Botswana Integrated Water Resources Management & Water Efficiency Plan

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Foreword

Botswana is a semi-arid country that experiences low rainfalls resulting in scarce water resources. While the country continues to experience drought years (progressively intensified by climate change), it also faces increased pressure for fresh-water supply due to rapidly increasing urbanisation and climate change requiring a series of measures to remediate the situation. These measures include drilling of more boreholes, construction of the North-South Carrier Phase 1, development of dams to augment the water resources and desalination of saline underground water - especially in areas where water demand is high and fresh-water resources are scarce.

These challenges have motivated us to look beyond "business as usual" to more integrated solutions for water as a driver of human development. The Botswana Integrated Water Resources Management and Water Efficiency (IWRM-WE) Plan represents our "long-term solution". The goal of this plan is to *"Improve people's livelihoods and welfare and contribute to sustained economic growth, economic diversification, social justice and poverty eradication through efficient, equitable and sustainable water resources development and management."* The development of the plan came at a time when the Water Sector was undergoing a series of reforms, and the plan took cognizance of the changes that will result from these reforms and also the recommendations made in the National Water Master Plan Review of 2006. The IWRM and Water Efficiency plan has integrated all sectors and it is hoped that through appropriate and efficient water resources management, development and utilisation, Botswana will be able to elevate agricultural production and food security, expand the number of people accessing potable water and proper sanitation, increase and improve water delivery services, and as a result diversify the economy.

The development of the plan included comprehensive stakeholder consultations, which have resulted in several strategic areas for implementation. These strategic areas are as follows: efficiency of water allocation; water supply and demand management; IWRM mainstreaming in development and land use planning; establishment of an IWRM-WE enabling environment; development of catchment area management approach; management of shared water resources; institutional capacity building in IWRM; stakeholder participation in IWRM; maintaining water quality and pollution control; and last but not least, integration of ecological water requirements.

While the Government of Botswana is committed to the implementation of this noble plan through the creation of enabling environment (policy, legislative and institutional framework), I urge the private sector, civil society, local communities and other stakeholders to sustain their ownership of this plan and participate actively in its implementation.

The Ministry of Minerals Energy and Water Resources would like to thank all stakeholders that participated in developing the plan under the leadership of the Project Steering Committee (PSC) including the Global Water Partnership (Botswana Chapter) who were highly instrumental in developing the project proposal that lead to this plan. The Ministry also thanks the Kalahari Conservation Society for facilitating the development of the IWRM-WE Plan. The Ministry extends its highest gratitude to the Global Environment Facility (GEF) and United Nations Development Programme (UNDP) who provided

the financial support for a Plan so instrumental in aiding Botswana to meet the many Millennium Development Goals that water underpins.

Pula!!!

Mr. O. K. Mokaila

Hon. Minister of Minerals Energy and Water Resources

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List of Abbreviations and Acronyms

AFU ..... Automatic Flush Urinal
AMCOW ..... African Ministers' Council on Water
ANSI ..... Adjusted Net Savings Index
ART ..... Anti-retroviral Therapy
BALA ..... Botswana Association of Local Authorities
BCWI ..... Botswana Core Welfare Indicators
BHDR ..... Botswana Human Development Report
BIUST ..... Botswana International University of Science & Technology
BOBS ..... Botswana Bureau of Standards
BOCCIM ..... Botswana Confederation Commerce Industry Manpower
BOCONGO ..... Botswana Council of Non-Governmental Organisations
BOTEC ..... Botswana Technology Centre
BOWELS ..... Botswana Water Efficiency Label System
BTO ..... Botswana Tourism Organisation
CAR ..... Centre for Applied Research
CBNRM ..... Community Based Natural Resource Management
CBO ..... Community Based Organisation
CC ..... Climate Change
CCA ..... Climate Change Adaptation
DBES ..... Department of Building and Engineering Services
DEA ..... Department of Environmental Affairs
DL(W)UPU ..... District Land (& Water) Use Planning Unit
DWA ..... Department of Water Affairs
EFR ..... Environmental Flow Requirements
EHES ..... Environmental and Hydrological Engineering Services
EWR ..... Ecological water requirements
EIA ..... Environmental Impact Assessment
GEF ..... Global Environment Facility
GoB ..... Government of Botswana
GW ..... Ground Water
GWP ..... Global Water Partnership
GWP-SA ..... Global water Partnership (Southern Africa)
HATAB ..... Hospitality and Tourism Association of Botswana
HIES ..... Household Income and Expenditure Survey
IC ..... International Consultant
IWRM ..... Integrated Water Resource Management

IWSD ..... Institute of Water and Sanitation Development
IZS ..... Interim ZAMCOM Secretariat
KCS ..... Kalahari Conservation Society
LBPTC ..... Limpopo Basin Permanent Technical Committee
LEA ..... Local Enterprise Authority
LIMCOM ..... Limpopo Watercourse Commission
LIMID ..... Livestock Management and Infrastructure Development
MCM ..... Million Cubic Metres
M&E ..... Monitoring and Evaluation
MDG ..... Millennium Development Goal
MFDP ..... Ministry of Finance and Development Planning
MMEWR ..... Ministry of Minerals, Energy and Water Resources
MP ..... Member of Parliament
NAMPAADD ..... National Master Plan for Arable Agriculture and Dairy Development
NAPs ..... National Action Plans
NC ..... National Consultant
NCSA ..... National Conservation Strategy Coordinating Agency
NGOs ..... Non Governmental Organisations
NMPWWS ..... National Master Plan for Wastewater and Sanitation
NMPSWW ..... National Master Plan for Sanitation and Wastewater
NPFW ..... Non-Potable Fresh Water
NRW ..... Non Revenue Water
NSC ..... North South Carrier
NWMP ..... National Water Master Plan
NWMPR ..... National Water Master Plan Review
OKACOM ..... Okavango River Basin Water Commission
O&M ..... Organisational & Management
ORASECOM ..... Orange-Senqu River Commission
PDL ..... Poverty Datum Line
PEI ..... Poverty and Environment Initiative
PEIB ..... Poverty and Environment Initiative in Botswana
PET ..... Potential Evapotranspiration
PMTCT ..... Prevention of Mother to Child Transmission
PMU ..... Project Management Unit
PR ..... Public Relations
PSC ..... Project Steering Committee
RBOs ..... River Basin Organisations
RSAP ..... Regional Strategic Action Plan I – III (SADC)

RWP.....Regional Water Policy (SADC)
RWS.....Regional Water Strategy (SADC)
SADC..... Southern African Development Community
SAPs.....Strategic Action Programmes
SD .....Sustainable Development
SEA ..... Strategic Environmental Assessment
SMEC ..... Snowy Mountain Engineering Company
SW .....Surface water
TAC .....Technical Advisory Committee
TAG..... Technical Advisory Group for Botswana IWRM-WE project
TAG..... Transitional Advisory Group for LIMCOM
T.b.a. .....To be assessed
ToR ..... Terms of Reference
TWW .....Treated WasteWater
UNAIDS.....United Nations Programme on HIV &AIDS
UNCED..... United Nations Conference on Environment and Development
UNDP.....United Nations Development Programme
UNEP .....United Nations Environment Programme
WA.....Water Accounting
WAVES..... Wealth Accounting and Valuation of Ecosystem Services
WB..... World Bank
WCED .....World Commission on Environment and Development
WCU .....Water Conservation Unit
WDM .....Water Demand Management
WE .....Water Efficiency
WI.....Water Initiative
WRB.....Water Resources Board
WSR .....Water Sector Reform
WUC ..... Water Utilities Corporation
WWTW .....Waste Water Treatment Work
ZAMCOM.....Zambezi Watercourse Commission
ZOP .....Zambezi Operationalisation Plan

Executive Summary

The preparation of the Botswana Integrated Water Resources – Water Efficiency (IWRM-WE) Management Plan, fulfils Botswana's commitment made at the 1992 World Summit of Sustainable Development in South Africa. The Plan was commissioned by the Department of Water Affairs (DWA) and implemented by the Botswana Water Partnership's Secretariat (Kalahari Conservation Society) under the auspices of a project "Accruing multiple global benefits through Integrated Water Resource Management/Water Use Efficiency Planning: A demonstration project for sub-Saharan Africa". The project was funded jointly by the Government of Botswana, United Nations Development Programme (UNDP) and the Global Environment Facility (GEF). This IWRM-WE Plan has been developed at a time when Botswana is implementing extensive water sector reforms that covered institutional reorganisation, legislative and policy formulations. The country's Water Act was first promulgated in 1967; one year after Botswana gained independence. Many of elements of the legislation had become ineffective in dealing with the present and future challenges of water resources management which include population increase, and more recently, climate change. The IWRM-WE Plan is a coordinating and catalytic framework that supports water use and management in different sectors leading to greater economic and environmental efficiencies. The water sector reforms have given the Department of Water Affairs (DWA) (together with the Water Resources Board (WRB)) the responsibility for water resources management and planning. Therefore, the implementation of the Plan will be driven by DWA.

The *Vision* of the IWRM-WE Plan...

- All people and the environment have adequate access to sufficient water of adequate quality and economic production and growth is not curtailed by water shortages.

The overall *goal* of the Plan is :

- To improve people's livelihoods and welfare, as well as contribute to sustained economic growth, economic diversification, social justice and poverty eradication through efficient, equitable and sustainable water resources development and management.

The IWRM-WE Plan has been prepared over a two year period (2010-2012) with extensive stakeholder consultations in districts, among economic sectors, civil society and the private and public sectors. The process was driven by the Project management Unit (PMU) at the Kalahari Conservation Society (KCS), by the Project Steering Committee (PSC) and Technical Advisory Group (TAG). The Centre for Applied Research (CAR) was contracted to carry out the scoping study for the Plan and its subsequent development. The Department of Water Affairs (DWA) organised a National Stakeholder Workshop on Water (*Pitso ya Metsi*) in September 2012 in Mahalapye to discuss the draft final plan. Further details of the consultations are provided in Volume 2 of the IWRM-WE Plan for Botswana.

Water resources pose a major environmental and development challenge. Water resources are increasingly scarce; the opportunities of additional water infrastructure are limited and the costs very high. The estimated combined sustainable yield of Botswana's well fields and storage dams is

165 Mm^3/ annum or 216 L/person/day, based on the 2011 national population census estimate of 2,024,904. This is less than the current water demand of around 200 Mm^3/a or 262L/person/day. New dams will relieve the situation by increasing the overall yield to 317 million m^3/a (415 L/person/day), but this will only offer temporary relief. More efficient water allocation, water conservation and use of shared water courses will be required to balance water supply and demand.

The findings of the 2006 Review of the National Water Master Plan (NWMPR) were generally confirmed during the IWRM-WE Plan preparation, but the growth of the mining sector is expected to increase competition for scarce water resources more than anticipated in the Plan (which assumed constant water consumption for mining). Future irrigation development could also strain water resources unless irrigation relies mostly on treated effluent. 'Business as usual' is no longer a suitable management option and as the NWMPR puts it: ' water resources strategies to meet Botswana's water demand for the next thirty years will be dominated by the two issues of water resources stewardship and water demand management rather than capital development works' (SMEC and EHES, 2006, vol.1, p.193).

No water should be wasted, all treated wastewater should be re-used or recycled and all population groups (current and future) should have access to water for their basic needs and livelihoods. Moreover, sufficient (quantity and quality) water should be available for the environment to conserve biodiversity and a healthy environment. The Plan adopts the following IWRM *principles*:

- Water resources are ecological, economic and social goods that need to be managed accordingly;
- Water management is not the sole responsibility of government, but of all stakeholders, including water users, women, the private sector, academia and civil society;
- Decentralised water management is most effective, for example at the water catchment area level; and
- Water resources need to be wisely used and governed.

The Plan distinguishes ten strategic areas (SA) for action, shown in Figure 19. For each strategic area, specific objectives are developed together with activities required for implementation. A total of 55 activities are recommended, spaced in time as follows:

- Immediate: 9 activities
- Short term (2013 – 2015): 35 activities
- Medium term (2016 – 2023): 17 activities
- Long term (2024 – 2030): 3 activities

Implementation of the Plan is urgent as over half of the activities are accorded high priority. Most others are medium to high priority followed by some medium priority activities. Implementation of some activities has already started.

In line with the water sector reforms, the WRB and DWA should drive and coordinate the Plan's implementation. While DWA is being restructured based on its new mandate, it is relieved from water supply responsibilities and therefore stands a better chance to effectively implement this plan. It is important that implementation does not wait the outcome of the on-going reorganisation

project. Some activities can be immediately implemented to maintain the momentum generated by the Plan preparation. However, a wide range of stakeholders (more than hitherto) need to participate in the implementation of parts of the plan and should regularly assess the progress with the implementation.

Key institutional features of the Plan include; (ii) Greater inclusiveness and participation of stakeholders; (ii) A holistic approach with close linkages to development and land use planning; (iii) Decentralised catchment area institutions linked to national institutions; (iv) Separation of water sector management tasks; v. Full integration of transboundary water management; vi. Based on current institutional capabilities, and realistic capacity building efforts; and (vii) Integration of fresh and wastewater planning and management.The institutional set up for the Plan implementation is fully aligned with the water sector reforms. The strategy for implementation of the IWRM-WE Plan does not seek to create entirely new water institutions but rather increase capacity and effectiveness of existing ones. The institutional responsibilities are as follows.

- Water Utilities Corporation (WUC)
  - Delivery of potable water to the entire country;
  - Delivery and management of wastewater treatment services.
  - The WUC needs to develop institutional capacity in each water catchment.
- The water regulator (not yet established)
  - Financial sustainability across the water sector, reducing wastage by facilitating the streamlining of operations and determining revenue requirements to inform regular tariff adjustments;
  - Oversee compliance of service standards to ensure efficiency and protect consumer rights.
- Department of Water Affairs (DWA)
  - Assess, plan, develop and maintain water resources for domestic, agricultural, commercial, industrial and other uses in the whole country;
  - Assist and advise in the formulation of water resources development and management policies and legislation (DWA will be the secretariat of the WRB).
  - The DWA needs to develop institutional capacity in each water catchment.
- Water Resources Board (WRB, not yet established)
  - Oversee and allocate Botswana's scarce water resources;
  - Resource monitoring and development of water related policies;
  - All major sectors and stakeholders should be represented in the WRB;
  - The WRB needs to develop institutional capacity in each water catchment. These would effectively become catchment area councils. They will advise on and engage in water resource management in their respective catchments.
- Catchment Management Committees (CMC, not yet established)
  - Based on existing Community-Based Organisations (CBOs) for Natural Resources;
  - Where CBOs are inexistent, CMC are to be established as sub-committees of Village Development Committees (VDCs)
  - Responsible for local-level planning;
  - Control and monitor use of water and catchment ecosystem resources

The role of stakeholders outside government has been limited in the past, and needs to increase. Specific to the IWRM-WE Strategy, its implementation should be the responsibility of the WRB and DWA. It is proposed that an IWRM Unit is established within DWA to drive and monitor implementation of the plans. This unit should also provide for the establishment of a stakeholder

participation committee or forum comprised of stakeholders from government, civil society, private sector, local communities, researchers and academic institutions. The IWRM unit will coordinate capacity building initiatives for relevant stakeholders. The Unit will, in association with relevant stakeholders, develop IWRM outreach and awareness material to enhance capacity on IWRM. DWA and WRB will further provide for development, review and harmonisation of water related policies to support implementation of the IWRM-WE plan. WUC also needs an IWRM unit and it needs to implement its existing IWRM&WDM plan. It is imperative that WUC fully exploits opportunities of integrated wastewater and fresh water management. As the agricultural sector is the largest water user, the Ministry of Agriculture needs to strengthen its agricultural water capability to ensure efficient and productive water utilisation in agriculture based on the re-use of treated effluent. Local government entities will facilitate coordination and implementation at district level and should be linked to local communities, private sector and national levels as well. Local government departments and local authorities will also provide guidance to local communities, assist in capacity building of communities and provide for interactions between locals and private sector. They will also oversee monitoring and evaluation of local level activities.

Table 1: IWRM-WE Strategic areas, objectives and activities.

Strategic Area	Objectives	Activities
1. Increasing efficiency of water allocation	a. Maximise (socio-) econ. benefits of water allocations reduction; b. Ensure adequate water allocations to strategic sectors; c. Maximise use of non-potable water for sectors that do not require such water.	1. Establishment of prioritisation of demand categories exempted for efficiency allocation process. 2. Development of water allocation efficiency guidelines for DWA and Water Resources Board, and establishment of overall sectoral water allocations; 3. Establishment of water accounting capability at DWA 4. Carry out of sectoral IWRM assessment and an economic cost benefit analysis of water use and the opportunity costs for three sectors: irrigation; mining; energy.
2. Water Supply and Demand Management	a. Full reuse & recycling of treated effluent; b. Reduce WUC water losses; c. Raise awareness about water saving practices and appliances; d. Promote proven water saving technologies; e. Develop new sustainable conventional and non-conventional supply opportunities	1. Increasing the reuse and recycling of treated wastewater ; 2. Improvement of treated waste water (TWW) outflow quality. 3. Carry out a feasibility study of water kiosks in areas without water supply and small scale trade in TWW. 4. Implementation of the WUC water loss reduction and the national IWRM-WDM Strategy, including dry sanitation. 5. Design and implement a Botswana Water Efficiency License (BoWELS) water conservation certification system. 6. Negotiate WDM covenants with major water user sectors (mining, irrigation and industry) and water audits with major individual water users (e.g. KBL and BMC).
3. IWRM mainstreaming in development and land use planning	a. Integration of IWRM into economic growth, trade policies, in the NDP/DDP cycle and in land use planning; b. Integration of IWRM in EIA/SEA process; c. Development of a water-saving technology sector.	1. IWRM monitoring of implementation of the water Sector Reforms Incorporation of IWRM and WDM into Mid-Term Review and full integration in NDP11 preparation process. 2. Integration of IWRM & WDM in land use planning. 3. Development of IWRM & WDM guidelines and standards for water service providers, end users and water resource managers. 4. Integrate IWRM in poverty eradication efforts: review the potential livelihood and poverty impacts of water (supply) management in the past and identification of opportunities to eradicate poverty through water management and supply.
4. Establishment of an IWRM-WDM enabling environment	a. Establish a policy environment supportive of IWRM, including a policy, Act and set of standards, and shared water courses; b. Harmonisation of policies with other RBO member states	1. Finalisation, adoption and implementation of the Water (and Waste Water) Policy, including economic, legislative and consultative instruments. 2. Development and approval of a revised Water and Waste Water Act. 3. Successful completion of the water sector reforms process. 4. Design economic and legislative instruments to stimulate the use of non-potable water and TWW in irrigation and mining. 5. Full integration of IWRM in the development planning cycle, EIA/SEA procedures, environmental health and disaster management.
5. Development of catchment area	Review possible catchment area management models and develop an appropriate	1. Review suitable catchment area water management approaches within the parameters of the current water sector reforms and new Policy (and Act) and international experiences

Strategic Area	Objectives	Activities
management approach	model for Botswana.	2. Review different decentralised catchment area institutional structure.
6. Management of Shared Water Resources	a. Compliance with SADC Protocol on Shared Water Courses b. Obtain fair, sustainable and equitable access to water resources and sharing of benefits c. Promote cooperative planning and development of shared water resources	1. Review and harmonisation of Botswana Water Policy and New Water Act with other member states and with SADC Shared Water Courses Protocol. *2.* Assessment and efficient use of alternative domestic water resources use prior to applications for shared water. *3.* Participate in the development and implementation of TDAs, SAPs and guidelines for water allocation and benefit sharing based on the IWRM perspective, leading to clarity about water entitlements and responsibilities. 4. Strengthen the capacity of the International Waters Unit (IWU), DWA.
7. Institutional capacity building in IWRM	a. Institutionalisation of IWRM in lead water sector institutions; b. Establish planning and implementation capacity in lead water sector institutions; c. Incorporation of IWRM in training programmes in Botswana; d. Intensify the use of regional capacity building opportunities	1. Review of IWRM training opportunities and market needs, including E-learning opportunities; review opportunities for training locally, internationally and the use of electronically supported learning. 2. Targeted training of key staff at major water institutions to develop IWRM & WDM champions. 3. Establishment of IWRM & WDM units in WUC, DWA and in major end-user institutions. 4. IWRM and WDM related research and recycling technologies. Government in collaboration with other stakeholders should establish an IWRM research fund to promote research and develop (young) water professionals.
8. Stakeholder participation in IWRM	a. Ensure stakeholders participation in IWRM; b. Enhance IWRM knowledge and understanding; c. Improve access to and share information on IWRM;	1. Development of awareness programmes for different stakeholder groups. 2. Document and share best practices on IWRM and WDM in Botswana and abroad. Establishment of informative water billing to provide incentives for water conservation; *3.* Establishment of IWRM and WDM dialogues with women, youth, poor and other vulnerable groups and development of targeted training programmes. 4. Review operations of (the few) existing water use associations and pilot the potential of CBOs as WUAs.
9. Maintaining water quality and pollution control	a. Maintain water quality to meet water standards b. Maintain water quality to meet the standards for discharges into environment	1. Establishment of a national water quality monitoring network (ground and surface water) and regular sampling. 2. Measurement of inflows and outflows of Waste Water Treatment Works (WWTW) and improved management of WWTW
10. Ecological water requirements water	a. Maintain the natural quantity and quality of water resources; b. Ensure adequate water for the environment;	1. Conduct Ecological Water Requirements(EWR)/ Environmental Flow Requirements (EFR) studies in all major river basins and incorporate into policy and legislation; 2. Conduct studies of EWR for heavily used aquifers and well fields, particularly those near valuable ecosystems; 3. Environmental rehabilitation campaigns: bush encroachment control plan, exotic species control plan and a control plan for water hyacinth and *Salvinia molesta*.

Monitoring and evaluation (M&E) is a vital part of the policy cycle to ensure successful and efficient implementation of the Plan. M&E is essential to ensure that implementation of the plan is on track, to measure short and long term impacts, to evaluate the impacts, and recommend changes to the plan or its implementation (if necessary) (GWP, 2004). A detailed M & E system has been developed to monitor the Plan implementation, including indicators, roles of different stakeholders and feedback of the results into the decision-making and implementation processes. Where current data are missing, the baseline situation needs to be established at the start of the implementation process.

The plan can be financed from various sources, both domestically and internationally. Domestic funding sources include the government budget (NDP10, the annual government budgets and specific funds such as the National Environmental Fund), the private sector (e.g. mines, farmers, tourist and operators) and communities. Some activities can be immediately funded under the collaborative UNDAF programme (joint programme of GoB and the United Nations System in Botswana). Successful implementation of the plan will lead to long-term financial savings. For example, savings from reduced reticulation water losses could be used to finance WUC M&E and stakeholder consultation. The Water Regulator should contribute towards more efficient operation of water service providers associated with monopolies, and the resulting financial savings can be reinvested into water resources management. Finally, effective awareness raising campaigns and stakeholder participation should lead to water and costs savings. International funding sources include the Global Environmental Fund, the Green Fund and multilateral and bilateral ICPs. Further funding opportunities exist, for example through GWP-Southern Africa, Cap-Net and WaterNet, in particular for training and research. In the past, Botswana has made limited use of such funds and efforts to access international funding need to be intensified. The draft Water Policy envisages the establishment of a Water Research Fund that will be largely supported by government allocations, royalties and water user fees. Sustainable financing for development and management of water resources, both in the long and short-term is essential. This is to be assured through the following:

- Operation and maintenance costs need to be met from domestic sources;
- Water service providers need to be efficient and minimise their O&M costs, while ensuring delivery;
- Capital investments can be met by domestic and international loans and grants, seeking to minimise total loan and repayment costs; and
- Grants should be used for specific one-time expenditures or projects, while provision is made for meeting future extra O & M costs.

Furthermore, financing strategies need to contribute to social equity and sustainability, primarily through cross-subsidisation of access to basic water needs by other users or government; an even and fair distribution of the implementation costs; and social acceptance of willingness to pay for adequate water supplies and for reuse of treated wastewater. Policy reforms to accommodate polluter-pays-principles and promoting prudent financial management are equally important.

1 Introduction

Water resources remain one of the most critical issues for economic growth and the integrity of natural ecosystems, and human societies that depend on them. This has been recognised since the 1992 United Nations Conference on Environment and Development (UNCED) in Brazil and the 2002 World Summit on Sustainable Development in Johannesburg. The importance of water resources as strategic natural capital featured prominently again in the discussions about the 'Green Economy' in the Rio +20 Summit of 2012.

Many countries, including Botswana, are facing a range of interrelated challenges, including: water scarcity, water quality degradation, inadequate sanitation facilities, climate change, persistent poverty as well as increasing and competing demands for water resources. In many instances, a solution to one challenge has been the source of yet another challenge. For instance, irrigated agriculture has brought exponential increases in food production while also resulting in the collapse of riverine ecosystems, drying-up of rivers and ultimately the very dams supporting irrigated agriculture. Challenges of water resources management and use require integrated approaches that address them holistically across all sectors. Integrated Water Resources Management (IWRM) has emerged as a globally accepted concept aimed at achieving sustainable development with respect to water resources. The IWRM concept essentially recognises water as a fundamental asset to a country's national socio-economic and environmental needs. It is "a *process that promotes the coordinated development, management and use of water, land and related natural resources in order to optimise the resultant economic, social and environmental welfare in an equitable manner without compromising the sustainability of vital ecosystems"* (Global Water Partnership, www.gwp.org).

IWRM strives to balance the varying interdependent demands on water resources within four sustainability pillars, i.e. economic efficiency, social equity, environmental sustainability and institutional sustainability. The associated principles are adapted and expanded from the 1992 Dublin Principles, outlined in Box 1 below.

In order to operationalise the IWRM principles, the Global Water Partnership (GWP) has developed a framework or 'Tool Box' with three core components that address specific problems and offer solutions to a wide range of water management problems (www.gwpsa.org).These components require political commitment and support; established institutions;, as well as human and financial resources. The Toolbox defines these components as follows:

- **The enabling environment**, in which government ensures that comprehensive policies and laws are developed with clarity on entitlement to water, allocation of water, as well as roles and responsibilities of water users and providers. This component also requires countries to allocate necessary financial resources in order to meet varying water needs;
- **An appropriate and effective institutional and organisation framework**, as well as institutional capacity building for skilled and informed human resources at all levels, are essential for the implementation of IWRM; and

- **Effective management instruments** to govern among others, water resources assessment, plans for IWRM, water use efficiency, social change, conflict resolution, regulatory framework, economic instruments, and information exchange.

Box 1: Principle of Integrated water Resources Management.

Principle 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. This suggests that water is a natural asset that needs to be sufficiently maintained to ensure sustenance of the services it provides. The principle takes into consideration the fact that water is required for various purposes, services and functions and therefore its management has to consider the demands placed on the resource and should be integrated.

Principle 2: Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels. Active participation is required especially at decision-making level. It is also about stakeholders taking responsibility, recognising the effects of their actions on other users and the environment as well as accepting the need for change to improve water efficiency. However, participation can halt processes, undermine development and can be costly to participants if it is carried out in the absence of clear objectives and timelines, informed stakeholders, and appropriate systems for negotiation and conflict resolution.

Principle 3: Women play a central part in the provision, management and safeguarding of water. The role of women as providers and users of water and guardians of the environment has seldom been reflected in institutional frameworks for development, planning and management of water resources. Gender awareness and participation are therefore crucial to sustaining the resource. Participation of both men and women in influential positions in the water sector can accelerate the achievement of sustainable water use and management.

Principle 4: Water has an economic value in all its competing uses and should be recognized as an economic good. After the basic human needs and the ecological requirements, it should be allocated to its highest value in terms of value added, poverty reduction, employment creation and/or livelihood improvements. Managing water in an economic manner can achieve efficiency in water use, equity and encourage water resource conservation. Countries apply various economic instruments and incentives to support efficient water use, water demand, conservation, meet social needs and recover cost of supply.

Principle 5: Water is a basic need and is therefore a social good. Water resources need to be accessible and affordable for all people. The resource needs to be available at affordable prices taking into consideration the needs of the poor and vulnerable members of the society.

Principle 6: The water management structures need to be sustainable, transparent and accountable. The decision-making process and choices need to be transparent and water providers and planners need to be accountable. This implies that information needs to be available to and shared with all stakeholders.

Source: expanded from Lundqvist *et.al*., 1994.

IWRM is a general concept whose components need to be adapted to each country's needs and challenges. Several lessons need therefore to be learned to successfully implement IWRM (adapted from GWP TEC, 2009). Firstly, IWRM is a means to an end, as it prescribes goals to be accomplished, the context that determines what strategic areas and activities are important, and when they are needed. Secondly, IWRM is an iterative process that varies from one country to another and is an adaptive approach – one that can accommodate emerging challenges, constraints and social priorities. Thirdly, development, use and management of water resources must reflect country challenges, priorities, and governance approaches. Water management will not be successful if it is a stand-alone system of governance, separate from other governance structures in the country. Fourthly, IWRM includes both 'hard' and 'soft' components. It includes the infrastructure needed to harness water for productive use and the management interventions required for efficient use of water; mediates between competing users and uses; and protects the resource and ecosystems that depend on it.

Development of country-specific national Integrated Water Resources Management-Water Efficiency (IWRM-WE) plans by 2005 is a target set by Heads of State at the World Summit for Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002. This ambitious target has not been fulfilled as a number of countries are still lagging behind. A global survey (UN-Water, 2008) showed that only 38% of the developing countries have an IWRM-WE plan. The Botswana IWRM WE Plan therefore, constitutes the fulfilment of the country's commitment and undertaking to the global and regional agreements.

1.1 IWRM in Botswana

Integrated water resources management is fairly widely practised in Botswana, but not yet formally elevated as the cornerstone of water resources management. This is primarily due to the fact that the Water Act, having being first promulgated in 1967, is outdated and the National Water Policy is still in draft form. However, the review of the Botswana National Water Master Plan (NWMPR; SMEC and EHES, 2006) clearly identifies the need to adopt IWRM, especially to shift focus towards water demand management, as well as reuse and recycling of treated wastewater. The proposed shift is based on environmental (water scarcity) and economic (cost) reasons. Water shortages and escalating water costs could threaten economic development and livelihoods. Box 2 shows some statements that underline the shift towards IWRM.

Box 2: Some important quotations from the National Water Master Plan Review of 2006.

'*Continuation of current practices is the most costly course of action to follow. It will require* more *government subsidies and large capital works. (vol.12, p.41)*

'*Duplication of the North South Water Carrier (NSC) is a very expensive option to pursue. Despite it being uneconomic, it may still proceed for political and strategic reasons, which could be equally valid. However, these reasons should be transparent, as all consumers will eventually pay for these decisions'* (vol. 12, p.9).

Source: SMEC and EHES, 2006

Clearly, water demand management (WDM) can no longer be seen as a temporary 'drought relief' programme but a vital part of the IWRM strategy. Moreover, water for productive use needs to be based on allocative efficiency, which is currently a neglected policy area. The concept of Allocative Efficiency is explained in more detail under Section 3.11, page 53. Other priority components for IWRM in Botswana include:

- Mainstreaming water resources management in development planning and poverty eradication efforts;
- Institutional reform and effectiveness;
- Financing needs, water tariffs and subsidies;
- Finalisation of water policy documents and laws;
- Constructive and effective implementation of WDM measures that can immediately be implemented, instead of such measures remaining as 'pilots', leading to unnecessary water wastage.

Apart from the NWMPR, the IWRM-WE Plan should incorporate the results of the water sector reform project (2008 – 2013), which changes and defines the roles of major

stakeholders; reviews the finances, tariffs and subsidies of the sector; and would be the cornerstone of the water policy and water legislation (World Bank, 2009). The IWRM-WE Plan should therefore incorporate past and current work on water accounts.

In the past, the Department of Environmental Affairs (DEA) carried out an environmental economics project that led to water accounts (DEA and CAR, 2006). The Wealth Accounting and Valuation of Ecosystem Services (WAVES) partnership between the World Bank and a number of countries has led to the prioritisation of water accounting in Botswana (CAR and Econsult, 2012). Botswana's priority for the natural capital approach is reflected in the Gaborone Declaration that was adopted at a Summit on Sustainability for Africa held on24th and 25th May 2012. Water accounting can be used to monitor resource use trends, integrate water resource management into development planning, and to improve water allocative and technical efficiencies. DWA intends to use water accounting as one of its IWRM-tools. The IWRM-WE strategy needs therefore to incorporate the results of earlier projects and policy initiatives, such as the DWA water conservation project. Moreover, several water quality standards are already in place (e.g. drinking water, bottled water, livestock water) or in preparation (e.g. irrigation water quality standards). The following 'good practices' were identified during the DWA water conservation project (listed in CAR, 2010):

- Clear verifiable target for 96% reuse/ recycling of wastewater by 2030. This target sets a clear agenda for the wastewater sector; the extended WUC mandate should make it easier to reach that target. The IWRM-WE strategy should ensure that progress with achieving the target is monitored;
- Reuse of treated wastewater is increasing, particularly for agriculture (e.g. Ramotswa and Glen Valley), but there is need to ensure that the use is productive and yields safe produce;
- Certain pilot interventions (e.g. replacement of AFU and meters) conducted by the WCU-DWA, have shown major resource savings and/or economic benefits; and
- Many new institutional government houses are fitted with rainwater harvesting facilities, like water tanks, to encourage tenants to utilise rainwater. The important step is to ensure use of the stored water, and extend the initiative to the general public.

The IWRM-WE Plan needs however, to also address gaps and weaknesses in Botswana's water resource management. These include the lack of clear targets that can guide and accelerate IWRM implementation; government domination in water management with limited participation of other stakeholders; slow pace of putting IWRM in practice after the 2006 NWMPR; slow progress with the water sector reforms; and gender issues are hardly considered in water resource management, which has remained a predominantly male area. Specific IWRM gaps and challenges include:

- Approval of the 2012 Water Policy and an outdated legislative environment;
- Inadequate attention for allocative efficiency;
- Prioritisation of demand categories (e.g. basic needs and environmental requirements);
- Inadequate attention for water quality;

- Failure to upscale interventions with proven positive, short term benefits (e.g. automatic urinal flush systems, reduction of non-revenue water);
- Inadequate integration of land and water use planning;
- Limited efforts for rainwater harvesting and for carrying out water research.

