

## Managing Flows for Sustainable Development: Learning from the Limpopo River Basin



Water and Nature Initiative

Final Report, December 2007  
Regional Office for Southern Africa

## Executive Summary

The IUCN Regional Office for Southern Africa (ROSA), through its Water Programme implemented a project entitled: *Managing Flows for Sustainable Development: - Learning from the Limpopo Basin*. Initial funding for this project was from the IUCN Water and Nature Initiative (WANI). WANI was a 6 year action programme to demonstrate that ecosystem-based management and stakeholder participation will help to solve the water dilemma of today – bringing rivers back to life and maintaining the resource base for many.

The main objective of WANI was to mainstream ecosystems approach in water resources management. WANI was implemented across the globe in river basins such as the Mekong, Tacana (Mexico Guatemala), Senegal, Volta, Pangani (Tanzania and Kenya). In southern Africa it was implemented in the Okavango and the Limpopo River Basins. In the Limpopo the focus was on Environmental Flows (EF) and this report documents the project outputs, experiences and lessons learnt.

### **Main outputs**

#### Component 1: Awareness and Training

Awareness of the concept and importance of environmental flows was communicated to stakeholders through a number of products including:

- A fact sheet on the Limpopo Flows project was produced highlighting key features of the Limpopo basin and the flows project interventions on training and awareness, the flows assessment work on the Mzingwane catchment and the field visit.
- A global environmental flows network was established ([www.eflownet.org](http://www.eflownet.org)) to facilitate the awareness raising, capacity building and implementation of environmental flows within Southern Africa and worldwide. The network's overall aim is to allow people to access, share and discuss information, knowledge, experiences and case studies related to environmental flows. Within the global network a Southern Africa Regional Network is being developed. Members of the global network from Southern Africa are already active participants in discussions and resource sharing.
- More than 500 copies of posters were distributed within the Limpopo basin and to key stakeholders. The aim of the posters was to aid in awareness raising on Environmental Flows. The posters had a generic message, “ **Managing Flows to secure livelihoods and maintain the environment**”.
- FLOW: The Essentials of Environmental Flows, a WANI toolbook was reprinted (1000 copies) and distributed in Southern Africa. FLOW was also translated into Portuguese so as to improve understanding of environmental flows in the Southern Africa Development Community (SADC) Lusophone countries and the world over
- Field exchange visits were conducted in both Lesotho and the Pangani. Participants from SADC countries were exposed to the environmental flows policy, the operational procedures as well as results of a monitoring audit conducted on environmental flows implementation in early 2007 for the Lesotho Water Highlands project. A visit was undertaken by officials from the Limpopo River Basin to the Pangani River Basin in Tanzania in June 2007. The officials from the Limpopo basin and Pangani were able to share knowledge and lessons on EF assessments

- A regional training course was held in December 2006 in Cape Town, South Africa for water professionals on managers to familiarize them with the concept and importance of assessing and implementing environmental flows.

### Component 2: Demonstrating Environmental Flow Assessment

An environmental flows assessment (EFA) was demonstrated in the Mzingwane subcatchment of the Limpopo Basin. The products produced from this assessment included:

- Specialist reports for the environmental flows assessment were produced on hydrology and water resources, hydraulics, social issues, ecology(botany), geomorphology, aquatic invertebrates, fisheries, water quality and agriculture/economics. The reports were from results collected during dry season and wet season field assessments in November 2006 (dry season) and March 2007 (wet season), and a desktop literature review.
- The Downstream Response to Imposed Flow Transformation (DRIFT) methodology was adopted for the Mzingwane EFA during 2007 by Southern Waters. Data from the specialist reports was entered into DRIFT. Outputs of DRIFT analysis indicates expected changes in river condition as a result of improved flow allocation regime (flow quantity and timing) downstream of a development (in this case the Mzingwane dam).

WANI funding initiated a Flood vulnerability assessment in the Lower Limpopo in Mozambique. This is an ongoing project - IWRM Demonstration in the Lower Limpopo - funded by the Danish International Development Agency (DANIDA). Products included:

- Updating of current spatial patterns of the fast changing terrain features based on the best available data sources (e.g. optical satellite data sources such as Spot and LandSat) with some minor field control due to time limitations. This created a basis upon which to estimate the terrain parameters most likely to be impacted by any flood event accounting for the changing conditions after 2000.
- Current levels of livelihoods were documented based on field works surveys supported by practical field observations and structured and semi-structured interviews.

### Component 3: Piloting Environmental Flows

An EFA had previously been conducted for the Blyde River, but did not focus on determining ecological water requirements and did not adequately cover the aspect of livelihoods. IUCN and the South African Department of Water Affairs and Forestry (DWAF) are working together to conduct further flow assessments, this time paying particular attention to the competing uses, and specifically community livelihood issues. Products include:

- A contract with DWAF to implement a number of activities that would improve the confidence in the Reserve (environmental water allocation) determination and implementation of the Reserve. Funds mobilised by IUCN are being used to effectively improve stakeholder participation
- A fact sheet on the Olifants initiative was compiled as information for dissemination to stakeholders.

### Component 4: Harmonizing Legal Frameworks

- A review of legal provisions to identify areas for mainstreaming environmental flows at national level, and assessment of level of domestication of Protocol on Shared Watercourse Systems has been produced.

## ***Main lessons learned***

### Data and time limitations

Lack of data on many river systems in the region limits application of environmental flows in the region for a long period. Adapted hybrids of the formal methods which emphasize participation and inclusiveness such as those applied in the Pangani and the Mzingwane will remain useful in the interim and this has to be mentioned in training.

There were also time limitations within the project. Realistically, there is the to have longer time frames for projects, about 5 or more years to enable projects to really add value to what the government agencies will be working on.

### Constraints to implementing EFA assessments recommendations in semi-arid and arid areas

The EFA recommends that flood releases for certain types of floods should be released at the beginning of the season to give enough time for organisms that require aquatic environments to complete their life cycles. However, this was found to be too risky by the key stakeholders in the Mzingwane. They indicated that although they would want to provide water for the environment, they could not risk releasing water early on in the rainy season before they actually know what they were going to receive. Any release of water will have to be delayed and be based on assessment of the rainy season and other water supply sources and should involve key stakeholders.

### Capacity building

Capacity to undertake and operationalise EFA in Southern Africa is still very low. Based on the experiences of the project, the best way to build capacity is to train a team of people and take them through a real assessment. This model of capacity building may be time consuming and costly, but helps in reducing dependence on the developers of EFA models (such as DRIFT). Currently, there is still relatively heavy dependence on the originators of the environmental water requirements methodologies within the region (Southern Water) for tools (DRIFT, Building Block Method, etc) and guidance on their application and the methods are not yet adapted to ephemeral rivers. Thus, it is a challenge to provide examples on the application of EFA to seasonal basins, which are found in a large part of the region.

### Stakeholder involvement

The key stakeholders were able to understand the importance of carrying out an EFA as they were involved at every stage of the EFA assessment right from the initial planning workshop, to the presentation of the outputs of the DRIFT analysis. When undertaking EFA exercises it is essential to conduct a scoping exercise to identify key stakeholders that needs to be involved to be able to operationalise the results of the assessment.

