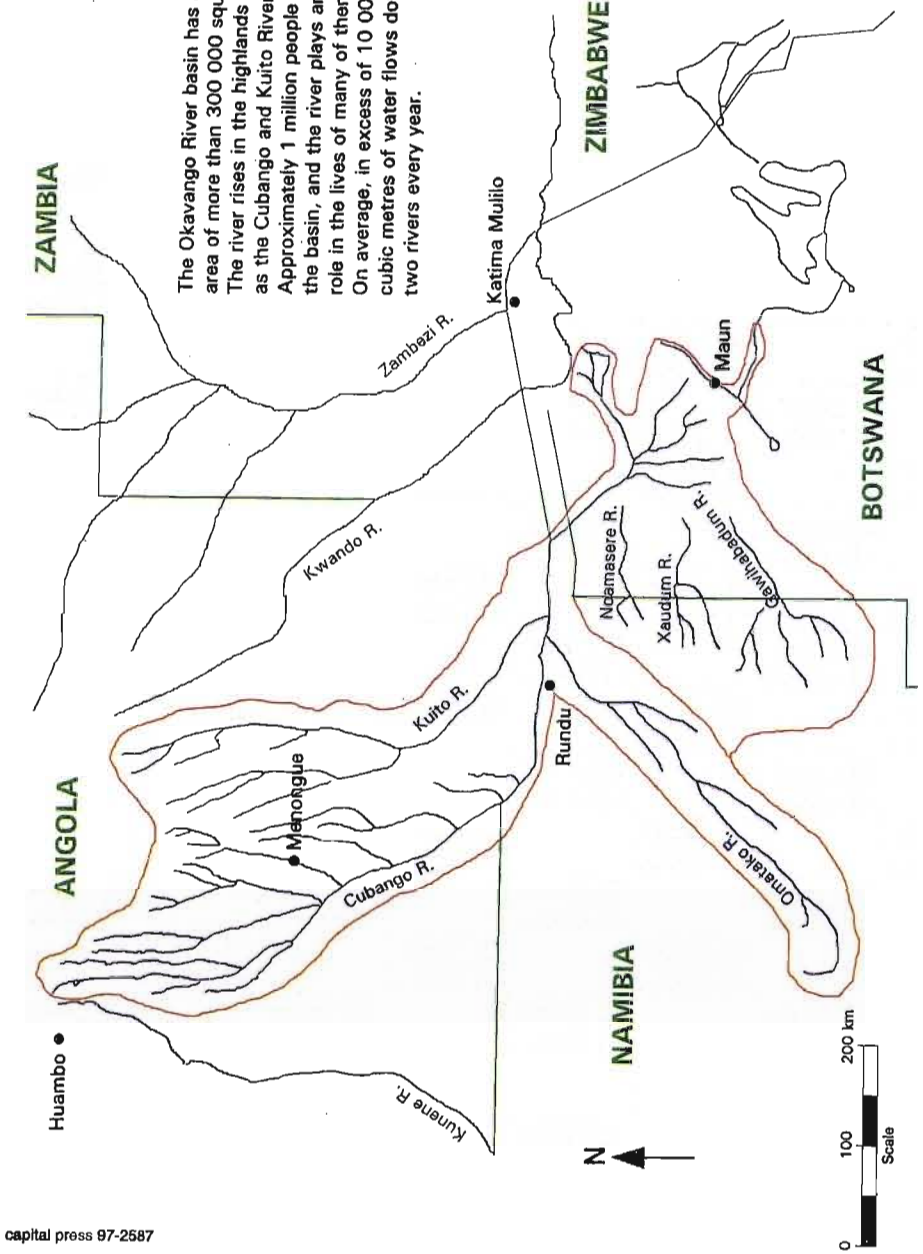
Appendix One:

OKACOM Leaflet



The Okavango River basin has a catchment area of more than 300 000 square kilometres The river rises in the highlands of Angola as the Cubango and Kuito Rivers. Approximately 1 million people live within the basin, and the river plays an important role in the lives of many of them. On average, in excess of 10 000 million cubic metres of water flows down these two rivers every year.

THE OKAVANGO RIVER BASIN

capital press 97-2587

OKACOM

PERMANENT OKAVANGO RIVER BASIN COMMISSION

MISSION STATEMENT

OKACOM is an initiative of the three Okavango River Basin states, Angola, Botswana and Namibia. The Commission has the functions of advising the governments on the sustainable development of the basin and of co-ordinating investigations and research activities.

A **OKACOM** é uma iniciativa dos três estados da Bacia do rio Okavango,- Angola, Botswana e Namibia. A commissão tem as funções de aconselhar os governos sobre o desenvolvimento sustentável da bacia e de coordenar investigações e actividades de pesquisa

OKACOM kwa zi tota po yirongo yitatu eyi ayi ruganesa mukuro gwaKavango, ngamoomu Angola, Botswana ntani Namibia. Komiti kwa zi tulira po nositambo sokugava magano kepangero kweyi yokuhamena ekuliko neruganeso lyomema nomu naya vhura kufira sinka nsitwe zomukuro kumwe nomadiva ntam nonomusare edi konontere domukuro.

