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Incorporation of Water Demand Management in National and Region Water Policies and Strategies

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REPORT PREPARED FOR IUCN SOUTH AFRICA OFFICE
WDM SOUTHERN AFRICA PROJECT PHASE 2

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Abbreviations

AMCOW	African Ministerial Conference on Water
CBA	Cost Benefit Analysis
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry (South Africa)
EIA	Environmental Impact Assessment
FFA	Framework for Action
GWP	Global Water Partnership
IWRM	Integrated Water Resources Management
MOC	marginal Opportunity Costs
NEPAD	New Economic Programme for African Development
PPP	Polluter-Pays-Principle; also Public-Private sector Partnership
RSAP	Regional Strategy and Action Plan
SADC	Southern African Development Community
SADC-WSCU	SADC Water Sector Coordinating Unit
SAWINET	Southern African Water Information Network
UAL	Un-accounted Loss
UPP	User-Pays-Principle
VAT	Value Added Tax
WC	Water Conservation
WDM	Water Demand Management
WSCU	Water Sector Coordination Unit
WSSD	World Summit on Sustainable Development

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1 Introduction

The IUCN- South Africa country office has commissioned this study, as part of the regional Water Demand Management Study phase 2. According to the terms of reference, the main purpose of this discussion paper is:

> *To capture all key policies and strategies in WDM for inclusion in the formulation of national and regional water policy and strategy*

The main tasks are to review key regional water initiatives in terms of water demand management, and to analyse the country reports on the status of WDM in Southern Africa, produced during phase 1 and 2 of the IUCN-WDM project (phase 1: Botswana, Namibia, South Africa and Zimbabwe; phase 2: Malawi, Mauritius, Mozambique, Swaziland and Zambia).

The discussion paper should lead to policy recommendations at the national level as well as the regional level. The results need to feed into projects 9 (guidelines for National Policy Review in member states), 10 (support development of National Water Sector Strategies and Policies) and 11 (Regional Water Sector Policy and Strategy) of the Regional Strategy and Action Plan (SADC WCSU, 1999) and in on-going efforts to strengthen national WDM implementation. The study's main issues and questions are summarised in Table 1.

Table 1: Main issues and questions for this study

Issues	**Main questions**
Policy issues	What are the specific policy issues that the WDM Ph II and I have identified?
WDM incorporation into policies and strategies	How has WDM been addressed in the new water policies in South Africa, Namibia and Botswana? How can WDM be incorporated into policies and strategies of phase 2 countries? What generic recommendations can be made to the other SADC countries that have not yet officially incorporated WDM into their national policies? What are the broad content and process related aspects of this?
Policy reform	Which policy reforms are needed in order to mainstream WDM in the SADC region based on the previous questions and based on 'regional' implications of WDM, as highlighted in the WDM country studies?
Institutional reforms	What institutional reform is required nationally and regionally to mainstream WDM in the SADC region?
WDM and shared water	What are the specific WDM issues that need to be investigated relating to 'shared water' and what are the policy implications of these issues?
Institutional responsibilities	What are the institutional implications of promoting WDM at different spatial levels?
Appropriate spatial action level	What actions should be taken at the national level and what needs to be dealt with at a regional level?

Source: Terms of Reference.

The study has been analytical rather than descriptive. No attempt has been made to make an inventory of all findings and recommendations of the literature. Instead, efforts have focused on the key issues that emerged from the literature analysis.

The study was carried out in two months (April-June 2003). The data collection has been restricted to accessible literature through IUCN South Africa, SADC documentation, internet-searches and personal contacts. A wide range of organisations/ institutions have been approached, searched and/ or consulted (Waternet, Water Research Fund, GWP-SATAC, Water Utilities Cities project, DWAF South Africa, DWA-Water Conservation Unit Botswana). The country WDM reports were exploratory in nature, and meant as baseline studies. Therefore, they vary in detail of information and analysis. It was sometimes difficult to distinguish between what is on the ground and what is planned, but not yet implemented. Consequently, their usefulness for this study also varied.

Water policies and strategies are in a state of flux, and are changing rapidly in some countries. Although an attempt was made to use the latest information (e.g. Namibia and South Africa), it is likely that some of the most recent developments have not been fully incorporated. Where possible preliminary results of on-going studies under SADC projects 9 and 10 have been incorporated.

The information has been analysed using a comprehensive checklist based on the concepts of Integrated Water Resource Management (IWRM) and Water Demand Management (WDM) and using the issues and questions in Table 1.

The structure of the report consists of three main parts. The sections (1-3) introduce the concepts of IWRM and WDM. The basics of integrated water resource management are discussed in section 2. Sections 3 and 4 deal with the need for and basics of water demand management. Sections 5 to 7 focus on water resources and initiatives in southern Africa. Section 5 summarises the major water initiatives of SADC such as the SADC Protocol on Shared Watercourses, while section 6 discusses other regional initiatives. Section 7 presents a summary of the findings of a water resource assessment, carried out as another IUCN study by Dr. Nkhandi. Sections 8 to 10 result from the analysis and discuss the major WDM policy issues (section 8), WDM policy reforms in southern Africa and institutional reforms (section 10). Section 11 summarises the major conclusions and recommendations

2 Integrated Water Resource Management

The approach of Integrated Water Resource Management (IWRM) is now commonly adopted globally and in southern African water strategies.

At the regional level for example, the RSAP uses the approach to outline its strategy and to select programmatic areas (SADC-WCSU, 1999). The Southern African component of the Global water Partnership is also based on IWRM. The African position paper on Water and Sustainable Development that was prepared for the 2002 World Summit on Sustainable Development (WSSD) embraces IWRM, and considers it most appropriate to link the New Partnership for Africa's Development (NEPAD) with prudent water management.

At the national level, most new policies, strategies and programmes in southern Africa are based on IWRM (e.g. South Africa, Namibia, Zimbabwe, Zambia). Older strategies and policies do not reflect IWRM, and remain biased towards traditional ways of supply augmentation.

According to the Global Water Partnership's toolbox, IWRM is a process, which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. This description has been adopted in SADC projects 9 and 10. The overall IWRM goal is to ensure an efficient (low-cost, and increasing welfare), equitable (meeting essential needs and provision of affordable water) and environmentally sustainable (no water mining unless substitutes can be found in time; sufficient water to meet ecosystem requirements) water provision in the short and long term. In 1992, four guiding principles for IWRM were established in Dublin: decentralised water management, participatory water management, water as an economic good[1] and genderisation of water management

At the 2002 World Summit on Sustainable Development (WSSD) in Johannesburg, the following recommendations relevant to IWRM were accepted:

- Develop IWRM-and water-efficiency plans by 2005;
- Improve efficiency of water use and promote efficient water allocation among competing uses;
- Support technology diffusion and capacity building for non-conventional water resources;
- Support developing countries in their efforts to monitor and assess the quantity of water resources, including through networks, data bases and indicators;
- Develop regional/national strategies with regards to river basins, watershed and groundwater management

IWRM is easier formulated than implemented. Its implementation is more demanding and challenging than traditional supply-biased water management, and this may explain why the implementation of IWRM policies has been slower than the formulation. Serageldin (2000) argues that effective IWRM requires radical technological changes, strong political commitment and substantial funding from both the public and private sectors. Funding is particularly problematic in developing countries,[2] which experience low economic growth, high indebtedness and which try to reduce the role of government. From an IWRM perspective, it is even more important to ensure that the available funding is correctly spent (see Box 1 for an example).

Box 1: Poor investment decisions due to neglect of WDM potential

In Marondera, a Zimbabwean town of 54 000 inhabitants a dam was constructed at some 20 km away from the town by central government to overcome water shortages. The dam was completed in 1997 at no cost to the municipality.

[1] This implies, among others, that water has a cost and value, and productive water is needed for economic growth/ production.

[2] Weak management structures make it also difficult to sustain the long term perspective that is essential for IWRM.

When the dam was constructed, the municipality planned to build a water treatment plant using the biological nutrient removal technology to solve sanitation problems. This plant could produce a re-use flow of 8 million litres per day. The municipality decided to build the water treatment plant, and postpone the pipeline to connect the dam to the town's water supply.

Similar examples of poor investment decisions are likely to be found in other Southern African countries.

Source: Robinson, 2002, p.7.

One of the main benefits of IWRM is that it opens a broader range of solutions to water supply and shortage problems than those that are traditionally considered.[3] This benefit of IWRM can, however, only be fully exploited if the alternative options are systematically evaluated in terms of their economic, social and environmental impacts, using environmental impact assessments (EIA) and cost-benefit analysis (CBA). The wider range of options includes:

- increase in traditional water supplies (e.g. dams and boreholes);
- increase in non-traditional supplies (e.g. water harvesting, water recycling/re-use and desalination);
- reduced wastage and greater user efficiency (more output per m^3 of water), economic diversification and greater allocative efficiency (promotion of sectors that use less water or use water more productively) and finally curbing water demand (e.g. after demand prioritisation).

Five types of interventions can be used: physical/ technical measures, water resource and development planning, legislative measures, economic measures and education other awareness raising and consultative instruments.

A good example of the IWRM thinking relevant to southern Africa is given in Box 2.

[3] This historical bias has led Hazelton et al (2002) to formulate IWRM as "overcoming supply side bias in the southern African water sector, by striving to ensure that water is continually used optimally in order to promote equity and sustainability".

Box 2: The importance of allocative efficiency for IWRM

Allocative efficiency may be more important than user efficiency.