1.2 IWRM and National Development Planning Framework

The successful implementation of IWRM requires mainstreaming in the national and district development planning frameworks. Consequently, the Botswana IWRM WE Plan is linked to these development planning frameworks through Vision 2016, National Development Plan (NDP) 10 and District Development Plans 7 to bring together water related activities into an implementation framework. Vision 2016 (Presidential Task Force, 1996) is Botswana's long term strategy (1996-2016) to achieve socio-economic and political development that will transform the country into a competitive, winning and prosperous nation. Prepared in collaboration with all stakeholders, the Long Term Vision consists of eight pillars that represent the aspirations of Batswana about their long-term future and required implementation strategies. The Vision has ambitious targets most of which are also part of the Millennium Development Goals developed by the UN, namely:

- Trebling of per capita income (to US$8 500 in 2016);
- Average annual economic growth rate of 8%;
- Full employment by 2016;
- Halving of poverty by 2016 and poverty eradication by 2016;
- Access to good health and education facilities by 2016;
- Access to safe drinking water and adequate sanitation facilities by 2016;and
- No new HIV &AIDS infections by 2016.

There has been significant progress towards the achievement of Vision 2016. However, some objectives will be difficult to achieve in the remaining period. Examples include trebling of the per capita (p.c.) income (now around US$3 500), poverty eradication (poverty rate of 20.7% in 2009/10; Statistics Botswana, 2011), full employment (unemployment is around 17%), sanitation goals, and stop of new HIV&AIDS infections. The country is still highly reliant upon mineral revenues, which are predicted to decline sharply between 2025 and 2030. It is therefore crucial for Botswana to develop other growth engines to sustain the economy beyond 2016. The Vision is operationalised through the 10th NDP (Government of Botswana, 2009) that outlines the policies and key programmes aimed at achieving the Vision objectives during 2009-2016. This seven year plan (2009-2016) coincides with the time horizon of Vision 2016; unlike previous NDPs, it is based on integrated development planning where focus is on key tangible outcomes and results. Implementation of NDP 10 is undertaken within a realistic annual budget where each Ministry is allocated financial resources within which activities are funded. It is expected that (a large) part of the financing of the implementation of the IWRM-WE Plan needs to originate from ministerial budgetary allocations. At district level, development plans are prepared by local government with specific programmes and strategies for each district to cater for priorities and needs at the local level.

The overall development progress with the implementation of Vision 2016 and NDP10 is shown in Table 2. The Table shows significant progress but also identifies socio-economic challenges such as poverty eradication and reduction in unemployment.

Table 2: Progress towards achievement of Vision 2016 and NDP 10 goals

Vision 2016 Pillar	NDP goal	Progress
1. An Educated, Informed Nation	• Adequate supply of qualified, productive and competitive human resources • Innovative and productive use of Information and Technology	• Increased net enrollment at all levels (primary 92%, junior Secondary 50%, Senior Sec 20%, tertiary 11.4% • High & rising literacy rate (81%) • Improved access to information (print & electronic media) (Radio Botswana 1, 85%, BTV, 40%) • Improved connectivity (mobile phone penetration 91%; computers in 6.7% of households; on average a computer is available for every 28 students in secondary schools.
2. Prosperous, Productive & Innovative Nation	• Sustainable rapid economic growth • Well developed & reliable infrastructure • Sustainable management of natural resources	• National growth of the economy has been high, though slowing recently (average real GDP growth of 6% a year from 1994 to 2010) • Greater gender balance in the workforce (female participation at 44% as at 2010) • Expansion of 'Informal sector' increases employment for 'hard to employ' • However, unemployment remains a problem (29% unemployment rate in 2008)
3. Compassionate, Just & Caring Nation	• Eradication of absolute poverty • Adequate social services • Affordable & quality health care • Prevent new HIV & AIDS infections	• Significant improvements in the fight against poverty (97% access to safe drinking water in 2010; sanitation standards increased from 39% in 2001 to 52% in 2006) • A well-established and accessible health system in place nationally (84% of pop accessed facilities within radius of 5km and 95% within radius of 8km in 2007 • Population below the Poverty Datum Line (PDL) reduced from 47% in 1993 to 30% in 2002)
4.Safe & Secure Nation	• Public safety & protection • Territorial integrity and sovereignty •	• Drop in incidence of road accidents and fatalities (106/10000 people in 2004 and dropping to 80.6 in 2011). Incidence of fatalities also dropping, 31 in 2004 to 24.7 in 2006 • Improved training and equipping BPS and BDF and recruitment of more women into the Forces • Improved infrastructure to deal with newer forms of crime ('white collar') and major threats ('disaster preparedness')
5. Open, Democratic& Accountable Nation	• Transparency and accountability in all public & private institutions. • Enhanced & sustained participatory democracy • Rule of Law	• Botswana ranked highly (Regionally and Internationally) in terms of standards of 'good governance' ' • Ranked number 1 in Africa in terms of 'control of corruption' • Improved representation of tribal groups in Ntlo ya Dikgosi (House of Chiefs)
6. Moral & Tolerant Nation	• Enhanced cultural heritage & diversity	• Greater tolerance and acceptance of differences between people – their religion, language, ethnic background • Greater gender sensitivity and equality of opportunities for women • Incidence of teenage childbearing steadily dropping (though factors in addition to 'responsible parenting' could also be a factor)
7. United & Proud Nation	• Strong National Identity & Unity	• A number of factors have been promoting social stability – fostering religious freedom; celebrating cultural diversity; ensuring tribal neutrality in the Constitution; etc.
Source: CAR and Econsult, 2012		

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2 The Process of Developing the Botswana IWRM & Water Efficiency Plan

The IWRM-WE Plan is rooted in the government's undertaking made at the 2002 World Summit on Sustainable Development to prepare a national IWRM-WE Strategy and is also a follow up to the 2006 NWMPR. The management instruments recommended in the NWMPR should be implemented, inter alia, through a National Water Resources Strategy "utilising the NWMPR as a 'living' document with continual updating as new data, new policies and new priorities are incorporated, coordinating the water needs of various sectors, and taking into account of relevant international agreements related to the use of shared water courses" (SMEC and EHES, 2006, vol.1, p 206).

The IWRM-WE Plan is premised on international best practice, Botswana's Long Term Vision 2016, the National Development Planning framework as well as existing water, development and related sectoral and resource policies, strategies and legislation. The National IWRM-WE Plan strives to: "*improve people's livelihoods and welfare, and contribute to sustained economic growth, economic diversification and social justice through efficient, equitable and sustainable water resources development and management*". The Plan needs therefore to contribute towards poverty eradication, sustainable economic growth and environmental sustainability.

2.1 T he Process and Framework of Developing the Plan

The development of the Botswana Integrated Water Resources Management and Water Efficiency Plan span over a two year period. It started with a scoping study aimed at identifying water-related opportunities, challenges and issues, as well as the stakeholders. Figure 1 below depicts the various inputs and dynamics of the planning process followed in developing the plan. Results of the scoping study were used to development a framework for the IWRM-WE Plan. As the water sector reforms were on-going concurrently, the planning benefited from existing impetus for change, nationwide. At the strategic level the planning process was driven by Vision 2016, the Millennium Development Goals (MDGs) and the Sustainable Development agenda. These strategic elements are described below.

2.1.1 IWRM and Sustainable Development

The concept of sustainable development (SD) seeks to achieve development, which is not at the expense of the environment and the future generations. Since the launch of the concept of sustainable development, emphasis has changed and shifted in time. Focus was initially towards poverty reduction and social aspects; later however, global environmental issues, governance and institutions were added; and most recently, economic aspects through the concept of Green Economy was included on the list. As a result the SD concept has been enriched and has become more useful and acceptable to decision makers. The 2012 Gaborone Declaration on Sustainability for Africa bears testimony to this (see Annex 1, page 146).

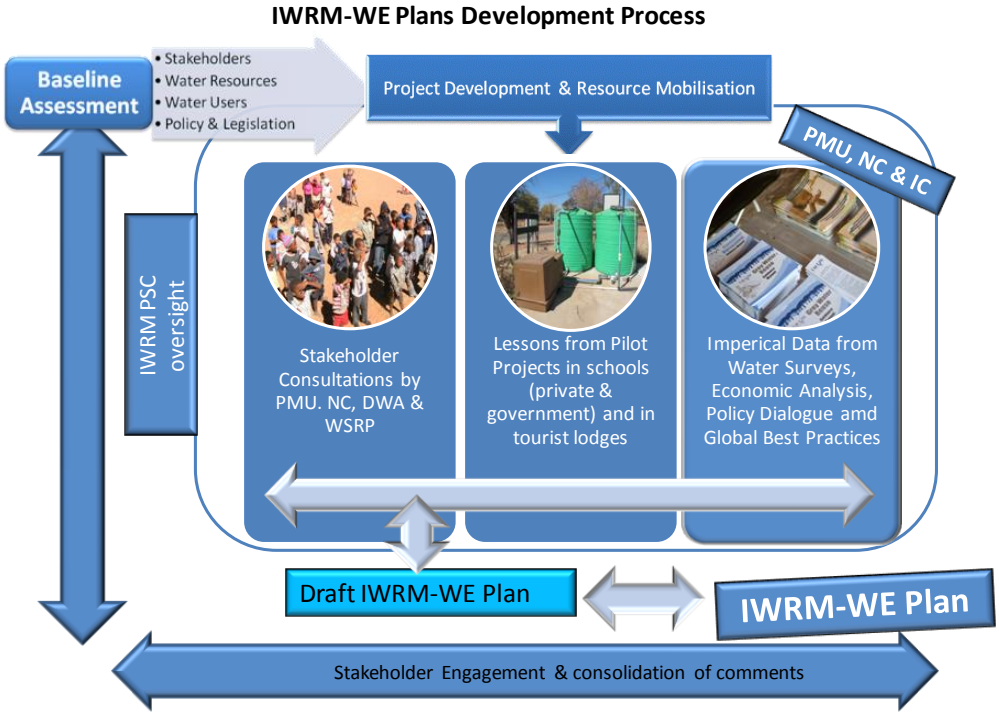


Figure 1: An outline of the process followed in developing the Botswana Integrated Water Resources and Water Efficiency Plan.

Sustainable development is often depicted as having ecological, economic and social objectives and issues (WCED, 1987); governance and institutional objectives are in some cases added. Sustainable development provides therefore, a solid foundation for implementing IWRM principles, which in turn, can be interpreted as the water specific version of sustainable development. Each country needs to determine its own priorities for IWRM and there is no easy blue print that fits all countries. Much work, also in southern Africa, has been carried out on operationalising IWRM (e.g. Cap-Net, Global Water Partnership and WaterNet). The GWP Toolbox is a useful IWRM sharing and information dissemination mechanism that guides IWRM implementation and development of IWRM plans. Its main purpose is to support the water sector to identify and use tools suited to improve water management governance and to facilitate capturing and exchanging experiences derived from IWRM processes.

2.1.2 Conceptual framework

Water is essential for human needs and economic sectors and therefore the resources should be managed holistically in an integrated manner. The conceptual framework for IWRM-WE in Botswana (Figure 2 below) merges sustainable development and the three key components of the IWRM toolbox, namely; (i) enabling environment, (ii) appropriate and effective institutional framework, and (iii)

effective management instruments. The water sector is at the centre of the diagram. It is important that both the current and future situations are reviewed in the IWRM-WE Plan. Water resources availability, as well as water consumption and use are closely linked through the provision of environmental services (e.g. water consumption, water transport, recreation, and pollution absorption[1], are vital input into agriculture and many other commodities). At the same time, investments in well-fields, dams, water carriers and the deployment of desalination technologies collectively determine the Botswana's fresh-water storage capacity.

Water resources occur in various ways that include ground water, surface water, and treated waste-water. Under-ground water varies widely in terms of quality with highly saline sources in the western part of Botswana and in terms of rates of replenishment of the aquifers. Many of the surface water sources in Botswana occur within shared (transboundary) riverbasins.

Similarly various types of water use should also be considered as follows:

- Consumptive and non-consumptive (e.g. recreation and transport) use;
- Productive (e.g. agriculture, mining & industry) and household use;
- Use by different water service providers (e.g. WUC and self providers such as mines and livestock owners);

The water sector needs however to be analysed within the perspective of sustainable development. This broader perspective is represented by the four sustainability circles with their linkages (ecology, economics, social and institutions). The major focal points for each sustainability aspect are shown in the circles. The sustainability framework applied to the water sector will therefore generate the issues and options for IWRM, and suggest what interventions are necessary in establishing the enabling environment; and the effective institutional set-ups, as well as the management instruments.

At all levels of the framework, cross cutting issues such as climate change and poverty are considered. For instance, the impacts of climate change on water resources availability and use can be assessed and strategies for intervention be identified. Furthermore, spatial variations within the country need to be taken into account at all times.

[1]Wetland systems can act as waste filters removing pollutants before they can flow into nearby bodies of water hence help control pollution of water resources.

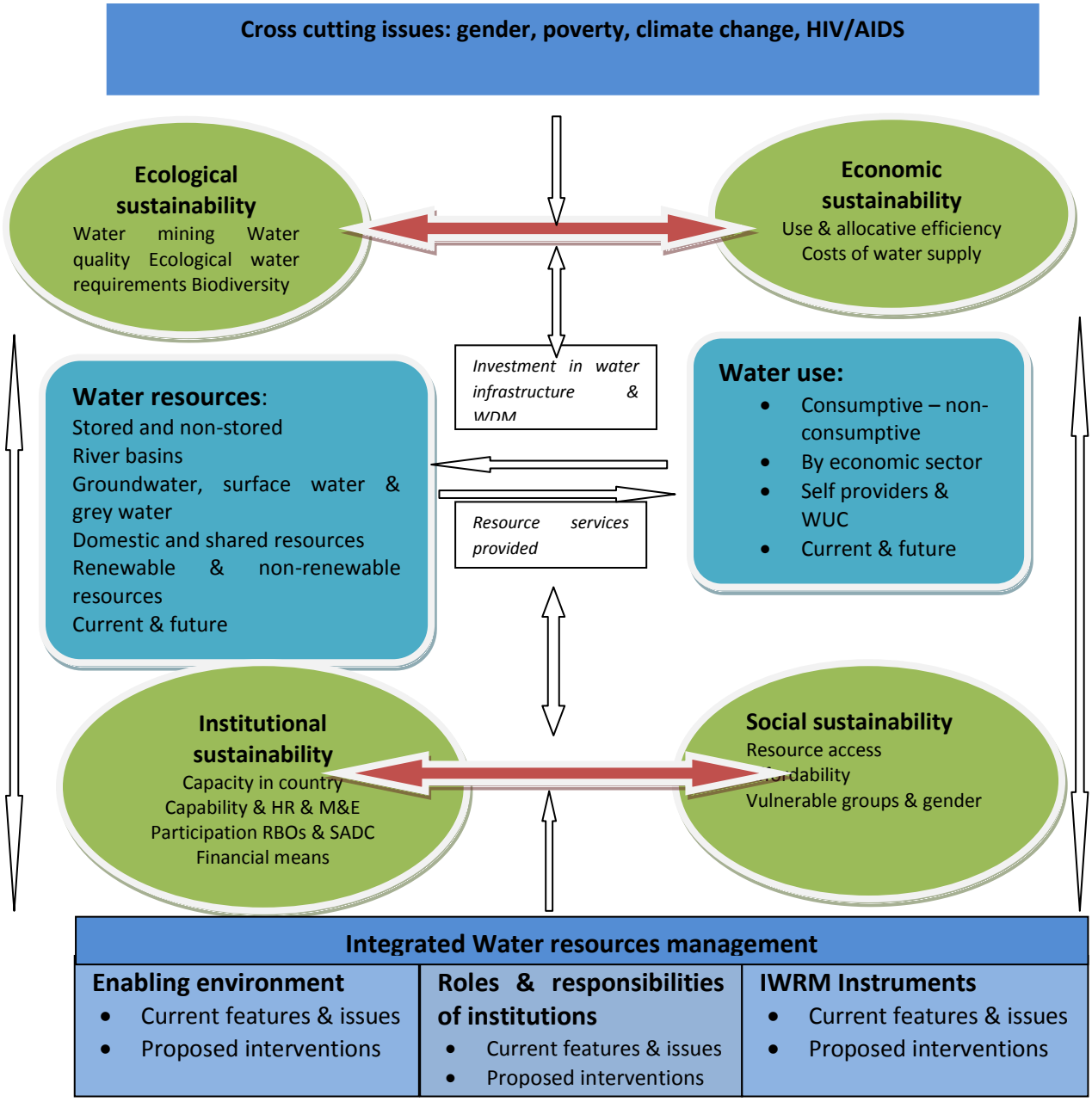


Figure 2: Conceptual Framework for the development of the Botswana IWRM-WE Plan.

Further details of the IWRM toolbox that was used are given in Box 3.

Box 3: Characteristics of GWP's IWRM toolbox.

I. Enabling environment: This focuses on policies, legislative framework, and financial incentives. It also highlights the importance of legislative framework that embraces IWRM principles the need for funding the implementation of IWRM..

II. Appropriate and effective institutional framework: Emphasis here is on creating an organisational framework and building institutional capacity. Implementation of IWRM requires a shift towards decentralised management of water resources and strengthening of institutions to deal with required changes. It is also essential to build institutional capacity through mainly training and empowering civil society.

III. Effective management instruments: This characteristic is made up of several sub-categories, covering areas of water resources assessment, plans for IWRM, efficiency in water use, social change, conflict resolution, regulatory framework, economic instruments and information exchange. Water resources assessment provides a basis for institutions to understand the current status of its resources. Developing IWRM plans provides a roadmap for implementation and monitoring of progress in implementing IWRM. Water efficiency relates to efficiency in use and water supply systems. Social change instruments include integration of IWRM in education curricula, communication strategies and awareness raising aimed at changing behaviour towards water use efficiency and management. Conflict management tools deal with conflict resolutions and consensus building. These tools relate to facilitation, mediation fact-finding, negotiation and arbitration. Regulatory instruments are statutory tools dealing with protection of water resources whilst economic instruments deal with pricing and charging for water and wastewater (mis)use and management. Information exchange instruments calls for development of proper information storage systems and sharing of IWRM data and experiences. Whilst assessment instrument addresses issues of risk, social, environmental, as well as economic and vulnerability assessments.

Source: www.gwpforum.org

2.1.3 Stakeholder consultations

The process of IWRM-WE plan preparation involved extensive consultations with stakeholders. The consultations started in 2004 and were concluded in September 2012. Early consultations are reported in Appendix A, Volume 2. This appendix also includes summaries of consultations during the actual plan preparation from 2011 to 2012.

The stakeholders consist of institutions in the water sector itself (suppliers, planners, regulators and decision makers), a wide range of water users, civil society, interest groups and institutions dealing with capacity building and knowledge management. Most stakeholders are found within the country but some are at the level of the regional economic community (e.g. Southern African Development Community – SADC) and continental level (e.g. African Union - AU) and international (e.g. UN). The identified stakeholders are shown in Table 3 below. It is important to recognise the importance of the private sector as major water users (and self providers of water) and providers of water-use technologies such as cistern systems, showers, and automatic flush urinals.

Consultations were held during the scoping phase, which provided the focus of the preparatory process. Further stakeholder consultations were held during the preparatory process, including the following:

- Sectoral consultations with agriculture, mining, tourism and industry/ services;
- Consultations with WUC and DWA;
- District consultations. Under the scoping study, three district assessments were undertaken (South-East, Central and Ngamiland). Additional consultations should therefore be carried out at district level; and
- Consultations with government as a water user, focusing on the most important water using ministries and departments;
- A consultative meeting about ecological water requirements; and

Table 3: Identified IWRM stakeholders

Sector	Sub-sector	Stakeholder in Botswana
1. Water Sector: service provider & water managers	National	Department of Water Affairs (DWA), Water Utilities Corporation (WUC), Water Sector Reform, Water Apportionment Board (WAB) & Water Regulator, Botswana Bureau of Standards (BOBS), Department of Buildings and Engineering Services (DBES), River-Based Organisation (RBOs), Southern African Development Community (SADC), World Health Organisation (WHO)
2.Water users: economic sectors	Agriculture	Ministry of Agriculture (MoA) (dryland crops, livestock & irrigation) National Farmers Association
	Tourism	Department of Tourism(DoT) , Hotel and Tourism Association of Botswana (HATAB), Botswana Tourism Organisation (BTO), Botswana Wildlife Management Association (BWMA), CBNRM forum & BOCOBONET, Tour operators
	Mining	Dept. of Mines, BOCCIM, Mining companies
	Industry & service sector	BOCCIM, Water appliances supply sector
	Domestic consumers	Consumers and civil society
	Government (local and national)	Central government – ministries, Local government Parastatals (BHC, BPC, BTC, WUC),
3.Environmental water use		Dep. of Environmental Affairs, Dep. of Waste, Management and Pollution Control , Dep. of Wildlife & National Parks, Parliamentary Committee, Dep. of Meteorological Services, SADC, RBOs
4.Cross cutting issues		Poverty: MFDP (e.g. PEI) Gender: Dep. of Women's Affairs, gender NGOs Climate change: dep. of Met. Services HIV-AIDS: NACA, HIV-AIDS NGOs.
5.Civil Society		KCS, Somarelang Tikologo, Gender and HIV & AIDS NGOs, GWP-SA, CAP-Net and WaterNet.
6.Human resources – skills and knowledge development and management		Ministry of Education, Ministry of Science & Technology, University of Botswana (incl. ORI) , BIUST & BCA, BOTEC & RIPCO
Note: Summaries of the consultations and lists of participants are presented in Volume 2, Appendix A.		

- A consultative meeting with capacity building and knowledge institutions.

District-level consultations were conducted in Kgatleng, South East, Palapye (Palapye sub district), and Letlhakane (Boteti sub district). Map 2, page 36 shows the various districts cities towns and some of the major villages in Botswana. A meeting was held with the Deputy Council Secretary for Central District in preparation for meeting with the whole Central District Council team. In the case of Central district, the project team has been advised to have separate meetings with the sub districts because they are close to the ground and each sub district has unique problems. Several general observations emerged from these consultations:

- Water resources planning and management is still regarded as an issue for DWA and WUC only;
- Planning for water resources has mostly focused on domestic consumption;
- Water quality issues have not been given adequate attention, especially when it comes to treated waste water. Consequently, the use of treated waste water is low as many treatment systems in use are not designed and constructed with treated effluent re-use as part of their initial designs; and
- Water conservation is rarely practiced and there are very few plans for water conservation, even in areas of serious water shortages.

Ten issues emerged during the consultation process and are listed below:

- Districts need clarification on the relationship between the IWRM project and plan on the one hand and the Review of the NWMP on the other hand to avoid duplication of efforts;
- There is lack of understanding of the water sector reforms process. In some areas the district felt that the consultation about the take-over of the water supply by WUC did not spell out the problems that the district might encounter due to the changes in the roles. These changes include the increase in the cost of water bills and even in the cost of water connections;
- Lack of understanding of the role that sectors outside of the water sector can play in water resources management. Many of the sectors within the districts always view water resources management as a role for the DWA and now for WUC. They do not see how they can play a role in the management and even planning for these resources;
- There is a need for community consultations in the form of workshops where ideas can be interrogated and ideas exchanged;
- Issues of water quality need to be addressed especially in areas with high salinity. In areas such as Boteti, there is a serious problem of water quality. Issues of water quality within their region need to be addressed fully and a sub district needs to be assisted in how to plan for the most economical way of managing their resource;
- The use of water resources in some areas which have been polluted need to be explored whether the water can be beneficially utilised;

- The use of appropriate technology has to be explored. For example, galvanised pipes should not be used in areas of high salinity, and more appropriate types could be promoted especially for government institutions;
- The districts also highlighted that there is a need for a concerted effort to mobilise the communities and not just the government institutions; and
- The councils must be encouraged to include rain water harvesting requirements as part of the building control code; and
- Major housing institutions such as Botswana Housing Corporation must be required to include rainwater harvesting within their designs.

2.2 Lessons Learnt

The Steering Committee role in the project formulation was to be technical and administrative at the same time. This was an oversight as it was pecked at Directorship level under dictates and understanding that IWRM is meant to inform and help in revision of policies of both water managing and water using entities. However in reality these are busy people in all respects hence high ranking officials ultimately comprised the Steering Committee under the leadership of DWA Director. The committee quickly realised during the scooping report that they needed to advise the project on governance and policy issues relating to the project than reviewing technical reports. To this end, a Technical Advisory Committee (TAG) was established to work directly with the consultants under the chairmanship of the Project Technical Advisor. This worked well but the TAG was too big to to discuss progress and delineate the contours and contents of the plan and this necessitated regular interventions by the Steering Committee to ensure accuracy and correctness of reports. The national consultant agreed the TAG was too big and a small working group comprising members of the TAG has been useful to provide necessary feed back to the consultants and to review the documents to meet stakeholder wishes.

Though the project document was signed in December 2008, the first disbursement was only made in December 2009 and the budget was two (2) years old. This generally affected the start of the project as the implementation started almost a year late. At that time, the co-financing that was to come from the UNDP Country Office and the Global Water Partnership – Southern Africa (GWP-SA) had passed its time. The co-financing was to cover the biennials of 2008 – 2009 and the late start meant that implementation coincided with the end of that period. It was of great assistance that Kalahari Conservation Society advanced the project funds during the first year.

Good scoping exercise was essential to focus the plan preparation at an early stage. Further data collection and analysis was necessary to select strategic areas and activities. The results were used for stakeholders to discuss strategic areas, objectives and activities. The analysis required a significant resource input from consultants and officials in various sectors to create ownership of the plan. Turnaround time for inputs should be flexible for further consultations, hence more time for plan development. The contents of the plan needs time to evolve, mature and gain agreement. Botswana took sixteen (16 months) and more time was needed at the end to reach a consensus with consultants and technical experts. However in comparison with experiences from elsewhere, 12 months seems the minimum. It

was also of great advantage to have the same consultant who undertook the scoping exercise to be part of the development of the IWRM plan as both parties had similar understanding of issues.

The analyses of IWRM-WE Plans of other countries and GWP-reports were very useful. Kenya, Zambia, Namibia and Israel were particularly useful. These plans gave a good idea about general plan requirements and options for plan development. However, the plans are quite different and as per GWP guidelines, each country should accommodate the development of its own plan outline and structure, based on its own unique situation in terms of water resources, demand and the policy environment. Botswana had three main advantages during its plan development process:

- Two national water master plans (1991 & 2006) with plenty of data and information;
- On-going water sector reforms that provided platform for extended consultations which should lead to a more integrated and efficient IWRM.
- Water accounts covering the period 1992 – 2003/4.
- Process and agreement to develop the Water Policy and review the Water Act, Borehole Act and the Water Works Act.
- Completion of the project: Towards effective involvement of Local Governments (LoGo) in Integrated Water Resources Management (IWRM) on the Limpopo river basin.
- On-going Regional Capacity Building and Knowledge Management activities through GWP/SA.

There was already momentum in the country influenced by the realisation that Botswana as a water scares country had to transform its water sector to meet its water demands. There was also an important realisation that the activities of the NWMP (2006) review were referenced by various stakeholders as having provided the first IWRM development experiences; hence IWRM had a precedence only the sequence of process and depth of stakeholder consultation differed.

The project is unique in that a PMU undertook demonstration projects on efficient Water Demand Management and ultimately replicate with national and regional institutions. The pilots were funded through co-financing from the Botswana Government and procurement was at times a challenge. Other challenges emanated from the need and understanding of the pilots by the recipient institutions and this delayed take-off and continuous monitoring.

The pilot's that were rehabilitated and had baseline data provided good information for analysis and documenting and assisted in meeting objectives of the IWRM-WE project. The lessons learnt from such pilots are distributed country-wide. Over 94 schools (primary and secondary) were visited during the implementation of the IWRM Demonstration phase. The schools visited were encouraged to start replication. Of the 27 schools that visited the demonstration projects, two have already commenced demonstrating rain-water harvesting. These are Marobela Vocational Training Centre and Mokubilo Primary School. There is a widespread perception that WDM measures need to be approached on a national scale as existing and recent pilots have demonstrated their importance.

School administration is not responsible for cost of services such as water and electricity. The incentive for conservation of water is therefore undermined although these institutions are major users of water. In most institutions such as schools, prisons and the police, the bill for services is normally paid by a separate entity. For schools, the water and electricity bills are paid for by the Ministry of Education (Regional Education Office) and for primary schools by the District Councils. As such the school administration do not have an appreciation of the amount of water they are using and cannot even explore ways in which these bills can be reduced. Even if they go the extra mile of engaging in water conservation initiatives, they are not given the money they are saving so that they can use it for the benefit of their schools. This has led to very poor accountability on the part of the school management when it comes to the usage of both electricity and water.

On the other hand schools that are owned by institutions such as churches get their grant from government and they are to use this grant to cover water, electricity, feeding and other developmental activities. Such schools therefore appreciate the benefits of reducing their water bills as this will help them have more money for other pressing needs within their schools. The system used in such schools helps the management to be more accountable for resource usage as well as being more receptive to water conservation initiatives.

There is therefore an urgent need to help the relevant ministries especially Ministry of Education and Skills Development to review and reform the school administration so that the policies and acts governing schools incentivise efficient water-use. The Ministry of Education and Skills Development and the Department of Building and Engineering Services (DBES) were engaged at Director-level and they fully subscribe to this change.

As efficient water-use is not institutionalised in schools, i.e. being part of job descriptions of specific staff positions or committees, frequent staff movements in the schools lead to lapses in water conservation as such efforts are usually dependent on the conviction of individuals who hold positions of responsibility in the school. Where there was a devoted teacher or school head, the demonstration projects proceeded well, but when the individual was transferred, the remaining officers distanced themselves from the initiative. This is attributed to the fact that the initiatives had not reached a point of being institutionalised into the school management. Lessons learnt from IWRM demonstration projects and from the development of the IWRM Plan are listed below.

- Assigning dedicated representatives from each institution to ensure continuity and facilitate progress proved useful. Changing representatives affected the efficiency of the TAG and made it difficult to build IWRM capacity.
- A small drafting committee representing the Steering Committee worked more effectively with the consultants.
- The IWRM-WE Plan development has to be coordinated between different project structures, as this has improved the turnaround time for consultations and writing-up needed to be balanced between the consultants and the flexibility to address issues and smoothly move as team.

- Scheduling the scoping exercise early in the planning process, preceding the analysis for the plan, consultations, and using the outputs to inform the write-up of the plan proved an essential sequence.
- International experiences and GWP material need to be used and adapted to IWRM-WE Plans of any country.
- Joint consultations with on-going water sector reform and relevant processes was important for cost saving and utilisation of standardised information. IWRM-WE planning gets more cost effective if coordinated with existing planning and reform processes.
- Demonstration projects should be developed at the beginning of the project for results to be demonstrable within the project lifespan for effective adoption and replication.
- Water demand management strategies should be practised at all levels (from individual, households, to institutions).

2.2.1 Plan implementation

During consultations people expressed worries that the IWRM-WE Plan will not be implemented soon. This is the fate of many plans and strategies in Botswana and DWA's involvement appears too limited to really push implementation. This is by design as many plans have lead to other stakeholders taking an observer role as the implementation was not spread across stakeholders but concentrated within the water department. It was made clear by various project structures that the MMEWR was the lead Ministry and various sectors have been identified to partake in the implementation of the plan. It was further recognised that the Plan should become a large part of the work programme of the new WRM organization that DWA will become under the water sector reform programme. It was suggested that DWA should prepare an implementation strategy prior to finalisation of the IWRM-WE Plan. The plan provides for activities that can be immediately implemented and this needs to be encouraged. The advantage being that the Steering Committee was well balanced in terms of representation and included even planning officers from the MFDP who should understand budgetary requirement of the plan across sectors. Implementation is expected to benefit from formal approval by Cabinet after being tabled by MMEWR. It was suggested by various sectors that the proposed Water Resources Board oversees and supervises the implementation of the plan.

The following lessons were learnt from the above process:

- During finalisation of the plan, the lead implementing agency needs to coordinate the implementation of the plan to ensure that all sectors identify their roles in the Plan.
- Consultations with large water-users such as Agricultural and Mining sectors were essential and beneficial to advise in the planning and implementation.

2.2.2 Project Organisation

The PMU was hosted by the KCS, an environmental NGO on the virtue of it hosting the Botswana Chapter of Global Water Partner (GWP) – a multidisciplinary forum on water. The PMU consisted of a Project Manager and Project Administrator plus a Technical Advisor from DWA. Regular one hour meetings (twice a month) were held between the PMU and CAR consultants to ensure progress and resolve project issues. The KCS CEO or Deputy CEO periodically attended these meetings to continue their backstopping role to the PMU. There were also scheduled meetings with the International Consultant to facilitate inputs into the plan and collaboration with the National Consultant which were limited to technical deliverables. This system worked reasonably well, and contributed to the plan being finalised on time.

In some instances, scheduled meetings were postponed as the PMU were engaged in other project activities that included regional and international conferences. The linkages between the planning process and other project activities helped to increase the stakeholder engagement. The results of the demonstration projects have been beneficial to the IWRM-WE Plan but would have been more useful to be produced in the middle of the project for further scrutiny and evaluations. The location of the PMU at KCS was meant to allow greater participation of the non-water sector institutions and it has worked extremely well. The Director of DWA chaired the Steering Committee and was deputised by DWA Deputy Directors as alternates. This indicated the commitment of the Department to the project and MMEWR should be appreciated for this decision. They went further to supply Information, Communication & Technology (ICT) equipment through their co-financing to the project staff on time before projects funds were channelled to KCS, including a project vehicle after project inception.

However the change of Technical Advisor three times compromised continuity with project stakeholders. However the Department acted swiftly on this as when the initial Advisor was promoted to be Deputy Director in the Department, the project was still reporting directly to her within the Departments structure. It is also evident that the changes were unavoidable as the project coincided with the Water Sector Reforms and there was a lot of movement within the MMEWR.

The lessons learnt are as follows:

- The housing of the project within an NGO was suitable for greater participation and access by all stakeholders. Although there were challenges with secondments, the Technical Advisor could still have been based at the NGO for on-the-spot planning and efficient decision-making;
- As an NGO, KCS through its systems of financial planning and budget management was able to pre-finance the project based on the goodwill and intensions of the project partners and their belief in the project. This is an important attribute to processes and projects of this nature;

- PMU staff should have considerable understanding in managing large projects with multiple stakeholders. Though IWRM experience is not crucial, understanding is essential to manage the process;
- The pilots provided a good lesson for WDM for the PMU to document and create awareness;
- Keep core staff for the entire project period for monitoring and knowledge management;
- His Excellency the President of the Republic of Botswana was briefed on the project concurrently through the line-Ministry and the Society. For example, the project featured in the national Presidential address in 2012 before its completion.