OKACOM ke lekgotla la mafatshe a mararo a Angola, Botswana le Namibia a noka ya Okavango e a ralalang. Lekgotla le tlhametswe go gakolola mebuso ka diriso e e lolameng le go gokaganya ditlhotlhomiso tse di amananng le noka e.

Angola
Ministério da Energia e Aguas
GABHIC
Cx. P. 6695
LUANDA

Tel: + 244 393 681
Fax: + 244 393 687

Botswana
Ministry of Mineral Resources and Water Affairs
Department of Water Affairs
Private Bag 0029
GABORONE

Tel: + 267 360 7100
Fax: + 267 303 508

Namibia
Ministry of Agriculture, Water and Rural Development
Department of Water Affairs
Private Bag 13193
WINDHOEK

Tel: + 264 296 9111
Fax: + 264 232 861
email: okacom.nam@iwwn.com.na

Maikaelelo a pampitshana e ke:

- Go go itsese ka thulaganyo ya paakanyetso tshekatsheko ya lekgotla la OKACOM.
- Go kopa tirisano mmogo le go tsenya lebogo ga gago.
- Go simolodisa thulaganyo ka go therisanyo magareng ga rotlhe batsaakarolo le OKACOM.

OKACOM ke eng?

Erile ka ngwaga wa 1994 mebuso ya mafatshe a Angola, Botswana le Namibia ya tlhoma lekgotla la Okavango River Basin Water Commission (OKACOM) go gokaganya le go tlhomamisa tiriso ya noka le mafatshe a a e tlhakanetseng.

Ke bo mang ba ba mo OKACOM

OKACOM e tlhamilwe ka ka babirela mmuso ba maemo a magolwana ba le bararo go tswa mo mebusong ya mafatshe o o mararo. Mo godimo ga bone go ka tlhophiwa ba gakolodi ba palo e e batlwang. Se se dira gore go nne le therisanyo e e tlhomameng fa gare ga makalana a mebuso, morafe le ditlhopha tse di nang le kgatlhego.

Mosola wa OKACOM ke eng

Noka ya Okavango e botlhokwa mo matshelong a batho ba le bantsi mo borwa jwa Aferika. Ke nngwe ya dinoka mo lefatsheng e nang le sepopego sa yone e le nosi.

Ka go lemoga se, go a tlhokafala go re go laolwe tiriso e e ka fokotsang boleng jwa noka e ka go dira lenaneo le le tlhamaletseng la tiriso ya yone. Lenaneo la mothale o, go botlhokwa gore le tlole melelwane le dikeletso tsa bonosi tsa mafatshe a noka e fetang ka o ne mme le itebaganye segolobogolo le tiriso e e nang le bokamosa ka go diragatsa therisanyo.

Mosola wa lekgotla la paakanyetso tshekatsheko ke eng.

Mosolo o o maphata mararo

1. Go rulaganyetsa kgokagano le therisanyo. Go tlhama ditsela tsa disela la go buisanya gore gore go tle go nne le kgokagano, therisanyo le tirisanyo fa gare ga batsaa-karolo. Se se tla a dira gore batsaa-karolo botlhe ba nne le seabe mo go direng lenaneo la tiriso ya noka.
2. Go seka seka kitso e e teng ka noka e le go bona gore e tlheaela fa kae.
3. Go tsaya kgato mo go se se tlaabong se lemogilwe se tlhaela ka kitso ya nako e ka maikaelelo a gore lenaneo la tiriso ya yone enne e e lolameng.

Se se tlaa diragala mo nakong e e kae?

Lenaneo la paakanyetso tshekatsheko le solofelwa go bo le feditswe ka kgwedi ya Mopitlo ka 1998. So solofelwa gore tshekatsheko ya tikologo le ya lenaneo la tirioso di ka tsaya dingwaga di ka nna thataro go wediwa.

Keeng noka ya Okavango ele botlhokwa go le kana?

- Matshwititshwiti a batho a itshedisa ka meamuso ya lefatshe le metsi.
- Lekgobokgobo la Okavango le le fa gare ga lefatshe la komelelo le ikaegile ka go elela ga noka ya Okavango.
- Tiriso e e tsweleletseng pele ya metsi le lefatshe le le mo makgobokgobomg le tlisa letshogo la gore tikologo le ditsa tlholego tse di ikaegileng ka legobokgobo di kare phelelong tsa nyelela.

Solofela

- Dilo ga dina go kgonega tshotlhe ka nako e le enngwe. Tema go se e khutshwane. Go ka nna ga re tsaya dingwaga dile thataro.
- Le tlaa nna le nna le ditshono tsa go tsenya lebogo mo tshekatshekong ya tikologo le go dira lenaneo la tiriso ya noka.
- Megopolo le dikakanyo tsa lona re tlaa di tlotla.