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## Abbreviations and Acronyms

CEM	Commission for Ecosystem Management
CITES	Convention for Trade of Endangered Species
DEAT	Department of Environmental Affairs and Tourism
DFID	UK Department of International Development
DRIFT	Downstream Response to Imposed Flow Transformation
DWAF	South African Department of Water Affairs and Forestry
EF	Environmental Flows
EFA	Environmental Flows Assessment
EIA	Environmental Impact Assessment
GWP SA	Global Water Partnership South Africa
IUCN	International Union for the Conservation of Nature and Natural Resources-The World Conservation Union
IUCN SUR	IUCN South America
IUCN HQ	IUCN Headquarters
IWRM	Integrated Water Resources Management
IWMI	International Water Management Institute
DANIDA	Danish International Development Agency
MAR	Mean Annual Rainfall
MoU	Memo of Understanding
ROSA	Regional Office for Southern Africa
SADC	Southern Africa Development Community
WANI	Water and Nature Initiative
ZINWA	Zimbabwe National Water Authority

## 1 Background

In July 2001, the Netherlands Ministry of **DGIS** contributed US\$ 13 million in catalytic seed-funding to the IUCN Water & Nature Initiative (WANI). The objectives of WANI were to:

- demonstrate ecosystem management in river basins
- empower people in sustainable water management
- promote wise governance of water resources
- develop and apply economic tools and incentives
- create and share knowledge
- promote awareness and learning from our experiences

The WANI grant would contribute to these objectives through thematic interventions, policy campaigns, the development of tool-kits and project demonstration sites. WANI would work at international, regional, national and river basin levels to influence policy processes and demonstrate wise water governance through capacity building to local stakeholders.

The IUCN Regional Office for Southern Africa (ROSA), through its Water Programme implemented a project entitled: *Managing Flows for Sustainable Development: - Learning from the Limpopo Basin*. In addition to the Limpopo Basin, other basins that were proposed and ultimately approved as WANI demonstration sites included: the Mekong River (Cambodia, Lao PDR, Thailand, Vietnam); the Volta River (Burkina Faso, Ghana), the Okavango Delta (Botswana), Tacaná River (Mexico, Guatemala), Komadugu Yobe River (Niger, Nigeria), the Pangani River (Tanzania, Kenya) and Lake Tanganyika (Burundi, DR Congo, Tanzania, Zambia).

### 1.1 Limpopo Basin

The Limpopo River Basin, one of the main transboundary river basins in the Southern Africa Development Community (SADC) region extends through Botswana, Zimbabwe, South Africa and Mozambique covering a total area of some 415,000 square kilometers and with a reach of approximately 1,700 kilometres. The basin includes arid and semi-arid areas with average rainfall in the whole basin estimated at 520 millimetres (ranging between about 200 to 1200 millimetres). The area of the basin in South Western Zimbabwe received as low as 100 millimetres of rainfall in 2006/2007-rain season. The major flow related challenges in the basin include the intense and frequent droughts, flooding due in part to cyclone events, increasing demand on water, extensive but unequal development levels in the basin and insufficient information exchange and coordination for resource management.

### 1.2 Environmental Flows

An environmental flow (EF) is the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flow is regulated (Megan Dyson, et al (eds) 2003). Environmental flows provide critical contributions to river health, economic development and poverty alleviation, and also ensure the continued availability of the many benefits that healthy river and groundwater systems bring to society.

There is growing recognition that modification of river flows can lead to degradation of the downstream river resource, including the river channel, floodplain and estuary, and its associated ecosystems. The changes occurring to rivers due to regulation have led many countries to explore the possibility of mitigating against these changes through the allocation and management of flows to maintain river function. Some 25 countries globally implement

Environmental Flow Assessments (EFA) using various approaches and enabling environment instruments.

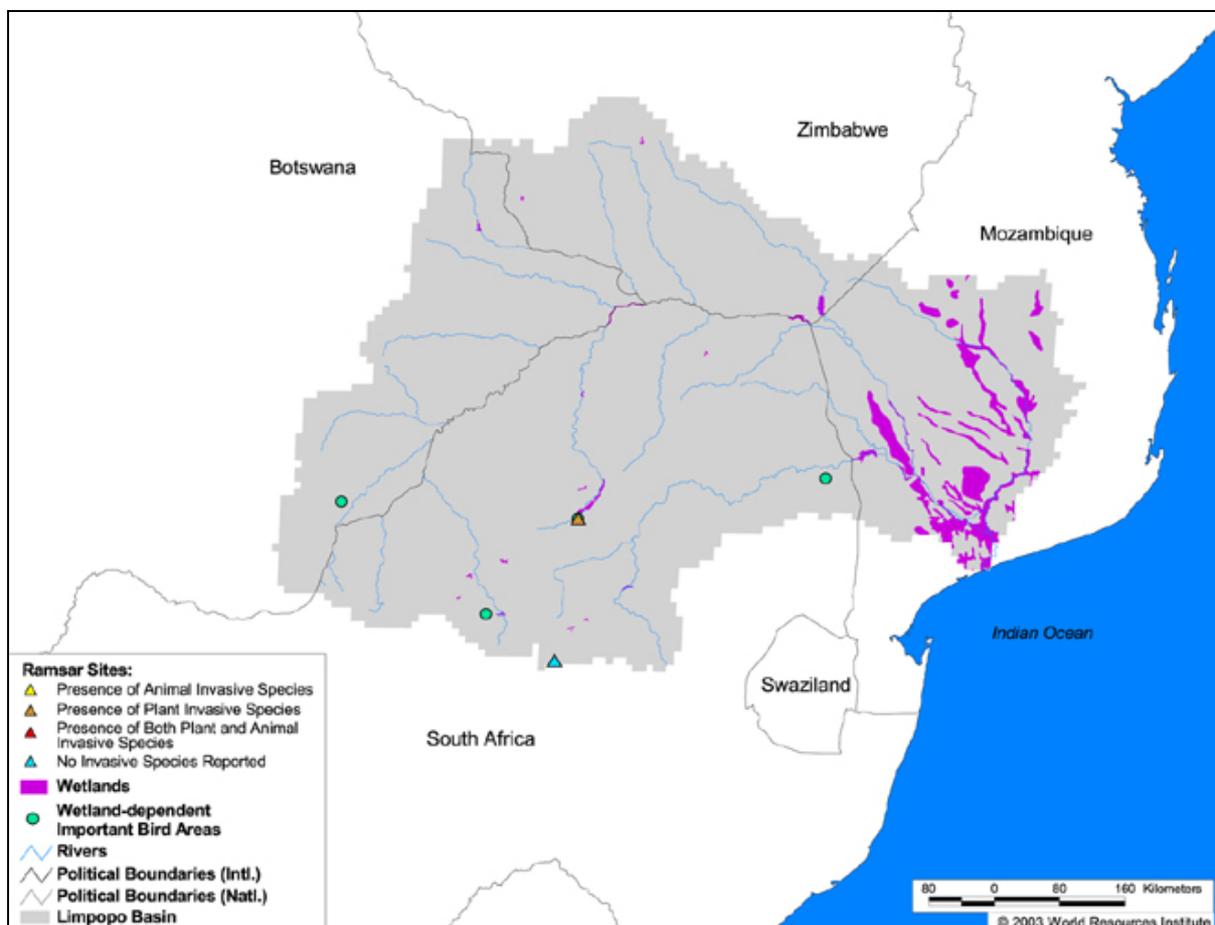
The Limpopo Basin is one of the most developed in southern Africa and the natural flow regime and ecology of the river course has been modified as a result of the construction of numerous dams on the tributaries of the Limpopo River, the majority of which were built to store water. As a result, surface flow in the main channel ceases entirely in winter (dry season) although water continues to flow in the deeper alluvial deposits.