According to Allan (1995, quoted by Lundqvist 1997):

> "*If allocative efficiency is not achieved, it is possible, and even common, to be doing the wrong thing extremely efficiently. It would be much more useful to be doing the right thing, that is with efficiently allocated water, a little bad"*

Allan uses the example of Israel's agriculture, which is extremely water efficient, but the sector accounts for 70% of the country's water consumption and only contributes three to five percent of GDP.

The example also applies to irrigation in Southern Africa. Given the large water consumption by irrigation, two questions need to be asked:

- How much water should be allocated to irrigation given the needs of people and other economic sectors?
- How can the water efficiency of irrigation be improved?

Both questions need to be addressed to develop efficient, equitable and sustainable water management systems in southern Africa.

Source: adapted from Lundqvist, 1997.

In conclusion:

- IWRM makes common sense, and is globally accepted. Countries are committed to the preparation of IWRM plans by 2005;
- IWRM offers three management interventions to secure efficient, equitable and sustainable water provision: expand traditional supplies, develop non-traditional supplies and control water demand. The choice between these interventions should be informed by EIAs and CBAs); and
- IWRM is demanding, and serious efforts need to be put into its implementation.

Recommendations:

1. Implement the WSSD-undertaking to prepare IWRM and water efficiency plans;
2. Systematically compare the options to expand traditional and non–traditional water supplies, and to manage the water demand; and
3. Allocative efficiency should be given much greater attention as part of water planning.

3 The need for water demand management

Water demand needs to be managed for social, economic and environmental reasons. The IUCN WDM study has clearly shown that WDM serves economic and resource conservation purposes. The water saved can be used to improve access to water for people, and serve a social purpose.

Some countries like Zambia and Malawi have mostly economic reasons for WDM. These countries do not experience acute and widespread water shortages, but WDM reduces

water losses and costs. As a result, more people can be provided with safe drinking water or more water can be used productively (e.g. industry). In other countries such as Namibia, Botswana and South Africa, water resources are extremely scarce, and need to be used efficiently to safeguard future economic growth and prevent resource depletion. In those countries, WDM serves environmental and economic purposes.

Reasons for WDM include the following:

- Environmental reasons include current or future water scarcity due to demand growth, droughts, and avoidance of adverse environmental impacts of dams and well fields;
- Economic reasons include the lower costs of WDM as compared to new supply schemes (high opportunity costs; see also box 1). If operation and maintenance costs of WDM are lower, further savings are achieved;
- Other reasons include building upon indigenous knowledge and resource management systems, unmet water and sanitation policy commitments that require more water in future and water needs for production and economic growth.

There are growing WDM opportunities for re-use and recycling due to urbanisation and improved sanitation, technological advancement (e.g. prepaid system, leak detection, desalination) and computerisation and data analysis (e.g. computerised billing systems).

WDM may stimulate innovation and technology development, and boost economic growth. Examples of economic benefits are given in Table 2. The information is incomplete and therefore there is need for cost-benefit analysis of WDM measures as compared to the construction of new dams etc.

Table 2: Examples of economic benefits of WDM

Type of economic benefit	**Results**
Delayed infrastructure	Gauteng: US$ 105 million per annum
	Windhoek: deferred by ten years
Irrigation up-grading	Efficiency increased from 40 to 95%; water for additional 3 800 ha.
Water loss reduction	Water losses in urban Botswana were reduced from 30 % in 1997 to 9% in 1999. This saved the service provider Pula 21.5 million per annum or around 16% of its gross revenues.
Savings in water production	Windhoek: N$ 6.8 million/ annum

Sources: Goldblatt et al, 1999; Lange et al, 1999; Louw and Kassier, 2002.

4 Water demand management

Water demand management (WDM) is an integral and indispensable part of IWRM[4]. It aims to increase water efficiency through both wise use and reduction in use to reduce

[4] South Africa and Namibia distinguish WDM from water conservation. WDM is part of the broader concept of water conservation that covers WDM measures as well as protection of water resources (DWAF, 2003).

or to postpone the need to build more dams and drill more boreholes (adapted from Macy, 1999, p.38). According to the RSAP, WDM 'seeks to maximize the usage of a given volume of water by curbing in-essential or low-use values through price or non-price measures' (SADC-WSCU, 1999, p.57). WDM comprises *short-term* measures (often drought related) and *long-term* measures.

Two interpretation of WDM are found in the literature. The narrow interpretation refers to interventions that influence water demand only. This is usually takes the form of lower consumption or lower consumption growth. The broader and more common interpretation refers to interventions that influence water demand *and* increase supply from non-traditional water sources. From an IWRM perspective, it is critical that both aspects (demand management and non-traditional supplies) are fully incorporated in water policies and strategies. Key themes of 'narrow' WDM are increasing user and allocative efficiency. For 'broad' WDM rainwater harvesting, desalination and return flows are additional key themes. While the narrow interpretation is easier understood, the broader interpretation covers more of IWRM, and is therefore more relevant.

WDM can be promoted through a wide range of technical, planning, economic, regulatory and consultative instruments. Examples of instruments are given in Table 3. Instruments are targeted towards specific stakeholder groups, i.e. water planners, water service providers and end-users. In the absence of a WDM policy, few countries make use of the entire range of instruments. WDM efforts usually focus on education, water pricing and technical measures (e.g. retrofitting and leakage reduction). Regulations are widely applied during droughts.

Table 3: Examples of the range of WDM measures

WDM area	Technical measures	Planning	Regulations	Economic	Consultative
WDM in resource management functions	Removal of invading alien species Wet land rehabilitation Dam storage optimisation (e.g. less evaporation) Artificial recharge	Water catchment management Protection from overutilisation Managing land use Water quality management Drought contingencies Allocative efficiency	BAT water [practices as compulsory alternative in EIA/SEA procedure in water stressed areas		Awareness and education, social marketing
WDM in distribution and supply functions	Infrastructure optimisation Parallel infrastructure for different water classes; Loss minimisation; Reduction of UAW; Metering; Pressure management; Pre-paid metres Common-property management of standpipes	Town planning services Re-use and reclamation WDM in building standards	Regulations, norms and guidelines	Incentives Higher energy prices make pumping expensive. Volume-based effluent charges	Education, awareness, training Covenants for monopolies of WSPs
WDM for end-users	Metering Different service levels Loss minimisation Retro-fitting existing systems	Irrigation scheduling Crop choice Agricultural extension Auditing Minimising institutional use	Domestic use guidelines and restrictions Guidelines for private and public sector Drought restrictions Proper level and structure of tariffs Amendment of water irrigation fees (too low and linked to area; not m^3)	Effective billing and pricing Product standards Differential tax rates (e.g. VAT). Higher energy tariffs make pumping expensive Volume-based effluent charges	Education, awareness, training
WC for return flow management	Minimising infrastructure Minimising pollution Minimising losses Minimising infiltration Reclamation	Infrastructure optimisation Minimising pollution	Effluent standards	Effluent charges	Education, awareness, training Covenants for irrigation sector and public sector

The potential for demand reduction is significant, and ranges from 20 to 50% on the short-term (e.g. during droughts) to 40 to 60% on the long-term (Macy, 1999). Although detailed figures are not available, it is stated that WDM measures are 70 to 80% cheaper than the construction of additional dams, well fields and associated water transfer schemes (Louw and Kassier, 2002). In urban settings, the savings may be as high as 90% (HR Wallington, 2003).

Despite the policy shift towards IWRM and the apparent advantages of WDM, WDM is not yet widely incorporated into national and regional water policies and strategies. Some countries, in particular South Africa, Namibia and to a lesser extent Zimbabwe

and Botswana, have developed WDM policies, strategies and guidelines. In most countries however, WDM is not explicitly considered. At the regional level, the RSAP deals with WDM, but does not mention WDM explicitly into its strategic policy objectives and projects.

WDM is a tool that should be carefully used. In general terms, WDM measures are warranted if they have net social benefits and if they are more efficient than other interventions. If there are no net social benefits, WDM can only be justified on environmental grounds. If there are net social benefits, two situations may prevail. Firstly, there may also be net private benefits. In this case, no incentives are necessary, but it may be necessary to ensure access to information and technology by the water users. Secondly, there are net private costs, which discourage water users from WDM implementation. In this case, water regulators have to implement regulations or economic incentives. In all events, the net befits of WDM have to be compared with the net benefits of traditional supply measures.

In conclusion:

- WDM is integral part of IWRM, but not yet commonly applied in southern Africa;
- WDM can have large economic benefits;
- WDM is interpreted in a narrow and broad sense.
- WDM targets different stakeholders, including water planners, service providers and end-users; and
- WDM has not yet been widely adopted or implemented in southern Africa.

Recommendations:

- The narrow interpretation of WDM should be adopted in southern Africa; however, non-traditional supply measures should be given equal attention within IWRM planning;
- WDM measures and instruments should be targeted towards water planners, service providers and end-users.

5 SADC initiatives on water management

Water has been a focal area of SADC since the early 1990s. This is in recognition of the strategic importance of water for regional economic integration and the dominance of shared water resources. It is also in pursuit of the SADC objective of achieving 'sustainable utilisation of natural resources and effective protection of the environment' (art. 5 of the SADC Treaty).

The Protocol on Shared Water Course Systems was agreed upon in 1995, and subsequently amended in 2000. The SADC environmental policy considered water as one of the key priorities for accelerated and equitable economic growth on a sustainable base (SADC-ELMS, 1996). The SADC water sector co-ordinating unit (WSCU) was established in 1996 in Lesotho, and moved to the SADC secretariat in April 2003. In 1999, a regional strategy and action was formulated for integrated water resource development and management. Subsequently, projects have been formulated for the implementation of the RSAP.