2.2.3 Role of Consultants

The role of the national consultant was to conduct a scoping exercise and facilitate the plan preparation with the PMU, reporting to the Steering Community through the TAG. The scoping exercise was undertaken in 2010 and a draft final plan circulated in December 2012. The international consultant commenced duties when the drafting of the plan had commenced but merge well with the drafting process. This merger of the two consultants also required that some of the stages had to be revisited for consensus building. Delays in procuring the International Consultant were mainly due to budget limitations.

There were greater benefits to the process when the national and the international consultants time schedules were synchronised in the latter stages of the plan as contributions were structured and on time to the satisfaction of both parties. The review log of all issues and contribution by all stakeholders as expressed by the consultants is also a good tool for monitoring the process and maintaining stakeholder's interest and confidence that their issues are accommodated. The formation of working group was also of great assistance to the consultants as it provided room for discussions and written contributions. This enhanced ownership of the plan and will hopefully extend to the implementation process.

The following lessons were learnt:

- Fully integrate the work of consultants (national and international) in the entire project work plan to enhance, delivery, continuity and integration of different project components;
- An (international) consultant needs to be involved during the entire project to bring in international experiences/ best practices / benchmarking.
- Develop guidelines for coordinating contributions and deliverables of the national and international consultants

2.2.4 Stakeholder Consultations

Inclusive participatory processes are important for IWRM planning. It is therefore important to identify all possible stakeholders at the initial stages of preparing the plan. This would also aid in building ownership of the plan once endorsed. Stakeholder consultations were held according to plan and some were conjunctively with those geared at the water policy development to avoid burn out. This was particularly the networks in Civil Society and Private sector as their issues were expected to be the same for these purposes. The project Technical Advisor role was also to link and encourage participation of Government the institution and this was a good approach as some Government Department responded quickly and with right level of participation when the invitation were directly signed at the Department of Water Affairs than the PMU. The Director of Water Affairs signed a number of invitations to facilitate stakeholder engagement. The consultations were also extended to other relevant water sector and relevant sectoral gatherings and this proved beneficial as it was the case with the Water Pitso, NDP 10 review committee for sustainable development and Parliamentary forums.

The following lessons were learnt:

- Stakeholder consultations are critical components of the IWRM-Plan development. However, they are not a goal on their own. The purposes are to ensure that knowledge of stakeholders are fully taking into account and benefit plan development;
- The ultimate plan should be supported and 'owned' by the main stakeholders to facilitate implementation;
- The results of consultations need to be documented and accounted for to maintain interest;
- Avoid burn out and join efforts with other national efforts for greater impact; and
- Involve the lead Ministry in invitations for greater and right level of participation

2.2.5 Communication, Awareness and Capacity Building

The project had a robust communication, awareness and capacity building component that targeted various stakeholders at local, national and regional/ international levels. A number of information products through memorabilia and visual aids were developed during the project implementation.

Three brochures and five Fact sheets were prepared on various thematic areas with a focus on IWRM and Water Efficiency and were disseminated to various stakeholders Internationally, Regionally and Nationally. During the project lifespan, every issue of the Kalahari Conservation Society (Host institution) newsletter included an article on IWRM-related issues and distributed widely. The project team further produced articles to newspapers and international journals mainly through

GWP-SA. Articles were produced for GWP-SA Water Cooperation newsletter for 2013, the UNESCO newsletter to mark the year of water cooperation.

The project also has a website linked to those of DWA, KCS, GWP-SA, UNDP and the Department of Environmental Affairs, amongst others. The project produced memorabilia which included waist coats, shirts, hats, pens and bookmarks with IWRM messages.

The project participated in a number of international events to present and give coverage to the project interventions and progress. The project participated in two SADC multi-stakeholder dialogue meetings; one in Maun, Botswana and another in Ezulwini, Swaziland. The project held a side-event at the 2012 World Water Week in Stockholm, Sweden seeking to highlight successes and challenges of implementing the project concurrently to a national Water Sector reform. The project also attended the GEF International Water's Conference in Dubrovnik, Croatia where the project had an exhibition booth and also shared experiences with other fresh-water projects sponsored by GEF.

Within the country, the project made presentations and exhibitions at the Annual Water Conference; the WUC organized Water Resources Management Conference, the Botswana Sanitation Conference and the annual national water week celebrations. The project manager also made a number of presentations to Radio Botswana *Tikatikwe Programme* on the benefits of IWRM Planning. The project also participated in transboundary initiatives such as the Limpopo farmers meetings between South Africa and Botswana which were geared towards addressing water resource management issues for stakeholders using the Limpopo River.

Building capacity of the various stakeholders on water issues was an important component of the project, originally planned to be implemented jointly with WaterNet. However by the time the project activities commenced, the specific phase of the Waternet capacity building activities have been completed. In response, the project together with the Department of Water Affairs sought the help of Swedish International Water Institute (SIWI) to support capacity building hence a three-year capacity building programme was developed. The programme started in 2012 and will end in 2014; co-financed by Swedish International Development Agency (SIDA), DWA, UNDP-sponsored Capacity Building Network (CapNet) and the IWRM-WE Project. A number of trainings on IWRM and related topics have been conducted since 2012 with participants from various government institutions, NGO's and parastatals.

The project also collaborated with the KCS Education Unit in awareness activities in schools in Botswana. These included Madiba Secondary School, Our Lady of the Desert, Motsumi Junior Secondary School, Gumare Junior Secondary School and Matshekge Hill Secondary School. The training focused primarily on water-use efficiency. The Project Technical Coordinator also carried out several awareness-raising road shows throughout the country covering schools in excess of 200. At a

regional level, the project supported the participation of the IWRM pilot schools at the annual Environmental Education Association of Southern Africa Conference (EEASA) in order for them to share experiences and lessons learnt in implementing IWRM-WE pilot projects. This appears to have attracted attention. Many schools (both primary and secondary) in Botswana have been inviting the project to present IWRM and water efficiency concepts at schools. The investment both in project exhibitions and financing selected schools to participate at the EEASA conference appears to have been an important catalyst.

Lessons learnt were as follows:

- Communication, awareness and capacity building are expensive interventions hence it is important to engage as many interested parties as possible in order to share the costs.
- Staff movements in government departments and NGO's means that the above interventions have to be done regularly and to a critical mass of staff within the respective organization, for continued support, ownership and sustainability.
- It is imperative for the programme to be proactive and dynamic and look beyond the partners outlined in the PRODOC so that the project can deliver beyond the original scope.

3 Situation Analysis of Water Resources and the Sector

The Botswana IWRM-WE plan is being developed at the time when most countries in Southern Africa have developed their IWRM plans and are at different stages of implementation with very different experiences. Therefore the Botswana plan was premised from these experiences to provide lessons learnt that have considered and interrogated these differences. The plan seeks to use these experiences to improve IWRM implementation in the country. In Botswana, implementation of IWRM has been happening albeit the absence of a plan. Botswana has, through regional sharing contributed to some earlier thinking in the application of IWRM principles.

Several factors impact on the availability and management of water resources in the SADC region and these include extreme climate variability and the impacts of climate change; population growth and migration (between and within countries); economic growth, unsustainable water and land use practices; degradation of watersheds; wetlands degradation and destruction; introduction of alien species, including alien water weeds and alien aquatic species; and increased water demands due to economic development. Groundwater abstraction for agriculture, mining and domestic purposes is contributing to a decline of aquifers. Water quality in the region is threatened by siltation due to deforestation, intensive irrigation, pollution from mines, cities and industries, including leaching from landfills, and poor sanitation facilities.

In response to these challenges, water reforms are being implemented in the region for effective water governance. Water reforms have progressed to in the different states with varying challenges and successes. Implementation of IWRM in all countries will be driven by development and political processes taking place in each country.

3.1 IWRM-WE Implementation Experiences in Southern Africa

At a regional level, SADC has embraced IWRM through the development of a SADC Vision of Water, Life and the Environment, the Regional Water Policy and Strategy implemented through the rolling 5-year Regional Strategic Action Plans (RSAPs-IWRM), The Regional Strategic Action Plans focus on key enabling, institutional, strategic and infrastructural dimensions of water resources management at the national and transboundary levels. At the regional level the SADC RSAP–IWRM is driving the implementation of IWRM and a lot of work has been done in creating institutions at the transboundary level to advice countries on sustainable management and development of water resources in shared watercourses. The SADC RSAP is also instrumental in driving infrastructural development for water supply, food security and energy security.

At the national level: The content of IWRM-WE plans developed have been found to vary quite considerably between countries. A trend can be seen in several countries of alignment between the water resources strategy/plan and the national development plans. Several national development plans make direct reference to water issues. The challenge appears to be translating such planning into implementation. The UN Water and AMCOW 2012 Status Report on WRM in Africa, which GWP helped to prepare, indicates that many countries have developed IWRM plans but only half of these have taken the actions necessary to implement

them. To this end GWP has undertaken to help these countries to implement their plans, emphasising local engagement and building capacity to put policies into practice. A review of IWRM implementation in selected countries in the region revealed the follow results.

3.1.1 IWRM in Lesotho

Lesotho developed an IWRM strategy in 2007 with three key strategies under it: the Water and Sanitation Policy, a Water Demand Management Strategy and a Drought Management Strategy. The development of the plan was preceded by the Lesotho IWRM Road Map exercise, the same process followed in Angola. The Lesotho Water Partnership was instrumental in engaging stakeholders in the IWRM strategy development process preceded. Lesotho also linked its implementation plan to the Water Sector Improvement Project funded by the World Bank to ensure prioritised actions are funded.

3.1.2 IWRM in Malawi

The IWRM-WE plan In Malawi is linked to the Malawi Growth and Development Strategy and the MDGs and though finalised in 2008 with a high level of stakeholder engagement. A number of the interventions highlighted in the IWRM-WE Plan have been integrated into the national budget indicating government's commitment to taking forward the IWRM process.

3.1.3 IWRM in Namibia

Namibia completed its plan in 2010 and its implementation has been supported by the country's planning processes, policy and legislation such as the Constitution, the Decentralisation Act and the National Development Plans. The plan has received the necessary ownership within the Government. It considers the overall vision of the country (Vision 2030) as well as the poverty reduction strategies. This indicates that a home-grown plan easily links with the national processes and as such its implementation can be infused into the various sectors.

3.1.4 IWRM in Zambia

The Zambia plan has been heralded for its transparent and participatory process since it commenced in 2002. The IWRM Planning Process was preceded by the Water Resources Action Plan process which led to the development of the Zambia Water Bill which was enacted in 2011. The IWRM plan had considerable political support and was adopted as the primary instrument for implementing the water related programmes of the Fifth National Development Plan which, together with the National Long-term Vision, sets out the development objectives and plans. The IWRM Plan in Zambia was also critical in the development of the 6th National Development Plan and mainstreaming climate change into water related activities. The Zambia IWRM Plan was a major input in the development of the World Bank's

Zambia Water Resources Development Strategy which has drawn in a considerable amount of funds for implementation.

3.1.5 IWRM in South Africa

The National Water Resources Strategy sets out how South Africa aims to achieve IWRM. Each Catchment Management Agency must develop a Catchment Management Strategy for its area, in line with the NWRS. The implementation of the NWRS in South Africa has been slow, however, a lot is being done on the ground in order to manage the scarce resource in a sustainable manner.

3.1.6 IWRM in Mozambique

Current institutional framework of the water sector in Mozambique was established in agreement with Law no. 16/91 of 3 August (Water Law of 1991) with the subsequent development of the National Water Policy of 1995 the National Water Policy (Resolution number 7/95) was substituted by the new Water Policy of 2007. The Water Policy of 2007 was a revision of the National Water Policy of 1995. A Water Resources Management Strategy was also developed through stakeholder engagement and guides the implementation of IWRM in Mozambique.

The Ministry of Public Works and Housing and the National Water Directorate are the entities responsible for the water sector, and as such, for water resources management and water supply and sanitation to urban and rural areas. Water resources planning, development and management falls under the auspices of National Water Directorate, who delegate some of the functional responsibility related to water resources management to five regional water authorities, each of which is made up of contiguous basins. Thus the regional water authorities, are responsible at 'catchment' level, are the smallest water management units, albeit with limited responsibilities and limited provision for stakeholder participation.

3.1.7 IWRM in Swaziland

The IWRM plan for Swaziland commenced in 2005 and coincided with the development of a Water Resources Master Plan as per the dictates of the Water Act. As it was the case with the development of the Botswana IWRM-WE plan, there were efforts to combine processes that were geared towards efficient management of water resources, i.e. the master plan and the IWRM plan.

3.1.8 IWRM in Zimbabwe

In Zimbabwe, a Water Resource Management Strategy was passed in 2000, and activities under the strategy are being implemented. There is some progress on each of them. The institutions have been established but are not financially sustainable

yet. In October 2012 the Zimbabwe Water Policy was developed – and this will provide a basis for the review of the Water Act.

3.2 Conclusions and Lessons from Southern Africa

Progress in the development of IWRM plans in Southern Africa is significant. However, implementation is lagging behind. This phenomenon is not confined to Southern Africa but most of the developing countries worldwide.

Learning from the experiences in the region - it is important to ensure that IWRM in integrated in development planning, as water is central to growth and development. Putting water at the centre of development will ensure countries invest in water security.

In Botswana where water is a scarce resource, there is need to ensure that issues of managing and developing the resource are mainstreamed into development planning processes. With the uncertainty posed by climate variability and climate change in Africa, it is important to ensure that investments are made water resources management in order to sustain growth and development in countries. For the Botswana plan to be implementable, it is critical to continue the links that facilitated the development of the project and create a role for them in implementation and or monitoring. The link will also continue the interest of the non-water sector people and understandably make water part of the broader development planning process. This could in turn encourage fundraising through the structures and sectoral budgets. As identified under the LoGo water project (2008) these areas can be elaborated as follows to successful in implementing an IWRM plan:

- **Financial planning** - realistic long-term planning of finances is key to implementation of your Action Plan. External funds may have to be raised and this will only be possible with credible planning. A systematic, transparent and participatory planning process, with a professional approach to implementation and management, will help convince investors, development banks, national or international donors, to make financial resources available.
- **Partnerships and pooling of local resources** - overcome budget constraints by creating win-win situations, especially in partnerships (e.g. tourism). Convince your partners to invest resources from their side - mobilising expertise, energy, and readiness for voluntary contributions of time and work from all sides will contribute to implementation.
- **Regular review of progress against indicators** – it is important to always keep objectives and targets in mind. Your approach must be flexible if it is clear things are going wrong, and timely adjustment of activities should be made to avoid wasting resources.
- **Communication** - keep the public informed about successes, but also remain prepared to communicate those things that don't work as expected. Transparency will increase the credibility of government and of the strategy. Creative communications will increase accessibility – organise events, open days and exhibitions to raise the profile of completed work.

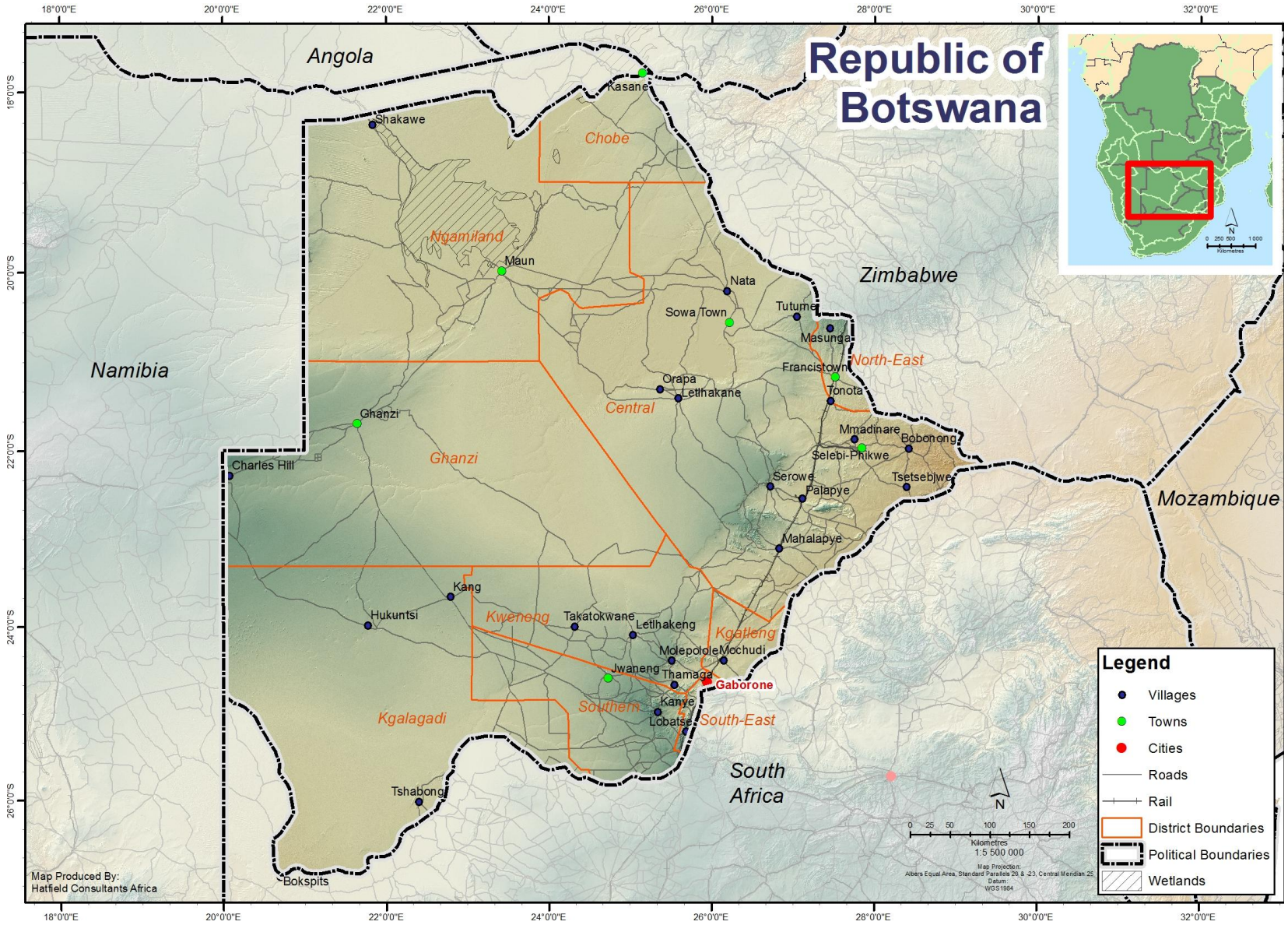
- **Monitoring and evaluation** - Monitoring and evaluation enables systematic learning from experience. Monitoring applies the previously defined indicators to observe and record the effects of measures taken and projects implemented. Monitoring consists of the systematic collection of specific data and other types of information. Monitoring has to take place on an on-going, regular basis, with aggregation and interpretation of results occurring in an evaluation process at defined intervals. Evaluation sets the results in the context of the agreed targets and objectives, and identifies whether management measures can lead to desired improvements. If this is not the case, recommendations for change must be formulated.

3.3 Botswana's socio-economic development

Botswana is located in the centre of Southern Africa; it is land locked and semi-arid. It shares borders to the south and east with South Africa, to the north-east with Zimbabwe, and to the west and north with Namibia and in the top north with Zambia (see Map 1 below). The

Map 1: Location of Botswana in southern Africa.

country covers approximately 581 730 km^2between latitudes 18^o S and 27^{o}S and longitudes 20^o E and 29^o E. The country is generally flat with an average altitude of 1,000 metres (ranging from 600 m and 1,490 m). As a result, there are few suitable dam sites and most dams are shallow, and have high evaporation losses. The lowest parts of the country are the Okavango Delta in the northwest, the Makgadikgadi wetlands and the area between the Shashe and the Limpopo Rivers in the north east.



Map 2: Cities, towns and major villages in Botswana.

3.4 Demography

According to the 2011 Population and Housing Census, the total population is 2,024,904 compared with 1.7 million in 2001. The population has grown faster than the forecast 1.8 million for 2011 which was based on the 2001 census data (CSO, 2005). Population projections for the period 2016 – 2031 are shown in Figure 3 below. As with the 2011 forecast, the figures are likely to be underestimates as the impacts of various development programmes on health, nutrition and education impact positively on fertility and life expectancy rates. The country's population could be at least 2.5 million in 2031. The average population density is 3.5 person/km^2.

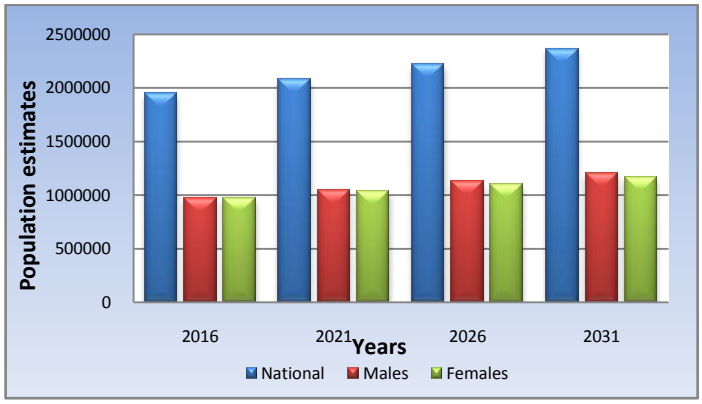


Figure 3: Population estimates for Botswana for the period 2016 – 2031 (CSO, 2005).

The population is growing fastest near Gaborone in south eastern Botswana. This is reflected in rapid growth in Gaborone itself (22%) and the spill over into surrounding villages (e.g. Mogoditshane, Tlokweng, Gabane, Ramotswa Metsimotlhabe and as far as Molepolole). As a result, population growth is fastest in South East District (53%), followed by Kweneng East (35%) and Ngwaketse West (31%) (see Figure 3 above and Table 4 below). In rural areas, district capitals and generally large villages (primary and secondary centres) with better services and amenities grow more quickly than the smaller villages (tertiary centres and lower). The rapid growth in south eastern Botswana puts considerable pressure on water service providers to meet the growing demand.

3.5 Economic Growth and Structure

Botswana has grown rapidly since its Independence in 1966, and as a result, the country became a middle-income country. However, current annual per capita growth rates are modest at 3 to 5%. Rapid growth was mostly facilitated by diamond abstraction and wise use of its revenues (i.e. reinvestment in other forms of capital). Diamond revenues have been used to build infrastructure, including dams, well fields, roads, communication networks, electricity infrastructure, and to provide health care, education and training for Batswana. In other words, Botswana has reinvested mineral revenues in human, financial and physical capital, leading to a positive net-adjusted net savings index (ANSI; World Bank, 2011). This index indicates that economic development is likely to be sustainable. The public sector is the second largest sector of the economy and is the largest employer. Tourism is a growing sector and has become a significant contributor towards the national GDP. Other important sectors include trade, transport and communications, as well as finance and business services. The changes in the structure of GDP over the years are depicted in Table 5, page 39. The contribution of the agricultural sector declined from 42.7% to 2.4% in 1966 and 2011 respectively while the mining sector showed a growth from zero in 1966 to 32% in 2011. While tourism and government have gained ground,

most of the other sectors have lost importance. The manufacturing sector is small, and has lost importance in terms of value added. Economic diversification is therefore a major priority for development planning.

3.6 Unemployment and poverty

Despite the economic growth, unemployment remains high due to a modest growth in formal employment and a rapid increase in the labour force. In 2010, there were around 330 000 formal sector jobs, and a further 250 000 people employed in the informal sector and traditional agriculture, out of a labour force estimated at 710 000 (CAR and Econsult, 2012). The unemployment rate is currently estimated at 17.8% (2009/10 Botswana Core Welfare Indicators survey). Job creation, particularly in the formal sector, is lower than the economic growth rate. Unemployment is exacerbated by the stagnant agricultural sector, which has adversely affected rural development and rural poverty. However, the poverty rate has fallen significantly from 31% in 2002/3 to 21% in 2009 (BCWI survey). In tackling poverty, government has undertaken a number of initiatives such as: the Revised National Policy on Rural Development (2002), National Poverty Reduction Strategy in 2003, the 2007 Community-Based Natural Resources Management Policy, Citizen Entrepreneurship Development Agency, provision of subsidies in the agricultural sector, Poverty Environment Initiative, back yard gardens and alternative packages, and a range of social welfare programmes (e.g. *Ipelegeng*[2], pension scheme, orphan and destitute support).

Table 4: Population census estimates of cities, towns and population census regions in Botswana for years 2001 and 2011 (CSO, 2011).

Settlement	2001	2011
Cities & Towns		
Gaborone	186 007	227 333
Francistown	83 023	100 079
Lobatse	29 689	29 032
Selibe Phikwe	49 849	49 724
Orapa	9 151	9 544
Jwaneng	15 179	18 063
Sowa	2 879	3 599
Total cities & towns	***375 777***	***437 374***
Villages & rural areas		
Kanye-Moshupa	113 704	129 462
Barolong	47 477	55 103
Ngawketse West	10 471	13 697
South East	60 623	92 843
Kweneng East	189 773	256 833
Kweneng West	40 562	47 841
Kgatleng	73 507	92 247
Central - Serowe/Palapye	153 035	188 174
Central – Mahalapye	109 811	117 492
Central – Bobonong	66 964	70 806
Central – Boteti	48 057	56 209
Central Tutume	123 514	144 895
North East	49 399	59 829
Ngamiland East	75 070	96 356
Ngamiland West	49 642	61 748
Chobe	18 258	23 449
Ghanzi	33 170	43 370
Kgalagadi South	25 938	30 016
Kgalagadi North	16 111	20 484
Total villages & rural areas	***1 305 086***	***1 600 854***
Total Botswana	**1 680 863**	**2 038 228**

Source: 2011 Population & Housing Census, preliminary results brief.

[2] Ipelegeng is a labour-intensive programme aimed at including non-skilled citizens in the mainstream economy by offering labour-intensive employment in government.

3.7 Botswana and the MDGs

The country is committed towards meeting the MDGs and according to GoB and UNDP (2010), substantial progress towards achieving the goals has been made is areas such as poverty reduction and health. The country continues to sustain its traditional focus on key MDGs such as education, health, water and sanitation and Human Immune-deficiency Virus/Acquired Immune-Deficiency Syndrome (HIV/AIDS) control. As far as the seventh[3] MDG is concerned, 97% of the population has access to safe drinking water and this is somewhat higher than the average (93%) for upper middle-income countries and well above the figure for Sub-Saharan Africa. A lower proportion (79.8%) has access to improved sanitation (GoB and UNDP, 2010). In general, access to water and sanitation is lower in rural areas than in urban areas. The Botswana MDG Status Report 2010 (GoB and UNDP, 2010) points at achievements in poverty reduction, nutritional status of children, almost universal primary education, gender parity in primary and secondary schools, increased gender parity in senior management of public and private sector, various health improvements and improved communication (especially mobile phones) and internet/ computer use.

Table 5: Share of GDP by economic activity for selected years from 1966 to 2011 in Botswana.

Economic sector	1966	1985/86	2008/09	2011
Agriculture	42.7	5.6	1.9	2.4
Mining & quarrying	-	48.9	31.9	32.3
Manufacturing	5.7	3.9	4.1	4
Water & electricity	0.6	2	2.4	2.8
Construction	7.8	4.6	5.2	5.7
Trade, hotels & restaurants	9	6.3	11.1	12.6
Transport	4.3	2.5	4.3	4.4
Banks, insurance & business services	20.1	6.4	12.8	10.9
General government	9.8	12.8	17.6	16.1
Social & personal services	-	2.5	4.4	4.1
Adjustment items	-	4.4	4.4	4.9
GDP	100	100	100	100
Sources: CAR and Econsult, 2012.				

3.8 Water Resources and their Potential

From an IWRM perspective, the development of the water sector needs to be understood within the broader socio-economic and environmental context. In the absence of a national water-balance study, the World Bank (2010a) lists the following key indicators for Botswana's water resources and sector:

Sustainable yields of aquifers: 96Mm^3/annum
Current sustainable yields of storage dams: 73.2Mm^3/annum
Additional sustainable yields of dams under construction: 72.7Mm^3/annum
Sustainable yield per capita/day: 216Litres/person/day
Planned sustainable yield per capita/day: 415Litres/person/day
Potential sustainable yields from shared water courses: 550 – 1750Mm^3/annum

[3]Ensure environmental sustainability

The above indicators show that the current sustainable yields from aquifers and dams (169.2 Mm^3) are less than the estimated annual water demand of around 200 $Mm^3$and therefore the additional safe yields from new dams (72.7 Mm^3) are much needed. In future, Botswana needs to increase its water use efficiency as well as negotiate use of shared water courses with neighbouring countries. Below, more details are provided about the environmental context of the sector.

3.8.1 Climate, drainage and catchment areas

The hydrology of Botswana is shaped by the following climatic factors (DEA & CAR, 2006):

- **Low rainfall**. Botswana experiences generally low rainfall (see Map 3 below). The mean annual rainfall varies from a maximum of over 650mm in the north-eastern area of Chobe District to a minimum of less than 250mm in the extreme south-western part of Kgalagadi District;
- **High rainfall intensities.** Even though Botswana is classified as a semi-arid to arid country, it experiences very high intensity rainfalls;
- **Rainfall seasonality.** Rainfall is concentrated in the period October- April and as a result, most rivers are seasonal or ephemeral;
- **High temporal variability of rainfall.** Rainfall in Botswana is highly variable overtime. This temporal variability of rainfall is mirrored in the time distribution of run-off and river flow. Generally, variability is higher where rainfall is lower. Climate change is expected to increase variability; and
- **High spatial variability of rainfall.** There is high variation of rainfall from one area to another. Even over the same catchment area, rainfall can vary highly from one part to another.

Botswana can be divided into six drainage basins or catchments, five of which are shared with neighbouring countries (DEA & CAR, 2006). These are listed in Table 7 below, and described as follows:

The Molopo/Nossop River forms the southern border between Botswana and South Africa. The river drains in a generally westerly direction, and ends up in Orange River. Due to the low rainfall in the basin the river has negligible flows for most of the time (it is not gauged);

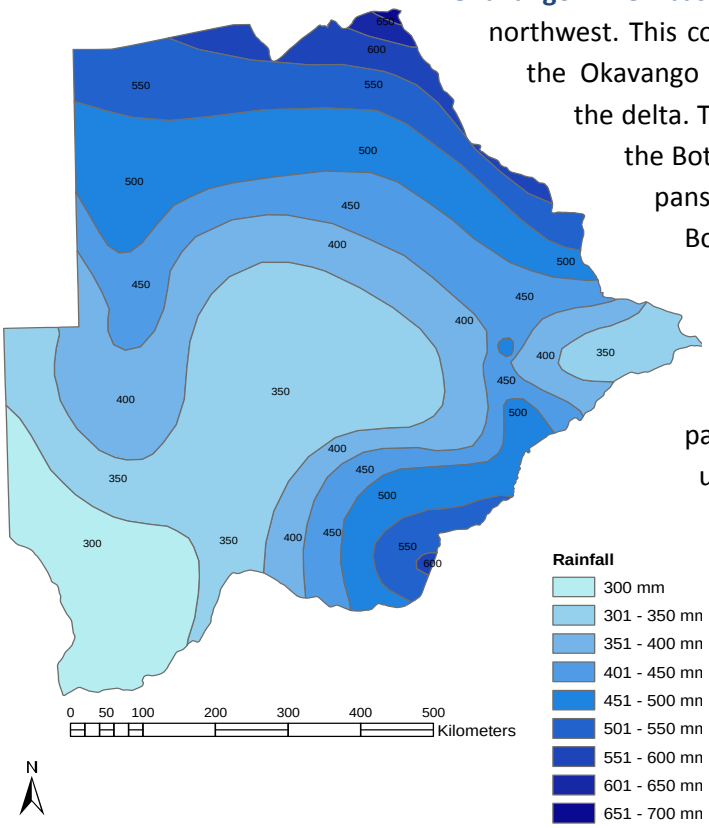
Limpopo River basin in the eastern part of the country. The Limpopo River forms the eastern border between Botswana and South Africa. Most rivers in eastern Botswana drain into the Limpopo River, including the Notwane, the Bonwapitse, the Mahalapye, the Lotsane, the Motloutse and the Shashe Rivers. Most dams are found in this basin, which constitutes a drainage area of some 80 000km^2.

Makgadikgadi drainage basin to the west of the Limpopo basin. On the eastern side of the pans, the Mosope, Mosetse and the Nata Rivers all drain into the Makgadikgadi pans. The Boteti River feeds the western side of the wetland, which is part of the Okavango

wetland system. The Nata River is the largest of the rivers draining into the Makgadikgadi pans. It drains a total area of 21,216 km^2, most of it is located in Zimbabwe.

Kwando/Linyanti/Chobe Rivers in the north of the country. The Kwando originates in Angola and enters Botswana through the Caprivi Strip in Namibia. In Botswana, it spreads out into the Linyanti swamps, which drains into the Savuti and Linyanti Rivers, eventually reaching the Chobe River, which attracts large numbers of wildlife and tourists.

Okavango River basin and Delta system in the northwest. This comprises the Okavango River, the Okavango Delta, and the outlets from the delta. The system also extends down the Boteti River to the Makgadikgadi pans. The delta is one of Botswana's major tourist attractions.



Map 3: Rainfall map of Botswana showing average annual rainfall (in mm) (DEA & CAR, 2006).

Internal drainage system:. The remaining part of the country is the uncoordinated internal drainage system. All runoff is lost through evaporation and seepage. In the central Kgalagadi, there are some fossil river channels, which run in an easterly direction. These rarely ever carry any significant runoff.

3.8.2 Surface Water

Botswana surface water resources are restricted to ephemeral and perennial rivers and water stored in reservoirs. The perennial rivers (Limpopo[4], Chobe, Zambezi and Okavango) are shared watercourses, and their management and use are subject to the SADC Protocol on Shared Water courses. Botswana's surface water resources are limited and unevenly distributed over the country. Most sources are in northern Botswana, while most people live in south eastern Botswana in and around Gaborone. The average annual run-off is 1.2mm, ranging from zero in western and central Botswana to over 50 mm per annum in the north. The average annual run-off implies a total annual run-off of 696Mm^3. Most of the run-off cannot be captured due to the lack of suitable dam sites, high

[4]This river is no longer perennial.

variability of run-off in time as well as high evaporation. An outlook of Botsana's rivers is depicted in Map 4 on page 44.