The Limpopo flows project contributed to the adaptation of globally established environmental flows methodologies in Southern Africa. Components of the project included training and awareness raising, environmental flows assessment, and implementation, and a review of protocols and laws relating to environmental flows. The Mzingwane Catchment in South Western Zimbabwe was designated as the site for demonstrating environmental flows assessment.

### 1.3 Project Goal and Purpose

The development goal for the Managing Flows for Sustainable Development: - Learning from the Limpopo River Basin was *“to contribute to the improvement of the health of river ecosystems that benefit local livelihoods in Southern Africa”*.

In pursuance of some of the challenges faced in the development and management of water resources in Southern Africa, the purpose of this project was *“to facilitate the mainstreaming of environmental flows in water resources management policies and practices for the sustenance of ecosystem services and community livelihoods”*.



**Figure 1.** Map of the Limpopo River Basin

**Source:** <http://www.iucn.org/themes/wani/eatlas/html/af11.html>

## **1.4 Project Development**

IUCN ROSA secured approval of the project concept for *Managing Flows for Sustainable Development:- Learning from the Limpopo River Basin* from the Water and Nature Initiative at IUCN Head Quarters in August 2005. The approval also marked the beginning of an inception Phase for the project. A sum of USD 25,000 was released to IUCN ROSA to conduct the inception phase.

The inception phase extended from September to November 2005, with the most important outcomes being mobilization of project stakeholders in the four riparian States, namely Botswana, Mozambique, South Africa and Zimbabwe and consolidation of key project activities including confirmation of project sites. Inception meetings with stakeholders from each country introduced the project background, goal, objectives and proposed components, as well as invited inputs into the project design.

In October 2005, IUCN ROSA held a one-day technical inception workshop for the project in Johannesburg South Africa. Participants that attended the workshop were mainly from the government departments that deal with water resources management from Botswana, South Africa and Zimbabwe, as well as IUCN Staff members from the Regional, Botswana, Mozambique and South Africa offices. There were also presenters and participants from other institutions who came in to share their experiences on relevant programmes and initiatives, including SADC, IUCN East Africa, International Water Management Institute (IWMI), University of KwaZulu Natal and the IUCN Commission for Ecosystem Management (CEM).

The purpose of this meeting was to provide information about the project and environmental flows assessment and implementation to key stakeholders. It also provided an opportunity for group work discussions, which reviewed the project logical framework, the implementation arrangements and provided concrete recommendations on the way forward.

Implementation of the project included four components, which are described in more detail in section 2 on project outputs. A fifth component was on project management.

### **Component 1: Communication Awareness and Training**

*Riparian States and Limpopo Basin Commission made aware of environmental flow provisions, assessment methods and experiences from other basins:*

- Experiences on environmental flow assessment from other basins disseminated in the Limpopo River Basin.

*Improved awareness and willingness to include environmental flows in river basin management in Southern Africa*

- Regional network of EF practitioners in Southern Africa established and learns from EF project in Limpopo and other river basins.

*Communication, Training and awareness materials documenting methods, examples and experiences developed and disseminated:*

- IUCN Flows toolkit disseminated among stakeholders in the SADC region (English and Portuguese).
- Publicity material developed and disseminated among stakeholders in the Limpopo basin.
- Available EF education material synthesized and training modules produced.

- Regional EF training seminar.
- Exchange visits to selected EF sites demonstrating good EF practice conducted.

### **Component 2: Demonstrating EF Assessment**

*Environmental flow demonstration sites, resulting in site-specific assessments for setting environmental flows objectives:*

- The Limpopo basin water audit and river classification conducted.
- Environmental water requirements for protected areas in the Shashe and catchments explored and determined
- Community based risk adaptation strategy developed in the Lower Limpopo

### **Component 3: Piloting EF Implementation**

*Piloting of Environmental Flow implementation in specific parts of river basin to benefit local communities:*

- EF in the Blyde river determined and operationalised.

### **Component 4: Harmonizing Legal Frameworks**

*Willingness to harmonise legal frameworks to incorporate EF in the Limpopo River Basin:*

- A review of legal provisions to identify areas for mainstreaming EF at national level and assessment of domestication of the shared watercourse protocol.
- Guidelines on review of policy, legal and strategy frameworks to incorporate EF produced and disseminated among the four riparian states of the Limpopo River Basin.
- Basin level EF policy Dialogue including parliamentarians, policy makers, managers, scientists and civil society convened to deliberate on the role of EF in maintaining ecosystem health and sustaining livelihoods and harmonization of policies, legislation and strategies.

### **Component 5: Project Management**

*Project managed and run successfully:*

- Technical and financial reports produced on a half yearly basis and reviewed by IUCN Headquarters (HQ) and partners.
- Documenting lessons learnt, elaborating further projects and mobilization of funding to complement the WANI support together with and mobilizing partnerships such as Global Water Partnership South Africa (GWP SA), SADC, Transboundary River basin Authorities, Research and training agencies (WATERNET, WARFSA), IWMI and United Nations agencies active on environment and water issues in the region.
- Monitoring and evaluation systems set in place for the project, leading to lessons learned being integrated into activities on an on-going basis.
- Elaboration of further projects and mobilization of funding to complement the WANI support.
- Appropriate management, technical and administrative support provided to enable the project to run smoothly

WANI contributed funding to the amount of USD 550,061 to *Managing Flows for Sustainable Development: - Learning from the Limpopo Basin*. Cofinancing of USD 250,000 was obtained from Danish International Development Agency (DANIDA) for developing a Community based risk adaptation strategy in the Lower Limpopo (Component 2). The Global Water Partnership (GWP) and Waternet contributed USD ? to fund a training course in December 2006 in Cape Town, South Africa (Component 1). The course trained 34 water practitioners and manager in the ecosystems approach to environmental flows, managing environmental flows for sustainable livelihoods, methods for determining environmental flows, introduction to water resources classification and operationalising environmental

flows. The total budget for the Blyde River assessment (Component 3) amounted to USD 90,274 with IUCN contributing USD 51,400 and South African Water Affairs and Forestry DWAF contributing USD 38,874. Funds mobilised by IUCN are being used to broaden the scope environmental flows to improve effective stakeholders participation

## 2 Project Outputs

At the output level, a range of activities were undertaken for each of the key project component activities. These are described in greater detail in the text below the summary tables.

### 2.1 Component 1: Awareness and Training

Outputs	Activity
<b>COMPONENT 1 AWARENESS AND TRAINING</b>	
1.1 Riparian states and Limpopo Basin Commission made aware of environmental flows provisions, assessment methods and experiences from other basins	1.1.1 Experiences on environmental flow assessment from other basins disseminated in the Limpopo River Basin
1.2 Improved awareness and willingness to include Environmental Flows in river basins management in Southern Africa	1.2.1 Regional network of EF practitioners established
1.3 Communication, training and awareness materials documenting methods, examples and experiences developed and disseminated	1.3.1 Printing of flows tool-book and publicity material and dissemination in the basin and in SADC region
	1.3.2 Available environmental flows training material synthesized and disseminated
	1.3.3 Environmental flows training seminar convened
	1.3.4 Exchange visits to selected environmental flows sites demonstrating good EF practice conducted

#### 2.1.1 Dissemination of experiences

A fact sheet on the Limpopo Flows project was produced highlighting key features of the Limpopo basin and the flows project interventions on training and awareness, the flows assessment work on the Mzingwane catchment and the field visit. The fact sheet is being disseminated among stakeholders in the Limpopo River Basin.