5.1 SADC environmental policy

In 1996, SADC-ELMS formulated the SADC environmental policy, which is called equity-led growth and sustainable development, and has three overall goals:

- accelerate economic growth with greater equity and self reliance;
- improve the health, income and living conditions of the poor majority; and
- ensure equitable and sustainable use of the environment and natural resources.

These goals imply that there should be sufficient productive water that is efficiently used, that people have adequate access to clean water for domestic use and small-scale agriculture, and that watersheds, aquifers and ecosystems be protected. The quality of surface and groundwater resources needs to be protected and shared water resources should be used efficiently, sustainably and equitably.

No explicit reference to IWRM or WDM is made in the document.

5.2 Regional Strategic Action Plan for Integrated Water Resource Development and Management in SADC countries (1999-2004)

The RSAP has adopted a holistic approach towards water development and management. Seven strategic objectives are distinguished:

1. Improve legal and regulatory framework at the national and regional level;
2. Improve national and trans-boundary river basin management and planning;
3. Strengthen linkages among macro-economic, social and environmental policies;
4. Improve information acquisition, management and dissemination;
5. Support awareness building, education and training;
6. Promote public participation; and
7. Invest in infrastructure.

A summary of the major water issues in Southern Africa is presented in Table 4. It is remarkable that water stress is not considered to be a common problem (mentioned by less than four countries). Clearly, the assessment of water scarcity in the region warrants further research[5]. Instead, lack of participation and involvement of women are most widespread together with inadequacies in water and sanitation infrastructure. Legal and policy weaknesses and inadequate information are also widespread.

The plan has separate sections on water demand management, water conservation and sustainable development.

Delayed investment costs and reduced environmental costs associated with supply expansion are mentioned as the major reasons for WDM. WDM requires action at three levels: the establishment and implementation of progressive government policies, special incentives for water users, and implementation of efficiency measures. A wide range of instruments is mentioned to support WDM, including water tariffs, pollution charges, water quota, water banking, auctions, licenses, water quality and product norms, and WDM-demonstration projects.

[5] There is need for Southern African indicators of water scarcity.

Table 4: Water issues and constraints in twelve SADC countries.

Frequency	Water Issues	Constraint
Widespread (at least in 76% of countries)	Public participation	Inadequate community participation Inadequate women involvement
	Infrastructure	Inadequate access to sanitation Inadequate access to safe drinking water
	Sustainable development	Overgrazing
Widespread (in 51% to 75% of the countries)	Legal aspects	No comprehensive national water law
	Institutional strengthening	No overall water policy/ strategy Weak national water institutions Inadequate manpower
	Sustainable development	Inadequate water conservation measures Pollution from sewage Soil erosion and deforestation
	Information	Inadequate water resource data base Inadequate hydro-meteorological monitoring network
	Infrastructure	Inadequate water resources infrastructure
Less common (in 26-50% of the countries)	Legal	Non-ratification of protocols
	Institutional strengthening	Poor coordination mechanisms Ineffective shared basin institutions
	Sustain able development	Pollution Aquatic weeds Land salination
	Information	Inadequate water user information Inadequate monitoring of sediments and water quality
	Infrastructure	Inadequate flood control
Not common (in 25% or less of the countries)	Sustainable development	Potential water stress Herbicide pollution Cross-border pollution

Source: modified table 4.4, RSAP, p. 92/93.

The RSAP accords block tariff water pricing a central role in water conservation. Requirements include metering, proper reading, and effective revenue collection systems. The water efficiency of irrigation has to increase given its large share in the total water consumption. The example of community involvement in Namibia's rural water supplies is mentioned.

The current economic instruments hardly encourage conservation and sustainable use of water. There is need to strengthen the use of economic instruments, and to identify and remove subsidies and tax advantages that encourage water wastage. It is recommended that water authorities in SADC countries systematically analyse demand side options to increase allocative and user efficiency (p. 75).

The RSAP identified thirty-one priority areas have been selected for the seven objectives (Table 5). All objectives and priority areas fit into IWRM. Four priority areas (in italics in Table 5) are directly linked to WDM, i.e. balancing demand and supply, water conservation, best management practices and shift towards most efficient use of water resources. Several other priority areas are indirectly linked to WDM.

Table 5: Objectives and key issues of the RSAP

Objectives	**Priority areas**
Improve regulatory and legal framework	Harmonise laws, drinking water standards, water quality standards enforcement of standards, dispute resolution framework and equitable use of shared rivers through river basin commissions
Improve national and transboundary river basin management, planning and coordination	Strengthen national water authorities, improve regional cooperation in river basin management, equitable use of shared rivers through river basin commissions, intersectoral planning and coordination of water sectors in each country and strengthen SADC WSCU
Strengthen linkages among macro-economic, social and environmental policies	*Shift water used to most efficient use,* cost recovery*, balance demand with supply and conserve water resources*
Improve information acquisition, management and dissemination	Monitoring, assessment, info access and exchange, hydro-meteoreological data banks, research, inter-disciplinary knowledge
Support awareness building, education and training	Share knowledge, *best management practices*, regional and national centres of excellence, education, technical cooperation, IWRM training.
Promote public participation	Stakeholder identification and participation, community-based water resource management groups, special policies for needs of women and disadvantaged groups
Invest in infrastructure	Rehabilitate and expand infrastructure, meet demands of multiple users, *ensure efficient water use*, holistic planning of water works, and balance social and environmental goals with infrastructural goals.

Note: direct WDM areas in *italics*.
Source: RSAP, p. 100-102.

In conclusion, the RSAP is entirely based on IWRM, and makes explicit reference to WDM: best management practices, water conservation, balancing demand and supply, and promoting allocative and user efficiency.

Recommendation: Make sure that the explicit references to WDM in the RSAP are incorporated in the RSAP projects

5.3 SADC Protocol on Shared Water Course Systems

The Protocol is entirely based on the IWRM notion. The Protocol seeks to facilitate the establishment of shared watercourse agreements through river basin commissions, advance sustainable, equitable and reasonable use of shared water, promote integrated, coordinated and environmentally sound development and management of shared watercourses, harmonise legislation and policies for management of shared watercourses, promote research, technology development, and information exchange on shared water courses. The use of shared water should balance water development and conservation of the environment, and cooperation should be established for all projects with an impact on shared watercourses. Moreover, the use should be equitable and reasonable, and international laws should be respected. Environmental water needs have been explicitly recognised. Use entitlement depend on biophysical and environmental factors, the social, economic and environmental needs of states, the population size dependent on the share watercourse, existing and potential uses, conservation and economic use of water and finally the availability of alternative of comparable value to a particular planned or existing use (art. 3.8).

Shared water courses are systems of surface and ground water flowing into a common point and passing or bordering two or more SADC countries. The implementation of the SADC Protocol is currently restricted to river basins, but it is important to note that the Protocol covers aquifers too.

Although the Protocol does not mention WDM explicitly, several provisions can be used to fully incorporate WDM in the implementation of the Protocol. These include:

- The prevention of alien species that to interfere with shared watercourses is a direct WDM intervention;
- Entitlement to the use of shared water depends on the availability of alternatives to planned and existing uses (art 3.7b);
- Harmonisation of water uses and necessary interventions for sustainable use of all states (art 3.1);
- The user conditions of conservation and economic use of water, and of evaluating alternatives to current and planned uses before shared water can be used;
- The EIA requirement for all projects with an impact on shared water;
- The need for environmental protection implies that sufficient water should remain for environmental conservation. In view of the increasing use of shared water, the precautionary approach suggests that WDM measures should be considered prior to further increases in use of shared water;
- WDM can be incorporated into the guidelines and standards that will be developed for the river basins; and
- The river basin commissions and the multilateral agreements provide opportunities to integrate WDM.

In conclusion, the Protocol offers good opportunities for the incorporation of WDM into multilateral agreements for shared river basins. While each individual country looks at a small portion of the river basin, the implementation of the SADC Protocol should ensure that the entire basin is considered in its totality.

Recommendations:

1. Determine the appropriate WDM level and measures in the shared water basins as part of water basin agreements and plans;
2. Recognise WDM measures as alternative for use of shared watercourses in EIAs and economic project appraisals;
3. Ensure that the cumulative impacts of water abstractions are considered; and
4. Incorporate WDM explicitly in future amendments of the Protocol.

6 Other African initiatives

The Water Vision is being implemented through the framework for action (FFA). Among others, the FFA tries to influence the water positions taken by African countries at the WSSD and the water actions taken by NEPAD.

The Global Water Partnership for Southern Africa (GWP-SATAC) aims to promote IWRM in Southern Africa through regional cooperation and influencing national and regional water policies and strategies. According to its 2001 annual report, GWP has

been successful in consolidating regional partnerships, supporting SADC-WSCU, establishing several national GWPs and in networking (links with SAWINET and Waternet). GWP made little progress with influencing regional policy formulation and with finalising the FFA. Plans to prepare IWRM guidelines, establish best practices and guidelines for national mapping of IWRM gaps did not materialise. GWP has recently produced a toolbox for IWRM.

The Water Research Fund supports research and consultancies on IWRM and has supported WDM studies (e.g. on tourism in Namibia).

In 2002, the African Ministerial Conference on Water (AMCOW) was established in Abuja, Nigeria. AMCOW brought six water issues as African priorities to the WSSD. These include IWRM, linkages between water, food security, environment and international market access, vulnerability to climate variability and change, reliance on shared water resources, inadequate access to water and sanitation and lack of funds for infrastructure development.

7 IUCN regional water assessment

According to the terms of reference, the paper needs to incorporate the most important findings of the water assessment study, carried out for IUCN South Africa. Below, is a brief synopsis of the main findings, as supplied by Dr. S.Nkhandi, Tanzania (text in italics has been added by this study).