Botswana has around 100 reservoirs; most of them are small and primarily used for agriculture. The Ministry of Agriculture has listed 92 dams of small to medium size, mostly for livestock use. The safe yields are unknown and water storage is not monitored (SMEC and EHES., vol.3, 2006). Agricultural dams are generally poorly managed and their productivity is very low (for livestock or irrigation). The Water Utilities Corporation (WUC) operates six large reservoirs[5], accounting for well over 90% of the total storage capacity (Gaborone, Nnywane, Bokaa, Shashe, Letsibogo and Ntimbale dam). Their capacity and safe yields are shown in Table 6. The safe yields are estimated at a mere 20% of the total dam capacity and amount to less than half of the annual water consumption. The sustainable yields of dams are low as compared to their capacity due to erratic river flows, high rates of evaporation (28.5% higher than the sustainable yields) and limited dam site suitability. Once the Dikgatlhong, Lotsane and Thune dams in eastern Botswana are fully operational, the safe yield would double (SMEC and EHES, 2006). These dams are considered to be the last suitable dam sites. In addition to domestic dams, Botswana has an annual water quota of 7.3Mm^3 from the Molatedi Dam in South Africa (reduced when the dam level is low).

Table 7: Main drainage basin in Botswana, their size and location.

Drainage Basin	Region	Area (km^2)
Limpopo	East	80 000
Makgadikgadi	North	30 000
Okavango	North-West	97 000
Kwando/Linyanti/Chobe	North	26 000
Molopo/Nossop	South	71 000
Uncoordinated (internal)	Central	259 000

Source: Department of Surveys and Mapping, 2001.

Table 6: Botswana's major dams

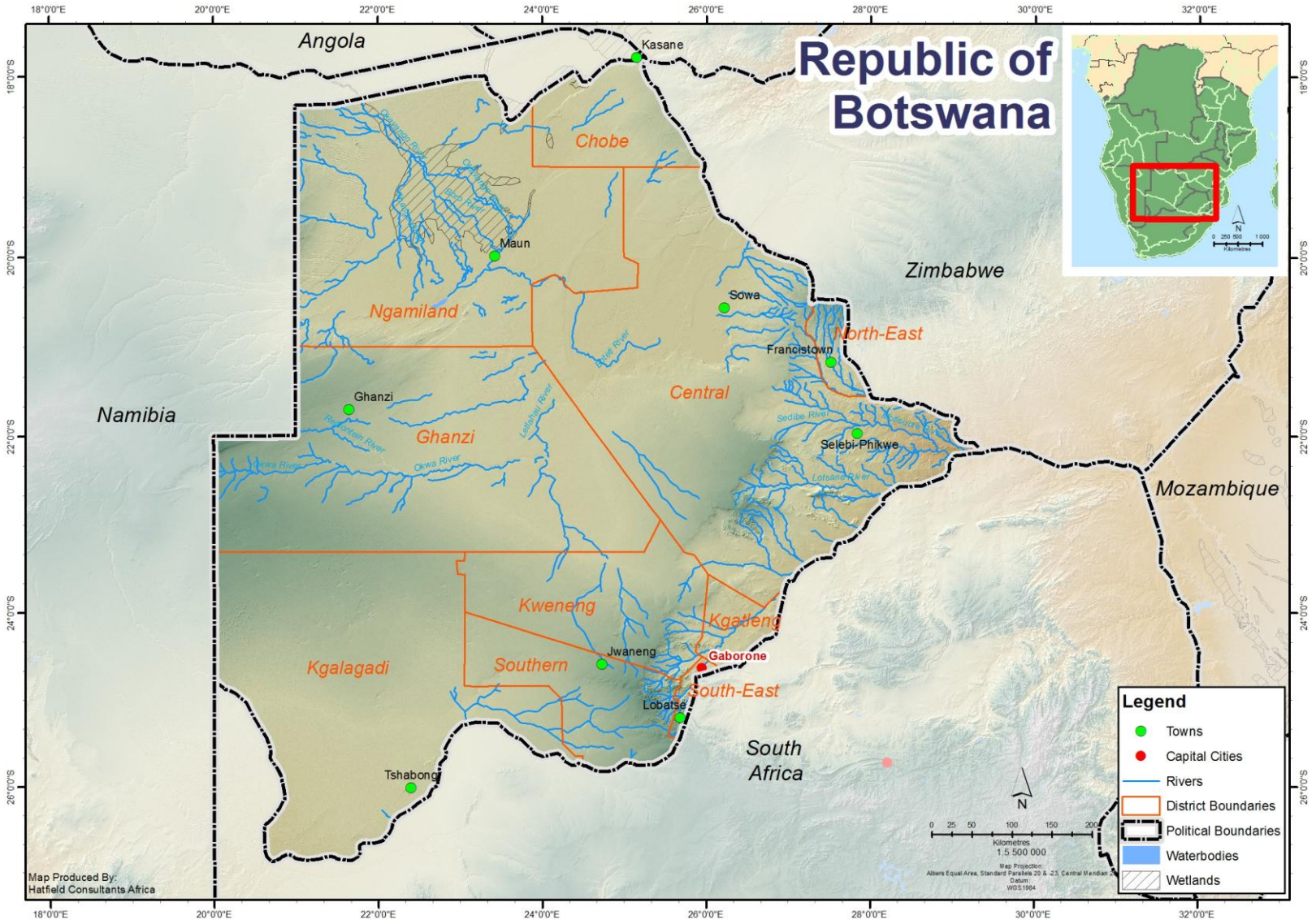
Dam	Catchment area (Km^2)	Capacity Mm3	Evaporation (Mm3/yr)	Hydro. sustainable yields (Mm3)	Sustainable Yields (Mm3)	Mean annual runoff (Mm^3)
Gaborone	4 300	144.2	38	7	10	31
Letsibogo	5 690	104	35	16	20	57
Nnywane	238	2.3	3.2	0.3	0.3	1.9
Bokaa	3 570	18.5	13	0.1	1.1	9
Shashe	3 630	85.3	36	22	40	84
Ntimbale		26.5	6	…	2.9	…
Total		380.8		45.3	73.2	173.9

Sources: SMEC and EHES, 1991, WUC annual reports (in DEA and CAR, 2006); Stephenson, 2006; DWA and WUC data.

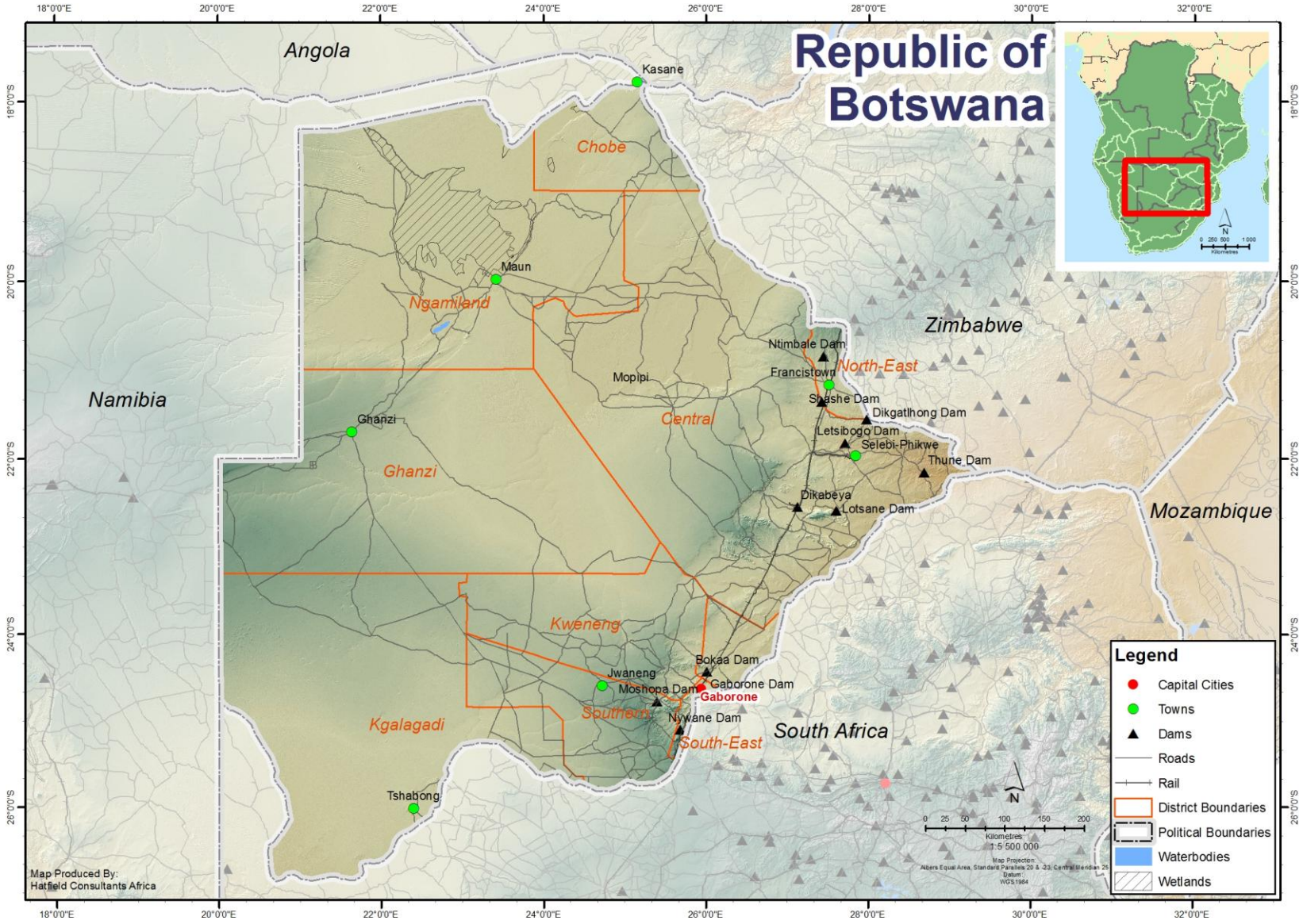
No significant amounts of water are abstracted from the Okavango and Chobe Rivers due to the low population density in the areas, and minimal irrigation demands. It is also interesting to note that Debswana has constructed a storm water dam in Orapa to augment the mine's water supply.

[5]Three additional dams are under construction: Dikgatlhong (capacity: 398 Mm^3; safe yield of 62 Mm^3) ,Lotsane (capacity: 42 Mm^3; safe yield of 6.5 Mm^3) and Thune (capacity 90 Mm^3; safe yield of 4.2 Mm^3). The evaporation/ sustainable yield ratio of these dams is more favourable than that of existing dams. The disadvantage is the required long distance water transfer.

DWA carried out a survey of potential small to medium dam sites. Thirty four sites emerged as having some potential and a preliminary design was done for 12 of those. Only the Mosetse dam had a more than local water supply potential (capacity of 31.7Mm^3 and estimated yield of 7.9Mm^3 p.a.; SMEC and EHES, vol.3, 2006). The 2006 NWMPR concludes that potential water use from the Okavango should be restricted to villages in the panhandle. While the Nata River has some potential for abstraction (of about 52.5Mm^3), the main source of future surface water is the Chobe-Zambezi (550 - 1,700Mm^3 p.a.). Abstraction would be subject to the SADC protocol on Shared Water Courses and negotiations through ZAMCOM. Botswana has requested permission for annual abstraction of 500Mm^3 from the Chobe River for long term augmentation of water supply in eastern Botswana and agricultural projects north of Pandamatenga. Locations of major dams in Botswana is shown in Map 5, page 45.



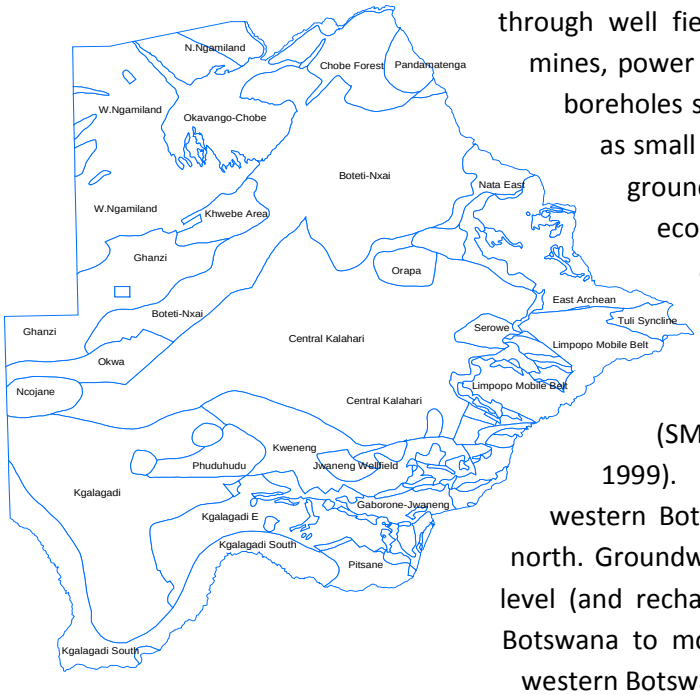
Map 4: Botswana's main rivers.



Map 5: Botswana's major dams.

3.8.3 Groundwater Resources

In the past, Botswana relied mostly on groundwater resources. However, groundwater resources are limited in quantity and quality, and the limited resources are unevenly distributed over the country. As shown in Map 6 below, most of the well-fields are located in the eastern and north eastern part of the country.



Map 6: Major well-fields in Botswana.

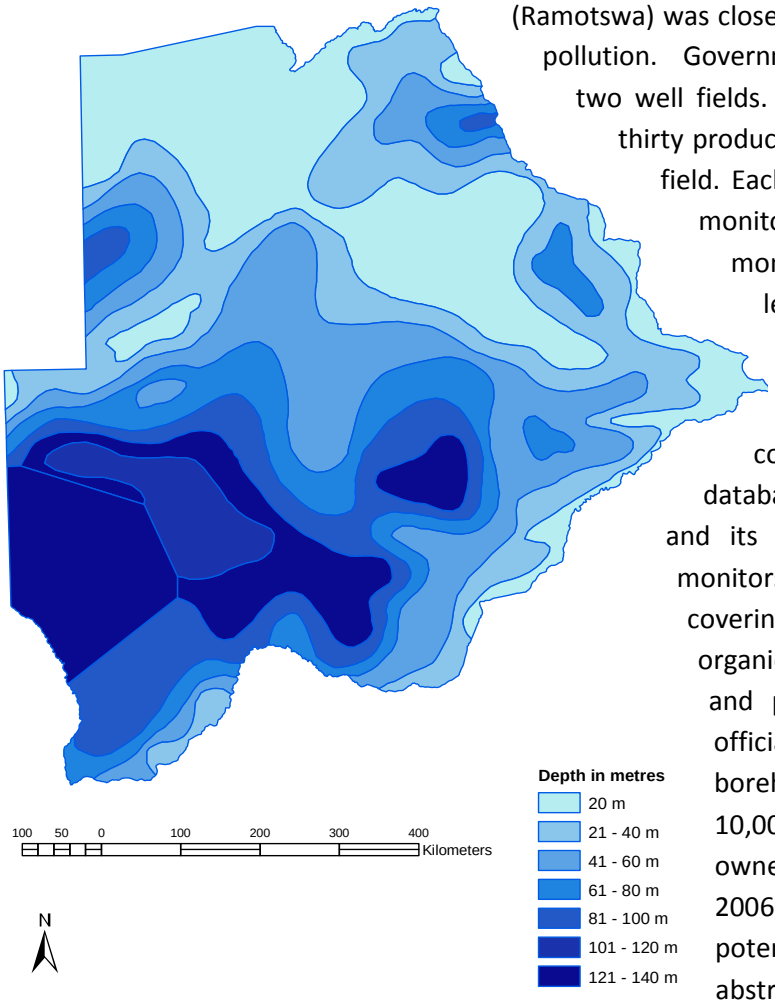
Source: Department of Surveys and Mapping, 2001.

Groundwater collects in aquifers, and is abstracted through well fields, mostly for use in villages, mines, power plants, and irrigation; individual boreholes serve the livestock sector as well as small villages. Only a small part of the groundwater resources can be economically abstracted due to high abstraction costs, low yields, poor water quality, and remoteness of aquifers in relation to consumer centres (SMEC *et. al.*, 1991, Masedi *et. al.*, 1999). Recharge is virtually zero in western Botswana, rising to 40 mm. in the north. Groundwater depth is related to rainfall level (and recharge): around 20 m in northern Botswana to more than 100 m deep in south western Botswana (see Map 7, page 47).

Botswana's total groundwater resources are estimated at around 100 billion m^3 with an average annual recharge at 1 600 Mm^3/a (Dep. of Surveys and Mapping, 2001 and SMEC *et. al.*, 1991). The 2006 NWMPR estimates a (much lower) total sustainable yield of 96 Mm^3/annum from developed and potential wellfields/aquifers. These different figures illustrate that further work is needed on groundwater exploration and development to assess the sustainable amount of groundwater that can be used. Several well fields (Dukwi, Serowe, Kanye, Ghanzi and Tsabong) are already being mined[6] (or will soon be).

[6]Groundwater is mined when groundwater abstraction occurs at a faster rate than the annual aquifer recharge rate (SMEC, *et. al.*, 2006.

In 2003, Botswana had thirty well fields[7], and another thirteen have been proposed. Out of the thirty existing well fields, twenty-seven were operational, two were rested (Palla Road and Mochudi), and one well field (Ramotswa) was closed in 1995 due to water pollution. Government operates twenty-two well fields. On average, there are thirty production boreholes per well field. Each well-field has several monitoring boreholes to monitor the yields, water levels and quality of well-field.



Map 7: Average depth of groundwater (metres below surface).

DWA has a computerized well-field database named WELLMON and its water quality division monitors the water quality, covering elements such as organic pollution, NO_3, TDS and pH. There are 25,000 officially registered boreholes of which over 10,000 are government-owned (SMEC and EHES, 2006). Several aquifers offer potential for future abstraction. Some of these, such as Kalahari aquifer (near Gweta) and the Ntane sandstone aquifer (near Bobonong) are underutilised. Other aquifers still need to be studied in more detail to assess their sustainable yields (SMEC *et. al.*, vol.4, 2006). Sand rivers in eastern Botswana could become another water source in future, particularly for local uses, with annual sustainable yields of 2.5 to 55Mm^3/km of sand river).Saline groundwater is common in western and northern Botswana, limiting its use opportunities or necessitating desalination in the Kgalagadi district and parts of Boteti sub-district.

3.8.4 Shared Water Resources

Most of Botswana's surface water resources are shared with neighbouring countries. Some of the aquifers also transcend Botswana's boundaries. The 2006 NWMPR argues that in future use of shared water resources is inevitable, especially those of the Chobe/

[7]Jwaneng, Kanye and Orapa are each treated as one well-field.

Zambezi River (some 0.5 to 1.7 billion m^3). A large water transfer scheme from the Okavango Delta is not recommended (SMEC and EHES, 2006). Modest abstraction from the Nata River (52.5 Mm^3) is considered a future option. The Limpopo is currently mostly used by South Africa. Botswana receives water from Molatedi Dam (up to 7.9Mm^3 per annum), but the amount is under revision based on recent dam yield figures. Botswana is also part of the Orange Senqu River Basin Commission (ORASECOM) and entitled to apply for water withdrawals. Current water allocations from shared rivers amount to 500 Mm^3 from the Chobe Zambezi and the water transfer from Molatedi Dam (5 – 7Mm^3 per annum). No formal water allocations have as yet been agreed upon by any of the four RBOs in which Botswana is a member. The relevant policy and legislative environment for shared water resource use and management is further discussed in Chapter 4.

3.8.5 Wastewater Resources

According to the 2003 National Master Plan for Wastewater and Sanitation (NMPWWS; SMEC *et.al*. 2003), Botswana had 64 wastewater treatment works (WWTWs) in 2003 with a total treatment capacity of 90,974m^3per day or 33.2 Mm^3/annum. Urban centres (Gaborone, Francistown, Lobatse, Jwaneng and Selebi Phikwe) account for over 80% of the inflows at the treatment plants. Total inflow increased from an estimated 14.8 Mm^3in 1990 to 29.2 Mm^3 in 2003. While the pond system is still most common, other technologies have been used with a higher outflow-inflow ratio[8]. The planned expansion of sewerage and sanitation infrastructure will lead to a rapid increase in the availability of treated wastewater (TWW). The NMPWWS estimates that over 73 Mm^3 of TWW will be available in 2030 (SMEC *et.al*. 2003).

Table 8: Water use by economic sector (Mm^3/a)

User category	1992	1996	2000	2003
Agriculture	72.9	70.6	76.0	63.4
Mining	12.8	14.4	24.1	26.8
Manufacturing	3.9	2.1	4.0	5.1
Water + electricity	0.0	0.8	0.5	0.7
Construction	0.0	0.4	0.4	0.4
Trade	0.2	0.7	1.0	1.2
Hotels and restaurants	0.2	0.5	0.8	0.8
Transport + communication	0.0	0.2	0.2	0.3
Insurance, banking, business	0.0	0.5	0.7	0.8
Social and personal services	0	1.2	1.7	2.4
Government	8.7	8.8	11.1	11.5
Household use	36.1	41.1	48.1	56.9
WUC private sector	7.7	0.0	0.0	0.0
Grand total	140.3	141.3	168.6	170.3

Source: DEA & CAR, 2006.

3.9 Water Demand

National water demand has been estimated in the 1991 NWMP (SMEC *et.al*., 1991) and its 2006 Review (NWMPR; SMEC and EHES, 2006), and in the Botswana Water Accounts (DEA and CAR, 2006). The Botswana Water Accounts recorded water consumption by sector (agriculture, mining, manufacturing, service sector, government and domestic use), institution (water service providers DWA, WUC and DCs as well as self providers such as mines and livestock owners), and by source (ground, surface and wastewater) for the period 1990-2003. These are summarized in Table 8. The accounts have not been up-dated since

[8]Under the pond system, the outflow is around 50% of the inflow due to high evaporation. Outflow can exceed 90% of inflow with technologies such as trickling filter and activated sludge treatment. This economic benefit is not yet used.

2006. According to the Water Accounts, annual water consumption increased from 140Mm^3 in 1990 to 170Mm^3 in 2003, and is now estimated to be around 200Mm^3. Self-providers (mostly mines and borehole owners) supply most water (86Mm^3), followed by WUC (50Mm^3), District Councils (22Mm^3) and DWA (12Mm^3). WUC will be the sole water service provider by 2014.

The use of surface water is growing faster than that of groundwater due to the construction of new dams and the NSC; however, groundwater still accounts for 56% of the total water use. Wastewater is hardly used (3Mm^3) even though its supply (29Mm^3 in 2003) has grown faster than overall water demand. Another major advantage of wastewater is its proximity to demand centres, reducing the need for long distance water transfer schemes. Most wastewater is available in south eastern Botswana where water shortage is most acute.

In terms of economic sectors (see Table 8 above), agriculture is the largest water user (63Mm^3), followed by domestic use/households (57Mm^3), mining (27Mm^3) and government (12Mm^3). Water use of the mining sector, government and households is growing rapidly while that of agriculture is stagnant. Water consumption of the mining sector more than doubled in the period 1992 – 2003. Based on the WA and an assumed annual increase of 2%, current water demand is estimated to be around 200 Mm^3/a

The NWMPR (SMEC and EHES, 2006) observed that water demand forecasts from the 1991 NWMP were too high due to lower population growth and the impacts of HIV-AIDs. This made it possible to postpone some of the recommended infrastructure (e.g. doubling of the NSC and dam construction). The NWMPR forecasts are based on revised population forecasts and estimates for irrigation and livestock demands. However, the NWMPR neglects the (growing) demand from the mining sector.

Several institutions have been involved in water supply in the past. The principal suppliers are WUC, DWA, District Councils and self-providers (mostly mines and livestock farmers). Under the Water Sector Reforms, WUC will assume all water supply responsibilities of DWA and DCs. Below, the performance of WUC and DWA are briefly summarized. DWA and WUC supplied the data for the analysis. In addition, it is noted that the Ministry of Agriculture is developing small earth dams and wells for water supply to agriculture (livestock and irrigation).

3.10 Access to Water and Level of Water Consumption

Access to potable water has improved in time due to an increase in the number of individual connections in urban and rural areas. In 2001, 150 connections existed per 1000 people and this figure increased to an estimated 175 connections/1000 people in 2011. The difference between urban areas and large rural villages are small. However, differences in per capita domestic water consumption are large between urban areas and large villages. In 2001, per capita domestic water use in rural areas was 21.6 L/d compared to 176 L/d in urban areas. Around 2010, both figures had declined but the difference remained significant (7.1 L/d and 120 L/d resp.[9]).

[9]The cause of this decline needs further investigation with DWA and WUC.

3.10.1 Water Utilities Corporation

The analysis refers to the period 2002-2010, when Water Utilities Corporation (WUC) was primarily responsible for urban water supply. Water supplies were all surface water, sourced mostly domestically (92.2%) and a small portion from Molatedi dam in South Africa (7.7% or 4.6Mm^3 on average). Water availability (production and imports) has never exceeded 70 Mm^3 and, as shown in Figure 4 below, has not grown over the last decade. Annual water production varied between 47.8 and 62.5Mm^3 with an average of 54.6Mm^3. WUC produces mostly treated water; a small amount of raw water (0.1%) is produced, for example, for the copper nickel mine in Selebi-Phikwe and to Lobatse in 2002-2004.

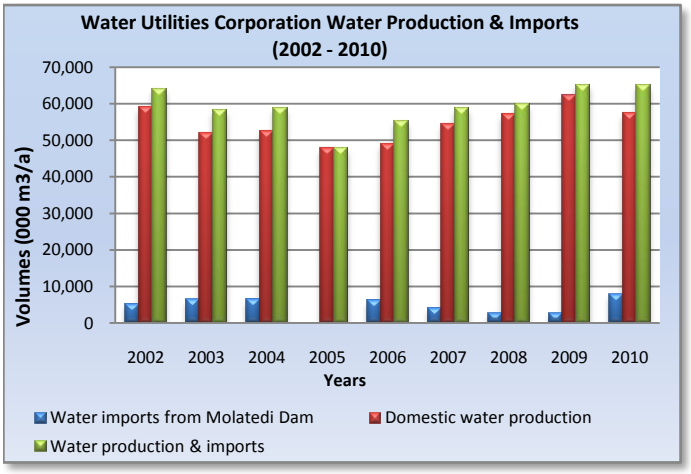


Figure 4: Water Utilities Corporation water production and imports from 2002 to 2012 [Source: based on WUC Data].

Figure 5 shows that the annual consumption (i.e. sales) is lower than the production with an average annual consumption for the period of 46.8 Mm^3 (compared to an average water availability of 59.2 Mm^3) and a range of 41.4 and 53.0 Mm^3. The losses (production – sales) are on average 14.3 % (6.2 % for raw water) with a range of 13.3% to 15.0%. These losses are lower than the widely used WUC figure of 22%10. The number of WUC connections has increased from 53,677 in 2000 to 96,459 in 2009 (i.e. the first year where WUC had more water connections than DWA).

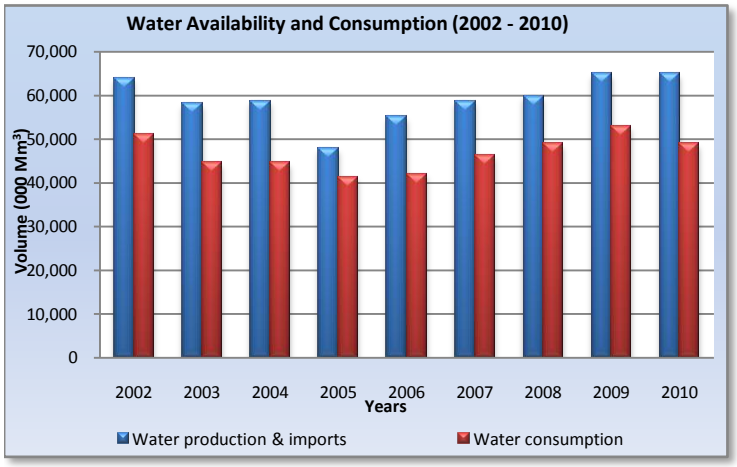


Figure 5: Trend in Botswana's water availability and water consumption during 2002 to 2010 [Source: based on WUC data].

[10] This may be due to different definition or use of different data base. The true losses need to be assessed and analysed in more detail.

An analysis of the main users (Figure 6) shows that government is the largest WUC client (38% in period 2002-2010) followed by domestic users (35.3%) and the business sector (26.7%). The prominence of government was partly due to the fact that WUC sold water from the NSC to government (DWA), which is then sold by DWA to domestic users and businesses in large villages. This means that the (lucrative) government share will decrease after the water sector reforms have been fully implemented. This process started in 2010. Figure 6 shows the reduction in government consumption in 2010, while the consumption by domestic and business users continued to rise.

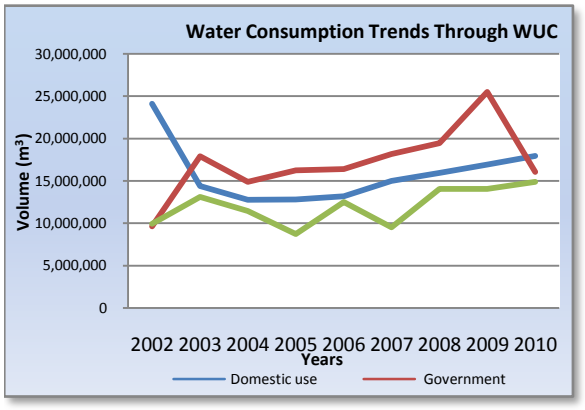


Figure 6: Trends in WUC water consumption by sector (m^3/a) [Source: based on WUC data].

WUC has long distinguished service provision centres: Gaborone, Jwaneng and Lobatse in the south and Francistown, Selebi-Phikwe and Sowa in the north[11]. In addition, WUC manages the NSC. The Gaborone region accounts for almost half of the WUC sales, reflecting the strong water demand in south-eastern Botswana. However, the water consumption in this region has not increased in the period 2002-2010 despite population and economic growth. This finding suggests that water use has become more efficient (see Figure 7 below).

3.10.2 DWA

DWA secures mostly groundwater from aquifers throughout the country; in recent years, DWA also purchased (surface) water from the North South water Carrier (NSC), operated by WUC. DWA provided production, consumption and loss figures for 16 large villages for the period 2000-2010: Tsabong, Ghanzi, Kanye, Ramotswa, Mogoditshane, Tlokweng, Molepolole, Mochudi, Thamaga, Mahalapye, Palapye, Serowe, Letlhakane, Tonota, Maun and Kasane. The results

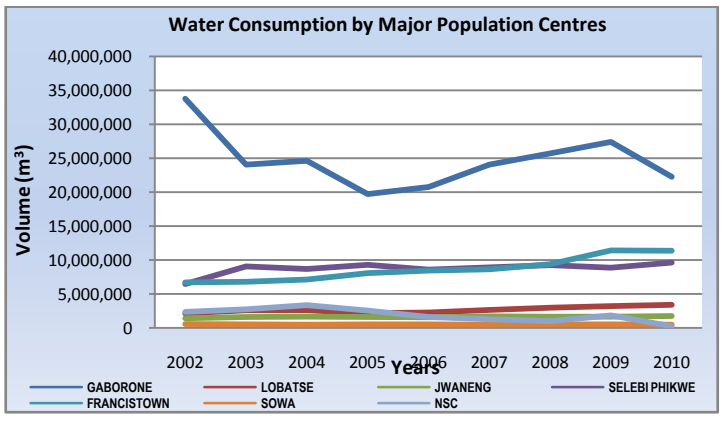


Figure 7: WUC water consumption by region (old supply areas; 2002-2010; m^3) [Source: based on WUC data].

[11] After the water sector reforms, WUC distinguishes management centres, business areas and clusters

are summarised in Figure 8. Water production increased from 23.1Mm^3 to 27.6Mm^3 in 2008, before production fell sharply to 12.5Mm^3 in 2010 because of the hand-over of water supply in villages to WUC.

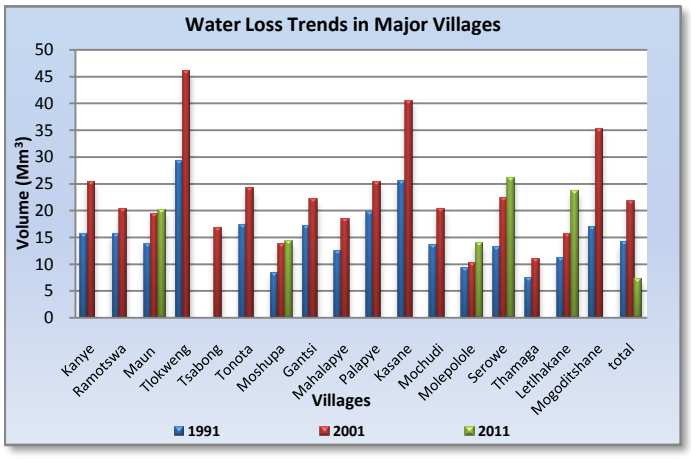


Figure 8: Water losses in major villages in Botswana.

The annual water consumption tripled between 1990 (6.4Mm^3) and 2008 (19.2Mm^3) but dropped recently due to hand over to WUC (13.4 Mm^3). Domestic use and government are the largest consumers; consumption by the industrial and commerce sectors is small and stagnant.

The number of individual connections also doubled between 1990 and 2008, from 63, 244 in 2000 to 124,208 connections. Per capita water consumption has increased between 1991 and 2001, but dropped recently due to the transfer of water distribution responsibilities to WUC.

The average annual loss in DWA service areas is estimated to be 25.7% for period 2002-2010: There is no visible improvement discernible in time (see Figure 9 below). The loss figure is higher than the WUC losses. Large loss variations were found among villages (depicted in Figure 10) and between years in the same village. Ghanzi recorded the lowest annual loss at 12%, while the losses were highest in Kanye (44.6%) and Ramotswa (45.9%). Large inter-annual differences exist within villages too. The figures point at differences in the quality of the water infrastructure, differences in maintenance and differences in record keeping and monitoring. WUC needs to address these challenges to reduce losses.

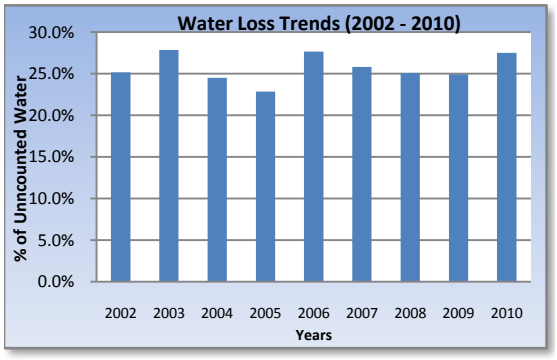


Figure 9: Trend in DWA water losses (2002-2010) [Source: DWA data].