#### 2.1.2 Environmental Flows Network

An email discussion forum established at HQ ([Env\\_Flows@indaba.iucn.org](mailto:Env_Flows@indaba.iucn.org)) was populated within Southern Africa through the Limpopo Flows contact list and other networks in which the Water Programme staff are participating. This resulted in a large flow of exchanges involving practitioners and officials from the SADC region.

Funds from the Limpopo project were also used to initiate further development of the Global Environmental Flows Network at a global and regional scale in the form of a website ([www.eflownet.org](http://www.eflownet.org)). Much of the knowledge and experience on environmental flows is in Southern Africa, thus documents, information and case studies from the region are being used to populate the site. The email discussion forum has migrated to the website to allow more specific and regional discussions to take place. In addition, a Southern Africa regional network is being developed, which includes a webpage on the Global Environmental Flows

Network website. Waternet are contributing to the development of this regional network, and have agreed to promote the website and network.

Promotion of the network and events beyond the website has taken place. For example, seminars on how to develop the network and what can different stakeholders provide and gain from the network were held at World Water Week in Stockholm in August 2006, and at the International Environmental Flows Conference in Brisbane, Australia in September 2007. Other regional networks are also being developed that will link with the Southern Africa Regional Network.

### 2.1.3 Communication, training and awareness materials

#### Posters

Posters depicting messages on environmental flows were developed to publicize the project and deliver messages on key elements of environmental flows. The three messages adopted are: Balancing interests among competing users and uses; defining flows as part of integrated management of river systems; and providing for downstream maintenance of livelihoods and the environment. These messages were further elaborated on to provide definition of the key statements as a means of raising awareness of the critical issues on environmental flows. The posters were used both at regional events and at project meetings.

**Poster 1: *Defining flows as part of integrated management of river systems:***

*Environmental flows reflect society's informed decision to allocate water for meeting the requirement of a chosen condition following a process of environmental, social and economic assessment. The Flows are best set as part of integrated planning and management of river system.*

**Poster 2: *Providing for downstream maintenance of livelihoods and the environment:***

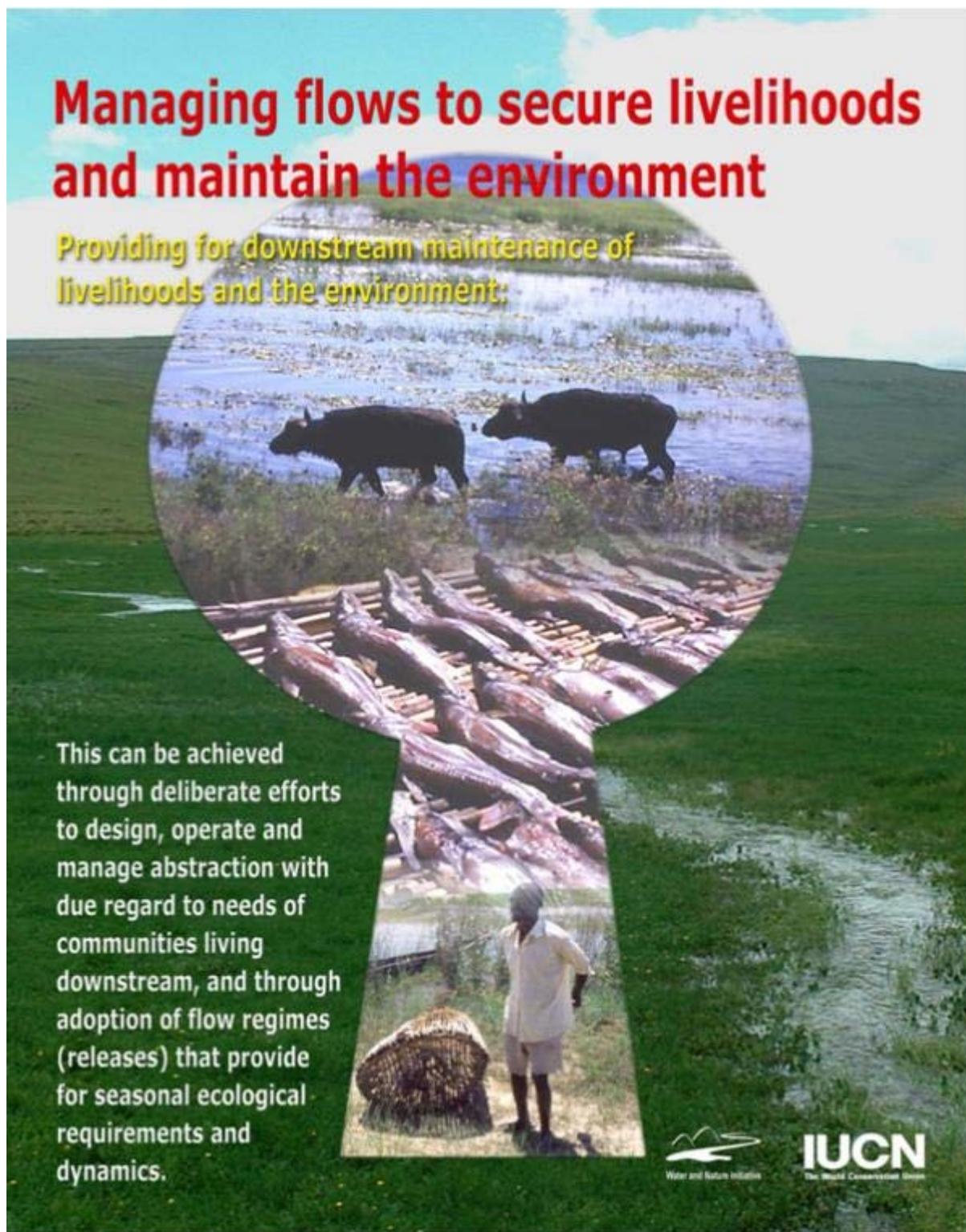
*This can be achieved through deliberate efforts to design, operate and manage abstraction with due regard to the needs of communities living downstream, and through adoption of flow regimes (releases) that provide for seasonal ecological requirements and dynamics.*

**Poster 3: *Balancing interests among competing users and uses:*** *Strengthening cooperation and balancing a wide range of interests is crucial to setting flow allocation scenarios. This could be premised on the idea that well-established and adequately negotiated flow regimes will ensure resource security for all water users, sustainable economic development and alleviation of poverty.*

# Managing flows to secure livelihoods and maintain the environment

Providing for downstream maintenance of livelihoods and the environment:

This can be achieved through deliberate efforts to design, operate and manage abstraction with due regard to needs of communities living downstream, and through adoption of flow regimes (releases) that provide for seasonal ecological requirements and dynamics.

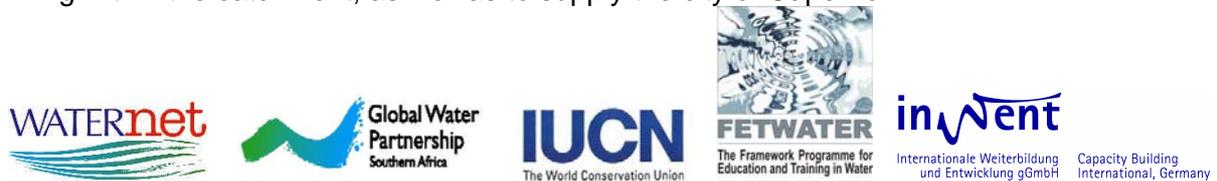


## Training

Environmental Flows training under the Limpopo Flows Project was conducted between the 4<sup>th</sup> and 14<sup>th</sup> December 2006. The training was originally scheduled for March 2007 but was brought forward to take full advantage of complementary activities by other regional organizations carrying out training related to integrated water resources management in the SADC region. A partnership among IUCN ROSA, GWP SA and Waternet, discussions on which commenced in Gaborone, Botswana July 2006 resulted in joint delivery of the training

with participation of all SADC countries in December 2006. GWP SA's interest was in highlighting the importance of environmental flows in IWRM and Water Efficiency Planning, while the interest of Waternet was in building capacity on environmental flows as part of general IWRM training. Subsequent to the initial design of the training several other agencies expressed interest in making a contribution to the training, these included Department of Water Affairs and Forestry, South Africa, UNESCO, FETWater, InWent and the Finish Development Cooperation.