The assessment of water resources in the SADC region indicated that:

- Water is unevenly distributed in space and in time. Abundant water resources are found in the north and east while limited or no water is found in the dry southwestern part of Southern Africa. High water flows occur during the wet season, while low or no flows are observed in the dry season. Droughts are endemic to Southern Africa.
- Most surface water sources are shared with other countries (up to 70%);
- Surface water sources are sensitive to changes in climatic conditions. Droughts have a serious impact on water availability, and often lead to critical water shortages in parts of the region. Global climate change is likely to aggravate water stress;
- The distribution of water resources is unrelated to population distribution and economic development.

The above mentioned facts will have to be taken into consideration in the development of the Regional Water Policies and Strategies by the SADC Water Sector, which will aim to promote the sustainable, efficient and integrated utilization of water resources for the benefit of the people in the SADC region.

As input to the above mentioned anticipated process the following actions on policy implications are recommended.

Noting that water is unevenly distributed with space and time, the distribution of water in unrelated to population spread and that about 70% of the available freshwater are shared watercourses, the following actions are required:

- Develop a common water vision among the SADC countries
- Facilitate spatial and temporal redistribution of water;
- *Incorporate comparative water (dis-) advantages in spatial planning of settlements and location of economic activities;*
- *Prioritise countries and areas in southern Africa, where WDM is most urgent;*
- Transboundary cooperation in shared watercourses
- Water resources management at the regional level, and promote the efficient and sustainable use and conservation of water in the region;
- Promote effective water policies and action programmes in the SADC states;
- Pollution control of water bodies in the shared watercourses;
- Hydrological monitoring of shared watercourses and establishment of common database and protocol on data exchange among member states; and
- Facilitate stakeholders consultations, participation and partnerships
- Measures to address water conflict between member states.

The sensitivity of surface water sources requires the following actions: drought and flood mitigation measures, dam safety regulations/ plans, and reservoir operation procedures in the event of a flood or drought. The requirement for a wide range of multidisciplinary and specialised expertise requires the following actions: capacity building and training; promote water research; and promote cooperation between scientists from different states dealing with hydrology, climatology and protection of water resources

8 WDM policy issues

In this section, the main policy issues for the incorporation of WDM into water policies and strategies are discussed. The issues emerged from the analysis of the WDM country reports as well as from other literature. The issues imply recommendations for national and regional policy reforms that will be discussed in greater detail in sections 9 and 10.

Although WDM is an integral part of IWRM, it is recommended that '*affirmative WDM action*' be taken for the near future to rapidly counter the historical bias towards development of dams and well fields prior to maximising the efficiency of existing systems. Once IWRM is properly balanced, 'affirmative action' can be halted.

WDM is best introduced and implemented when policies and legislation are being reviewed, and when new capital investments have to be made. It will be often necessary to allow for a grace period to minimise negative social and economic impacts.

WDM should be gradually implemented based on the local needs and implementation capacity. Leak and water waste reduction and increased water use efficiency are the easiest components. More advanced forms of WDM include addressing allocative efficiency and re-use and recycling, and could be introduced when water scarcity rises or the implementation capacity has sufficiently grown. Capacity concerns should also be considered in implementing decentralisation and environmental and socio-economic project proposals.

8.1 Elaboration and operationalisation of IWRM

Most Southern African countries experience a growing water demand, and this growth is expected to continue in future as large parts of the population will get access to safe water and more productive water is needed to boost economic growth. At the same time, the supply costs of water are escalating because of the need for more dams and water transfer schemes. Public expenditure of the water sector will increase unless greater efficiency of existing systems can be achieved (WDM), cost recovery can be improved and/or private sector funding is forthcoming.

IWRM needs to carefully weigh the environmental, social and economic costs and benefits of further increasing traditional supplies, development of non-traditional supplies and demand management. Environmental and economic appraisals of projects and programmes are necessary to identify the most suitable intervention. In doing so, the role of WDM in IWRM needs to be made explicit both at the national and regional level.

It is recommended that the following IWRM components need to be considered:

- Demand prioritisation. Countries such as Namibia and South Africa first meet people's basic water needs and ecological needs (*ecological reserve*) before water is allocated to other users. It is not easy to determine the ecological reserve, but the precautionary principle could be applied (e.g. Namibia);
- Decentralisation of water management. Only a few countries have made progress with decentralisation, for example to catchment management agencies (Namibia, Mozambique, South Africa and Zimbabwe) or to communities (Namibia and Zambia). Power can be decentralised to water basins and to communities to manage local supply systems (Mozambique);
- Mechanisms to address allocative efficiency (e.g. through water basin approaches, water markets and natural resources accounting);
- Design of specific WDM measures for water planners, water providers and end-users (cf. Table 3);
- Participatory water management. The participation of civil society (private sector, communities and NGOs) in water management is generally low, causing a variety of problems (e.g. non-payment, lack of private sector investments, misunderstanding of WDM);
- Introduction of WDM incentives for the self-provider[6]'s sector and performance monitoring. This sector accounts for a significant part of water consumption and pays very little for water (apart from the water development costs); and
- Increased cost recovery from end-users based on the notion of water as an economic good. Most countries have identified the need to reduce water subsidies (where socially acceptable) to reduce the financial burden of the public sector and/or to provide incentives for efficient water use.

8.2 Overcoming WDM constraints

The IUCN-WDM Constraints study (Hazelton et al, 2002) identified the supply bias of water engineers and politicians and the lack of capacity and range of skills and finances

[6] Self-providers are usually located in rural areas. They have to produce the water themselves that they consume. The government grants water abstraction rights, but otherwise, there is little control and monitoring.

as the key constraints of WDM implementation. The lack of a proper understanding of WDM, inadequacies in infrastructure and lack of appropriate incentives, in particular pricing mechanisms, are the other major constraints. In some areas, water scarcity is not widespread or felt, making it difficult to implement WDM initiatives.

Countries with funding constraints should prioritise WDM measures that generate revenues or are not costly to implement. With respect to attitudes and perceptions, end-users tend to associate WDM with 'drought regulations and life style restrictions' that bear a negative connotation. Water engineers often lack a proper understanding of WDM, and their minds are still set on solving water supply problems. A priori uncertainty about the exact impact on water consumption may be another reason for the slow implementation of WDM. If the impact of WDM on water consumption is not certain in advance or cannot easily be predicted, water planners will probably prefer conventional supply interventions whose supply impact can be predicted with a reasonable certainty[7].

The constraints can be overcome by a combination of the following measures: awareness raising, demonstrating the WDM-benefits, formal education, involvement of economic and social disciplines in water management, improvements of technical infrastructure and the effectiveness of billing systems, greater costs recovery and better water pricing.

8.3 Priority areas for WDM policies and strategies

The country studies show that WDM is needed throughout southern Africa, but the form and priorities are likely to differ from area to area. WDM efforts should concentrate on areas where the largest comparative environmental, social and economic benefits can be achieved. Increasing water efficiency in the agricultural sector should be a priority of most Southern African countries. Agricultural policies need to be revised taking into account the need for improving allocative efficiency. In principle, WDM should be implemented where the net marginal social benefits are higher than those of other interventions.

8.3.1 Tariff policies

According to the WDM reports, water tariffs are low in most of southern Africa, and the pricing principles are not consistent across sectors. The largest water user (agriculture tends to pay the lowest prices. Low water prices may lead to water wastage, and offer little incentive to invest in WDM. Water subsidies need to be reviewed, and similar pricing principles should be applied across sectors and end-users. Standard environmental policy principles, particularly the user-pays-principle and the polluter-pays-principle should be used in the review of tariff reviews.

In view of the rapidly rising costs, water pricing should be based on the marginal opportunity costs (MOC), offering a stronger WDM incentive. Cross-subsidisation through block tariffs can ensure that low-income groups retain access to water for their basic needs. Water prices in irrigation are often linked to the amount of land under

[7] It would be interesting to compare the predicted water supply from well fields and dams with the actual supplies. I suspect that there may be a significant discrepancy between both, leading to higher supply costs and necessitating additional intervention measures earlier than planned.

cultivation, and not the amount of water used, offering little incentive to increase water efficiency.

8.3.2 Reducing leakages and unaccounted water losses

The loss rates vary greatly, but they are generally high and offer opportunities to save water. Figures for unaccounted water from southern Africa and elsewhere are summarised in Table 6. Taking a moderate norm of 15% loss as acceptable[8] (Louw and Kassier, 2002), many cities and countries (not just in southern Africa or developing countries!) have a high potential to save water. The wide range of losses also supports this assertion. WDM-opportunities arise with rehabilitation and expansion of water infrastructure and with changing cultural attitudes towards water wastage and re-use of treated effluent.

Table 6: The extent of unaccounted water losses

Country	Country average	Urban areas	Rural areas
Zambia		Lusaka: 50% at costs of US 41000/day	
South Africa		1984: Pretoria 21.8% Johannesburg: 12.8% Cape Town: 8.3%	
Zimbabwe		2000:Bulawayo:20% Mutare: 52%	
Mauritius	Around 50%		
Namibia		Windhoek; 18%	
Botswana	Estimated at around 15.7%	Urban areas: 9%	Large villages: 9 –54% Other villages: 24% with range of 12-35%
Swaziland		Around 40%	
Mozambique		Maputo; 65%	
Malawi		Lilongwe+ Blantyre: 15-30%;	regional water boards: over 50%
Other countries		Cities in developed countries: range from 2.3% (Amsterdam) to 23.7% (London) 1984 Montevideo: 32.2%; Paris 19.2% and Oslo 46.8%	

Sources: Lange et al., 1999; Macy, 1999; Gumba et al, 2002; Dalhuisen, 2002.