3.10.3 Water Self Providers

The importance of the role of self-providers is underestimated. Few realise that self-providers produce more water than all other service providers together. They operate outside water works areas and require water abstraction permits from the Water Apportionment Board (WAB). Monitoring of water abstractions is inadequate (especially for livestock and irrigation) and therefore the total use of self-providers has to be estimated. The WA estimated the self-providers' consumption to be around 80Mm^3 in 2003 (Figure 12). The mining and livestock sectors are the largest self-providers. Self-providers use mostly groundwater from individual boreholes (by livestock owners) or dedicated well-fields (by mining companies).The role of self-providers in water resource management needs to be recognised in the IWRM-WE Plan. Furthermore, recording and monitoring of their water production and consumption needs to be strengthened as they use a state owned resource.

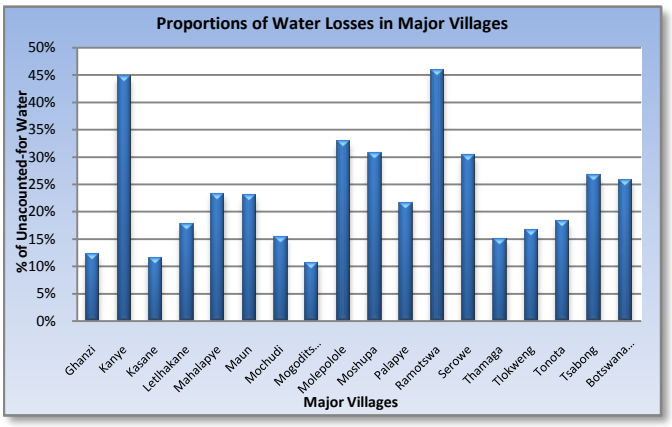


Figure 10: Average annual water losses by village [Source: DWA data].

3.11 Allocative Water Efficiency

Efficiency of water allocation is implicitly addressed in the NWMP1 and NWMPR. Despite this, water allocations have been relatively efficient compared to neighbouring countries. The comparison of water accounts of Botswana, Namibia and South Africa shows that Botswana achieves the highest value added per m^3 (see Table 9). Excluding agriculture, Botswana produced R405/m^3 compared to R340/m^3 and R193/m^3 for Namibia and South Africa. The reasons for the higher efficiency need however further investigation[12]. While agriculture receives the most water, the value added/m^3 is by far the lowest in the agricultural sector. This should be a reason to increase agricultural water efficiency particularly where competing uses exist. It should be noted however that other productivity measures need to be added such as employment generation (jobs/m^3), poverty reduction (income (for the poor)/m^3) and food security

Table 9: Water productivity in Botswana, Namibia and South Africa [Source: Lange and Hassan, 2006, p. 180].

Water productivity	Botswana	Namibia	South Africa
GDP/m^3 of water	236	93	65
GDP/m^3 of water (except	405	340	193
Value added agriculture/m^3	14	7	3
Value added mining/m^3	513	389	142
Value added	1 000	455	215
Value added services/m^3	2 962	1 113	606

[12]Possible reasons include the dominance of the mining sector with a high unit value and different structure of the industrial and tertiary sectors. The dominance of irrigation in Namibia and South Africa only partly explains the higher efficiency in Botswana.

(kg/m^3). Agriculture will feature better in these areas, but the value added concern remains.

One of the reasons for the favourable water efficiency figure has been the policy switch in the late 1980s from food self sufficiency towards food security. This has led to growing imports of water intensive food products and exports of beef and livestock, but led to considerable water savings (see above and Earle, 2001 for a comparison with Namibia, South Africa and Zimbabwe).

Table 10: Botswana's net annual water imports (+) and exports (-) by sector (Mm3/annum).

Sector	Total	Green water	Blue water	Grey water
Crops	297.3	178.2	100.3	18.8
Livestock	-203.1	-202.1	3	1.3
Industry	-1.4	0	0.3	-1.7
Total	**92.8**	**-23.9**	**98.3**	**18.4**
Source: adapted from Mekonnen and Hoekstra, 2011.				

A global country analysis of water flows associated with imports and exports (so-called virtual water or VW; Mekonnen and Hoekstra, 2011) shows that Botswana has 'saved' a large amount of water through international trade, mainly through the imports of food (water savings of 978Mm^3/annum). The analysis distinguishes blue (water abstracted from the environment and reticulated to users), green water ('natural' water, basically rainfall) and grey water (polluted water in the production process). The extra water use associated with livestock exports is modest at 163 Mm^3/annum. Some of the main findings for Botswana are presented in Tables 10-12.

Table 11: Botswana water savings due to Virtual Water trade by sector (Mm^3/annum).

Sector	Total	Green water	Blue water	Grey water
Crops	972.0	947.8	16.6	7.6
Livestock	-163.2	-162.5	-0.9	0.2
Industry	-8.8	0.0	-0.5	-8.3
Total	800.0	785.3	15.2	-0.5
Source: adapted from Mekonnen and Hoekstra, 2011				

Table 11 shows that Virtual Water trade is highest for the crop sector due to the high water requirements of food production in other countries (297 Mm^3/annum). If all food imported would be grown domestically, 800 Mm^3/annum more water would be needed; the virtual water imported for food is mostly rainfall captured (785 Mm^3) and 15 Mm^3 of reticulated water (irrigation). This is more than a third of Botswana's current blue and green water footprint (see Table 12 below).

In brief, Botswana's current trade patterns of large food imports and large exports of livestock products are efficient in terms of water use. The footprints of domestic use and industry are likely to increase in future due to population growth, improved living conditions and economic diversification. Therefore, allocative efficiency and 'water trade' should be an integral part of the Water and Waste Water Policy. The opportunity costs of sub optimal allocation are expected to rise in future. Particular attention should be paid to food production and security, including irrigation, and to country allocations from shared watercourses. How much water can be allocated to this sector and what type of water (e.g. grey). If Botswana gets an abstraction quota from shared rivers, its allocation must be optimized to meet development and IWRM objectives.

3.11.1 Water Quality

Water consumption for human activities and environmental use require maintaining an adequate water quality. Changes in water quality, either on surface water or groundwater, to low quality, may pose threats to human and animal health and eventually to the environment. Water quality problems in general may include high salinity, offensive odour and colour, and water pollution. However, the water quality of reticulated water in many villages falls often short of the highest potable drinking water standard (BOBS).

Table 12: Botswana's water footprint (Mm^3/annum).

Sector	Total	Green water	Blue water	Grey water
Crops	513	508	5	0
Livestock	1 721	1 685	36	0
Industry	35.1	0	1.8	33.3
Domestic	79	0	7.9	71.1
Total	**2 348**	**2 193**	**51**	**104**

Source: adapted from Mekonnen and Hoekstra, 2011

Pollution is likely to increase in future with economic growth and diversification, and therefore control measures need to be taken now to prevent pollution and/or expand water treatment facilities (e.g. sewerage and desalination). Some of the factors that contributed to water quality problems are the following:

- Insufficient legal protection of groundwater (and use monitoring), leading to over abstraction and subsequent salt water intrusion into freshwater aquifers;
- Inadequate protection of catchment areas leading to pollution from activities such as agriculture, pit latrine toilets in areas with high water table;
- Natural salinity of groundwater, which is common in western and northern Botswana; and
- High solar radiation resulting in high evaporation, leaving salts in the water.

In general sand rivers reflect low concentrations of dissolved salts. According to the NWMPR the hydro-chemical samples show the water to be of excellent chemical quality (TDS <200mg/l) well within BOBS standards. Standards for various water products (see Figure 11) are set by the Botswana Bureau of Standards (BoBS). Water from sand-rivers is generally classified as calcium bicarbonate water. However, the sand-rivers are at risk of pollution, especially from cattle watering points. Such contamination was found in Nkange River, where potassium and nitrate concentrations were associated with nearby hand-dug wells.

Ground water quality data are currently kept in two separate databases maintained by the Department of Geological Surveys (DGS) and the water quality section of DWA. There is need for an integrated water quality database. Water samples are collected monthly for major ion analysis and four times per month for microbiological analysis from operating well fields. There is need for a national spring monitoring network with water quality samples taken at each of the springs. Water quality database contains water quality analysis of surface and groundwater. DWA, WUC and DWMPC have laboratory facilities for water quality analysis. The DWA and WUC labs are used for the analysis of

freshwater while the DWMPC's one is typically for the analysis of wastewater samples. Wastewater samples are also tested at the WUC laboratory as part of the organisation's new mandate of wastewater management. The DWA laboratory is currently underutilised and could be merged with DWMPC's to establish one national environmental lab.

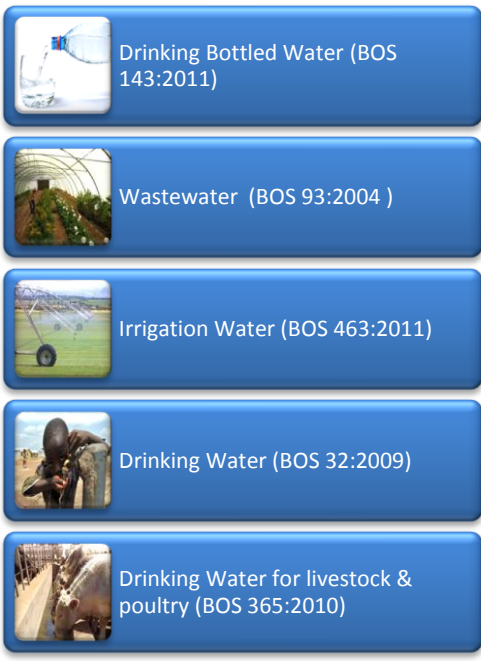


Figure 11: Quality standards (set by the Botswana Bureau of Standards) for water products.

Sanitary conditions have a large impact on surface and ground water quality. The planned expansion of sewerage and treatment facilities should lead to improvements in groundwater quality. However, concerns remain. The most common household sanitary facility employed by the village populations located within the near vicinity of the rivers is pit latrines. In 1996, well-field abstraction was discontinued in Ramotswa village as seepage from pit latrines in the village caused nitrate levels to rise above the water quality standard (50mg/l). Of the three aquifers in Lobatse only the Pitanyane aquifer is active as contaminant problems have rendered the others unsuitable for potable supply. In addition, expansion of Maun has encroached into the well field, creating higher contamination risks. According to Moffat *et.al.* (undated) water pollution in Maun is due to the fact that the Gomoto and Upper Boro areas have a number of lodges, whose sewage disposal could affect the water quality of near rivers. The Maun pollution problems are: (i) The state of the reticulation system and the distribution of water; (ii) The chemical water quality does not meet the Drinking Water Quality Guidelines set by the World Health Organisation (WHO) of 2010 and also for Botswana; (iii) The faecal coli-forms are generally low implying that the water is safe for human consumption; and (iv) Village pit latrines and industrial sites that affect some of the boreholes, hence polluting ground water near rivers. To improve the situation, DWA has recommended a protection zone to be reserved free from any land use that could affect the ground water in this area (SMEC *et. al.*, 2006).

The NWMPR points out that DWA does not maintain a systematic surface water quality measurement sites and database in the same way as discharge. Over the years, surface water quality has been determined at a number of sites by the Pollution Control Unit of the DWA. The Pollution Control Unit has carried out water quality assessments at Gaborone Dam and in the Okavango Delta. However, the samples were not taken from established water quality measurement sites. The WUC maintains a more systematic water quality monitoring system at its facilities, and the available data is considered more valuable in characterizing surface water quality than the ad-hoc data from DWA.

Therefore, it is recommended that the DWA sets up water quality monitoring stations at its flow gauging sites (SMEC and EHES, 2006).

Water quality monitoring requires more attention to prevent major pollution problems in future. The water quality needs regular monitoring through a systematic monitoring system and integrated data (groundwater, surface water, springs and treated effluent).

4 The Water Sector Policy and Legal Environment

IWRM requires a supportive policy and legislative environment, both nationally and internationally. This chapter reviews the national 'environment' followed by a review of the southern African environment. The institutional framework associated with policies and legislation is examined in Chapter 5.

Botswana's policy environment is characterised by a draft National Water and Wastewater Policy (2012) which has been in draft form since 2004. The draft policy embraces IWRM best practices and concerns but is yet to be finalised and adopted to drive and guide the water sector. The framework also contains several laws that are fragmented and outdated. These legislative instruments therefore fall short of recent IWRM concerns and need to be revised based on the IWRM principles (see Box 1, page 9). Through the Water Sector Reform process, these instruments are being revised and new ones being developed (World Bank, 2009). The 2006 NWMP is arguably the driving force behind the country's water resource management framework. Organisations such as Debswana and WUC have developed their own IWRM strategies, which are currently being implemented. Notably, WUC is currently developing a wastewater reuse policy to guide utilisation and management of the resource in Botswana.

4.1 Policies and Plans

4.1.1 National Development Plan 10 (NDP 10)

The NDP 10 is the current development plan (2009-2016). It indicates that the Water Act of 1968, the Borehole Act of 1956, the Waterworks Act of 1962 with its amendment Act of 1983, and the Water Utilities Act of 1970 with its amendment of 1978, govern the water sector. Other acts, which influence the sector, are the Local Government District Act, Aquatic Weeds Control Act and Public Health Act.

NDP 10 refers to the implementation of the water sector reforms programme. DWA is responsible for construction of strategic water infrastructure such as dams and water transfer schemes, and for water resources management, whilst WUC assumes nation-wide responsibility for water delivery in settlements and for wastewater treatment.

Specific water infrastructure projects include:

- **Further dam construction -** The completion of Dikgatlhong, Lotsane, Thune and Mosetse dams will increase the total dam capacity from 393Mm^3 to 948Mm^3, while combined yield will increase from 68Mm^3 to 147.9Mm^{3}per annum.
- **Further groundwater investigations -** During NDP9, investigations were undertaken in Maun, Kang, Phuduhudu, Bobonong, Matsheng, Botlhapatlou, Boteti and Masama. The expected water demand and yields from these well fields are shown in Table 13 below. The Botlhapatlou investigation is expected to be completed in NDP 10.

Regular water quality monitoring and testing for chemical, physical and microbiological constituents will be done to ensure compliance with the Botswana Standard for Drinking Water Quality Specifications (BOS 32:2009). Such tests include the water quality of dams and well fields. Water quality monitoring in rural villages water supply is seldom done.

During NDP 10, Government plans to establish an independent quality monitoring and evaluation division, under the new Regulator (discussed under the draft national water and wastewater policy below) and establish water quality testing laboratories.

According to NDP 10, DWA developed a water conservation programme with activities such as (i) installation of a pre-paid metering system in 13 major villages, (ii) measuring water losses through metering, zoning and in-situ meter-testing at Palapye and Molepolole, (iii) replacement of automatic flushing urinals at government institutions with manually operated flushing urinals. DWA also conducted pilot exercises on rain-water harvesting at Shoshong Senior Secondary School, Khawa village, Ledumang Community Junior Secondary School and other schools. The results from these activities were used to inform the extensive education and awareness campaigns on efficient use of water. DWA also piloted a wetland system that treated wastewater from DWA offices for reuse. This wetland system reduced departmental water consumption by 30 percent. The project is now being replicated by a number of institutions such as Mbiroba camp in Seronga as well as Motsumi Secondary School in Letlhakane. Under the Water Sector Reform Programme, DWA assumes responsibility for water resource planning and management and for major water infrastructure.

Table 13: Well field water demand and yield.

Well field	Demand (m^3/day)	Yield (m^3/day)	Yield (Mm^3/Year)
Kang	3525	7860	2.9
Matsheng	1680	9637	3.5
Botlhapatlou	14000	14000	5.1
Bobonong	6500	6289	2.3
Masama	25000	25000	9.1
Maun	13700	24650	10.1
Total	**64405**	**87436**	**33**

Source: Department of Water Affairs

4.1.2 National Water Policy (2012)

The draft policy aims to provide a framework that will foster access to good quality water by all users and also advocates for sustainable development of water resources in support of economic growth, diversification and poverty eradication. This policy is premised on the core principles of sustainable development taking into consideration the objectives of IWRM. The policy adopts a decentralised catchment area approach and uses the precautionary principle. These overarching guiding principles include *equity, efficiency and environmental sustainability*.

Equity: The policy recognises the importance of water for basic needs and water allocation for basic needs will receive priority. The second priority is given to the environment as it is the pillar for economic growth and social development followed by agriculture and commercial/industrial uses. Gender issues and social equity are also supported by the policy.

Efficiency: Water is recognised as an economic good hence costing and pricing of the resource should consider its economic value of water. The regulation and delivery of

water services' responsibilities are to be separated so as to improve efficiency of these functions.

Sustainability: This principle recognises that fresh water is finite and vulnerable hence essential to sustain the lives of Batswana. The value of water as an environmental asset is recognised and that its management and planning require all stakeholders to be on board including the local communities. Catchment management approaches are encouraged and the use of the precautionary principle is highlighted as a strategy that enhances environmental integrity efficiency and equity.

The Policy seeks to establish a Water Resources Board (WRB) with responsibility for equity and sustainable allocation of water resources as well as the efficient implementation of the IWRM plan. The WRB should be responsible for the coordination, implementation and periodic review of the National IWRM Plan. In addition, a Water Regulator will also be formed and primarily be responsible for ensuring financial

Table 14: Key focus areas of the draft National Water Policy.

Key focus area	Strategy for addressing the Issues
Water for growth	Developing and implementing water allocation guidelines for different uses, taking into consideration land use planning, economic instruments such as trade and water accounts.;
WDM and water conservation	Developing and adopting WDM principles and measures, backed-up by legal and economic instruments. Technology and innovation play a critical role in catalysing transition to water efficiency.
Domestic water supply and sanitation	WUC to take over all water supply and sanitation services, employ full cost accounting structure and cost recovery measures for water supply and sanitation services, thus ensuring the highest economically feasible standards of service.
Water for environment and tourism	Developing environmental standards and guidelines for the protection of aquatic ecosystems, assessing and determining ecological water requirements for all catchments through the application of such instruments as Strategic Environmental Assessments and Environmental Impact Assessments.
Water for agriculture	Promote integrated planning and development within the agricultural sector, research and development in water efficient and climate resilient agriculture.
Water for mining and industry	Determine water balance for all developments and integrate mine dewatering and industrial effluents in the planning framework- licensed water use.
Water for energy	Integrate water development guidelines in the energy equation, and promote adoption of water efficient technologies
Information management	Creating data inventory and assessments for water resources, coordinating through such facilities as the Clearing House Mechanism, and providing regular reports to stakeholders.
Research and development	Securing a sustainable fund for research and development in the water sector which provides for partnerships with academia, private sector and international institutions to strengthen and facilitate research and capacity development.
International cooperation	Institutional and policy frameworks to integrate transboundary water issues and management, adopting guidelines for shared water allocation and benefit sharing.
Monitoring & Evaluation	Developing measurable indicators to track and assess performance, and an integrated monitoring framework that is fully compatible with national and international standards

sustainability in the water sector, guiding and monitoring development and implementation of water tariff structures as well as ensuring that service providers comply with service standards.

The policy has identified eleven key focus areas and indicates strategies for addressing issues under each area and these are important for the national IWRM-WE Plan. These are highlighted in Table 14 below.

The above strategies and measures are important and relevant for IWRM but they are still in draft form (as is the policy), and therefore finalisation and implementation needs to be accelerated. Some observations are made regarding the shortfalls of the policy. These are as follows:

- Climate change and its impacts on Botswana's water resources. Adaptation strategies are not alluded to despite the importance of tackling this issue and ensuring that management efforts and use patterns takes cognisance of this;
- Water pricing – Although water pricing is a separate component of the Water sector reform project, it deserves to be mentioned in the policy document;
- Water allocation – one of the principles of the policy is directed as the efficient allocation of water resources. However, the policy fails to give details as to how this allocation will be pursued and what efficiency measures will be considered to ensure that allocative efficiency will be achieved;
- Although the policy highlights water use for the environment, water protection and issues related to water quality are limited;
- Mobilisation and financing of water infrastructure have not received significant attention in the policy. These could include the use of both financial and economic instruments as measures to be used in accessing financial resources for the development of water related infrastructure;
- Although extensive participation was undertaken jointly by the Water Sector Reform project, IWRM-WE pilot project and the Water Policy formulation process, stakeholder participation needs to be stipulated in the Water Policy as an important component of IWRM. This includes approaches to enhancing stakeholder participation and capacity development efforts to facilitate efficient water resources understanding and management. Water management at all levels (national, regional and catchment/basin) should therefore be adequately highlighted; and
- Water is a resource that is essential for all services hence a necessity for all sectors. Given the nature of water, there are bound to be conflicts between users and competing uses hence conflict resolution issues should be afforded an opportunity in the policy.

4.1.3 Review of National Water Master Plan (2006) (NWMPR)

The Ministry of Minerals, Energy and Water Resources (MMEWR) through DWA conducted a comprehensive review of the first BNWMP of 1991. The NWMP Review (NWMPR) report identifies several outstanding recommendations from the first master plan. Examples include the postponement of Palla Road Well field (planned for 1996) and delay in construction of Dikgatlhong dam and NSC Phase 2. Regarding institutional recommendations, the Water Act has not been reviewed, there is no water pricing policy, and the Water Resources Board has not yet been established. The main recommendations of the NWMPR are discussed below by topic.

Surface and Ground Water Resources

Surface and ground water resources are limited and available resources are under pressure. There is need to promote WDM and use non-conventional water sources such as rainwater. A National Policy on Rainwater Harvesting should be formulated. Amendments to the Building Control Regulations and the Development Control Code are important to incorporate measures for harvesting rainwater and storm water (as well as encourage re-use and water efficiency).

Water Demand Management

The 2006 NWMPR advocates for WDM because about 46% of the developed water resources are wasted through losses and inefficient water use. Water losses in the distribution system need to be reduced, and the water use efficiency in industrial and institutional sectors need to be increased. In order to reduce the cost of water delivery, government should encourage development in central Botswana. The WDM

Box 4: WDM recommendations from the NWMPR.

- Urgent review of the draft National Water Conservation Policy
- Water monitoring i.e. of the water system operation
- Water conservation and demand management plans for all suppliers and for villages + towns with piped water.
- The policy of removing all public standpipes from people below the poverty line be reviewed, rationalised and abandoned.
- A major water user forum
- The water conservation unit should be properly resourced and funded to enable it to fulfil its future role of management of water resources
- The building codes and standards be reviewed in line with water efficiency and national products and services
- Building standards be policed by appropriate authorities
- Comprehensive review of the future of NSC to determine and correct major leaks
- A comprehensive review of the status of all water supply systems to indicate need for capital expenditure and major maintenance stock
- A comprehensive review of the status of national metering
- DWA investigate institutional consumption to ascertain appropriate conservation measures that can be introduced
- DWA & WUC undertake a detailed assessment of the industry and commercial sectors to evaluate their water usage, and to establish appropriate incentives to reduce water consumption in these sectors.
- DWA & WUC survey domestic consumers to establish the various price elasticities and ability to pay criteria
- DWA & WUC undertake a detailed assessment of the industry and commercial sectors to evaluate their water usage, and to establish appropriate incentives to reduce water consumption in these sectors.

Source: SMEC and EHES,2006.

recommendations are presented in Box 4 below.

Water accounting is useful for monitoring and evaluating Botswana's water resources state and use and for assessing water efficiency of economic sectors (DEA and CAR, 2006). Water accounting is also important to identify the costs and subsidies on water resource use and management and it could assist with improving allocative efficiency.

Environment

IWRM recognises that water needs to be reserved for the environment. This amount is often referred to as environmental flow requirement (EFR). Environmental flow is the amount required to sustain the integrity of the river ecosystem such as maintaining nutrient structure, water for recharge of aquifers, water for plants and animals. The Environmental Impact Assessment (EIA) is an important tool to ensuring that EFRs are maintained. The water authority, in association with DEA, should arrange for training of DWA staff on EIA. The NWMPR promotes subjecting development plans to a strategic environmental assessment to determine their impact on water demand.

Institutional and Legal Reform

The 2006 NWMPR identifies two main issues required to meet Botswana's water demand: 1. Water resources stewardship; and 2. Water demand management. The prioritisation of WDM signals a move away from the focus on supply and large water development schemes. The NWMP (1991) mainly focused on the latter. Water resources challenges facing Botswana include unreliable low rainfall, high evaporation rates, lack of suitable dam sites and under-utilisation of water demand management measures. In order to meet the identified requirements, the policy and institutional environment need to be adjusted to provide an enabling environment for recommended changes. The current water sector reform project is implementing the 'preferred option', identified from the NWMPR.

It is also important to curb pollution of the limited surface and groundwater resources. Treated effluent is available but it is currently used in limited quantities. There is need to strengthen institutional and legislative environments to achieve useful utilisation of wastewater. Botswana's development planning framework should take cognisance of limitations of water resources and incorporate these limitations in its planning. For example, location of water dependent industries close to water sources, incorporate water saving measure into building regulations and encourage water saving technologies.

Transboundary rivers are sources of water for Botswana; however, their use is subject to international agreements and protocols and most important they require protracted negotiations with neighbouring states. It would be prudent to request use of shared water resources after reaching efficient use of local resources. In addition Botswana needs to manage water, based on international best practice and adoption of the IWRM approach:

- Preparation of a national water resources strategy utilising the NWMPR as a 'living' document with regular updating as new data, new policies and new priorities are

incorporated, coordinating the water needs of various sectors and taking account of relevant international agreements relating to the use or sharing water resources;

- Providing assurance of supply to licensed users and simultaneously enforce compliance with licence conditions for construction of hydraulic works and in waste discharge permits;
- Maintaining a national water resources information system to enable knowledge-based assessment and monitoring of surface and groundwater, and for evaluation and revocation of existing licenses;
- Developing regulations to implement the provisions of the draft Water Bill; and
- Undertaking human resources development and training.

4.1.4 National Master Plan for Wastewater and Sanitation (NMPWWS; 2003)

The National Master Plan for Wastewater and Sanitation (2003) was preceded by the Policy for Wastewater and Sanitation Management (2001). The policy's purpose is: "to promote the health and well being of Batswana through the provision of appropriate and sustainable wastewater/ sanitation management and to introduce mechanisms for the protection and conservation of water resources" (SMEC et al, 2003).

The overall objective of the NMPWWS is "*to evaluate the current scenario on wastewater generation and disposal, on-site sanitation facilities and their impact on the environment, and to develop planning and implementation strategies for regulating the generation, collection and disposal of wastewater in an environmentally friendly and acceptable manner*." It is important for achieving the MDG goal of improving access to sanitation and adopting an IWRM approach towards wastewater utilization and considering it as a water resource.

The NMPWWS indicates that pre-2003 the emphasis of wastewater management was put on discharge without considering wastewater as an economic good. The NMPWWS seeks to change this attitude as a rapidly growing amount of wastewater will become available in future close to water consumption centers, therefore reducing the need for long distance water transfers. Major recommendations related to wastewater management are outlined as follows:

Legislative Instruments: There is need to enact legislation for the wastewater and sanitation sector. The legislation should cover issues such as; (i) the right to a clean and healthy environment; (ii) empowerment of regulators and stakeholders to protect the environment from pollution; (iii) institutional framework defining service standards; and (iv) stakeholder participation in planning, design and implementation of wastewater and sanitation management strategies. The legislation should further effect economic efficiency. Proposed additional legislative instruments include:

- Licenses for the operation of sewerage and wastewater facilities;
- Establishment of a National Asset Register, which records the performance of individual WWTW;

- Establishment of a permit system for commercial discharges of effluents; and
- Monitoring of Trade Effluent Agreements between industries and local authorities.

Cost recovery and affordability: An estimated BWP3.2 billion (2003 estimate) is required for the full implementation of the NMPWWS in the NDPs. The 2003 NMPWWS proposes to recover the operational costs for households, as full cost recovery is unaffordable for households (BWP1109 per household per annum). Therefore a national tariff average of about BWP290 per household per annum (BWP25 per month) is considered affordable and some BWP2.08/m^3 would be charged for collection and treatment costs. For the institutions the estimated return flow to the sewer could be rated at the equivalent rate for domestic at BWP2.08/m^3. For industry/commercial it is recommended that cost recovery be achieved through the Trade Effluent Agreement (TEA) and the TEA should provide the recovery revenue for that contribution. No tariff on the amount of discharge is being paid, and there is only a yearly charge payable (SMEC *et.al.*, 2003).

Wastewater plans and facilities: The NMPWWS identified 70 settlements where wastewater services are required and developed a set of strategic plans for these settlements to assist planners in coordinating these activities. The NMPWWS proposes that the planning and management of wastewater be extended to large villages, where most of the existing wastewater works are institutional, for example linked to prisons and hospitals.

Table 15: Distribution of population in Botswana's largest settlements (over 20,000 inhabitants).

Settlement	2001	2011
Gaborone	186,007	227,333
Francistown	83,023	100,079
Molepolole	54,561	67,598
Mogoditshane	32,843	57,637
Maun	43,776	55,784
Selebi Phikwe	49,849	49,724
Serowe	42,444	47,447
Kanye	40,628	45,196
Mochudi	39,349	44,339
Palapye	26,293	36,211
Lobatse	29,689	29,032
Ramotswa	20,680	27,760
Tonota	15,615	20,007

Source: CSO, 2011.

Wastewater treatment, reuse and recycling: The government has set a national target for 2030 to increase reuse from 20% to 96% of the outflow (or 48% of the inflow) through agricultural reuse and reduction of losses in the treatment systems. Agricultural reuse is seen to be economically viable in ten cities, towns and large villages listed in Table 15. The anticipated situation in 2030 will be: 48% of the inflows are reused; 42% is lost through evaporation and treatment and 10% is discharged into the environment.

IWRM is a fundamental discipline that cuts across all sectors of the economy, hence a number of sectoral and resource policies have a bearing on its implementation. IWRM-WE Plan implementation needs to be fully coordinated with the implementation of these policies. These policies are outlined in Table 16 below.

4.1.5 Legislation

Botswana's water related Acts (Water Act 1968, Water Works Act 1962, Water Utilities Corporation (WUC) Act 1970 and the Borehole Act 1956) are over forty years old and thus outdated. These legislative instruments are not consistent with current world water sector trends, nor the existing developments that are in place in Botswana, and therefore it is necessary that the WSR process accelerates efforts in revising these laws. Current guiding legal instruments for the water sector are summarised in Table 17.

Table 16: National policies that affect the Botswana water sector.

Sector	Policy instrument
Development	Revised National Policy for Rural Development (2002) Rural Development Policy and Strategy (2001) Vision 2016 Community-Based Rural Development Strategy (1996) Industrial Development Policy (1998) Poverty reduction strategy 2003
Environment & biodiversity	National Conservation Policy (1990) National Biodiversity Strategy and Action Plan (NBSAP) (2007) National Action Programme to Combat Desertification (2006) National Policy on Natural Resources Conservation and Development (2007) Community Based Natural Resources Management Policy (2007) Wildlife Conservation Policy (1986)
Water & wetlands	Wetlands Policy and Strategy (2001) Okavango Delta Management Plan (2007)
Land	National Settlement Policy (1998) National Policy on Land Tenure (1985) Review of the National Land policy, 2003 National Policy on Tribal Grazing Land (1975)
Forests	Draft National Forestry Policy (2005)
Agriculture	Arable Land and Development Programme (1997) Arable Lands Development Programme (1976) National Master Plan for Arable Agriculture and Dairy Development (NAMPAD) (2001) National Policy on Agriculture Development (NPAD) (1991)
Tourism	Ecotourism Strategy (2002) Game Ranching Policy of Botswana (2002) Tourism Master Plan (2000) Tourism Policy (1990)
Energy	National Energy Policy (2004) National Energy Policy and Master Plan (2006)
Gender	National Policy on Women in Development (1995) National Policy on Gender and Development (2008)

A significant body of other legal instruments that compliment IWRM are highlighted as follows:

- **Environmental Impact Assessment Act of 2011**. This Act provides for environmental impact assessment (EIA) of projects and strategic environmental assessments (SEA) of policies, strategies and programmes. The SEA and EIAs have to be approved by the Department of Environmental Affairs. The EIAs and SEAs guidelines need to adopt the IWRM concept;
- **Town and Country Planning Act 32:09 of 1978.** This Act controls the land use planning in urban areas. Urban planning should adopt IWRM and link land and water resources planning (e.g. storm water);

- **Tribal Land Act and Amendment Act Cap 32:02 of 1993**. This Act provides for the allocation and management of Tribal Land. Land Boards are the key institution responsible for allocation of Tribal land, issuing of user rights and imposing land use restrictions. Land use and allocation processes have a profound impact on water resources and demand, and therefore IWRM needs to be fully integrated in the implementation of the Tribal Land Act;
- **Agricultural Resources (Conservation) Act 1974.** This Act deals with veld products and has little direct relevance to water resources. It also covers Agricultural Resources Conservation (utilisation of veld products) regulations (December 2006);
- **Tourism Act of 1992.** This Act control tourism operations in the country and requires operations to be registered and licensed through the Department of Tourism. Water conservation measures could be integrated in the license requirements (e.g. similar to the ecotourism grading system);
- **Forestry Act No 23 of 1968, No 29 of 1980 and No 8 of 2005.** The 1968 Act provides for the establishment of Forest Reserves, Protected Trees, control of forest produce through licensing and imports and exports of endangered tree species in line with CITES. Maintaining forest resources and control of exotic species that consumer excessive water are important aspects of IWRM-WE;
- **Wildlife Conservation and National Parks Act 28 of 1992.** This Act aims to preserve and sustainably use wildlife resources in Parks and WMAs respectively. It provides for different wildlife zones and licenses for hunting, Park fees etc.
- **Waste Management Act Cap 65.06 of 1998**. The Act deals with solid waste, including hazardous waste (from households, industries and government) and requires districts, towns and cities to prepare waste management plans. The Department of Waste Management and Pollution Control (DWMPC) has the overall responsibility for waste management. Licenses are requires for waste collection and disposal. Improper waste management and disposal poses risks of water pollution. Failure to prepare waste management plans is therefore an IWRM concern;
- **Mines and Mineral Act No 17 of 1999.** This Act provides for prospecting and mining licenses for minerals. The prospecting license gives holders the rights to drill boreholes; the mining license

4.1.6 Water Sector Reforms

In recognition of increasing demand on water resources, the need to provide water services to all citizens, as well as inadequate policies, laws and organisational structures in the sector, it was realised that there is need to adjust the water sector to be able to address these. Moreover, the water and sanitation services were provided by several institutions where water was supplied by Water Utilities Corporation - WUC (in towns and cities), Department of Water Affairs - DWA (in large villages) and the District Councils – DCs (in small villages). This framework has resulted in uneven level of services, lack of transparency for government subsidies and lack of accountability. DWA was also responsible for water resources management while DCs managed wastewater. Another challenge is that the government has committed itself to provision of piped water to all citizens by the year 2016 and also needs to be consistent with international best practices in water resources management. Lastly, there is lack of financial sustainability in the water sector hence the need to enhance efficiency, employ targeted subsidies and adopt a modern and effective system for tariff regulation. Therefore through the 2006NWMPR, the government is implementing a water sector reform process (WSRP) to counteract the issues mentioned above. Technical assistance was sought from the World Bank and the involvement was organised in two phases:

Table 17: Botswana's water legislative instruments.