Ultimately 34 water practioners and managers from all SADC countries benefited from the training. The ROSA target for the training was 14 participants. Modules covered under the training included the ecosystems approach to environmental flows, managing environmental flows for sustainable livelihoods, methods for determining environmental flows, introduction to water resources classification and operationalising environmental flows. A field visit to the Berg River in the Western Cape provided participants with an opportunity to carry out field practical on aspects of environmental flows assessment. The Government of South Africa is currently building a dam on the Berg River to stabilize water supply among communities living within the catchment, as well as to supply the city of Cape Town.



## Training Course on Environmental Water Requirements

Stellenbosch 4<sup>th</sup> to 14<sup>th</sup> December 2006

### Translation of Flow to Portuguese

The IUCN WANI publication *Flow: The essentials of environmental flows* (Dyson, M. Bergkamp, G. Scanlon, J. (eds), 2003) was translated into Portuguese. The translation was realized through input from IUCN ROSA both Harare and Maputo, and IUCN South America (SUR) Brazil. This is in order to provide an internationally acceptable version of Portuguese given that the language varies across different regions of the World. IUCN South America also facilitated design of the translated publication and printed at least 400 copies for distribution among their constituents. IUCN ROSA printed an additional 2,600 for sharing with Water Programme HQ and for distribution in Southern Africa.

#### ***Fluxo – Elementos essenciais de fluxos ambientais***

Este manual contém conselhos práticos para implementar fluxos ambientais em bacias fluviais de todas as partes do mundo. Explica como determinar os fluxos necessários, adaptar a estrutura jurídica e financeira, e envolver todas as partes interessadas nas negociações. Fluxo lança um caminho que nos permitirá superar os conflitos que decorrem de recursos hídricos limitados e da degradação ambiental, e chegar a um sistema de manejo de água que reduza a pobreza, assegure a saúde dos rios e compartilhe a água do mundo de maneira equitativa.

#### **Sobre a UICN**

A UICN – União Mundial pela Natureza reúne governos, órgãos públicos e uma ampla gama de organizações não-governamentais numa parceria inédita. Por ser uma União de membros, a UICN busca influenciar, encorajar e ajudar as sociedades do mundo a conservarem a integridade e diversidade da natureza, assegurando que todo uso de recursos naturais seja equânime e ecologicamente sustentável.

<http://www.iucn.org>

#### **Sobre a Iniciativa Água & Natureza da UICN**

A Iniciativa Água & Natureza da UICN é um programa quinquenal de iniciativas que visam demonstrar que a gestão de ecossistemas e a participação de todas as partes interessadas ajudarão

a resolver o dilema hídrico contemporâneo – restituindo vida aos rios e preservando o patrimônio de recursos naturais para todos.

<http://www.waterandnature.org>

IUCN Fluxo Elementos essenciais de fluxos ambientais

### Exchange visits

Field exchange visits were conducted in both Lesotho and the Pangani. In the case of Lesotho the visit was arranged to coincide with the meeting of the SADC Hydrological Cycle Observing Systems, which drew hydrologists from all SADC countries together with the cooperating partners under the SADC project. Experiences were shared on the operation of the Lesotho Highlands Water Project environmental flows, the policy, and results of monitoring of the releases.

A visit was undertaken by officials from the Limpopo River Basin to the Pangani River Basin in Tanzania from 12-14 June 2007. The visit was for two and half days and comprised briefings, plenary/ group discussion sessions and field excursions as indicated in the agenda of the visit attached in Annex 1. The visit involved 21 participants, 9 participants from Southern Africa and 12 participants from Tanzania (4 women and 17 men). The visit exposes officials from the Limpopo basin to the experiences in environmental flows assessment in the Pangani River basin, and allowed participants to share knowledge and lessons on EF assessments between the two regions.

## **2.2 Component 2: Demonstrating Environmental Flow Assessment**

<b>Outputs</b>	<b>Activity</b>
<b>COMPONENT 2: Demonstrating Environmental Flow Assessment</b>	
2.1 Conduct rapid water audit and river ecosystem classification of major stretches of the river basin: river sources, wetlands, pristine areas, highly developed areas (with description of the developments categorized into e.g. urban centres, agriculture, protected areas, industry, mining) and ecosystem hotspots, overview of ground water resources, overview of estuary, and prominent management practices.	2.1.1 Carry out rapid water audit in biodiversity hotspots
2.2 Environmental water requirements for protected areas in the Mzingwane catchment explored and determined	2.2.1 Identify team of mentors and national specialists
	2.2.2 Select water development scheme for which environmental flows will be assessed (desk top and electronic exchange)
	2.2.3 Select homogeneous river reaches to use per water development scheme, for assessment of different parameters, both biophysical and socio-economic, in collaboration with team of mentors and Department of Water. Country technicians and PRA consultant to carry out field work
	2.2.4 Preparation of individual experts group reports and objective setting workshop
2.3 Community based risk adaptation strategy developed in the Lower Limpopo	2.3.1 Produce map of areas vulnerable to floods.

Outputs	Activity
	2.3.2 Produce report documenting current means of livelihoods during extreme low flows and poor water quality.
	2.3.3 Identify sustainable livelihood options to minimize impact of low flows and poor quality water, and potential early warning system to minimize impact of floods (including institutional arrangement).
	2.3.4 Disseminate maps and reports among decision makers in the basin.
	2.3.5 Upon review and approval by decision makers disseminate maps and reports among community structures through project national focal point.

### 2.2.1 Identification of Biodiversity Hotspots

Some of the main ecosystem “hot-spots” were highlighted and can be used to focus future water audit activities. The report found that there are a number of biodiversity hotspots and pristine areas within the Limpopo river Basin. These are in different categories such as state protected, private estates and communal areas in Botswana, South Africa and Zimbabwe. The main areas of biodiversity and natural, cultural and historical heritage importance are the Greater Limpopo Transfrontier Park shared between Mozambique, South Africa and Zimbabwe, The Limpopo-Shashe Transfrontier Conservation Area shared between Botswana, South Africa and Zimbabwe and the Matobo Hills World Heritage Site in Zimbabwe.

The only species known to be threatened in the Limpopo River Basin include the black and white rhino whose populations have declined worldwide from 65,000 in 1970 to 2,600. The southern white rhino was almost extinct at the turn of the 21<sup>st</sup> century when it was reduced to a single population of about 20 animals in the Hluhluwe-Umfulodzi district in South Africa. However, with careful management, numbers of the rhino have grown to about 8,440 today.

Another species of great interest to Convention on International Trade of Endangered Species (CITES) which is found in the Limpopo River Basin is the African elephant whose global population dropped from 1.3 million in 1979 to about 632,000 in 1989. Interestingly, in southern Africa, most notably the Limpopo River Basin countries of Zimbabwe, Botswana and South Africa, as well as Namibia, the elephant population is very healthy and increasing.