Losses are best documented for urban areas. It is unlikely that losses are lower in rural areas (cf. Botswana and Malawi).

8.3.3 Increasing the user efficiency

Water use efficiency needs to be urgently increased, particularly in key areas such as irrigation, luxury domestic use (water-wise gardening) and industrial use.

[8] Good : 10% or less; reasonable 11-15%; poor : over 15% losses.

Irrigation is of particular concerns because of its inefficient water use and its large share of water consumption. Box 3 summarises water-related aspects of irrigation in southern Africa, and clearly demonstrates the potential and need to use more water efficient technologies.

Box 3: WDM and irrigation in Southern Africa

Irrigation accounts for around 70% of the region's water consumption.

Efficiency rates of different systems vary widely: surface systems 45-55%; sprinkler 75%; centre pivot mechanical 80%; micro irrigation 85-90%. (Macy, 1999 and Louw and Kassier, 2002).

A switch from surface to drip irrigation could save up to 45% of water. Surface irrigation is still common (38% in South Africa and 25% in Zimbabwe).

In Swaziland a switch from dragline sprinkling to drip irrigation saved 1.5 mega litre/ha, led to increased production (volume and value) and led to cost savings of $192/ha (lower operation and maintenance costs).

Goldblatt et al. (1999) estimate that 10 to 20% of irrigation water can be saved. A 20% water savings in the agricultural water consumption of South Africa amounts to more than the aggregate water consumption of Botswana, Lesotho, Namibia, Swaziland and South Africa together. The savings would be 10 times the expected yields of the Katse and Mahole dam of the Lesotho Highland water Scheme (Louw and Kassier, 2002).

Constraints for WDM in irrigation: no meters, low water prices reducing the benefits of water savings, high costs of new technologies, water payments per hectare and not per m^3 and finally strong agricultural lobby groups.

The sector's value added per m^3 is much lower than that of other sectors. This warrants a review of water allocations to irrigation, and possible relocation of irrigation to the northern parts of Southern Africa with less water scarcity.

Sources: Goldblatt et al, 1999; Lange et al, 1999; Macy, 1999; Louw and Kassier, 2002; Mmwendera, 2002; UN-Habitat, not dated.

8.3.4 Re-using and re-cycling of waste water and water from hydro-electric power stations

The country studies demonstrate that re-use and recycling of waste and hydroelectric power water can make a significant contribution to WDM and IWRM. Re-use and recycling has assisted Windhoek to meet its demand (Box 5). In Mauritius, two-thirds of water used for hydroelectric power generation is dumped in the ocean without re-use. In Botswana, treated wastewater could relieve the pressure on the fresh water system of its capital Gaborone considerably. However, the economic and socio-cultural aspects of re-use and recycling need to be carefully considered to determine the best use of this water (e.g. separate water supply systems, re-entry in potable water system and limited use such as irrigation and gardening).

8.3.5 Addressing allocative efficiency

No country has adequately dealt with water allocations to sectors despite the fact that for countries with water scarcity, allocative efficiency is critical. The agricultural sector is the clearest anomaly in water allocation. It generates limited economic value, and consumes over half the region's water resources. Catchment area approaches, water pricing based on opportunity costing and water markets offer opportunities to promote allocative efficiency. Natural resource accounting is a useful instrument to identify allocative inefficiencies. Transparent criteria and mechanisms for water allocations are urgently needed.

8.4 Learning from existing WDM cases

Despite the absence of countrywide WDM-policies and strategies, most countries have examples of successful WDM cases. This demonstrates that WDM can be implemented without an enabling environment when the local need is sufficiently strong and that WDM is location specific. For example, water resources are inadequate to support a growing business (e.g. tourism and mines) or to provide secure, efficient and sustainable water supply systems (e.g. Windhoek and Hermanus see Box 4 and 5).

The lessons from these ad-hoc' WDM- cases should be used in WDM mainstreaming and affirmative WDM-action agenda (Box 6).

Box 4: Water conservation in Hermanus, South Africa

- Hermanus is a small coastal town located 120 km. east of Cape Town. A dam supplied water, but demand rose beyond the water allocation from the dam, particularly during the peak tourism season, when the population triples.
- In response, the local authorities designed and implemented a water conservation programme in 1996. The programme included the following measures: water loss management, clearing of alien vegetation and water-wise gardening, communication campaigns, education and school water audits, retrofitting and escalating block tariffs and informative billing.
- The results: a drop in water consumption of 16.5% one year after the project implementation. A drop of 25.5% during the peak seasons (November-February). The results exceeded expectations. Water audits and water loss management proved very effective. The audits led to a 50% decrease of school water consumption. Water losses decreased from 18 to 11%. Informative billing was appreciated by end-users; retrofitting proved expensive and unpopular.

Source: Goldblatt et al, 2000.

Box 5: Water conservation in Windhoek, Namibia

- Windhoek has low rainfall (360 mm p.a.) and high evaporation (3 400 mm p.a.). Urbanisation, the hidden water demand of low-income groups and economic growth are expected to put significant pressure on water resources.
- The city currently relies on surface water (17 M m^3), re-use of water (2.9 M m^3) and groundwater (2.3 M m^3). Plans exist to expand re-use of wastewater and the feasibility of artificial recharge is being studied.
- The city adopted a wide-ranging Water Demand Management Programme with the following components. Policy measures: block tariffs, abolishment of water subsidies, water re-use, smaller plot size, commitment to reduce water consumption by 50%, guidelines for wet industries, new wet industries are required to re-use water. WDM campaigns with information dissemination and WDM-advice. Legislative measures: water control officers, product standards, poll covers, and control of groundwater abstractions inside Windhoek. Technical measures: leak detection programme and artificial recharge
- Expected savings of N$ 6.8 million per annum (excl. benefits from delayed infrastructural investments.

Source: Goldblatt et al, 2000.

Box 6: Some lessons from WDM cases

- WDM interventions are feasible, and usually save money;
- Commonly used WDM measures: leak detection/ reduction, water pricing, awareness raising campaign;
- Most WDM measures concentrate on increasing water use efficiency. Priority areas for WDM include; reduction of water losses, irrigation and luxury domestic use (gardening and pools). Macy (1999) recommends that the limited WDM capacity is directed to areas where the greatest environmental and economic results can be achieved;
- WDM is most attractive when decisions about new infrastructure or rehabilitation of existing infrastructure have to be made;
- WDM requires collaboration between water planners, water service providers and end-users;
- WDM cases have to be based on local needs and conditions. Therefore, it is important that WDM is implemented at the local level (e.g. catchment area, river basin, settlements).
- WDM efforts and results have to be weighed. For example, water service providers could aim at reducing water losses to 10%. Further loss reduction would be too expensive;
- Droughts may accelerate WDM implementation. It is important that the 'drought momentum' is converted into long-term WDM interventions.

Two areas are rarely addressed, and therefore need government action:

- For irrigation, little WDM measures are implemented spontaneously; and
- Allocative efficiency is not common.

Sources: based on WDM country reports

8.5 Review of WDM and privatisation

The advantages and disadvantages of privatisation for WDM are not clear. The private sector will implement WDM if it increases its profits or it is needed to safeguard the long-term operations (e.g. mines in Botswana). The impacts of privatisation of water providers are not clear, and depend on the competitiveness of the market and the market conditions set by government. For example, cutting of UAL may be done if it increases profits, but may not happen if the service provider is able to pass on the costs of the losses to end-users. In that event, separate measures are needed to encourage loss reductions, for example through UAL loss norms or covenants.

There is need for a regional review of experiences with water privatisation and the potential of public-private sector partnerships from a WDM perspective. The latter offers opportunities to pool scarce human and financial resources.

8.6 Review of comparative water advantages and regional economic integration

The view that water is an economic good implies that the comparative advantages and disadvantages of countries, and the implications for regional trade and integration should be analysed. Efforts have intensified to bring water to people and productive activities, but the question should be asked whether it might be better to move water-intensive activities such as irrigation to areas with comparative water advantages. In theory, this would lower production costs and stimulate regional growth. Research is needed into this currently neglected issue, and the issue needs to be incorporated in regional and national strategies and policies.

9 WDM policies in southern Africa

9.1 The current situation

Southern African countries are in different WDM implementation stages. Namibia and South Africa are most advanced with clearly formulated policies and strategies that await approval. Large-scale WDM implementation has, however, not yet started. Botswana is in the process of formulating policies and strategies. Zimbabwe has approved a new Water Act (1998) and a new Integrated Water Management Strategy, which creates a good platform for WDM implementation. Most other countries have not yet formulated specific WDM policies and strategies, but are exploring opportunities to do so.

Namibia has recently prepared a new Water Management Strategy and new Water Act as part of the water policy and strategy review process. WDM is fully integrated into all aspects of water management and planning (Box 7). It is not known whether the documents have been formally approved.

In South Africa, the Department of Water Affairs and Forestry is responsible for WDM. South Africa approved a new 1998 Water Act and a Water Services Act. Subsequently, a draft Water Conservation (WC) and Demand Management National Strategy Framework (WC/WDM) was produced for extensive consultations. In addition, sectoral guidelines were drafted for agriculture, industry and water service providers, and subjected to extensive consultation. A final draft of the WC/WDM strategy has been incorporated in the draft National Water Resource Strategy (DWAF, 2002), and

WC/WDM strategies are being prepared for water services sector, agriculture, industry and mining/ power generation. The final draft for the water services sector awaits approval (DWAF, 2003).