Act	Details	Comment
Water Act, 1968	• Controls water resources use and presents an institutional framework for water allocation; • Ownership of public water by the state; • Everyone has the right to water for drinking, washing, cooking, livestock; • A water right is required to extract water: divert water, dam construction, water storage, use and effluent discharge into public water; • Possession of water rights does not necessarily mean that the amount of water is always available; • Provision to cancel the water quota if the available water resources do not meet current demand, if the right is not used within 3 years.	• Water quality issues are limited; • Due to lack of monitoring it is likely that users abstract more than they are legally entitled to and beyond the rate of recharge, particularly for groundwater resources. • Transboundary water use and management are not catered for; • Lacks detailed water pricing principles
Water Works Act, 1962	• Provision for gazetted water works areas; • These areas should have a designated water authority, e.g. WUC who has the right to take water, construct, make, purchase or take over all water works within the boundaries of the water works area and is also responsible for water supply; • Water charges should relate to the water consumed and metered readings; • Minister approves water charges	• Monopoly of water supply • Lacks detailed water pricing principles
WUC Act, 1970	• WUC is responsible for bulk water supply or in water works areas where it is given authority; • WUC will take necessary measures to ensure adequate water supply in areas of operation; • WUC should operate commercially and generate revenues for the agency.	• Lacks detailed water pricing principles
Boreholes, 1956	• Permission to develop a borehole should be sought from the Geological Surveys authority; • Geological Surveys keeps a registry of boreholes in the country. The department can at any point, access any borehole for inspection, water sampling, pump tests and is expected to keep records of these.	

Phase 1 (September 2008 to January 2009) assessing the reform, critiquing and offering expert advice for effective implementation of the reform option that the Botswana government had opted for;
Phase 2 (December 2009 to October 2010) developing terms of reference for institutions; communication strategy; water policy and tariffs policy; roll out plan of the phase out of water supply from DWA to WUC as well as wastewater management.

The reform should result in changes in institutional roles and responsibilities. WUC now has the overall water supply responsibility, and assumes responsibility for wastewater treatment and management as well. DWA on the other hand will be responsible for overall planning, developing and managing water resources. The WSR will also establish an independent Water Resources Board with an overall responsibility of overseeing and allocating water resources and the Water Regulator. In addition to institutional reform, the policy and legal instruments will be reviewed. The main outputs of the Botswana WSRP are summarised in Table 18.

Table 18: Key outputs in Botswana's Water Sector Reform Programme.

Category	Outputs and progress
Water system reform	Water Utilities Corporation takes over water supply systems. The process started in 2009 and is scheduled for completion in 2013.
Wastewater reform	Enhanced capacity within WUC to enable sound wastewater management in the country (ongoing) Wastewater systems and treatment works operated and managed by WUC (ongoing)
Legal and institutional frameworks	National Water Policy (2012 draft) Water Tariffs Policy Water Resources Board Water Regulator DWA assuming overall water planning, development and management (restructuring process is on-going)
Communication and participation	Communication strategy – draft Consultation of stakeholders on the process and mainly Water Policy

The reform process is expected to be completed by 2014. The remaining activities of the reform process should be aligned with the recommendations of the National IWRM-WE Plan.

4.2 The Regional Environment

SADC has developed a wide range of policy instruments for integrated water resource management since the late 1990s. The 2001 revised Protocol on Shared Watercourses promotes the establishment of river basin organisations and shared river basin management by member states. Furthermore, Regional Water Action Plans (I 1999 -2004 and II 2004- 2010) have been implemented in succession; the third one (III 2011- 2015) seeks to implement IWRM in southern Africa (SADC, 2011). In addition, the Regional Water Policy and Water Strategy were adopted (SADC, 2006 and 2007). Four sets of guidelines were prepared to support the operations of RBOs in SADC region[13]:

[13] A fifth set of draft guidelines for resource allocation and benefit sharing were not yet adopted.

- Establishment and development of RBOs;
- Environmental management of river basins;
- Stakeholder participation; and
- RBO funding requirements and sources.

Recently, SADC developed a climate change adaptation strategy for the water sector (SADC, not dated).

Water resource management in Botswana must therefore be in harmony with SADC policies and strategies. As a member of SADC and a party to several regional conventions and protocols, Botswana needs to ensure that its policies, the IWRM-WE Plan, and overall water resource management conform to the SADC water management commitments. The IWRMWE Plan should utilise the available support documents such as guidelines to strengthen its water management. Below, this section focuses on shared water resources. Summaries of other relevant SADC documents are provided in Volume 2, Appendix B.

4.2.1 The SADC Protocol on Shared Watercourses (Revised 2001)

The Revised SADC Protocol on Shared Watercourses became operational in 2003 (www.sadc.int). The Protocol is based on Helsinki Rules and the United Nations Convention on the Law of the Non- Navigational Uses of International Watercourses. Article 2 of the Revised Protocol seeks to foster closer cooperation for judicious, sustainable and coordinated management, protection and utilisation of shared water courses, as well as advance the SADC agenda of regional integration and poverty alleviation. Shared watercourses may be used by each riparian state without prejudice to its sovereign rights and subject the protocol's conditions. State parties shall take all appropriate measures to prevent the causing of significant harm to other Watercourses States. The country whose use causes such harm must take appropriate measures to eliminate or mitigate it and where appropriate compensation.

The financial and regulatory framework calls for member states to provide support to RBOs. Articles 5 of the Revised Protocol which describes the institutional framework for implementation includes the institutions and their functions. Art 5 (3) refers to the possibility to establish 'appropriate institutions for water management such as water course commissions, water authorities or boards'. The responsibilities of such institutions depend on the institutions' objectives, which should conform to the protocol's principles. The institutions are required to provide regular information about the progress of the protocol implementation in their particular basin.

The Revised Protocol calls for environmentally sound practices in the utilisation of water resources and supports the principles of Integrated Water Resources Management (IWRM).

4.2.2 River Basin Organisations

Botswana shares four rivers (Limpopo, Zambezi, Okavango and Orange Rivers) with other southern African states. These rivers have river basin organisations (RBOs) that are meant to provide a platform for cooperation in the utilisation of the water resources. The RBOs are formed based on the Revised SADC Protocol on Shared Watercourses. The RBOs are at different levels of development both in terms of infrastructure and institutions. Below is a brief summary of the RBOs, with more detail available in Annex 3, page 151. A more substantive review of the riverbasin organisations of southern Africa is available in Volume 2 of the IWRM-WE Plan. Map 8, page 75 shows the riverbasins that Botswana is a part of.

The Permanent Okavango River Basin Water Commission (OKACOM)

The Permanent Okavango River Basin Water Commission (OKACOM) was formed in 1994 through an agreement between Angola, Botswana and Namibia. The Agreement is based on the principles of equitable allocation, sustainable utilisation, and sound environmental management and benefits sharing and commits member states to utilise, manage and conserve the Okavango river basin resources in a coordinated and sustainable manner taking into account the social and economic needs of the riparian states.

OKACOM organisational structure is made up of the Commission, the Okavango Basin Steering Committee (OBSC) and the Secretariat. The Commission is made up of three Commissioners from each of the riparian states; Angola, Botswana and Namibia. The OBSC provides technical assistance to the Commission and has three task forces; Institutional, Biodiversity and Hydrology. The Secretariat provides administrative, financial and secretarial services.

OKACOM has developed and endorsed the Transboundary Diagnostic Analysis (TDA) and the Hydrological Data Sharing Protocol. The TDA has been consolidated with the Strategic Action Programme (SAP) to provide a guiding framework for future joint management of the basin.

The Orange-Senqu River Commission (ORASECOM)

The Orange-Senqu River Commission (ORASECOM) was formed by an agreement between Botswana, Lesotho, Namibia and South Africa in 2000. The ORASECOM structure is formed by the Council, Secretariat and Task Teams. The council is the supreme body of ORASECOM and provides technical advice to the riparian states on matters related to the development, utilisation and conservation of the water resources in the basin. Each member is represented by three delegates from agencies responsible for water affairs in the Council. The Secretariat is responsible for coordination and management of ORASECOM activities and serves as a repository of information related to the River Basin. The Technical Task Teams are made of representatives from member states and deal with issues on finance, legal, hydrological and communication.

ORASECOM is in the process of developing the TDA for the Orange-Senqu River Basin and this would define the approach to be adopted for the development of the basin. However, a preliminary TDA was concluded in 2008. ORASECOM has also developed a shared information system to enhance information sharing among stakeholders.

The Limpopo Watercourse Commission (LIMCOM)

The Limpopo Watercourse Commission (LIMCOM) was established by an agreement signed by representatives from Botswana, Mozambique, South Africa and Zimbabwe in 2003. The ratification process for the agreement was completed in 2011. This agreement is preceded by other agreements. The Limpopo Basin Permanent Technical Committee (LBPTC) was established in 1986 and the last meeting was in November 2010 in South Africa. LBPTC provided a platform for coordination and sharing of hydrological information and cooperation on disaster management. LBPTC coordinated the Limpopo Scoping Study and the development of River Basin Awareness Kit (www.limcom.org). Other agreements include:

- Joint Water Commission (JWC), Agreement between the Government of the Republic of Mozambique and the Republic of South Africa on Establishment of a Joint Water Commission in 1996 to deal with water resources of common Interest.

Box 5: Regional Water Commissions which Botswana is party to.

1. **Permanent Okavango River Basin Commission (OKACOM)**

Established in 1994, OKACOM acts as a technical advisory body on matters relating to planning, utilisation, development and management of the Okavango river basin by Botswana, Namibia and Angola. The OKACOM also performs such other functions pertaining to the development and utilization of such resources as the countries may from time to time agree to assign to the Commission (OKACOM Agreement). The Commission is not only an advisor but acts as an executing agent on behalf of the basin states. The commission has facilitated a number of notable projects to enhance management of the river basin, including a transboundary diagnostic analysis and formulating a Strategic Action Plan for the basin. OKACOM related projects include the Integrated River Basin Management Project, Southern African Regional Environmental Programme, Every River Has its People Project, Basin Wide Forum, the water audit project and the Futures Okavango.

2. **Orange-Senqui River Commission (ORASECOM)**

Botswana shares the Orange River with South Africa, Namibia and Lesotho and these countries have jointly formed ORASECOM, which is empowered to advise governments on technical issues relating to the Orange-Senqui Basin. The Commission has to investigate a water matter of mutual interest to arrive at an informed, mutually beneficial and acceptable conclusion and then must advise the Governments accordingly about the agreed course of action.

3. **Zambezi Watercourse Commission (ZAMCOM)**

The Commission strives to promote the equitable and reasonable utilization of the water resources of the Zambezi as well as the efficient management and sustainable development thereof. ZAMCOM's agreement was fully adopted in September 2011, with ratification from six out of eight member states. Its functions are similar to other regional RBOs and Botswana Government in Gaborone currently hosts the Secretariat.

4. **Limpopo River Basin Commission (LIMCOM)**

Formed in 2003 by the governments of Botswana, South Africa, Mozambique and Zimbabwe, LIMCOM's overriding objective is "to advise the Contracting Parties and provide recommendations on the uses of the Limpopo, its tributaries and its waters for purpose and measures of protection, preservation and management of the Limpopo(LIMCOM Agreement 2003)". One of be functions include establishment of measures and arrangements to determine the long term safe yield of the water available from the Limpopo. As a party to the Commission, Botswana has to adhere to the requirements of the joint agreement in utilising and managing the waters of the Limpopo.

- Joint Permanent Technical Commission (JPTC) between Botswana and South Africa on the Limpopo, Molopo and Nossop Rivers was formalised in 1987.

- Joint Permanent Commission for Co-operation (JPCC) a joint agreement signed between Botswana and South Africa in 1997 to deal with a variety of issues, including the transfer of water from the Molatedi Dam on the Marico River.
- Agreement Between the Government of the Republic of Zimbabwe and Republic of Mozambique on the establishment and procedures of a joint Water Commission concerning water resources of common interest, signed in 2002 (www.limcom.org).

The structure of LIMCOM includes the Council, Secretariat and Task Teams. The Council's role is to provide technical advice to the member states (contracting parties) on matters related to the development, utilisation and conservation of the water resources of the Limpopo River Basin. The Council is made up of delegates from each riparian state and each delegation is comprised of three commissioners. There is an Interim Secretariat hosted by Mozambique to facilitate work of the commission. Task Teams based on three thematic areas (legal, flood forecasting and technical) have been established. Each Task Team is made up of a member from each riparian state.

LIMCOM is developing a baseline assessment, its strategic framework and plan to guide future technical programmes and interventions in the River Basin.

Zambezi Watercourse Commission (ZAMCOM)

Zambezi River Basin is shared by eight countries: Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe. The Zambezi Watercourse Commission (ZAMCOM) agreement was signed by seven out of eight riparian states in 2004 in Kasane, Botswana. The ZAMCOM agreement has come into force after being ratified by the required two-thirds majority. The objective of ZAMCOM is to promote the equitable and reasonable utilization of the water resources of the Zambezi Watercourse as well as the efficient management and sustainable development thereof.

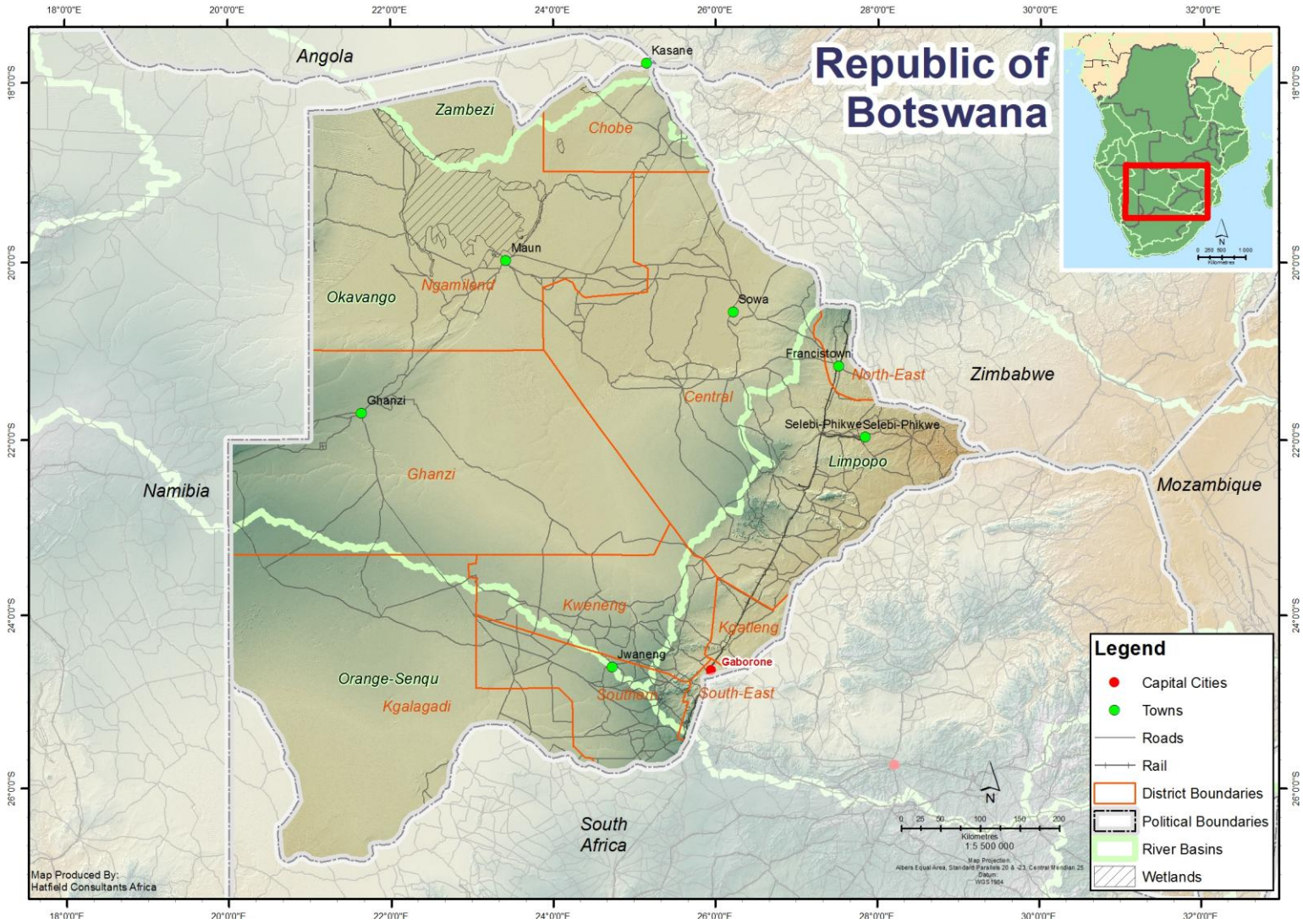
An Interim ZAMCOM Secretariat (IZS) has been established in Gaborone by the riparian states in May 2011. The main objective of the IZS is to facilitate the roll out of the Operationalisation Plan (ZOP), in fulfilment of the Commission's overall objective. The immediate objectives of IZS include to:

- Set up a functional Interim ZAMCOM Secretariat;
- Implement start-up actions of the ZAMCOM Operationalisation Plan (ZOP); and
- Support implementation of short term actions prioritised in the Zambezi IWRM Strategy (ZAMSTRAT) (www.icp-confluence-sadc.org).

ZAMCOM has a Transitional Organisational Structure. The IZS reports to the Transitional Advisory Group (TAG) made up of senior government officials from each riparian state. The Technical Committee is formed by Heads of Water departments from each riparian state. The IZS reports to the TAG through the Technical Committee. Ministers responsible for water from riparian states provide the overall guidance on the management of the Basin. The main status and progress of the four RBOs are summarised in Table 19 and Box 5 on page 72.

Table 19: Key documents for RBOs with Botswana membership.

RBO	Year of Agreement	Key studies – reports
OKACOM www.okacom.org	1994	Environmental Protection and Sustainable management of Okavango Basin Transboundary diagnostic analysis TDA 2011 NAPs and SAPs (being finalized).
ORASECOM **www.orasecom.org**	2000	IWRM Plan Phase 1 reports ORASECOM preliminary TDA 2008 IWRM phase 2 on going
ZAMCOM www.zamcom.org	2004	IWRM Strategy & Implementation Plan 2008 Multi Sector Investment Opportunities Analysis 2010.
LIMCOM www.limcom.org	2003	Limpopo scoping study 2010 Monograph study on-going
Sources: RBO websites		



Map 8: Riverbasins for which Botswana is a part..

5 Botswana's Institutional Framework for the Water Sector

Prior to the water sector reform, Botswana's water sector comprised several institutions, the key institutions being Department of Water Affairs, Department of Geological Survey, Water Utilities Corporation and District Councils. The nature of involvement ranges from formulation and implementation policies and legislation, planning, management, water supply, consumption, research and funding. The Ministry of Minerals, Energy and Water Resources (MMEWR) has the responsibility to coordinate development and operational activities within the sector together with energy and minerals sectors. Specific programmes and projects to fulfil these responsibilities are carried out particularly by the departments of Geological Survey and Water Affairs, in relation to water related matters along with Water Utilities Corporation (WUC). Other ministries involved in the water sector include Ministry of Local Government, Ministry of Environment, Wildlife and Tourism and Ministry of Agriculture. Table 20 outlines the major national water sector institutions and their functions.

Table 20: Summary of institutional framework for the water sector in Botswana.

Institution	Functions
Department of Water Affairs (DWA)	Water resource management and planning Planning and construction of strategic water infrastructure
Department of Geological Survey (DGS)	Administration of the Borehole Act of 1956; Investigates and monitors major groundwater systems in the country; Maintains the National Borehole Archive for the assessment of groundwater potential
Water Utilities Corporation (WUC)	Water supply to human settlements Bulk water supply to industries; Management of raw water reservoirs and water treatment; Operation and maintenance of water supply infrastructure wastewater management and treatment
Department of Waste Management and Pollution Control	Coordination and monitoring of sanitation and waste management; Administration of policy, legislation and programmes regarding waste management and pollution control Planning and development of wastewater treatment works
Water Apportionment Board (WAB); the secretariat is located at DWA	Granting and administration of water rights. The WAB will be abolished after the water sector reforms have been concluded.
Ministry of Lands and Housing	Land Boards and land use planners use the 8 km distance rule to plan the use of groundwater resources for livestock farming
Ministry of Agriculture (Water Development division)	Development of small agricultural dams; Development of groundwater resources for irrigation
Self-providers e.g. mines and farmers	Own water supply and management subject to attaining user rights from Land Board and WAB.
Other consumers; industry, households, etc	Utilise water for different purposes and employ conservation and management measures
Researchers and academia	Training for human resources capacity building and knowledge development as well as research and consultancy services
International Cooperating Partners	Funding and financing water sector activities, climate mitigation and economic policy reform

Sources: Draft National Water Policy, NWMPR and CAR, 2010

Botswana shares four international rivers with other countries within the region. The use of these shared resources is governed by treaties as each state cannot act unilaterally without consulting other riparian states. Therefore, as a requirement of mainly the Revised SADC Protocol on Share Waters, riparian states are required to establish river basin organisations (RBOs) or water commissions to coordinate,

cooperate and enhance integration in providing optimum utilisation and management of shared water resources. Botswana is party to four RBOs, which have been discussed earlier.

An International Waters Unit (IWU), based within the Ministry of Minerals Energy and Water Resources, supports the effective management of shared waters from the Botswana perspective. The Unit is also responsible for facilitating Botswana compliance to the requirements of Shared water resources need to be reflected in policy and legislation and should be harmonised with policies and legislation of other member states. The institutional capacity should also be enhanced to address transboundary water issues such as basin planning, benefit sharing, water allocation as well as information exchange to enhance optimal use of the water resources. International law affecting management of river basins needs to be well understood and negotiation, arbitration and mediation skills need to be enhanced to place the country in a better position to make well informed decisions about its shared water resources.

As recommended in NWMPR, Botswana is currently implementing a water reform process where new institutions are created and the roles of existing institutions are changed. Through the WSRP, new institutions are created and the roles of existing institutions have changed. The driving factor for the institutional reforms has been the concern for a more efficient and sustainable approach to water management. The reform was also necessary because Botswana's water resources management and water service provision rested with a number of entities, resulting in merging of different roles (e.g. water provision and water resource planning), inefficiencies and uneven levels of service as well as management gaps (e.g. regulator, policy development). The new institutional framework under the reform is described in the sections following.

5.1 Water Utilities Corporation (WUC)

WUC will be responsible for the delivery of fresh water and wastewater treatment services country wide. WUC has already taken over supply to most villages. The largest remaining area is Maun and surrounding areas. With regards to wastewater management services, all the entities in the country have been completely taken over except for the Maun area. WUC is on track in meeting the take-over target of all 540 villages by 2014.

5.2 The Water and Energy Regulator

This entity will be primarily charged with ensuring financial sustainability across the water sector, reducing wastage by facilitating the streamlining of operations and determining revenue requirements to inform regular tariff adjustments (Draft National Water Policy, 2011). The regulator will also oversee compliance of service standards to ensure efficiency and protect consumer rights. The regulator will, however, regulate more than one sector, e.g. water, energy, and telecommunications. This body should become financially sustainable in fully assuming its roles and responsibilities.

5.3 Department of Water Affairs (DWA)

The DWA will continue to be wholly financed by central government and has the overall responsibility to assess, plan, develop and maintain water resources for domestic, agricultural, commercial, industrial and other uses in the whole country. In order to effectively implement

these leadership roles, DWA will assist and advise in the formulation of water resources development and management policies and legislation. DWA will undergo a significant restructuring under the reform in-order to fully implement its roles and responsibilities.

5.4 Water Resources Board (WRB)

As an autonomous body supported by (MMEWR), the WRB will oversee and allocate Botswana's scarce water resources. It will also monitor these resources and develop water related policies. The Board with ensure independence and equity in the sustainable allocation of water resources. The WRB will replace the WAB and will have members from the following entities: MMEWR, Ministry of Environment, Wildlife and Tourism, Ministry of Agriculture, large water users, WUC, research and academia as well as civil society. It is envisaged that the Board will be wholly financed from the central government coffers. However, as time goes on, the revenues collected from licensing and water abstraction fees could support the operations of the Council.

Different institutions and sectors have each an interest in the management and use of water resources in Botswana. Water-related dialogue and consultation often concentrates on water users at the exclusion of such sector as health, housing, nature conservation and energy (especially where hydropower is absent). Ineffective coordination and fragmentation in the water sector has therefore contributed to ineffective management of the water resources. The reform process seeks to correct this anomaly. The process is ongoing and is expected to be complete by 2014. Upon completion, Botswana's water sector institutional framework will enhance sustainable and efficient utilisation and management of the country's scarce resources and support the achievement of Vision 2016 and Millennium Development Goals.

6 Financing of the Water Sector

Funding requirements for the water sector have greatly expanded with the expansion of the number of well fields, dams, water treatment works and settlement water reticulation and sewerage systems. In brief, government provides water in settlements (villages, towns and cities). DWA and WUC use a block tariff with rising water tariffs for higher user bands; tariffs are the same for domestic users and business/commercial users[14], but the tariff for government institutions is considerably higher. For social reasons, water provided through public standpipes was free, but public standpipes are currently phased out. WUC has to break even by law and therefore need to achieve full cost recovery (capital and O&M costs). DWA and Council rates are lower as they aim to cover the O&M expenditures. With the take-over of village water supplies by WUC, a new countrywide tariff policy is in preparation.

Outside settlements water users pay for their own supply, having been granted water rights. Therefore, there is no subsidy involved. However, water users are not charged for environmental externalities and for resource royalties (i.e. intrinsic resource value).

6.1 WUC Expenditures & Revenues

The average annual capital expenditures have been BWP368.2 million in the period 1990-2009. Figure 12 below shows the high and rising capital expenditures associated with the construction of the NSC in the 1990s. Capital expenditures will rise once more with the impending construction of phase 2 of the NSC and –later on- the possible pipeline from Chobe to the NSC. However, the associated capital costs will now be financed through DWA, as the construction of water infrastructure has become its responsibility.

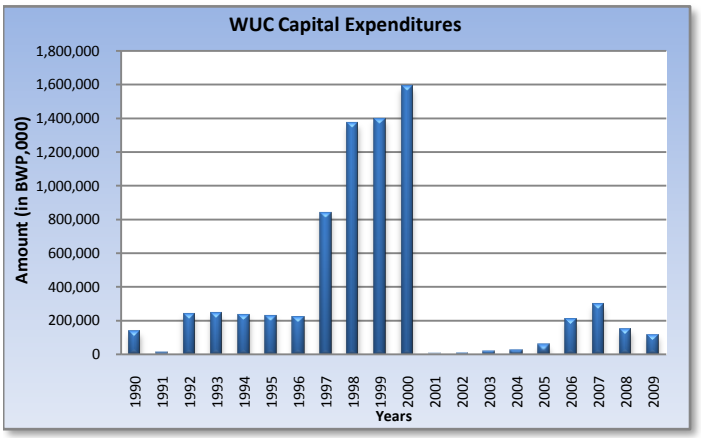


Figure 12: Water Utilities Corporation capital expenditures (BWP000) [Sources: Annual reports WUC.]

The average annual recurrent expenditures of WUC were BWP5.47/m^3, but the unit costs varied by region. The costs are around half of DWA's recurrent costs/m^3. While this difference may reflect the higher costs of providing water in rural areas, it could also reflect different supply efficiencies. The average WUC revenue/m^3 was BWP9.78/m^3, significantly exceeding the average annual recurrent expenditure. Table 21 shows that households and businesses pay half or less per m^3 compared to government. BCL for example, receives water at very low cost (BWP0.90/m^3) as part of an old agreement.

[14] Mines provide their own water supply or obtain water from WUC at negotiated rates. .

6.2 DWA revenues and expenditures

DWA provided data for the production, consumption and losses in large villages for the period 2000-2010. In addition, data were obtained for revenues and recurrent expenditures for the period 2003-2008. During the latter period, DWA spent BWP1.3 billion on recurrent expenditures while revenues amounted to BWP1.2 billion, leaving a shortfall of BWP155 million. The shortfall was most serious in 2003 and 2004, but was corrected from 2005 onwards. This is reflected in Table 22, which shows that the unit revenues were similar or higher than the unit recurrent expenditures from 2005 onwards. DWA recurrent cost recovery was much lower than that of WUC.

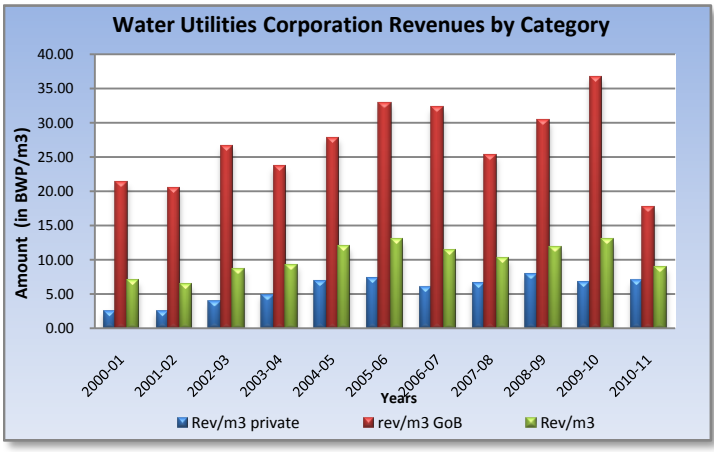


Figure 13: Differential DWA revenues by user category (BWP/m^3) [Source: adapted from DWA **data].**

Revenues were highest from government (53.6% during period 2000-2010) while domestic users and the private sector accounted for 46.4% of revenues. The high revenues from government were due to large government presence in the large villages and to the extra high tariff paid by government (Figure 14). This situation may prove unsustainable in future and also reduces the financial water conservation incentives for other sectors.

Table 21: Unit revenues by consumer category (BWP/m^3).

Consumer Category	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
Domestic Customers (2A)	6.44	5.98	6.10	5.58	5.89	5.96	6.11	6.72	6.50
Business & Industrial C	7.69	8.44	8.97	8.62	8.87	8.99	9.03	9.16	9.23
The Government (2C)	15.04	17.34	18.41	17.44	17.85	17.91	18.19	19.62	20.85
City Council (2D)	12.31	13.79	13.76	13.40	14.25	14.55	16.13	16.46	17.92
Business and Industrial	1.37	2.27	2.24	2.10	2.09	2.14	2.11	2.10	2.12
City Councils – Stand pipes	12.72	14.91	16.07	15.37	15.38	15.82	16.12	16.60	17.06
District Councils & DWA	12.93	14.22	16.08	15.12	15.24	15.25	15.32	14.89	14.56
NSC DC & DWA	8.56	9.36	10.26	9.85	9.85	9.85	9.85	9.85	
BCL special	0.80	0.84	0.86	0.90	0.90	0.90	0.90	0.90	0.90
Total WUC sales in BWP	8.66	9.53	10.48	9.52	9.72	9.87	10.05	10.45	9.72
Source: adapted from WUC data.									

Few data were found on capital expenditures. DWA's capital expenditures grew rapidly in the period 1989 – 2002. Real DWA expenditures from the Development and Consolidated Funds have tripled in this period to fund the establishment of water reticulation systems in all villages, and expansion and/or upgrading of older systems. More recent data could not be obtained from DWA. As DWA is now responsible for water infrastructure development, controlling and curbing the increase in capital expenditures down should become a major strategic challenge for DWA.

This can only be achieved by prudent IWRM and development of a balanced demand control and new (conventional and non-conventional) supply measures.

6.3 Private Water Sector

The private sector (mining and livestock) invests in the water supply of mines[15] and the livestock sector. Especially, the latter is important for drinking water supply for those who live outside villages. They often get or purchase water from livestock boreholes. Government provides subsidies for livestock water development under its Livestock Management & Infrastructure Development (LIMID) programme. Farmers pay part of the water supply costs.

Table 22: DWA expenditures and revenues (2003-2008; BWP/m^3).

Year	Recurrent expenditure/m^3 produced	Recurrent expenditure/m^3 consumed	Revenue/ m^3 consumed
2003	9.03	12.51	7.43
2004	8.73	11.56	9.66
2005	8.93	11.57	11.34
2006	7.28	10.06	10.76
2007	7.29	9.83	9.83
2008	8.26	11.02	11.09

6.4 Sanitation

Sewerage systems have been constructed in all urban centres. Presently, the government is rolling out an investment programme to construct sewerage and treatment systems for all large villages. The required investments are substantial and affordability is one of the concerns raised in the 2003 NMPWWS. According to SMEC *et. al.* (2003) investments of BWP3.2 billion are needed in the NDP10 to meet the policy objectives. The NMPWWS recommends an average household charge of BWP290 per annum and institutions would pay BWP2.08/m^3 used. Such rates would cover the estimated operational costs and therefore government would assume financial responsibility for the sanitation investments. Currently, plot owners pay a fixed annual service levy to the local authority, which includes payment for wastewater treatment. The new dual responsibility of WUC for wastewater treatment and fresh water supply offers the opportunity for a combined fresh water and wastewater treatment tariff.

6.5 Subsidies

Several subsidies currently apply to the water sector. To facilitate meeting basic needs, the rates of the first 5 m^3/month are low and subsidised by higher charges in the upper use bands. In areas where standpipes still prevail, government subsidises water consumption (beyond the nominal monthly service fee in SHHA areas). Government subsidises water consumption in urban and rural settlements both directly and indirectly. In rural areas, government has traditionally paid for water infrastructure and part of the recurrent expenditures. There are no such subsidies in urban areas. However, indirect subsidies are provided in urban and rural areas through the super tariffs paid by government. For large villages, this indirect subsidy (difference between government rate and average revenue unit price) is valued at BWP593 million in the period 2003-08. Without the super tariff for government, domestic users and the private sector would have had to pay an extra 81.5%.