There are also a number of natural and human threats within the Basin. Natural threats include drought, floods and cyclones, invasive species and animal diseases. Human threats consist of poverty, overgrazing, mining, effluent discharges, hydrological development, human traffic and agriculture.

### 2.2.2 Mzingwane Flow Assessment

An EFA was undertaken on the river reach downstream of the Mzingwane dam. The Mzingwane dam lies in the Mzingwane catchment in Zimbabwe a subcatchment of the Limpopo Basin. There are a number of flow related challenges in the subcatchment. There is water scarcity, erratic rainfall and frequent severe droughts in the catchment as a whole. Increasing water demand from City of Bulawayo as a result of population growth, economic activity and limited alternative sources is putting strain on limited water resources. There is less water available for downstream ecological needs and livelihoods from reservoir. There

is considerable catchment and channel degradation as a result of mining, fuel wood needs and diminishing grazing areas. Finally, communities have vulnerable livelihoods due to a limited natural resource base (fish, reeds, potable water and hygiene facilities, etc.).

In August 2006, a team from IUCN ROSA, the Zimbabwe National Water Authority (ZINWA) and the Mzingwane Catchment Management Agency conducted an initial survey of the Mzingwane Catchment, including visits to major storage, abstraction and monitoring facilities in the catchment. The purpose of the survey was to document key features of the catchment, identify main water uses and users in the catchment and to select suitable sites for conducting environmental flows assessment. This was followed by official consultations and approvals with the Ministry of Water, the Catchment Management Agency and the District Authorities on the overall project, proposed sites, and expected set of activities, including information requirements and types of outputs.

A planning meeting for EFA of the Mzingwane subcatchment was held on the 28<sup>th</sup> to the 29 September, 2006 in Bulawayo, Zimbabwe. The workshop established the team of specialists and adopted a workplan for conducting environmental flows assessment in the Mzingwane catchment. The workshop also adopted a suitable methodology for conducting the assessment based on previous experiences of flows assessments conducted elsewhere in southern Africa as well as in other catchments of Zimbabwe. The workshop was facilitated by a specialist with extensive experience on environmental flows assessment.

The local environmental flows assessment team consisted of hydrology and hydraulics, sociology, ecology(botany), aquatic invertebrates, fisheries, water quality and agriculture/economics specialists (external facilitators for the planning workshop and Downstream Response to Imposed Flow Transformation (DRIFT) analysis ) complemented the team. The team conducted dry season and wet season field assessments in November 2006 (dry season) and March 2007 (wet season), which included field data gathering and a desktop literature review). The area received approximately 100 mm rainfall in the 2006-2007 rainy season.

The DRIFT methodology was adopted for the Mzingwane EFA during 2007 by Southern Waters (a consulting company in South Africa). The methodology broadly involves a number of steps from planning with stakeholders, identifying the study sites, individual assessments for specialist fields and for the Mzingwane this involved (hydrology, hydraulics, geomorphology, social economic issues, fish, invertebrates, water quality and vegetation); a technical workshop to synthesize the results from each assessment and come up with recommendations for a flow regime to be adopted and then finally a meeting with stakeholders to decide on scenarios they would like to adopt for management of their water resources. The technical workshop to input the data from the specialist studies for the Mzingwane Flows assessment was in Bulawayo, Zimbabwe, from the 8th to 10th of May 2007. Outputs from the workshop included: generic lists from specialists' studies; future initial scenarios based on flow management in the Mzingwane; and preliminary recommendations based on the scientific studies.

At the end of June, 2007, IUCN staff presented results of the assessment to key stakeholders in Bulawayo. Results and recommendations of the assessment were presented and submitted to decision making authorities for consideration and use in future water allocation planning, water management and development, and to inform development initiatives in the catchment as a whole.

## DRIFT Results

Outputs of DRIFT analysis indicates expected changes in river condition as a result of improved flow allocation regime (flow quantity and timing) downstream of a development (in this case the Mzingwane dam).

The Mzingwane was found to be a very unpredictable river, which is mainly flood driven. The DRIFT analysis normally considers classes of flows categorized into Wet season low flows, dry season low flows, Intra-annual floods and Inter-annual floods. However in the Mzingwane EFA the dry season low and the Inter-annual floods were not considered.

The dry **season low flows** were omitted because the river is highly seasonal and there is mostly no flow in the dry season. In addition, any flow changes likely to occur in the dry season will be those associated with using the river to convey irrigation water to a small-scale community irrigation scheme about 3 km downstream of the dam wall. In discussion with the specialists, it was agreed that these releases would 1) be small and 2) be unlikely to adversely affect the river ecosystem. **Inter-annual floods:** These large floods currently overtop the dam wall mainly because 1) the dam can store < 100% of the Mean Annual Runoff (MAR) of the Mzingwane River and 2) the floods of this size,  $\geq 109 \text{ m}^3\text{s}^{-1}$ , cannot be released through the dam outlet structures and thus cannot be managed from the dam.

DRIFT outputs gave a number of conclusions which were presented to the key stakeholders. The main conclusions based on DRIFT outputs were:

- Improved river maintenance will benefit communities downstream of the dam who rely on the river ecosystem for a portion of their livelihood.
- A river condition approximating that upstream the dam can be achieved for downstream of the dam with an additional 6 million cubic metres (MCM) of water per annum, averaged over the whole record. This would be equivalent to an allocation of c. 30% of the MAR at upstream as opposed to the current 20%. Up to this point, significant incremental improvements in river condition can, however, also be achieved with incremental additional of 1 MCM, i.e., 2% increases in percentage MAR allocated to the river up to the 10%.
- Distribution of the flows is as important as the volume allocated to the river. Class 1 and Class 3&4 size floods are most important for improving the downstream condition. The correct timing of these floods is vital.
- Increasing the operating level of Mzingwane Dam will greatly facilitate the provision of EFs to the downstream river, and is in line with current plans by the Bulawayo authorities to reduce the risk of failure of the city's water supply by augmenting the supply with water from other nearby dams.

Moving forward from the determination of the EF, the DRIFT outputs can be used, together with other related information, such as dam yield, as a decision support tool to facilitate focussed discussion on the possibilities of building EFs into the operation of Mzingwane Dam. In this regard it is important to realise that the information presented on the EF considerations here, dovetail with the existing plans of the Bulawayo water managers.

Once an EF scenario has been agreed, operating rules for the dam will need to be established to ensure implementation of the agreed EF. This can be done, partly using, the DRIFT hydro software but will be informed by other factors such as yield consideration and operating levels of the dam. These are crucial inputs and some information on them will be needed before operating rules can be established. In all likelihood, this phase will necessitate discussion as experience in other parts of the world has shown that the creation

of a decision-support system for implementation and operation of an EF, e.g., formulation of operating rules for the dam, is an important contributor to the success of these endeavours (Brown and Watson 2007). Such a system should include multi-disciplinary input from the outset, including representation of an EF specialist/EF hydrologist.

### 2.2.3 Lower Limpopo Flood Vulnerability Assessment

Activities within the “Community based risk adaptation strategy for the Lower Limpopo” project output area were initiated using WANI funding, but are being further developed through funding from DANIDA.

In the Lower Limpopo the work carried out was based on the preliminary revision of existing flood vulnerability materials produced for the ATLAS for Disaster Preparedness and Response in the Limpopo Basin (FewsNet, INGC and UEM, 2003). From the existing GeoData Base it was found that existing information constituted a snapshot of the 2000 flood impacts. Most of the mapping layers requiring update were, therefore, associated to more dynamic spatial features such as: land use/cover, human settlements, road and general infrastructure.