Box 7: Water demand management in Namibia.

Namibia conducted a *Water Resources Management Strategy*, in which seven key themes were identified: strategic water resource assessment, shared water sources, water use and conservation, economics and financing, regulations, institutions and participation.

The final draft *Namibia's 2002 Water Policy* developed objectives and actions for each theme. The key themes for WDM are: water use and conservation, economics and financing, shared water sources and institutions and participation.

The following WDM related actions are listed:

- Preparation of a National Water Master Plan
- Development of a WDM strategy, including sectoral WDM guidelines with best practices;
- Economic incentives for water conservation: block tariffs, abstraction fee, water conservation tariffs, financial support for retrofitting and re-use and recycling;
- Regulations for metering and reporting of large water abstractions, water abstraction licenses, stricter enforcement;
- Regulatory and economic instruments to promote allocative efficiency;
- Removal of water wasting subsidies
- Full cost pricing for industry and agriculture (incl. Environmental costs and opportunity costs;
- Technical measures: reduction of losses; new water saving technologies.
- awareness raising:

The draft Strategy envisages major institutional reforms in which responsibilities will be separated:

- water management institutions (Water advisory council, water resource management agency, basin management committees and water cabinet committee (management, protection and conservation)
- regulatory institutions to deal with monopolies of service providers and water pricing: independent regulator, water pricing committee that reports to Cabinet;
- Service institutions (NAMWAR, Rural supplies etc.)
- Policy and Strategy institutions/ unit that deals with policy development and review and shared water.

IWRM and WDM are entrenched in the 2002 final draft *Water Resources Management Bill,* which deals with areas such as:

- Decentralised water management (region and basins)
- Water protection and pollution;
- Regional guidelines for efficient water management practices, and guidelines for efficient irrigation. The guidelines will refer to measures such as economic instruments, standards and water-saving technical measures

Sources: Ministry of Agriculture, Water and Rural Development, 2002 a and b

Box 8: Water demand management in South Africa

- Water management is based on the 1997 Water Services Act and the 1998 Water Act.
- The Water Act provides for a national water resources strategy (NWRS), which has to set out principles of water conservation and demand management. The Act also provides for water management areas (WMA) based on catchment areas and each with a management institution. Management plans have to be prepared for each WMA. Water resources have to be classified and an ecological reserve is to be identified that cannot be allocated. The Act refers to legislative and economic instruments, including the possibility to have a charge for water management and conservation. The Act requires service providers to promote WDM (and the Minister can make prescriptions), and permits prosecution of wasteful water users (after warnings have been issued but ignored).
- The Water Services Act includes the following relevant WDM components: requirement to review efficiency of water supply, including alternatives for current water supply, establishment of national standards for efficient and sustainable water use by service providers, water conservation measures among service providers, Water Board policies, including a WDM strategy for service providers and water use efficiency conditions for service providers and assigning DWAF the responsibility of assisting and monitoring water services development plans for water conservation.
- The Water Conservation and Demand Management Framework sets the scene for the development of a WDM strategy as part of the broader IWRM policy. WDM aids water security, offers cheaper alternatives than traditional supply expansion, leaves water to cover unmet basic needs and productive opportunities, and delays capital investments. The high water losses and water-use inefficiencies offer good opportunities for WDM.
- The National Water Resource Strategy (in preparation) has a separate chapter for water conservation and WDM with three fundamental principles: 1. water institutions need to supply water efficiently and effectively, minimise losses and promote WC and WDM among their consumers; 2. water users should use water efficiently and not waste; 3. WC/WDM is an integral part of IWRM and water service planning. The final draft WC/WDM Strategy for the water services sector awaits final approval. This strategy describes principles, concepts and the need for WC and WDM, and an action framework.

Sources: Goldblatt et al, 2000; DWAF, 1999; DWAF, 2002 and 2003.

In Zimbabwe, water demand management is an explicit component of the IWRM strategy (Government of Zimbabwe, not dated). Proposed interventions include market-based interventions (water pricing and effluent charges), technological interventions (loss reduction and recycling), special measures for irrigation, mandatory measures and public awareness raising. The Zimbabwe National Water Authority, and Catchment Area Councils will drive WDM implementation.

In Botswana, a National Water Conservation Policy and Strategy Framework document was prepared in 1999 (DWA, 1999), and subsequently a water conservation unit was established within the Department of Water Affairs. Reducing the pressure on existing conventional water supplies is the overall goal of the WDM strategy, which is to be realised by curbing consumption and by the development of alternative water sources. A 25 to 35% reduction of water demand on traditional sources is the target, half of which is to be realised by non-traditional water sources and half by demand reductions. The Strategy will rely on three main interventions: pricing, and other economic instruments,

technical measures and public education/ awareness raising. The water conservation unit is currently implementing a water conservation programme that includes awareness raising campaigns, technical interventions and consideration of water pricing. The forthcoming review of the country's first National Water Master Plan will pay explicit attention to WDM. Expected outputs of the review include a new Water Act and a comprehensive Water Policy (due in 2004).

Both Namibia and South Africa have decentralised water management to water basins and/or communities. Decentralisation of water management in Botswana has been limited to operation and maintenance of village water supplies to District Councils. There is no community involvement, and there are no catchment area institutions as yet.

Most countries covered by the second phase of the IUCN-WDM do not have explicit WDM policy components, although ad hoc WDM cases are found throughout southern Africa. Their challenge is really to build on the in-country WDM cases, their IWRM water policy framework and experiences from other SADC countries with more advanced WDM policy formulation, and to establish their own WDM policy and strategy as recommended in most country studies.

While recognising the specific needs of individual countries, several common components can be identified that could assist WDM development. Firstly, WDM should be given its rightful position with IWRM policies and strategies alongside development of traditional water supplies. Secondly, IWRM and WDM need to be integrated in procedures for environmental impact and strategic environmental assessments. WDM should be made a mandatory alternative to be considered as part of project appraisals, general development plans and sectoral development policies. Thirdly, social and economic cost-benefit analyses of alternative water projects, programmes and policies should be carried out to identify the most suitable interventions. Fourthly, WDM priorities should be determined by local needs and capabilities, and therefore WDM programmes are likely to differ from area to area. This can be facilitated by decentralisation of water planning and management.

9.2 National WDM policy reforms

Both external and local factors push and accelerate WDM at the national level. At the international and regional level, the SADC Protocol and donors encourage IWRM and WDM. As most countries depend on shared water, WDM should be a priority, as this could determine future access to shared water. Local WDM-initiatives in the public and private sector demonstrate the contribution that WDM can make to water management and planning.

Most countries adopt an evolutionary approach towards WDM focused on priority areas and taking into account capacity limitations. A gradual approach should, however, not become an excuse for no or slow action. WDM policy and strategy development are most urgent in water scarce countries, and in countries with difficult economic conditions.

WDM is currently more advanced in more developed and politically stable countries of Southern Africa, where water scarcity is a major problem. WDM may (wrongly) receive less priority in countries with lower per capita incomes and acute development problems. It is likely that political stability and good governance are pre-requisites for the

development and implementation of effective policies and strategies and for end-users to invest in WDM technologies.

In many countries, WDM is rooted in, and sometimes confined to drought measures. This is a mixed blessing. While drought periods have shown the potential of WDM measures, it has given WDM a negative connotation that hampers its implementation in non-drought periods. It is therefore an imperative of drought recovery strategies to mobilise sufficient support for continuous WDM, perhaps linked to traditional WDM measures and knowledge.

9.2.1 Development of WDM policies and strategies

The WDM-policy should have clear objectives and targets, guidelines for implementation in the country's main sectors, requirements for WDM plans for catchment areas and large urban areas, mechanisms to deal with user and allocative efficiency (e.g. through water markets, decentralised management and natural resource accounting). The WDM policy should have clear links with sanitation and energy sectors to ensure that re-use and recycling is considered. Finally, the policy should have a comprehensive set of instruments (see section 9.2.4 below).

WDM plans ensure that countries meet their WSSD undertaking to prepare water-efficiency plans.

Recommendation:

- All countries develop and implement a WDM policy and strategy, closely linked to IWRM strategy.

9.2.2 Establishment of an institution for water resources planning, management and monitoring

Few countries have an institution responsible for water resource planning, monitoring and management. For those who have, it is often part of the department of Water Affairs that is also responsible for water supplies. As a result, water planning and WDM often do not get the priority they deserve.

Recommendations:

- Establish institutions that are exclusively responsible for water resource planning and monitoring (e.g. water regulator or authority). This institution should have units dealing with water planning, WDM and shared water sources;
- Water monitoring, data collection and analysis/ research need to be expanded to improve the knowledge about the state of the water resources; and
- The optimal spatial level of water resource planning may differ from country to country. Water resource planning at the water basin level facilitates the incorporation of specific local conditions and factors. In small countries and countries with serious capacity constraints, centralised water planning may be more suitable. Water planning should be multi-sectoral, and hence address the issue of allocative efficiency.

9.2.3 WDM and water legislation

Water legislation needs to be based on the principles of IWRM, and make provisions for participatory and decentralised water management, linkages with wastewater, implementation of the UPP and PPP, and provide a basis for strong and effective instruments and institutional structures. WDM components need to be integrated into EIA procedures, project/policy appraisal methods, and in key sectoral legislation (e.g. irrigation).

Recommendations:

- WDM principles and components need to be explicitly mentioned in the overall water act and in EIA procedures; and
- The requirements of the SADC Protocol on Shared Watercourses should also be incorporated.

9.2.4 WDM instruments

Most countries heavily rely for WDM on water pricing, regulations, mostly for drought management and on awareness raising campaigns. These instruments are usually inadequate, for example because of the limited price responsiveness of end-users[9].