[15]No figures are available for water investments of the mining sector. However, investments are substantial as the watering costs are sometimes very high, as is evident from the fact that virtually no water leaves the mining operations.

No subsidies are provided for the mining sector operating outside planning areas. Livestock water costs have been subsidised for several decades through a series of financial support programmes. The subsidies range up to 60% of the boreholes costs for groups of livestock owners.

As government seeks to target its subsidies better in all sectors of the economy, it needs to terminate its own 'super' tariff and target the remaining water subsidies to those who can otherwise not afford water. The changes in subsidies need to be incorporated into the planned revised water tariff policy, which should also merge water and wastewater treatment charges.

7 Cross-cutting Water Resource Management Issues

7.1 Climate variability and water resources

Climate change has a direct impact on the hydrological cycle and the water resources. Consequently, several countries have a water section in their Climate Change Adaptation Strategy (e.g. Namibia and South Africa; Government of South Africa, 2010) and/or a climate change section in their IWRM-plan (e.g. Namibia; IWRMPJVN, 2010). The precise impact of climate change on individual countries is often still uncertain. This is particularly true for the amount of rainfall. However, widespread agreement exists about the rise in temperatures and the increase in climatic variability. Application of the pre-cautionary principle dictates that despite the prevailing uncertainties, adaptations are urgently required given the magnitude of the possible impacts and the costs of inaction.

In South Africa, climate change is expected to increase climatic variability with more run-off, increased incidences and severity of droughts and floods, accelerated sedimentation of dams, algae growth in dam water and increased evapotranspiration. These factors combined compromise water security as South Africa is already water stressed. Proposed interventions include exploration and use of 'new' water resources (treated effluent, groundwater and saline water), research, monitoring and evaluation, water demand management and adoption of a water catchment area approach.

The GWP manual on climate change and the water sector adds that given the uncertainties associated with climate change impacts risk assessment needs to be fully integrated in water and development planning. Moreover, it prioritises increasing allocative water efficiency as a key component of IWRM for adaptation to climate change.

The World Bank (2010a) conducted a study of climate change in Botswana and investigated its potential impacts and the risks involved. The study included a historical analysis of climate variability based on internationally accepted indicators. As a (semi-) arid country, droughts have been common in the past and floods have also occurred (though much less frequently). The historical analysis (1960-1990) shows that:

- Rainfall has historically been highly variable in space and in time (seasonal and annually);
- Droughts in terms of rainfall deficits are most common in northern Botswana, indicating that this area may be most affected by on-going climate change;
- Extreme droughts based on low rainfall and soil conditions are most common in south western Botswana; and
- High rainfall events with risks of floods are most likely in north eastern Botswana. Several large dams are located in this area.

The World Bank study further shows that climate change will become important additional water stress factor. Water resources will constrain development and growth more in future unless IWRM is successfully applied. Future growth requires emphasis on water demand management,

efficient water allocation and use, reuse of wastewater, rainwater harvesting and desalination. Most Global Change Model predictions for Botswana are the same in terms of increasing climate variability. They predict an increase in drought frequency and severity, particularly in western and northern Botswana. The frequency of storms will increase in western and northern Botswana and aridity and PET will increase. In south-mid eastern Botswana, part of Limpopo basin, precipitation is likely to decrease but there is a likely increase in flooding, putting infrastructure such as roads and dams at risk; there is a definite bias towards increased droughts and groundwater recharge is likely to decline. Analysis of the associated risk mitigation and adaptation will therefore be needed.

The World Bank study (2010a), further predicts that the economic impacts of climate change may be significant and diverse (without adaptation):

- Increased droughts will adversely affect the agricultural sector (crops and livestock);
- A decrease in groundwater recharge will reduce groundwater resources, affecting primary and secondary land productivity and ecosystem services; and
- Lowerrun-off (by as much as 30 to 40%; SMEC et.al., 2006) and higher evaporation rates will reduce already low safe yields from dams and adversely affect major tourism attractions such as the Okavango Delta. Changes in run-off will affect water storage in dams and public infrastructure such as roads and bridges. Sedimentation of dams may increase.

Several adaptation measures are recommended. The ones relevant to IWRM include i. strengthening of drought and flood risk monitoring and management based on verifiable indicators; ii. Water sector investments and increasing water storage and safe yields of water infrastructure through connecting dams, well fields etc. iii. Implement water demand management measures; iv. Create institutional responsibility for water resources management, which should include the integration of climate related risks for water resources management; this includes the adjustment of design standards to maintain current levels of service.

The SADC CCA Strategy for the water sector (SADC, not dated) also stresses the need to mainstream CCA in the water sector and related major water using sectors. The overall goal is to increase climate change resilience of the region and SADC countries (see 3.7.3). A Handbook on Climate Risk and Vulnerability for SADC also exists (Davis, 2011).

The above has the following implications for the IWRM-WE Plan:

- Water use efficiency is critical to sustain development and adapt to climate change;
- There is need for additional investments in water storage (top capture extra run off and overcome drought periods) and interconnectivity between water storage infrastructure to increase safe yields;
- Vulnerability assessment to climate change in the water sector are needed;
- Greater attention for early warning systems, disaster preparedness and management (droughts and floods);

- Research and development on CC, its impacts on water resources and adaptations;
- Sector assessments (e.g. agriculture, industry, tourism) need to fully integrate the water resources management and climate change;
- Monitoring and evaluation of water resources is critical to improve understanding of the impacts of climate change;
- There is need for modification of building and operational standards for dams (including de-siltation of dams), roads etc. to prevent flood damage; and
- WDM and use of non-conventional water sources are priorities.

7.2 HIV & AIDS and Environmental Health

Safe drinking water and sanitation is vital for environmental health, especially for people living with HIV & AIDS. Diarrhoea outbreaks have been associated with poor water quality. Good water supply and sanitation are required together with good hygienic practices. This will help to reduce diarrhoea outbreaks and keep HIV & AIDS infected people in good health and productive.

If the bread winner in the family is infected by HIV & AIDS and can no longer work, it may affect the family negatively as families may not be able to pay their water bills. This may lead to poverty and limit access to safe drinking water. The provision of free medication for HIV & AIDS helps to overcome negative productivity impacts and income losses but it is uncertain whether government can sustain free medication in future. Additional efforts such as home based care are therefore important.

Meanwhile In general, AIDS deaths lead directly to a reduction in the number of workers available in the water sector. These deaths mainly occur to workers in their most productive years. Due to the loss, younger and less experienced workers replace experienced workers, and consequently worker productivity is reduced. The loss of water engineers for example, can place entire water systems and investments at risk.

Botswana has a high HIV & AIDS infection rate. Females have a relatively higher prevalence rate of 20.4% and males 14.2% (CSO, 2009).HIV prevalence increases sharply with age peaking between the ages of 31 to 49 years and gradually declines with an increase in age for both male and female.

7.3 Gender

The role of both men and women in the water sector is important. However, there are gender differences and inequalities in the use and management of water resources, which inherently affect women in their efforts to have access to, and manage water resources. These differences are highlighted as follows (Johnson *et.al.,* 1997):

- Household responsibilities: women are responsible for managing domestic water supplies and these may conflict with productive water needs such as agriculture hence creating tensions for women;

- Productive uses of water resources: women and men use and manage water for productive uses and with the former mostly responsible for subsistence agriculture while men are often involved in commercial agriculture. Therefore the needs for water resources management differ between the two groups and attention is often directed towards commercial agricultural production;
- Access and control of resources: Control over how water resources should be used and allocated often rests with men hence ownership of resources by women is negligible. Therefore women rarely have equal access to water for productive use and are the first to be affected in times of water shortages;
- Health impacts: Women play a central role in family health and hygiene, especially those of their children. Therefore greater participation of women is likely to increase the handling of environmental health issues associated with water;
- Decision-making: Women tend to play a limited role in community decision making while men play a greater role. In many cases, women are reluctant to speak or risk conflict.

The role of women in the provision, use and safe guarding of water resources cannot be overemphasised. These roles have been globally recognised starting with the 1977 United Nations Water Conference at Mar del Plata, the International Drinking Water and Sanitation Decade (1981-90) and the International Conference on Water and the Environment in Dublin (1992). Reference is also made to the involvement of women in water management in Agenda 21 and the 2002 World Summit on Sustainable Development's Plan of Implementation. In southern Africa, the SADC Declaration on Gender, RISDP and Regional Water Policy accord gender as a priority issue. The linkage between gender and MDG water related goal is also important in understanding the linkages between gender, poverty and water management. These inter-linkages are illustrated in Table 23.

In southern Africa, and in particular, Botswana, the majority of people without access to adequate sanitation and safe drinking water are vulnerable groups living in poor informal settlements,

Table 23: Linkages between gender and water related MDGs [Source: UN Water, 2006].

MDG Relevant Targets	**Ensure Environmental Sustainability (Goal 7)** **Halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation (target 10)**	
	Contribution of domestic water supply and sanitation	**Contribution of sound water resources management and development**
Promote gender equality and empower women (goal 3)	• Reduced time, health, and care-giving burdens from improved water services give women more time for productive endeavours, adult education, empowerment activities, and leisure; • Convenient access to water and sanitation facilities increase privacy and reduce risk to women and girls of sexual harassment/assault while gathering water; • Higher rates of child survival are a precursor to the demographic transition to lower fertility rates; having fewer children reduces women's household responsibilities and increases their opportunities for personal development.	CBOs for water management can improve social capital of women by giving them leadership and networking opportunities and building solidarity among them.

mainly consisting of poor women. While women have been domestic water users and providers, in the SADC region, this role has seldom been reflected in policies and institutional structures of water resources development and management (SADC Regional Water Strategy). The strategy identifies various challenges impeding meaningful participation of women in the water sector:

- Limited understanding and integration of gender in IWRM;
- No appreciation of women's role in IWRM;
- Limited capacity of women to fully participate in IWRM;
- Lack of opportunities for women and vulnerable groups to participate in IWRM, for instance, lack of child care facilities and limited access to irrigation technology among others; and
- Reluctance of some service providers to engage women in IWRM related processes.

These challenges result in adverse health impact on women and their families and increased potential loss of their productivity. It is therefore imperative that an enabling environment is created for women to participate in water management related decision-making at distinctively high levels so that their issues are incorporated in IWRM. Therefore using a gender perspective and enabling the integration of women's knowledge of water resources use and management, will increase the chances of water resource use sustainability and overall environmental management.

Botswana has made significant progress in overall gender-mainstreaming. Commendable accomplishments include: development of a National Policy on Gender and Development; gender- mainstreaming in line ministries; amendment of laws to make them gender responsive; reviews of gender in sectoral policies; and ratification and acceding to regional and international instruments on gender such as the SADC Gender Protocol (MFDP, 2010).

The National IWRM-WE Plan is an opportunity to enhance equal participation and representation of women in the water sector. Through the pillars of GWP-IWRM toolbox, the following three spheres of activities need to be developed, strengthened and implemented so as to ensure effective water management. Within this system and based on the recommendations of SADC water policy, gender- mainstreaming can be systematically enhanced through:

- An enabling environment – developing and strengthening policies and laws to sufficiently institutionalise equitable participation of both men and women in the water sector. This requires support from political bodies and decision-makers. As such, there is need to identify gender gaps in the sector, clarify the role of various stakeholders, as well as advocate for consultations that include women and women related organisations. In addition, there is need for budgetary allocations for supporting structures and programmes that foster gender-mainstreaming activities;
- Modification of institutional roles – need to strengthen gender sensitive organisations and institutions such that there is adequate expertise in gender analysis and mainstreaming (GWP TEC, 2004). Therefore, the current institutional reform should ideally take this direction and should consider ways in which organisations are created by unequal gender relations. In addition, full participation of women in decision-making in water resource development and management is essential;

- Management instruments – As part of the National IWRM-WE Plan, there is need to develop strategies and plans that recognise the rights, needs and role of women in water use and management; and
- Monitoring and evaluation of the adopted mechanisms and approaches so as to assess their success and failure and determine how these can be addressed.

7.4 Poverty

The most recent poverty assessment indicates that poverty has declined to 21% in 2009 (BCWI survey), but remains a significant challenge to government. Therefore, poverty reduction and its subsequent eradication is a major development objective of government (as well as a Millennium Development Goal or MDG). Botswana is in a good position to meet the MDG target of reducing the percentage of people living below the PDL by half, but eradication remains a daunting task.

Poverty is traditionally measured through the poverty datum line (PDL) but internationally the percentage of people living on less than US$1/day is often used. The proportion of Batswana living below the Poverty Datum Line (PDL) has decreased from 30.6% in 2002/03 to 20.7% in 2009/10; in absolute numbers, the number of poor decreased from 499,467 (2002/03) to 373,388 (2009/10). The decline in poverty has been fastest in rural areas: from 321, 808 to 198, 544 between 2002/03 and 2009/10. In contrast, poverty has increased in cities and towns (from 39,113 in 2002/03 to 51,793 in 2009/10 (CSO, 2011).

In spatial terms, most districts have reduced poverty. However, there has been no gain in (Kweneng West 48.1% in 2002/03 and 48.6% in 2009/10) and little gains have been made in Ngamiland (Ngamiland West 53.3-47.3%, Ngamiland East 33.9-27.95 in 2002/03 and 2009/10, respectively).

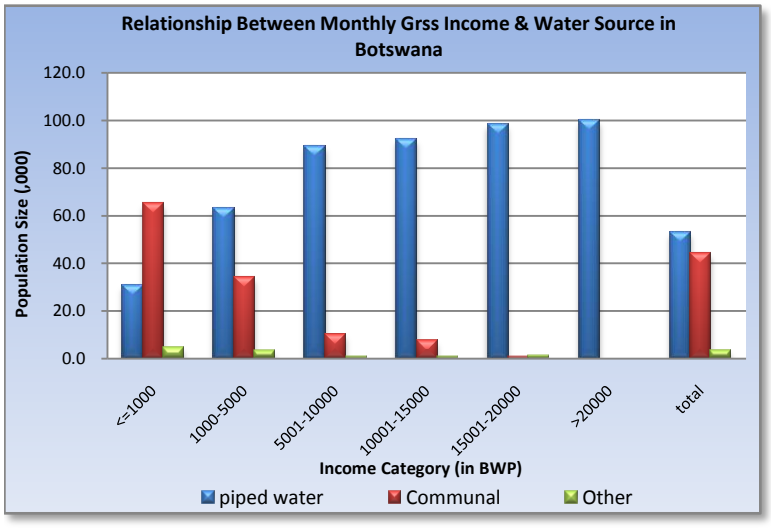


Figure 14: Relationship between gross monthly rural income and source of water (2002/3) [Source: GoB & UNDP, unpublished].

The proportion of people living below the dollar a day has also declined. The percentage declined from 36.1% to 8.3% for rural areas and 19.3% to 6.1% between 2002/03 and 2010. Using this measure, poverty is lower than using the PDL. Nationally the proportion has been reduced from 23.4% to 6.5%. The MDG target has been and there is scope to further reduce the proportion of people living below the US$1 per day. Income levels and poverty have major implications for access to water and sanitation. An in-depth analysis carried out for the Botswana Human Development Report (based on the 2002/3 HIES) showed:

- A positive relationship between income level and access to water/ and type of water connection. Private water connections are most common for monthly incomes of more than BWP1,000. Meanwhile, all households with the monthly income exceeding BWP15,000 have individual water connections.
- A positive relationship between income level and sanitation facilities. Pit latrines are the dominant type of sanitation for income levels up to BWP5000/month and flush toilets are most common for higher incomes. The trends are similar in urban and rural areas, but flush toilets are more common in urban areas due to the higher income level.

The Botswana Water Statistics (2009) indicate that 99.5% of the population in cities/towns get piped or tapped water and in villages the proportion is 84.1%. Even though the average for villages is relatively high, there are some areas like in the Okavango Delta where only 27.2% have access to piped water. Botswana has achieved the MDG targets on access to water and sanitation. In 2007, 79% of the population had access to improved sanitation and 96.2% of the population had access to improved sources of water (GoB & UN, 2010).

In order to achieve the MDGs through implementation of IWRM plans, GWP suggest that the IWRM plans should be aligned to MDG time frame with its 2015 deadline. It is therefore important to identify MGD-related water resource management priorities. A roadmap should have clear timeframes and associated targets. The UN Water and GWP suggest roadmaps could have MDG-linked indicators, monitored every three years: 2009, 2012 and 2015. Specific set of indicators with associated themes are suggested as follows:

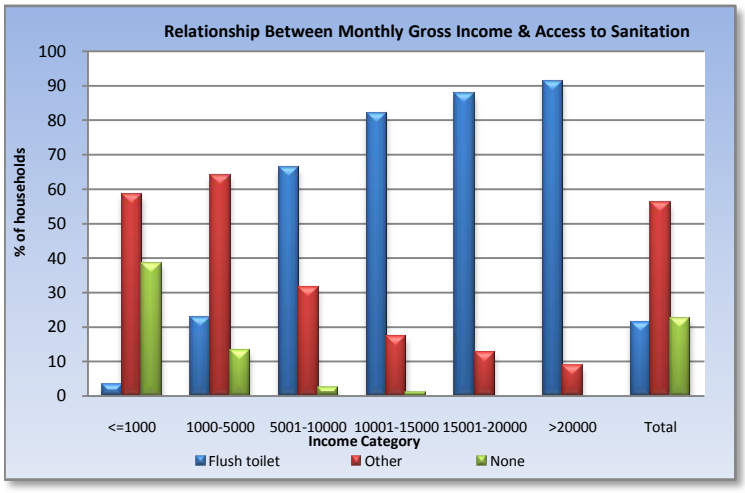


Figure 15: Relationship between gross monthly income (in Pula) and access to sanitation [Source: GoB & UNDP, unpublished].

- 2009: Focus principally on reviewing the extent to which key enabling conditions for the implementation of national IWRM priorities have been addressed. Note progress on specific IWRM change processes and the realization of the water-related MDGs;
- 2012: Focus principally on reviewing the progress of specific IWRM change processes. Note progress on enabling conditions and the realization of the water-related MDGs; and
- 2015: Focus principally on assessing the extent to which improving water management through IWRM has successfully contributed to the implementation of the MDGs. Note progress on enabling conditions and on specific IWRM change processes (UN Water and GWP,2009).

7.5 Governance and Water Integrity

Good governance is a key performance factor in any sector, including the water sector. World-wide, a significant portion of expenditures in the water sector do not reach their intended use and underperformance in service delivery is widespread. The water sector may experience integrity problems such as illegal connection, water losses, non-payment of supplied water, inappropriate allocation of water rights (e.g. ground or surface water), non adherence to the abstraction ceilings, illegal water pollution etc.

A 2008 assessment of water governance in the SADC region (Earle *et. al*., 2008) noted several governance concerns for Botswana's water sector:

- Water service providers have few mechanisms of engaging their clients to provide a direct feedback on their performance. In other countries such as Kenya and Zambia, this is done through the water regulators with performance assessments and/or citizen score cards (SIWI et.al. 2012; www.watergovernance.org). Clients' feedback is useful to improve the performance and efficiency of water service providers;
- Limited capacity in water governance issues of transparency and good corporate governance for sustainability and improved water supply;
- Very limited participation of NGOs, communities, water users and the private sector in water resources management and governance. Enhanced participation would help to focus IWRM efforts and improve the performance of service delivery. It is also essential to overcome capacity constraints of government and water service providers;
- Inadequate use of governance tools such as complaints systems, triangulation in monitoring water programmes; citizen scorecards; performance and diagnostic survey reports, track public expenditures in detail; and
- Inadequate access to and sharing of information on water delivery performance and other aspects of IWRM. This would enhance transparency and accountability.

The on-going water sector reforms have the potential to improve water governance, participation, transparency and accountability. The results cannot yet be assessed. Therefore, monitoring of the IWRM impacts of the reforms should be integral part of the IWRM-WE Plan implementation (listed as an activity under monitoring in the IWRM-WE Plan).

8 Water Resources Demand and Supply Forecasts

8.1 Water Demand Forecasts

Future water demand depends on a large range of factors, among others, population growth, urbanisation, settlement patterns, economic growth, economic diversification and welfare levels. All factors can only be predicted with a degree of uncertainty, making overall water demand forecasts more uncertain. Moreover, future water demand is influenced by policy decisions and choices. For example, a policy change towards food self sufficiency instead of food security is likely to require a large increase in water withdrawals for irrigation (unless rain fed crop production increase its production tremendously). The most important strategic policy areas are agricultural development, in particular irrigation, economic diversification, new mining activities and energy. It is important that water resources constraints are fully integrated into the review of suitable sectors for economic diversification. Diversification towards water intensive industries will accelerate future water requirements and (over) stretch available resources. Moreover, Botswana's comparative disadvantages in water resources should also be reflected in the trade policy and patterns.

Table 24: Water demand forecasts for Botswana (in Mm^3).

Demand category	1990	2000	2010	2020
Urban areas	20.9	45.0	72.0	103.1
Major villages	8.2	21.5	35.4	51.9
Rural villages	5.3	9.2	12.7	16.5
Other settlements	1.9	2.3	2.7	3.0
Mining	22.5	35.7	56.5	63.7
Livestock	35.3	44.8	34.3	44.1
Irrigation, forestry	18.9	28.9	38.5	46.9
Wildlife	6.0	6.0	6.0	6.0
Total	**119.0**	**193.4**	**258.1**	**335.2**

Source: SMEC *et. al.*, 1991 vol. 1.

The 1991 BNWMP prepared water demand forecasts for the period 1990-2020 (see Table 24 below). The forecasted demand was 258.1 Mm^3 for 2010 and 335.2 Mm^3 for 2020. Later on, the Water Accounts (DEA and CAR, 2007) suggested that the NWMP forecasts were too high, offering opportunities to postpone phase 2 of the NSC and dam construction. The WA showed water demand of 176 Mm^3 in 2003 while the BNWMP forecast for 2000 is 193.4 Mm^3, (or 10.4% higher).

Surprisingly, the NWMPR (2006) lacks a summary section for demand trends by sector. As a result, total demand forecasts had to be put together for the IWRM-WE Plan. The water demand forecasts for different sectors are discussed below.

8.1.1 Cities, towns and villages

The NWMPR base run predicts an increase in water demand from domestic use, the public and private sectors in settlements. Forecasts for domestic and settlement use are most detailed and elaborate. Water demand is expected to increase from 100.4Mm^3 in 2010 to 167.9Mm^3 in 2030 (excluding losses). These figures are based on population forecast based on the 2001 Population and Housing Census and need to be up-dated with the results of the 2011 Census.

8.1.2 Mining

The NWMPR assumed that water consumption by the mining sector remains constant at 28.1 Mm^3 (this figure is similar to the estimate of the WA). This figures provides for some of the existing mines (BCL, Debswana and Sowa), but not for water demand of other mines (such as Bosetu Mine, BK11, AK6, Tati Nickel) with an estimated annual water demand of 1.3 – 2.5Mm^3 for average and dry years) Further growth in the mining sector is likely and this may require significant water resources. WRC (2012) explored the water demands of mining sector in more detail and estimated the total demand from the existing mines in 2012 at 55.4Mm^3 with a peak of around 75Mm^3 in 2027. After 2027 closure of existing mines could reduce water demand, but it is probable that new mines will be opened before 2027, which will stabilise or further increase demand. In conclusion, mining water demand is expected to grow significantly in future.

8.1.3 Irrigation

According to the National Management Plan for Arable and Dairy Development (NAMPAAD), the area under irrigation will triple to around 5 200 ha (economic scenario) or 5 400 (social scenario) from an estimated 1 800 ha at present. The NWMPR position is that treated wastewater (26.7Mm3) and water from sand rivers (16.9Mm3) are the most suitable resources, limiting the amount of land that can be irrigated (4 360 ha assuming annual efficient[16] water requirements of 10,000m3/ha). Based on the (NAMPAADD) irrigation plans, water requirements are expected to be around 50Mm3. Assuming full re-use of treated effluent and sand river potential, some 7Mm3 of water has to be sourced from small dams, boreholes etc.

The actual water demand from irrigation may differ significantly from the above as it depends on the country's food security and agricultural policies and on the possible implementation of mega-projects, such as the Zambezi Integrated Agro-Commercial Development Project. The latter project involves irrigation of 20,000ha north of Pandamatenga, requiring an estimated 200Mm3. This is four times the above indicated future irrigation demand.

The NWMPR warns that future water demand associated with 5 000+ ha irrigation can be met, but with great costs to other users and sectors (SMEC and EHES, 2006, vol.1., p. 96). In other words, large-scale irrigation carries significant opportunity costs.

8.1.4 Livestock

The livestock sector has not grown in the past few decades and livestock numbers are not expected to grow dramatically in future. Consequently, the NWMPR anticipates a modest growth in water consumption by livestock from around 40Mm3 in 2010 to 50Mm3 in 2030. A stronger revival of the livestock sector would lead to a higher water demand.

[16] If the widely used norms of 12 and 15,000 m^3/ha are used, these sources could only irrigate 3,633 and 2.906 ha.

8.1.5 Overall NWMPR Forecasts

Forecasts in the 2006 BNWMPR are largely sectoral and they are difficult to aggregate to a national demand. Our interpretation of the demand forecasts of the NWMPR is presented in Figure 16. The water demand was estimated to be 193Mm^3 in 2010 and growth is expected to 228.7Mm^3 in 2020, and 285.8Mm^3 in 2030. Growth would occur mostly in the settlements due to increased domestic use as well as private sector and public sector development. This estimate wrongly makes no provision for mining expansion. Moreover, it assumes modest expansion of irrigation to around 5,500 ha in 2030. The discussion above shows that mining and irrigation could push up water demand significantly. The combined effect of implementation of all mining plans, the Zambezi Agro Commercial Development project (which is unlikely to be implemented as originally planned), and irrigation of the Pandamatenga farms would require 400 to 500 Mm3 extra.

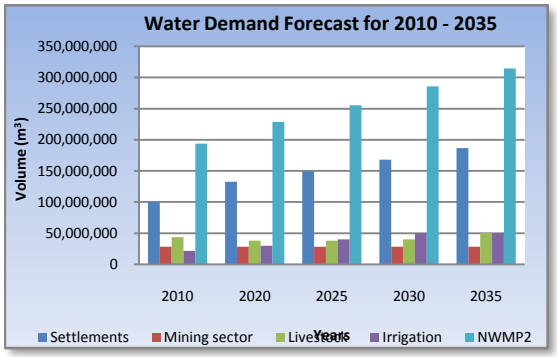


Figure 16: Demand forecasts of BNWMPR [Source: calculated from NWMPR with own corrections and assumptions].

The NWMPR (2006) forecasts are much lower than the forecasts of NWMP1 (1991). This shows that DWA – as the institution charged with water resource management, needs to regularly review and up-date forecasts based on new data (such as the 2011 Housing and Population Census), actual water consumption figures from WUC, and the water accounting results. Such update needs to inform their capital investment programme, especially the phasing of it.

8.2 Water Supply Forecasts

Water supply assessments indicate that the potential for increased groundwater consumption is very low as abstraction already exceeds recharges in most well fields. Further supply of groundwater is only considered feasible in areas not yet fully investigated, and therefore groundwater exploration should remain a continuous activity until the entire country is covered and documented. The NWMPR recommends groundwater use for potable consumption and livestock only. Consultations for this plan show that the mining sector will increasingly explore the potential of use non-potable (polluted or saline) groundwater for mining processing.

Current wisdom is that large scale domestic conventional surface water supplies will no longer be possible after the completion of the current dams. The recommended long term alternative is to use water from the Chobe-Zambezi and link this with the NSC as well as use water from the Nata River system. Both water sources are shared with other countries and abstraction requires consent of the other states. Good potential exists in western and northern Botswana to expand groundwater abstractions, for example around Maun and elsewhere in Ngamiland, Masama, Gweta, Botlhapatlou, Paje and Kang Phuduhudu (Water Surveys & Bergstann, 2008).

The current and planned sustainable groundwater and safe dam yields amount to 242 Mm^3 and is clearly insufficient to meet future water demand forecasts beyond 2020-2030. Therefore, there is need for:

- Increased sustainable use of groundwater where there are no alternatives;
- Increased use of non conventional water supply sources: treated effluent (estimated to be 73 Mm3 in 2030), increased use of saline and polluted groundwater and rainwater water harvesting;
- Reducing water losses in reticulation systems from the current +20% water loss figure;
- Reducing water wastage among water consumers;
- Negotiations for fair and equitable as well as sustainable water abstractions from shared water resources; and
- Greater allocative efficiency based on a combination of instruments such as tariffs, quota and sectoral agreements)

The NWMPR also 'warns' about the high costs of expansion of the water supply infrastructure, which can be ameliorated by water demand management efforts. Opportunities also exist in rehabilitation of small dams (for agriculture) and use of water from sand rivers. Increased climate variability is likely to adversely affect the safe yields of dams and requires additional water storage capacity. Supplies must be able to meet (modified) water demands during droughts and store excess run-off during floods. It is reported that Botswana has gained water abstraction rights for 495 Mm^3 from the Chobe Zambezi system. Moreover, it has to be realised that the investment and operational costs of transporting water over such a long distance will be very high.

The amount of wastewater will rapidly increase in future and this offers significant reuse and recycling opportunities. Modern treatment technologies may be more expensive than the traditional pond treatment system but the water losses of the former are much lower (40-45%) and the benefits of reuse and recycling could outweigh the higher treatment costs. Reuse/ recycling of all wastewater should be an IWRM priority (and help to achieve the 96% reuse target of the NMPWWS).

8.3 Supply and Demand

The above shows clearly that 'business as usual' is unwise because of resource-constraints and the high costs. The NWMPR puts it as follows: ' water resources strategies to meet Botswana's water demand for the next thirty years will be dominated by the two issues of water resources stewardship and water demand management rather than capital development works' (SMEC and EHES, 2006, vol.1, p.193). The NWMPR argues that '46% of the water developed from scarce water sources of Botswana are wasted through losses and inefficient use. This amounts to 57.6 Mm^3annually (SMEC and EHES.2006, vol. 5, p.7). The recovery potential is estimated at 32.4Mm^3 through focused campaigns. These figures need verification (as the same plan states that data are insufficient) but they show, however, the need for Water Demand Management and the opportunities to postpone major infrastructure projects and achieve economic savings.

As a follow up of the NWMPR, a cluster study was carried out for DWA to identify 'water surplus' and 'water short spatial clusters' and explore long distance water transfer schemes to meet demand up to 2035 (Water Surveys & Bergstann, 2008). The demand was based on up-dated mining water use and population figures. A total of 13 clusters were distinguished, with their future demand and supply summarised in Annex B. The main future water deficit clusters are the greater Gaborone cluster, Serowe-Palapye cluster and Orapa cluster. The greatest surplus clusters are located in the north east and to a lesser extent western Botswana, where there are good groundwater resources and demand is low. A wide range of transfer schemes were reviewed, including transfer of groundwater from Ngamiland via Ghanzi to Gaborone.

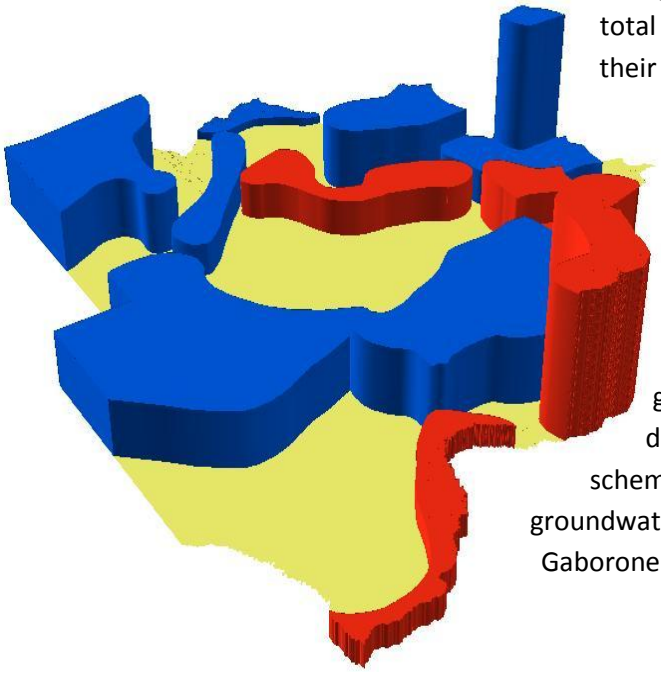


Figure 17: Three-dimensional Surplus and Deficit in the Clusters by 2035 (blue is surplus; red is deficit). [Source: Water Surveys and Bergstann, 2008].

In terms of water supply, the following was recommended by the 1991 NWMP and NWMPR:

- Construction of Dikgatlhong Dam and completion of Ntimbale, Thune and Lotsane dams;
- Increasing the safe yields of the water supply infrastructure through water transfer schemes, conjunctive use etc. Interconnection of a number of villages with water shortages to the NSC after completion of Dikgatlhong Dam. Increased the capacity of the NSC; and
- In the long term, construction of a pipeline from Kazungula to the NSC as Dikgatlhong Dam cannot meet expected future water demand. Government has formally notified member states of its intention to abstract 495Mm3 per annum from the Chobe River.

In addition, existing small dams for agriculture can be rehabilitated and opportunities for more small dams for livestock and irrigation should be utilised. In terms of water demand management, the following is necessary (expanded from the NWMPR):

- A water resources information system that collects, archives and analyses hydro-geological, hydrological, water-use and revenue/cost data for Botswana; water consumption data are currently not kept for easy analysis; water consumption in the growing tourism sector needs to improve, and tourism needs to use alternative water sources in dry areas (e.g. western Botswana);
- Improved wastewater technologies and treatment, leading to an outflow quality that is suitable for 'any reuse option, higher outflows (as % of inflows currently; the figure is currently estimated at 50% only due to high evaporation from evaporation and maturation

ponds) and 96% reuse of the outflows in 2030. It is important to increase the outflow/inflow ratio to at least 70%. This requires technological advanced treatment methods than evaporation ponds. The quality of the outflow needs to be monitored to ensure safe reuse and discharge;

- Assess desalination needs and potential, including a retrospective EIA of desalination plants in operation to assess their implications on the surrounding environment and their viability. In addition, global desalination trends (in terms of technology, costs and applications) should be regularly analysed to make sure that Botswana's saline water resources are optimally used;
- A comprehensive programme for water demand management and the use of pricing to achieve efficiency in use and equity in access;
- Increase current water use efficiency of agriculture, industry, the service industry, including government and domestic users;
- The environmental flow requirements need to be calculated using the Building Block Method (BBM) to avoid that water shortages are met at the expense of the environment. The NWMPR mentions EFR calculation at strategic place such as Mohembo, Shashe River downstream from Dikgatlhong Dam and the Thune River downstream from Thune Dam;
- Create 'water space' to support economic diversification and growth by developing mechanisms for enhanced allocative efficiency taking into account the opportunity costs of water use by each sector; and
- Capacity building, human resource development/ strengthening and knowledge base building in IWRM-WE, monitoring and water assessment.