The mapping exercise for the project, therefore, concentrated on the updating of current spatial patterns of the fast changing terrain features based on the best available data sources (e.g. optical satellite data sources such as Spot and LandSat) with some minor field control due to time limitations. This created a basis upon which to estimate the terrain parameters most likely to be impacted by any flood event accounting for the changing conditions after 2000.

Current levels of livelihoods have been documented based on field works surveys supported by practical field observations and structured and semi-structured interviews. The lower Limpopo is clearly an agricultural dependent region in terms of livelihood strategies. Small-scale agriculture (subsistence farming) is dominant along the upper reaches of the basin system. However, along the flood plains large-scale commercial farming is still starting to re-invigorate mixed with a large number of small plots that have been allocated to individual small farmers with no sufficient capital to engage in large-scale agriculture.

The dissemination of maps and reports among decision makers requires follow up phases, although a significant level of awareness is already present given the extent of impacts of recent floods and droughts. The current state of existing mapping and report products are still very static, documenting what has happen in the past. More dynamic materials crafted for planning and decision making still need to be produced. This is what is being developed in the context of another IUCN project –IWRM Demonstration in the Lower Limpop - aimed at developing a decision support system for planning and management of river basin related extreme events.

## 2.3 Component 3: Piloting Environmental Flow Implementation

Outputs	Activity
<b>COMPONENT 3</b>	
3.1 Piloting of Environmental Flow implementation in specific parts of river basins to benefit local communities – Blyde River	3.1.1 EF in the Blyde river determined and operationalised

After initial consultative meeting with DWAF and a field scoping exercise in 2006, the project decided to target the Blyde river catchment, a subcatchment of the Olifants in South Africa,

which is part of the main Limpopo River Basin, for demonstrating implementation of environmental flows. The Blyde was selected mainly to build on the work that IUCN and the Department of Environmental Affairs and Tourism (DEAT) are already carrying out on the Blyde River Canyon National Park to facilitate restoration of river basin ecosystems for community livelihoods.

DWAF has previously undertaken reserve determination on the Blyde River although that study primarily focused on determining ecological water requirements and did not adequately cover the aspect of livelihoods. Discussions with DWAF therefore culminated in the decision to conduct further flow assessments, this time paying particular attention to the competing uses, and specifically community livelihood issues. This aspect was not adequately addressed in the previous reserve determination exercise on the Blyde River.

A Memo of Understanding (MoU) was developed in consultation with DWAF to realize activities under this component. The MoU was then consolidated into a contract in April 2007 with DWAF to implement a number of activities that would improve the confidence in the Reserve (environmental water allocation) determination and implementation of the Reserve. DWAF indicated that they were willing to add and complement financial resources provided by IUCN to provide for a high confidence product.

The total budget for the assessment amounts to USD 90,274 with IUCN contributing USD 51400 and DWAF contributing USD 38874. The assessment has been running from February 2007 and will be completed in April 2008. Funds mobilised by IUCN are being used to broaden the scope environmental flows to improve effective stakeholders participation

Subsequent to a scoping meeting held in June 2007 which was attended by representatives from DWAF Head Office and Regional Office, IUCN ROSA and Kruger National Park the main issues in the Olifants catchment (including the Blyde) were identified and prioritized, and an indicative work plan highlighting activities that needed to be carried was developed. The main areas identified focused on legislation and policy, cooperative governance, technical study requirements, implementation and enforcement, monitoring and auditing and communication, awareness and capacity building. Priority issues identified were the need to expand the Upper Olifants wetlands strategy to cover the whole basin, the need to address unlawful water use, the need to develop an IWRM plan for the Olifants catchment, updating and review of the results of the Reserve determination study and assessment of socio economics linked to the Reserve determination. It was also agreed that there was a need to get high level management buy in from DWAF therefore it was recommended that a meeting be scheduled between IUCN Senior Management and the Director General of DWAF.

A fact sheet on the Olifants initiative was compiled as information for dissemination to stakeholders. Following the scoping meeting a revised workplan was developed and a contract developed for the implementation of the IUCN funded activities. The workplan highlights the main activities prioritized by DWAF based on the issues identified in the scoping meeting. These activities include the development of an IWRM plan, development of a wetlands strategy, reserve determinations, socio-economic assessments and assessment and remediation of water quality among other activities. IUCN's main interests include Reserve Determination, Socio-economic assessment, prioritization of wetlands, general public awareness and assisting the DWAF in fundraising for the overall plan.

## **2.4 Component 4: Harmonizing Legal Frameworks**

Outputs	Activity
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Outputs	Activity
<b>COMPONENT 4</b>	
4.1 Willingness to harmonise legal frameworks to incorporate environmental flows in the Limpopo River Basin	4.1.1 A review of legal provisions to identify areas for mainstreaming environmental flows at national level, and assessment of level of domestication of Protocol on Shared Watercourse Systems
	4.1.2 Guidelines on harmonization of policy, legal and strategy frameworks to incorporate environmental flows produced and disseminated among the four riparian states of the Limpopo River Basin and SADC.
	4.1.3 Basin level environmental flows dialogue including parliamentarians, policy makers and managers, scientist and civil society convened to deliberate on the role of environmental flows in maintaining ecosystem health and sustaining livelihoods, and harmonization of policy, legislation and strategies

### Review of legal provisions

The review of the treatment of environmental flows in the SADC Revised Protocol on Shared Watercourses and in the legal provisions in the four riparian states of the Limpopo Basin highlighted that although the concept of environmental flows is relatively new in the SADC region, attempts have been made to provide for it at both policy and legislative levels. Nonetheless, not much is being done to implement environmental flow requirements in the Basin.

The report found that issues of inadequate expertise and of generating the necessary information to determine and maintain environmental flows in the Basin still need to be addressed. Strategies to obtain sufficient information from stakeholders need to be developed to enable those charged with the management of water resources to strike a balance between consumptive/non-consumptive uses and environmental requirements of water. It is important for the relevant decision makers to understand the flow necessary to sustain or restore the integrity of a river, assess human influence on water flow and identify areas of incompatibility between people and nature to provide a foundation for next steps.

In addition, recognition of the tangible and intangible national costs of degraded rivers, acceptance of flow assessments as a tool for use in integrated river basin management, and supporting legislation to empower water managers to manage river flow according to environmental flows recommendations are some of the key challenges that need to be addressed in the Limpopo Basin. Existing national legislation in these countries has yet to establish a clear and systematic set of rules legitimizing the provision of water for environmental flows.

Finally, cooperation among countries is of great importance in allocating water to the aquatic environment in international river basins such as Limpopo River Basin. Stakeholder engagement and sharing water equitably is only one part of the challenge of transboundary water resources, using and managing water optimally and protecting the ecological integrity of river systems are other key prerequisites for sustainability. Issues such as the management unit in the riparian countries need to be addressed to allow for proper cooperation in the allocation of water. For instance, the management unit in Mozambique is the river basin and in South Africa it is the catchment. In the Revised SADC Protocol on

Shared Watercourses, the watercourse is the management unit. Harmonization of the management units would ease cooperation between the riparian States and in a system such as the Limpopo where water is already over allocated, the challenge of environmental flows remains to negotiate a more equitable reallocation or conservation of water from existing users and returning it to the river.