Recommendation:

There is need for a systematic review of existing and new WDM instruments with a view of broadening the types of instruments used and targeting the instruments towards specific stakeholders (water service providers, water planners and end-users). It is important that instruments are not merely seen as punitive measures (the 'stick') and contain positive incentives (the 'carrots'). Economic instruments should be based on the UPP and PPP. It is likely that the selected instruments will differ from country to country. Suggested areas for review include:

- Economic instruments: removal of overall water subsidies; cross-subsidisation for equity reasons; differential VAT rates for water-inefficient and efficient goods; tax advantages for the implementation of WDM technologies with net social but privately negative net benefits; new fees for groundwater use, product standards related to water efficiency; water pricing based on the marginal supply costs; economic effluent and electricity charges that deter water wastage
- Legislative instruments: ban of products that are unnecessarily wasteful in areas with and periods of extreme water shortages; audits, EIA/SEA.
- Consultative instruments: educational campaigns, audits, negotiated agreements between governments and key water users and providers (e.g. irrigation, ministries and water service providers) regarding water efficiency targets and WDM measures;

9.2.5 Decentralisation of water management

Mozambique, Namibia, South Africa and Zimbabwe have adopted decentralised catchment area management. Mozambique has adopted the basic management unit for

[9] The price responsiveness of end-users varies significantly. For example, an increase in water tariffs has very little impact on water consumption of the public sector and large parts of the private sector (Arntzen et al, 1999).

each river basin. Namibia and Zambia have made communities responsible for the management of rural village water supplies. Botswana has made (administrative) district councils responsible for the water supply of rural villages, but has otherwise retained a centralised water supply system.

Recommendations:

- Countries need to review their water management systems, and identify the most suitable local management levels, taking into account their physical conditions, capacities and socio-economic needs. It is important that civil society takes part in this review in order to determine the roles of the private sector, the general public and civil society; and
- Support and monitor the experiences with community-based water resource management (CBWRM).

9.2.6 WDM funding

WDM measures are integral part of IWRM, and therefore should be routinely funded from 'regular' water revenues. This is not yet the case. On the short term, specific sources of WDM funding could be established for a limited period. This has been in done in Windhoek (Namibia) by a small WDM surcharge on the water bill. Funding could also be sourced from the re-distribution of existing water budgets, a fixed percentage for WDM activities as part of the water budget and/ or WDM funding from increased revenues due to higher prices and reduced losses. Each country should determine which source of funding is most appropriate for its conditions. It is important to note that funding does not need to pose great problems.

Countries with budget constraints could start with revenue-raising WDM measures and measures that do not require government funds. In this way, private sector funding could be tapped for WDM. In addition, the potential of private-public sector partnerships needs to be investigated.

Recommendations:

- Create immediate WDM-funding opportunities through the use of the extra revenues generated by WDM measures or by a small surcharge for end-users;
- Review the budget allocations for water management and provision in order to secure WDM implementation on the longer term.

9.2.7 WDM and land use/ settlement planning

Settlement planning and architecture/building has large implications for water consumption. It is therefore recommended that IWRM and WDM concerns need to be fully integrated in land use and settlement planning. It is further recommended that WDM-standards and guidelines be developed for architecture and buildings.

9.2.8 WDM and the socio-economic environment

IWRM and WDM implementation appear to benefit from political and macro-economic stability and from good governance. Therefore, policy reforms are needed to promote

and maintain stability and good governance. Such reforms exceed the mandate of water institutions, but are nonetheless of critical importance for the water sector.

Water management has links with many other sectoral policies and programmes. It is essential that water concerns are integrated in such policies, and where conflicts arise to negotiate resolutions.

9.2.9 Harmonisation of standards and guidelines

National laws and strategies need to be harmonised with the SADC Protocol for Shared Water. This can be done by adoption of a range of standards (MIN-MAX). The WDM country studies clearly demonstrated that shared water is the rule rather than the exception, but that national policies and laws pay little attention to shared water.

Recommended areas for harmonisation include: water quality standards, effluent standards, IWRM principles, WDM incorporation into EIA guidelines, water efficiency norms and sectoral guidelines.

9.3 Regional policy reform

Many of the policy reforms recommended above also apply to the regional level. However, some reforms that specifically apply to the regional level should be considered. Firstly, a formal interpretation of the role of WDM in the Protocol on Shared Watercourses is needed. In our view the Protocol contains sufficient references to WDM components that can be exploited. Specific recommendations for this have been given in section 5.3. WDM needs to be integral part of the bi- and multilateral agreements that cover the entire water basins, and therefore deal with the cumulative impacts of national programmes and projects. From a regional perspective, WDM is most important in the water scarce water basin in the southern parts of southern Africa. Secondly, it is recommended that WDM norms be developed for key areas of water efficiency, such as acceptable UAL and irrigation losses. To accommodate different capabilities and development levels of countries, initially a range of norms could be used with a minimum and maximum. The range could be gradually reduced. Non-adherence to these norms could disqualify a country from access to shared water. Thirdly, the implementation of the Protocol needs to be expanded to major shared aquifers. Fourthly, the implications of comparative water advantages and disadvantages of countries for regional trade and integration need to be assessed. From a water resource perspective, water-intensive sectors such as irrigation are best located in countries with adequate water resources. Semi-arid and arid countries would then specialise in activities that require little water. There is need to study the benefits of regional specialisation based on water, taking into account other production factors and policy goals such as food security, employment and income generation.

10 Institutional issues and reforms

10.1 Current situation

In most countries, the state owns the water resources, and delegates (some of) the development and user rights to individuals, public and private institutions. Countries with recent water reforms have introduced catchment area management. Many governments have not yet separated their roles of owner, allocator of water rights, water provider and

manager. Few countries possess an institution responsible for overall water planning and management (i.e. IWRM), and few countries (Botswana, Namibia and South Africa) have institutions specifically responsible for WDM or WC. The complexity of institutional arrangements differs greatly among countries. This reflects the detail of water policies and strategies as well as the size and economic structure of countries. Small countries like Botswana and Namibia have a simple institutional structure, which is expanding to meet the needs of IWRM and WDMM. In contrast, South Africa has a more complex multi-tier system due to the magnitude of the economy and the growing water management tasks. Participation of the private sector appears as yet minimal, except in the self-providers sector. Public-private sector partnerships are also rare.

At the regional level, the SADC-WSCU plays a coordinating role in regional water management to stimulate sustainable development in Southern Africa. It does not have any water allocation and provision responsibilities and is therefore able to focus on IWRM, WDM and the implementation of regional programmes and projects.

10.2National institutional reforms

At the national level, the establishment of an institution that is primarily responsible for IWRM, water planning and management should be a top priority. This institution should not have water provision duties to prevent a supply bias, and be independent from sectoral interests. This institution should be responsible for the development and implementation of the National Water Policy, Strategy and Master Plan, and should carefully weigh the net benefits of traditional supply expansion, development of non-traditional supplies and demand control. Monitoring of water resources and water management, including IWRM and WDM, should be part of its responsibilities. The WDM institution could resort this institution.

Water allocation could best be done at a decentralised level of water basins to ensure that the entire water resources and sectoral demands are evaluated holistically, an water allocations reflect scarcity, economic and social considerations. Water basin authorities could also be responsible for water planning and management, and be supported and monitored by the central planning authority.

It is important that countries possess units that exclusively deal with shared water and multilateral agreements as Botswana and Namibia have. Most countries do not have sufficient capacity to adequately negotiate and implement such agreements. Capacities also differ within Southern Africa. Countries have different capacities to negotiate river basin agreements, and can make varying contribution to regional approaches. It is necessary that all countries participate in regional agreements, and see the benefits. The RSAP and the SADC WSCU could assist countries with capacity constraints to increase countries' capabilities and to reduce their disadvantages in negotiating and implementation capacities and skills.

Water service providers are established by law, and should not be involved in other water management activities. Water service providers work under the policy context determined by the water regulator, and obtain their WDM targets and incentives from there (e.g. through covenants).

Water self-providers have to apply for water rights, but their operations are otherwise largely unchecked. There is need to monitor their water consumption and efficiency and

stimulate WDM. Independent audits need to verify the water consumption and management. Self-providers located in catchment areas would become part of the catchment area management system.

It is necessary to establish adequate WDM capacity at central and local levels. Water basin authorities and communities are the 'natural' WDM institutions at the local level. It is important that skills and financial means are created to implement these tasks properly.

Institutions need to broaden their disciplinary expertise to be able to implement IWRM and WDM properly. There is need for expertise such as policy analysis, economic analysis (CBA), socio-cultural analysis, and gender analysis. WDM and IWRM training should be offered at formal educational institutions (polytechnics and universities) as well as short courses. WDM skills and capacity needs to be improved by training workshops and recruitment of a wider range of disciplines into water planning institutions to redress the technical, supply bias.

Improving understanding of WDM through awareness raising campaigns among politicians, water planners and service providers as well as end-users. Such campaigns should highlight the WDM-benefits and give WDM a positive 'flavour';

10.3 Regional institutional reforms

The key roles of regional institutions is to demonstrate the need for and value added of a regional approach in managing shared water resources as compared to the combined results of national efforts only and to support countries with implementation of their commitments. While WDM and WC are part of the RWSA, there is no WDM capacity at the level of SADC-WSCU or the river basin organisation. It is recommended that such capacity be established, mostly at the level of river basin organisations.

The expansion of the implementation of the SADC Protocol to major aquifers would require additional water basin organisation in future.

The country studies indicated that regional action is required to pool scarce IWRM and WDM resources through networking, web sites, training courses, and the establishment of a network of pilot project covering each country. Regional action is also required to strengthen the capacity of individual countries to properly negotiate and implement regional agreements as currently national capacities differ widely. Finally, regional action is needed to mobilise political commitment for WDM and IWRM. This is expected to have positive spin-off for national efforts.

11 Synthesis and conclusions

This section is a synthesis of the main findings, and does not pretend to be comprehensive. The recommendations made in the previous chapters are not repeated here.

The historical bias towards traditional supply solutions calls for affirmative action of WDM. This means getting WDM fully integrated into IWRM policies and programmes, and the development and implementation of WDM policies and programmes. Such

action would help southern African countries to meet their WSSD commitments to prepare IWRM and water efficiency plans by the year 2005. WDM saves water, and postpones some of the negative environmental impacts associated with dams and transfer schemes. It also saves money as WDM leads to lower unit water costs than investments in new dams and transfer schemes. The saved water can be used to increase production. Finally, it serves social purposes as the water savings can be used to supply more people with fresh water.

There is no blueprint for WDM policies and the necessary institutional framework for it, as WDM is driven to a large extent by local factors that show great variations within the region and within countries. Therefore, WDM policies and institutions need to be sufficiently flexible to encourage the right WDM applications for a given area. WDM is about using water resources more efficiently to serve more people or to benefit productive activities. WDM is not different from any good resource policy that promotes efficient, equitable and sustainable resource use. It is simply common sense that has been neglected for too long in the water sector. While there is no blueprint, countries may share components of WDM policies and institutions based on this realisation of common sense. These include the following:

- WDM is integral part of IWRM;
- Each country needs to identify and address the main WDM constraints, particularly the common supply bias, inadequate political commitment, inadequate WDM understanding and lack of appropriate incentives, including low water prices;
- Identification of WDM-priority areas such as tariff policies, unaccounted water losses, user and allocative efficiency, reuse and recycling, and learning from existing WDM cases;
- Need for separate policy institutions dealing with planning and monitoring, WDM and shared water;
- WDM legislation and a broader and stronger set of WDM instruments.

At the regional level, there is need to consider the implications of comparative water advantages for regional integration and trade.

As part of IWRM, WDM is a tool that aims to reduce water consumption and/ or to expand non-traditional supplies (desalination, water harvesting and re-use/ recycling). Key themes for WDM are: water use efficiency, allocative efficiency, demand prioritisation, rainwater harvesting, desalination, re-use and recycling. WDM can be pursued through physical measures and planning, legislative measures, economic instruments and consultative instruments, including awareness raising. At present, WDM primarily relies on awareness raising, water pricing and legislative measures during droughts. The base of the instruments is too narrow, and there is need for a stronger economic approach and a more binding consultative approach. Reviewing water-pricing mechanisms can do the former, and make pricing more consistent and transparent based on sound policy principles. The latter can be done by the use of covenants, i.e. negotiated agreements between government and water stakeholder groups (e.g. water service providers, irrigation sector and public sector institutions). The instruments need to be better targeted towards groups of stakeholders: a uniform approach for all stakeholders is not effective. Concrete policy issues include reducing unaccounted water losses, tariff policies, increasing users efficiency, increased re-use and recycling, addressing allocative efficiency and promoting regional integration through virtual water trade.

It is necessary to identify in which cases WDM yields higher economic, social and environmental returns than additional dams and well fields. Pressure to implement WDM comes from the bottom (forced by local resource scarcity) and from the top (regional Protocol). There is significant evidence that WDM is much cheaper than the construction of more dams and well fields. WDM makes therefore environmental and economic sense. It is therefore difficult to comprehend why WDM is making slow process. Priority areas for WDM among end-users are irrigation, water-wise gardening/ prevention of alien species and the public sector. Reduced leakages and re-use/ recycling are priorities for water service providers. Water planners need to prioritise better allocative efficiency and a better incentive package for WDM incentives. There is considerable scope to learn from existing WDM case studies that are found even in countries without and enabling environment.

Countries need to develop WDM policies, a WDM enabling water legislation and funding strategies for WDM. In addition, they need to identify the appropriate levels of decentralised water resource management based on local physical conditions, socio-economic needs and capacity constraints.

At the regional level, WDM capacity needs to be established at river basin level as well as in SADC-WSCU. The WDM opportunities arising from the Protocol need to be exploited, in particular through a river basin wide alien prevention programme, recognition of WDM as an alternative for use of shared water, and harmonisation of national guidelines, norms, and standards. It is important to implement the Protocol for major shared aquifers too. Other regional WDM issues include: regional review of water privatisation and WDM, comparative water advantages and regional economic integration and capacity building to ensure that the capacities of southern African countries become more comparable.

Annex A:

Table A.1: Constraints identified in the IUCN-WDM study.

Stakeholders	Constraints	Solutions
Water managers/ planners	Inadequate public funds for water provision due to macro-economic problems No private sector investment Lack of WDM- understanding Misconceptions Water abundance (Zambia) Aged and incomplete infrastructure (Zambia) Political interference Lack of effluent standards Available data are not analysed, particularly in cost terms	Design and implement WDM/IWRM policies and strategies, including guidelines Earmark extra revenues for WDM; Mobilise private sector investments; Redirect existing funds to most efficient solutions; Adequate water budgeting Education Awareness raising; Multidisciplinary, IWRM expertise Research and data analysis Develop standards for water quality, effluent, products Increase research capability and skills
Water Service Providers	Lack of financial resources Lack of human resources, particularly at district level Bias towards supply augmentation due to vested interests of consultants and decision-makers More difficult to implement Lack of WDM- understanding/ misconceptions Lack of metering of end-users Poor revenue collection (Zambia) Improperly designed instruments (e.g. flat rates and irrigation rates related to are and not water units).	Earmark extra revenues for WDM; WD surcharge; Mobilise private sector funding, e.g. through public-private sector partnerships WDM training and applications Broadening of disciplinary skills Compulsory comparative analysis of S and D measures Improved, computerised, billing systems Attitudinal change; Technical measures (loss reduction, metering, pre-paid systems)
Domestic end-users	Lack of WDM understanding Misconceptions Low water bills and part of production costs Water bills subsidised by employers No WDM incentives Complaints about poor services	Awareness campaigns Covenants Halting of employer subsidies Design of incentives and covenants Better service delivery
Productive end-users	Low water share in production costs No WDM incentives Political instability (Zimbabwe)	Covenants Tax relief Good governance
Self providers (producers and consumers)	No enabling environment Political instability (Zimbabwe) No effective water planning and control (Botswana and Zambia)	Expand government control-monitoring Establish instruments such as water prices and covenants

Source: Hazelton et al, 2002; IUCN-WDM Country studies reports.

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Annex 2: Glossary of important water resource terms

Allocative efficiency is achieved when a sectoral water re-distribution does not lead to increased production or well-being. The allocative efficiency improves if by relocating water uses, the total output for a given amount of water increases.

Aquifer is a formation that may either be a consolidated rock or unconsolidated pile of sediments, that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs (Botswana National Atlas, page 52.)

Best possible use of water (BPUW): deliberate allocation and use of water based on efficiency, equity and sustainability (based on Lundqvist, 1997)

Economically optimal water use: allocation and use of water in such a way that the net marginal benefits are equal among sectors and users. (based on Tietenberg, 1996).

Good water governance occurs where government bodies responsible for water establish an effective policy and legal framework to allocate water and manage water in ways responsive to national social and economic needs, and to the long term sustainability of the resources base. (GWP web-site)

IWRM is an approach that seeks to balance human, industrial, agricultural and environmental water needs. The overall goal is to ensure an efficient (low-cost), equitable (meeting essential needs and provision of affordable water) and environmentally sustainable (no water mining unless substitutes can be found in time; sufficient water to meet ecosystem requirements) water provision on the short and long term. IWRM is a 'process which promotes the co-ordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'. (Global Water Partnership Technical Advisory Committee, 2000)

*Shared watercourse:*a watercourse passing through or forming a border between two or more watercourse states (Revised SADC Shared watercourse Protocol).

Sustainable water use is water use that supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it (Gleich, 1996 quoted in Lundqvist and Gleich, 1997). Or: use of water up to the level of resource regeneration through recharge of groundwater and run-off/ storage of surface water.

User efficiency: refers to the amount of output produced with one unit of water (usually m^3).

Water basin refers to a river basin or area covering an aquifer.

Water demand management aims to increase water efficiency through both wise use and reduction in use to reduce or to postpone the need to build more dams and drill more boreholes (adapted from Macy, 1999, p.38). According to the RSAP, WDM 'seeks to maximize the usage of a given volume of water by curbing in-essential or low-use values through price or non-price measures' (SADC-WSCU, 1999, p.57).

Water conservation is the minimisation of loss or waste, care and protection of water resources and the efficient and effective use of water (DWAF, 2003, p. 15).

Watercourse: system of surface and groundwater consisting of by virtue of their unique physical relationship a unitary whole, normally flowing into a common terminus such as the sea, lake or aquifer.

Water stress exists when the water availaibility is less than 1700 m^3 per person per annum; *Absolute water scarcity*: water availability of less than 1000 m^3 per person per annum; *Acute water shortage*: water availability of less than 500 m^3 per person per annum. (Falkenmark 1994).

Water resource development: physical activities to improve the beneficial use of water for water supply, irrigation, flood alleviation, energy development etc. (Khupe, 1994)

Water resource management: the whole set of technical, institutional, managerial, legal and operational activities required to plan, develop, operate, and manage water resources (Khupe, 1994).