### Guidelines and dialogue

The developments by WANI in the region has enabled IUCN to position itself such that SADC has requested that IUCN facilitate a dialogue among parliamentarians, policy makers and managers, scientist and civil society in the coming year (2008) on the role of environmental flows in maintaining ecosystem health and sustaining livelihoods. This dialogue will lead to the development of guidelines that will harmonize policy, legal and strategy frameworks to incorporate environmental flows within the SADC region and individual countries.

## **3 Experiences and Lessons Learnt**

In the past decade, policies have begun to incorporate environmental issues including integrated water resources management (IWRM). The four riparian states of the Limpopo acknowledge in their Water policies the need to provide water for the environment (environmental flows). To date only South Africa has included it in its legislation and actually established the institutional arrangements (Resource Directed Measures Directorate was established in 2003 and a Chief Directorate in 2006) for conducting environmental flows assessment, which they term "Reserve determination". Because it has been provided for in the legislation and there are institutional arrangements in place for its implementation, it receives a budget from the government to be assessed, implemented and monitored.

The other countries have not set in motion the enabling environment for Environmental Flows Assessments. Most of the assessments that have been undertaken have tended to be driven externally for example in Zimbabwe assessments were undertaken in Pungwe, Shashe, and Save River basins, through UK Department of International Development DFID funding in 2001-2004 and was facilitated by Mott MacDonald Private Limited and Southern Waters Private Limited.

The latest assessment in Mzingwane was facilitated under the Limpopo Environmental flows project by IUCN. There is lack of an internally driven process to actually operationalise what is provided in the policies. Unless the governments themselves are committed and come up with institutional set up and steps to operationalise the provisions, providing for the environment will remain a wish, yet providing for the environment is a prerequisite for sustainable development as this is one of its pillars.

The main lesson for future improvement of similar initiatives is to provide an adequate time frame for implementation, especially of components with field operations. It could be better to select few but well timed activities for an exercise that introduces a relatively new science, such as environmental flows. It could also be beneficial to arrange for more field observation, and technical mentoring in carrying out work on a multi-disciplinary exercise such as is the case with environmental flows.

Nonetheless, the project has made some impact on raising awareness on environmental flows and this has been demonstrated by the support provided on the flows assessment, and during the field visits.

### **3.1 Data and time limitations**

Lack of data on many river systems in the region limits application of environmental flows in the region for a long period. Adapted hybrids of the formal methods which emphasize participation and inclusiveness such as those applied in the Pangani and the Mzingwane will remain useful in the interim and this has to be mentioned in training.

The Environmental flows project was aiming at adding value to the work that is being undertaken by government departments on environmental flows. In some countries it was possible to synchronize the timing of the project and the needs and pace of the collaborating government agencies, however in some cases this was not possible and resulted in outputs not being fully released as planned. There is need therefore to have longer time frames for projects, about 5 or more years to enable projects to really add value to what the government agencies will be working on.

### **3.2 Constraints to implementing EFA assessments recommendations in semi-arid and arid areas**

The conclusions of the Mzingwane EFA assessments indicate that the Mzingwane is a flood driven system as the Mzingwane lies in a semi-arid region. The EFA recommends that flood releases for certain types of floods should be released at the beginning of the season to give enough time for organisms that require aquatic environments to complete their life cycles. While this is the most desirable situation for implementing EFA, it was found to be very risky by the key stakeholders in the Mzingwane when these recommendations were presented. They indicated that although they would want to provide water for the environment, they could not risk releasing water early on in the rainy season before they actually know what they are going to receive. Any release of water will have to be delayed and be based on assessment of the rainy season and other water supply sources and should involve key stakeholders.

### **3.3 Capacity Building**

The training course on environmental flows for water professionals and managers faced a challenge in meeting the large demand and interest created by the extensive publicity through the different partners. Careful selection criteria must be implemented to ensure that key stakeholders are included in the training, but that numbers are still manageable. There is also a need for pre-training and post training activities to be formalized. This will provide more emphasis and relevance to the training offered at the regional level.

EFA and implementation requires input from a wide variety of specializations to elaborate water requirements for different sectors such as Ecology, Hydrology, Hydraulics, Sociology and Economics. This presents a challenge in training participants to an adequate level of knowledge. Training must provide introductions to each of these areas and why they are important to the whole assessment so all training participants have the same level of understanding of environmental flows. This limits the opportunity for more in depth discussions, thus participants were encouraged to seek further training in their own sectoral specializations in addition to the overall methodology of environmental flows.

The DRIFT methodology is holistic in that it looks at flow requirements for the environment, people and economic activities and usually includes a number of disciplines in the assessment such as (hydrology, hydraulics, geomorphology, water quality, aquatic invertebrates, fish, vegetation, social and economic issues etc depending on the critical issues for the river system). The experience of using DRIFT by the specialist team found that

there is need for the team and facilitators to undergo intensive training of the methodology, the software, how to interpret the results for each sector and holistically. There is need to be clear how the results can be simplified and interpreted for decision makers and how the decision makers can operationalise the results.

Capacity to undertake and operationalise EFA in Southern Africa is still very low. Based on the experiences of the project, the best way to build capacity is to train a team of people and take them through a real assessment. This model of capacity building may be time consuming and costly, but helps in reducing dependence on the developers of EFA models (such as DRIFT). Currently, there is still relatively heavy dependence on the originators of the environmental water requirements methodologies within the region (Southern Water) for tools (DRIFT, BBM, etc) and guidance on their application and the methods are not yet adapted to ephemeral rivers. Thus, it is a challenge to provide examples on the application of EFA to seasonal basins, which are found in a large part of the region.

The countries in the region need to agree on a standardized methodology for EFA assessments to be able to co-operate, especially in the case of shared river basins. The SADC Directorate on Infrastructure Services Division needs to kick start the process and encourage countries to operationalise the SADC protocol on Shared Water courses by agreeing on standard methodology and assessment of Shared Water courses which tend to be limited by the lack of such mechanisms. External support in assisting governments to put in place the frameworks for implementing and operationalising EFA and capacity building will go a long way in ensuring that the environmental conservation actually happens rather than just remaining in policy statements.

### **3.4 Stakeholder involvement**

At the beginning of the project a considerable number of people viewed provision of environmental flows in arid and semi-arid areas very suspiciously as it was believed that there was a requirement to provide water from dams to the environment during periods when rivers are normally dry. By the time the project was completed, the key stakeholders in Mzingwane understood that environmental flows does not mean providing water when it is normally dry but rather to try and mimic the natural flow pattern as closely as possible. They also understood that flows that they released for other uses such as irrigated agriculture; domestic uses are not necessarily environmental flows, but actually have the potential to harm biodiversity. This depends on the magnitude and duration of the flows as some organisms might start breeding and have their life cycles cut short when the releases are stopped.

The key stakeholders were able to understand the importance of carrying out an EFA as they were involved at every stage of the EFA assessment right from the initial planning workshop, to the presentation of the outputs of the DRIFT analysis. When undertaking EFA exercises it is essential to conduct a scoping exercise to identify key stakeholders that needs to be involved to be able to operationalise the results of the assessment.

In order to promote mainstreaming of environmental flows in field practices in the region, participants in the project recommended that higher level Officials including Heads of Departments and Directors should also be exposed to the training, perhaps tailored to their level of operation. Furthermore, DWAF in South Africa recommended that the Flows project be presented to their Director General and Minister so that the results of the project and recommendations are taken up by the government. Working with the relevant authorities also broadens that scope of engagement and allows for further collaborative opportunities to be explored. Other opportunities recognized for mainstreaming environmental flows in national practices is in environmental impact assessment (EIA) for infrastructure development and other water development projects.



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