Good examples of water demand management measures exist (see Box 6 below). They require up-scaling (e.g. storm water use in Orapa) and in some cases financial incentives as the short term costs for water users exceed the benefits (e.g. rainwater harvesting by households).

Box 6: Examples of water demand management interventions.

Example 1: rainwater harvesting by WUC clients

The average water consumption per WUC meter was 379 m^3 p.a. in 2008/9. The WUC average supply cost is P 7.22/m^3 with an average revenue per cubic metre sold of P 10.17/m^3 (WUC Annual Report 2008/09). In 2008/9 there were 78 018 individually metered connections.

A ten percent reduction in water consumption through rainwater harvesting would lead to water savings of 5.1 Mm^3 p.a. and a net revenue decrease of P 15.1 million for WUC country-wide (assuming unit production costs would not change). The water savings in terms of cubic metres could be used by WUC to serve other users and to postpone new infrastructure investments (leading to capital costs savings).

At the individual user level (government, business and domestic use), savings would be 37.9 m^3 p.a. equalling P 385. A 5 m^3 (5000 litre) rainwater catchment tank costs around P 2,500 giving a payback time of almost 6.5 years. This is dependent on water pricing, water use habits and number of rain events; so the potential for savings could be greater thereby decreasing the payback time.

Conclusion: rainwater harvesting tanks are not financially attractive for most water consumers at present. As there are major benefits to the country at large, targeted subsidies or tax incentives would be justified to stimulate rainwater harvesting.

Example 2: Storm water harvesting in Orapa

In 2009, Orapa and Letlhakane Mines commissioned the construction of a million cubic metre storm water dam whose primary objective is to harvest rainwater. The mine faces serious water shortages. The capacity was determined based on an 80% chance of filling up. Water is collected from run-off water.

The project costs are BWP58 million and (ground)water is saved equalling the capacity of 7 boreholes. The estimated benefits are BWP38.4 million (avoided capital costs of 7 boreholes) and annual lower operational costs of BWP0.5 million. The first year benefits are BWP 38.9 million and at least BWP 0.5 million in subsequent years.

Conclusion: storm water collection can be a major source of water; a Cost benefit Analysis would determine the financial returns and pay-back period.

Example 3: Replacement of Automatic Flush Urinals (AFU)

A retrofit was under taken during 2004 in Shoshong Senior Secondary School. The initial average flow into the toilet block was approximately 500 litres/hour. After the retrofit the flow into the toilet block was approximately 50 litres/hour, i.e. a savings of 450 litres/hour. In monetary terms this would equate to savings of almost P4 500/month for one AFU! As the costs of retrofitting were estimated to be around P5 000, the payback period would be less than two months! The question arises why we still have AFUs in the country while the resource and economic costs are so high?

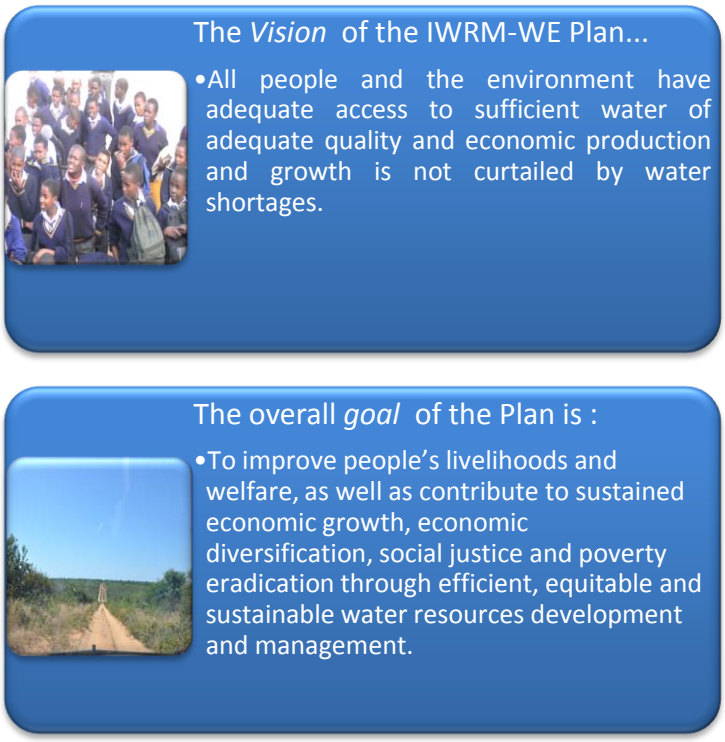
Conclusion: replacement of AFU has a very short payback time and considerable water savings. However, additional measures are necessary to promote complete phasing out of AFUs. These include awareness raising and regulations. Financial incentives are not necessary.

Source: expanded from CAR, 2010.

9 The IWRM-WE Plan

Botswana's water sector faces numerous challenges and opportunities for enhanced and accelerated IWRM and WDM implementation. Both the challenges and opportunities form the basis of development of the IWRM-WE strategy and implementation plan. Through a rigorous stakeholder consultation process, these were discussed and agreed to by consulted stakeholders.

The IWRM-WE Plan is embedded within the country's long-term Vision, and the National Development Plan objectives of sustained development, rapid economic growth, economic independence and social justice. Moreover, the Plan incorporates and builds upon water sector documents such as the NWMPR 2006, the national Water Policy as well as several water sector regional policy documents. Water provision and management cut across all economic sectors and are a key component of people's welfare. Botswana has done well in terms of increasing access to water and improved sanitation that it has achieved the MDG and national target for access to water (access of 96.2% in 2008); and it is likely to achieve the MDG and national targets for access to improved sanitation in the foreseeable future (79% in 2008[17]; GoB and UNDP 2011).



IWRM is essential in the pursuit of sectors' objectives as well as economic growth, diversification, and poverty eradication. As observed earlier, water is a key priority sector for meeting the MDG targets that requires significant attention from all stakeholders and relevant institutions. The strategies discussed in this report are therefore vital for meeting Botswana's National Vision 2016, NDP10, DDP7s and international obligations in reducing poverty and enhance environmental sustainability (MDGs).

The IWRM-WE Strategy is not an entirely new process. In fact, it incorporates activities and recommendations from the NMPWWS (SMEC *et. al.*, 2003), as well as the NWMPR (SMEC and EHES, 2006). It is also informed by the Water Policy, which has to be approved by Parliament (draft October 2012) as well as by the on-going water sector reforms. In other words, the IWRM-WE Strategy synthesises existing strategy and policy documents dealing with the (waste) water sector and aims to fill gaps and recommend activities for implementation.

[17] Up-dated figures from the 2011 Population Census will be available later in 2012.

This IWRM-WE Strategy ensures that the commitment of Botswana, made at the 2002 World Summit on Sustainable Development in Johannesburg, to prepare and implement an IWRM-WE Plan is met. Many other countries have prepared such plans or are preparing them.

Chapters 3 and 8 show that a gap between water demand and supply will occur in future if no interventions are taken. Such adaptations need therefore to be based on IWRM, and -as argued by the NWMPR- by a change in emphasis towards water demand management measures. Botswana is implementing a water sector reforms programme (2009 – 2014) aimed to address the sector's challenges. Although the reforms have the potential to implement IWRM better, day-to-day pressures of implementing the reforms could adversely affect IWRM and in particular WDM implementation. Therefore, the water sector reforms need constant support for integration and implementation of IWRM and WDM.

The situation analysis and demand-supply forecasts have revealed several overall gaps in water resources management. These include:

- The enabling policy environment lacks an approved Water Policy and a new Water Act;
- Botswana does not make use of the catchment area management model;
- Lack of up-scaling of successful WDM management technologies and best practices(i.e. successful technologies, pilot[18] and demonstration projects);
- Little participation in water management of water users, private sector and communities due to government domination;
- Inadequate institutional structures for IWRM in the water sector institutions and major water users; and
- No explicit coverage of gender and water resources as well as water integrity concerns (e.g. transparency, participation and access to information).

9.1 The IWRM-WE Plan: Vision, Goals, Strategic Areas and Specific Objectives

The Vision of the IWRM-WE Plan that all people and the environment have adequate access to sufficient water of adequate quality and economic production and growth is not curtailed by water shortages.

The overall goal of the IWRM Plan is therefore to improve people's livelihoods and welfare, as well as contribute to sustained economic growth, economic diversification, social justice and poverty eradication through efficient, equitable and sustainable water resources development and management. This requires that no water is wasted, all treated wastewater is reused or recycled and all population groups (current and future) have access to water for their basic needs and livelihoods. Moreover, sufficient (quantity and quality) water is available for environmental needs (species, and ecosystems) to ensure biodiversity and a healthy environment. The above

[18] Many consulted stakeholders argued that enough pilots and demonstration projects have been carried out and that it is time to upscale and implement IWRM and WDM projects.

requires an enabling environment for resource development, planning and management, appropriate institutional structures with clear designated responsibilities including local level structures as well as suitable management instruments. Strong political commitment is imperative for the achievement of this goal together with adequate funding commitment from government and other stakeholders.

9.2 IWRM-WE Principles

The Strategy recognises the following principles of IWRM (adapted from the Dublin principles):

- Water resources are ecological, economic and social goods that need to be managed accordingly. This means that water resources are limited and can deteriorate and deplete if not properly managed; moreover, the environment is one of the legitimate water users; water use has a cost and price and that people should have access to water to meet at least their basic needs;
- Water management is not the sole responsibility of government. Instead, it requires participation of all stakeholders, including water users, women, the private sector, academia and civil society;
- Water management is most effective if it is decentralised to water catchment area level and below. However, strong links need to be maintained between the local, district, catchment area and national levels to ensure consistency.
- Water resources need to be wisely used and governed. This implies that water resources management needs to be participatory, accountable and transparent. Furthermore, capacity needs to be built, utilised and maintained and stakeholders need access to information and data[19].

9.2.1 Strategic Areas

The Strategy covers ten strategic areas that have been developed based on priority water sector issues and challenges identified through the plan consultation process, policies, the WSRP and other related documents. These strategic areas are linked to the NWMPR (2006), NMPWWS (2003), the water reforms, NDP10 (2009-2016) and Vision 2016. Figure 18 and Table 25 show the overall structure and outline of the IWRM-WE Plan.

Figure 18 indicates the link between the vision, overall goal and the strategic areas with their specific objectives. Moreover, important crosscutting issues that need to be fully incorporated in all Strategic Areas are summarised: climate variability, poverty, gender, HIV & AIDS and environmental health, water governance and integrity.

The strategic areas and their specific objectives have been selected during the consultations which formed part of the IWRM-WE preparation process. The strategic areas cover the three key areas of IWRM toolbox (see Table 2, as listed in the GWP toolbox), i.e. management instruments (e.g. legislative, economic, social and WDM), the enabling environment (e.g. policies, strategies, legislation) and the institutional structures and capacity.

[19]These aspects are captured in the concept of water integrity. For example, see Earle *et.al*. (2008) for mapping integrity and accountability in water activities in SADC.

The activities for each SA are summarised in Figure 18 and Table 25. Each activity is explained in more detail in chapter 6. Successful implementation of the activities should contribute towards the achievement of the overall goal and Vision of the IWRM-WE Plan.

Figure 18: Structure of the Botswana IWRM-WE Plan.

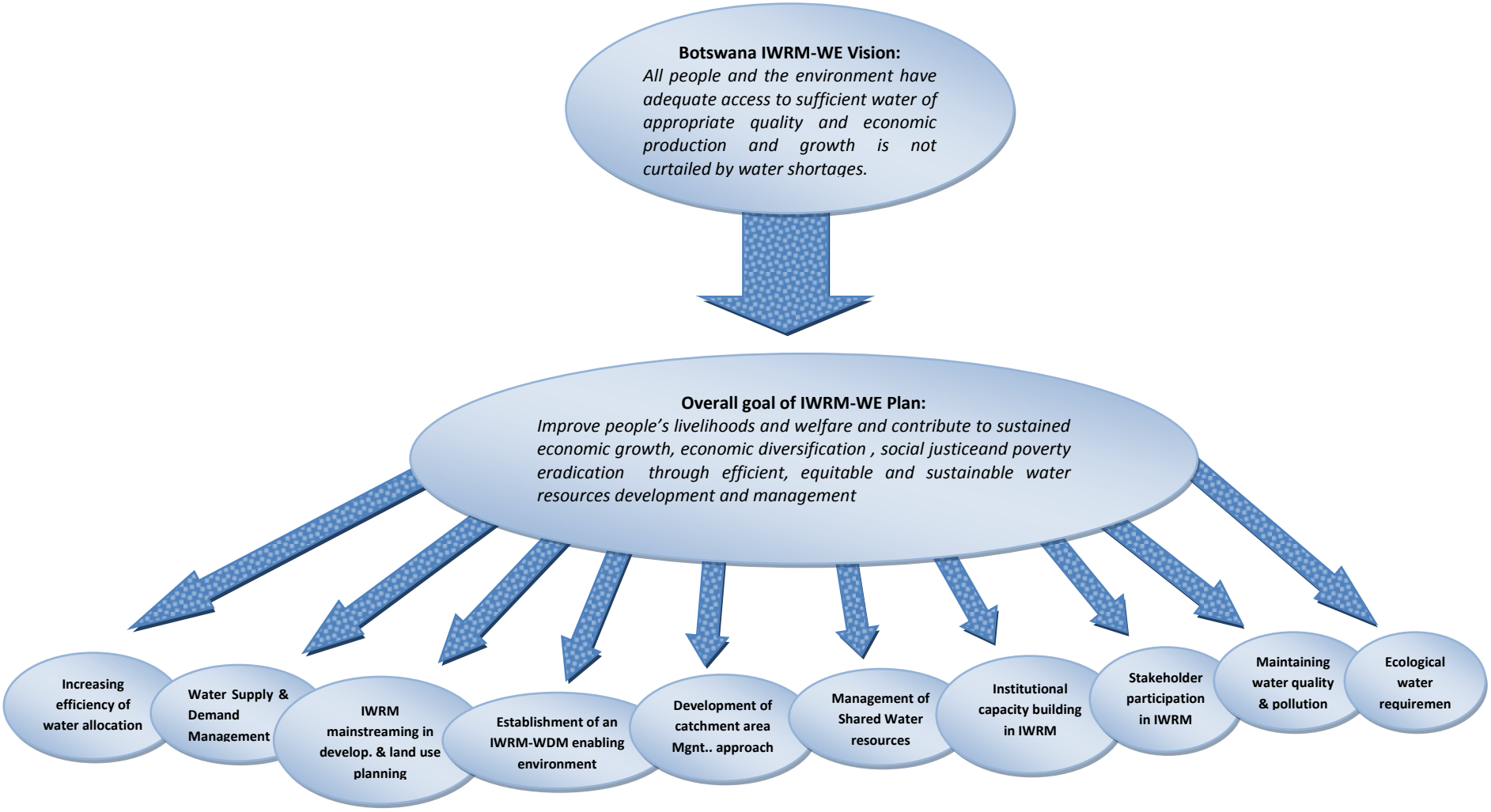


Table 25: IWRM-WE Strategic areas, objectives and activities.

Strategic Area	Objectives	Activities
1. Increasing efficiency of water allocation	▪ Maximise (socio-) econ. benefits of water allocations reduction; ▪ Ensure adequate water allocations to strategic sectors; ▪ Maximise use of non-potable water for sectors that do not require such water.	▪ Establishment of prioritisation of demand categories exempted for efficiency allocation process. ▪ Development of water allocation efficiency guidelines for DWA and Water Resources Board, and establishment of overall sectoral water allocations; ▪ Establishment of water accounting capability at DWA ▪ Carry out of sectoral IWRM assessment and an economic cost benefit analysis of water use and the opportunity costs for three sectors: irrigation; mining; energy.
2. Water Supply and Demand Management	▪ Full reuse & recycling of treated effluent; ▪ Reduce WUC water losses; ▪ Raise awareness about water saving practices and appliances; ▪ Promote proven water saving technologies; ▪ Develop new sustainable conventional and non-conventional supply opportunities	▪ Increasing the reuse and recycling of treated wastewater ; ▪ Improvement of TWW outflow quality. ▪ Carry out a feasibility study of water kiosks in areas without water supply and small scale trade in TWW. ▪ Implementation of the WUC water loss reduction and IWRM-WDM Strategy. ▪ Design and implement a Botswana Water Efficiency License (BoWELS) water conservation certification system. ▪ Negotiate WDM covenants with major water user sectors (mining, irrigation and industry) and water audits with major individual water users (e.g. KBL and BMC). ▪ Promote water efficient technologies for wastewater conveyance and sewer infrastructure. For instance, gravity sewer systems could be replaced with vacuum sewer systems for all new infrastructure developments. Dry toilets could also be promoted. ▪ Conventional water storage development: Feasibility studies of additional surface water storage opportunities and development of the viable storage opportunities; Feasibility of small dam construction for agriculture. This activity should be preceded by an inventory of all small scale agricultural dams and a performance assessment. Infrastructure development and water resource management to increase safe yields ▪ Non-conventional sources development: Study the future potential and best use of desalination plants; Rain water harvesting campaign and demonstration at three pilot sites and later roll out and apply to other areas countrywide; An inventory and performance assessment should be made of the current public and private rainwater harvesting infrastructure; and Establishment of storm water storage facilities based on run-off from roads and paved areas. A storm water strategy and guidelines should also be established indicating the suitable reuse practices for storm and rain water.
3. IWRM mainstreaming in development and land use planning	▪ Integration of IWRM into economic growth, trade policies, in the NDP/DDP cycle and in land use planning; ▪ Integration of IWRM in EIA/SEA process; ▪ Development of a water-saving technology sector.	▪ IWRM monitoring of implementation of the water Sector Reforms Incorporation of IWRM and WDM into Mid-Term Review and full integration in NDP11 preparation process. ▪ Integration of IWRM & WDM in land use planning: Integration of IWRM & WDM in District Land Use Plans; integration of rangeland management and ranching with the provision of livestock watering; encourage industrial and institutional development near the water resources or storage facilities.; development of a strategy for the provision and management of water at the lands areas

Strategic Area	Objectives	Activities
		▪ Development of IWRM & WDM guidelines and standards for: IWRM guidelines and benchmarks for water service providers, end users and water resource managers; design specifications of water reticulation systems to minimise losses; water efficiency guidelines for government building (design, construction and operation). These guidelines would also be useful for the EIA-SEA process; integration of TWW reuse or recycling and the construction of new wastewater treatment works; Water efficient building, including on-site wastewater treatment, dual distribution systems and reuse/ recycling; Irrigation & water wise gardening. ▪ Integrate IWRM in poverty eradication efforts: review the potential livelihood and poverty impacts of water (supply) management in the past and identification of opportunities to eradicate poverty through water management and supply: review poverty and resource impacts of the phasing out of public standpipes and recommend amendments or alternatives if necessary.
4. Establishment of an IWRM-WDM enabling environment	▪ Establish a comprehensive policy environment supportive of IWRM, including a policy, Act and set of standards, and shared water courses; ▪ Harmonisation of policies with other RBO member states	▪ Finalisation, adoption and implementation of the Water (and Waste Water) Policy, including economic, legislative and consultative instruments. ▪ Development and approval of a revised Water and Waste Water Act. ▪ Successful completion of the water sector reforms process. ▪ Design economic and legislative instruments to stimulate the use of non-potable water and TWW in irrigation and mining. ▪ Full integration of IWRM in the development planning cycle, EIA/SEA procedures, environmental health and disaster management.
5. Development of catchment area management approach	▪ Review possible catchment area management models and develop an appropriate model for Botswana.	▪ Review suitable catchment area water management approaches within the parameters of the current water sector reforms and new Policy (and Act) and international experiences ▪ Review different decentralised catchment area institutional structure.
6. Management of Shared Water Resources	▪ Compliance with SADC Protocol on Shared Water Courses ▪ Obtain fair, sustainable and equitable access to water resources and sharing of benefits ▪ Promote cooperative planning and development of shared water resources	▪ Review and harmonisation of Botswana Water Policy and New Water Act with other member states and with SADC Shared Water Courses Protocol. ▪ Assessment and efficient use of alternative domestic water resources use prior to applications for shared water. ▪ Contribute to and participate in the development of TDAs, SAPs and guidelines for water allocation and benefit sharing based on the IWRM perspective, leading to clarity about water entitlements and responsibilities. ▪ Contribute to and support for the four RBOs, involving Botswana ▪ Strengthen the capacity of the International Waters Unit (IWU), DWA. ▪ Expand or establish agreements for shared ground water courses ▪ Renegotiation and rewriting of Molatedi Dam Agreement between Botswana and South Africa.
7. Institutional capacity building in IWRM	▪ Institutionalisation of IWRM in lead water sector institutions; ▪ Establish planning and implementation capacity in lead water sector institutions;	▪ Review of IWRM training opportunities and market needs, including E-learning opportunities; review opportunities for training locally, internationally and the use of electronically supported learning. ▪ Targeted training of key staff at major water institutions to develop IWRM & WDM champions. ▪ Establishment of IWRM & WDM units in WUC, DWA and in major end-user institutions.

Strategic Area	Objectives	Activities
	▪ Incorporation of IWRM in training programmes in Botswana; ▪ Intensify the use of regional capacity building opportunities	▪ IWRM and WDM related research and recycling technologies. Government in collaboration with other stakeholders should establish an IWRM research fund to promote research and develop (young) water professionals.
8. Stakeholder participation in IWRM	▪ Ensure stakeholders participation in IWRM; ▪ Enhance IWRM knowledge and understanding; ▪ Improve access to and share information on IWRM;	▪ Development of awareness programmes for different stakeholder groups, including water users, communities, development and land use planners, decision makers, NGOs; ▪ Document and share best practices on IWRM and WDM in Botswana and abroad. Establishment of informative water billing to provide incentives for water conservation; ▪ Establishment of IWRM and WDM dialogues with women, youth, poor and other vulnerable groups and development of targeted training programmes. ▪ Review the operation of (the few) existing water use associations, who actually manage and maintain water sources at the local level. The potential of CBOs as WUAs should be piloted. ▪ Reinvigorate and strengthen Botswana Water Partnership
9. Maintaining water quality and pollution control	▪ Maintain water quality to meet water standards ▪ Maintain water quality to meet the standards for discharges into environment	▪ Establishment of a national water quality monitoring network (ground and surface water) and regular sampling supported by appropriate laboratory facilities at DWMPC and WUC. ▪ Measurement of inflows and outflows of WWTW and improved management of Waste Water Treatment Works ▪ Awareness raising campaigns and education to instil community knowledge and support for the importance of protecting and improving water quality and reuse and recycling of TWW
10. Ecological water requirements water	▪ Maintain the natural quantity and quality of water resources; ▪ Ensure adequate water for the environment;	▪ Carry out the EWR/EFR studies in all major river basins; ▪ Incorporation of EWR in the Water Policy, Water Act and EIA process and guidelines. ▪ Carry out studies of EWR for heavily used aquifers and well fields, particularly those near valuable ecosystems; ▪ Encouragement of sustainable use of groundwater resources (e.g. through resting when surface water is abundant). ▪ Environmental rehabilitation campaigns: bush encroachment control plan, exotic species control plan and a control plan for water hyacinth and salvinia molesta. ▪ Include EWR in all EIAs/ SEAs and ensure that EIAs are carried out for all major water infrastructure projects. ▪ (where possible) establish dam water outlets to facilitate water releases for the environment.

Based on Chapters 3 and 4, gaps were identified for each strategy area listed in Table 25, page 103.These gaps are further addressed in the implementation strategy for the strategic areas (Chapter 10).

Table 26: IWRM gaps in strategic areas.

Strategic Area	Gaps
1. Increasing efficiency of water allocation	Not considered; ad hoc, first come first served basis
2. Water Supply and Demand Management	Inadequate implementation of WDM, rainwater harvesting, reuse of TWW, improved water saving technologies etc.
3. IWRM mainstreaming in development and land use planning	No systematic integration of land use and water planning / management No systematic integration of water management in development planning
4. Establishment of an IWRM-WDM enabling environment	No approved Water Policy, No recent Water Act, No pricing policy No decentralised water management, Country currently in transition phase; outcomes difficult to predict; No climate variability adaptation plan in place.
5. Development of catchment area management approach	Not yet done
6. Management of Shared Water Resources	Good but slow progress; no water allocation and benefit sharing mechanisms.
7. Institutional capacity building in IWRM	Few IWRM units in key water sector institutions; WSR results unclear due to challenges of the transition.
8. Stakeholder participation in IWRM	Very limited.
9. Maintaining water quality and pollution control	No systematic monitoring network of water quality and inflows and outflows of WWTWs.
10. Ecological water requirements water	Inadequate data and studies; No attention for link bush encroachment and groundwater recharge; No plan to handle water consuming exotic tree species

9.2.2 Time period

The proposed time period for the IWRM-WE Plan is 2012 – 2030 with a division in three time periods:

- Short term: 2013 – 2015 (Mid Term Review and NDP 11 preparations; Vision 2016 and MDG deadline);
- Medium term: 2016 – 2023 (NDP 11); and
- Long term: 2024 – 2030 (2030: end of NMPWWS).

9.2.3 Cross-cutting issues

Earlier on in this report, cross cutting issues were identified, which need to be fully integrated in the plan and its strategic areas. Each is briefly discussed below.

Climate variability and change

Climate variability is integral part of Botswana's environment. Droughts and floods have occurred and will continue to occur in future. Climate change is expected to increase the incidence of droughts and floods. Therefore increasing climate variability needs to be incorporated in all strategic areas, in particular:

- Drought and flood risk monitoring and management need to be strengthened based on verifiable indicators;
- Increased investments in the water sector for water storage and safe yields of water infrastructure through connecting dams, well fields etc. In addition, an adjustment is needed of design standards to maintain services at the intended level; and
- Implement water demand management measures.

The above has the following implications for the IWRM-WE Plan:

- Water use efficiency is critical to sustain development and adapt to climate change;
- There is need for additional investments in water storage (top capture extra run off and overcome drought periods) and interconnectivity between water storage infrastructure to increase safe yields;
- Sector assessments (e.g. agriculture, industry, tourism) need to fully integrate the water resources management and climate change;
- Monitoring and evaluation of water resources is critical to improve understanding of the impacts of climate change;
- There is need for modification of building and operational standards for dams (including de-siltation of dams), roads etc. to prevent flood damage; and
- WDM and use of non-conventional water sources are priorities.

HIV/AIDS and Environmental Health

HIV & AIDS affects households, health, institutions and the water sector among other sectors as well as the country's overall economic growth and development. The high HIV prevalence rates in Botswana have resulted in a reduction in life expectancy, socio-economic hardships at the household, community and national level (e.g. high public expenditures on ARVs). HIV & AIDS is therefore a challenge for the water sector and it needs to be fully integrated in the IWRM-WE Plan.

Mainstreaming HIV & AIDS in the water sector should be planned for and requires time, human resources in terms of capacity and attitudes to mainstream as well as finances hence it should be budgeted for. Sensitization and mobilization of personnel and

community members are crucial. As the IWRM-WE Plan advocates for training, capacity building and awareness raising among stakeholders, these should integrate HIV & AIDS issues as well including its linkages with water allocation, use and management, its impacts on the sector and how it should be addressed. It is also critical for HIV & AIDS to be incorporated into environmental assessment tools such as EIAs and SEAs (as construction projects easily lead to increased local HIV & AIDS infections).

Generally, environmental health needs to be integrated in the IWRM-WE Plan as incidences of diarrhoea outbreaks and pollution concerns have clearly shown the links between diseases on the one hand and sewerage, sanitary and hygienic conditions on the other hand. Future economic diversification increases the pollution and environmental health risks, if no preventive measures are taken.

Gender

Gender mainstreaming is an integral part of management and equitable access to and use of water resources. Therefore application of IWRM can help address local gender and social disparities particularly in terms of access to and control of water resources, benefits, costs and decision making between men and women. While Botswana has made progress in gender mainstreaming in general and in various areas (e.g. agriculture and education), this has not extended to the area of water resources management. The IWRM-WE Plan has to ensure that both men and women's concerns are integrated and form part of the design, implementation, monitoring and evaluation of water related programmes and policies. The recommended strategies and activities should therefore ensure that all women and men equally participate in and benefit from the water sector.

Poverty

While poverty levels have declined, it remains a significant challenge to government in terms of achieving the Vision 2016's goal of poverty eradication and to a lesser extent the MDG on poverty reduction. The links between poverty and access to and use of water resources have been discussed earlier. All strategic areas of the plan should consider how access to and use of water resources can eradicate poverty and in turn how the poor can be supplied with adequate water resources for their basic needs.

Water governance and integrity

Water resources management needs to be transparent and accountable and information needs to flow between water service providers, water resources managers and water users. Furthermore, feedback mechanisms between users and service providers/ planners need to be strengthened to improve delivery. A greater role for communities, the private sectors and NGOs is needed to promote efficient delivery. This can be done through governance tools such as complaints systems, participatory water monitoring programmes, citizen scorecards, performance and diagnostic survey reports and tracking public expenditures in the water sector. Good governance needs to be incorporated in all strategic areas.

9.2.4 Communication of the IWRM WE Plan

The plan implementation requires effective communication to ensure that progress is made and understood. This is necessary for effective participation of all stakeholders and to ensure good water governance. Access to information and effective communication mechanisms (e.g. between water service providers and their clients) are essential. At the

time of completion of the IWRM-WE Plan, a communication strategy for the Ministry of Mineral, Energy and Water Resources and for DWA are being developed. It was judged unwise to develop an additional communication strategy for the plan. Instead, communication efforts in relation to the IWRM-WE Plan will be fully integrated in the DWA and Ministerial communication strategies.

10 The IWRM-WE Implementation Plan

While Chapter 9 contains the logic of the plan, the linkages between the goal, the strategies and the actions required to achieve the goal of IWRM in Botswana, this chapter gives more details of the Strategic Areas (SA) and the proposed activities. The sequence of the SA is not in order of priority.

10.1 Strategic Area 1 - Increasing Efficiency of Water Allocation

Water in Botswana has historically been allocated by the Water Apportionment Board upon review of individual applications for water rights. Water right allocation is not yet considered at the sectoral level. The main water-using sectors are domestic, irrigation, livestock, mining, industry, government and the service sector. At present, no assessment is made of the development impacts and efficiency of the allocated aggregate water rights. With mounting water scarcity expected in future, continuation of this practice is likely to curtail growth of some economic sectors (e.g. mining, electricity and irrigation). Mining, electricity generation and irrigation are likely to seriously compete for water in future and the opportunities costs of ignoring allocative efficiency will increase. These costs are highest in areas with serious competition for water, i.e. in (south-) eastern Botswana and around large settlements, mines or (new) irrigation schemes. The NWMPR 2006 recommends that irrigation in south eastern Botswana should not be based on surface water resources; furthermore it states that irrigation and landscaping are 'acceptable' uses of TWW. Increasing allocative efficiency of water rights is therefore a priority for the IWRM-WE Plan. This requires, among others, that water resources are segmented into different water quality categories, such as potable and non-potable water, including treated wastewater. Furthermore, demand prioritisation is needed to ensure that basic human needs and ecological requirements are always met. Finally, past trade patterns have saved Botswana large amounts of water and this has been an efficient policy choice. The full costs of water should be considered when developing new sectors and industries in Botswana (see also 10.3). The theme's objectives are to:

- Maximise the economic benefits of potable water allocations to sectors in terms of value added, employment creation and poverty reduction;
- Ensure adequate water allocations to economic sectors that are of strategic importance to the country or contribute to sustained economic diversification; and
- Maximise the use of non-potable water for sectors that do not require fresh water sources.

	Activity	Details
SA1.1	Establishment of prioritisation of demand categories in the Water Policy.	The recommended priorities are: 1. Basic human needs; 2. Strategic use (e.g. energy generation and food security); 3. Environmental requirements; 4. Other demands based on efficiency factors with emphasis on water productivity in terms of value added, food security, livelihood improvements and poverty eradication;
SA1.2	Sectoral water use and conservation target setting.	Consultations with leading economic sectors (e.g. agriculture, mining, construction, government and service industry) to negotiate and agree on IWRM and WDM targets for each sector. The targets will be included in sectoral covenants whose implementation will be regularly reviewed by DWA and WRB;
SA1.3	Development of water allocation efficiency guidelines for DWA and WRB	Based on water accounting and taking into account water demand priorities of the draft National Policy, establish principles and guidelines for water allocations to economic sectors, including

	Activity	Details
		particular for irrigation and mining;
SA1.4	Water accounting capability development at DWA	Development of improved water accounts in line with the UNSD and SADC requirements and national planning priorities. This will be done in the period 2012-2014 under the Wealth Accounting and Payment for Ecosystem Services Project (a partnership of Government of Botswana and the World Bank); the water demand by economic sector will be annually recorded and trends will be established;
SA1.5	Carry out of sectoral IWRM assessment and an economic cost benefit analysis.	This will lead to determination of sectoral water requirements, the economic efficiency of water use and the opportunity costs for: a. Irrigation; b. Mining; c. Energy; and d. Construction.

10.2 Strategic Area 2 - Water Supply & Demand Management

The NWMPR 2006 concluded that a switch towards water demand management is urgently needed to reduce the increase in water supply costs and to avoid water shortages. In the past, WDM was advocated mostly during drought periods, but there is now a clear need to make WDM a permanent, priority feature of IWRM. The BNWMPR 2006 further concludes that the water quality of TWW outflows is too poor for recycling and instead advocates reuse. The take-over of WWTW by WUC has, however, raised the expectation that the water quality of the outflow will improve and that recycling of TWW may become an option in the near future, particularly in south-eastern Botswana, where water is 'imported' from far.

The NMPWWS (2003) offers a plan for significant investments in new sewerage and wastewater treatment infrastructure in Botswana. Although implementation has fallen behind schedule due to government budget constraints, the amount of collected wastewater is expected to rapidly increase in future, offering growing opportunities for reuse. Cheaper and efficient wastewater and sewer conveyance systems should also be considered for new infrastructure developments. Vacuum sewer systems do not require large quantities of water to function as opposed to current gravity systems that are currently utilised in Botswana.

As in other countries, water conservation awareness raising campaigns have been successful in Botswana during droughts. Moreover, several pilot and demonstration projects have shown the water and cost saving potential of measures such as improved metering, phasing out of automatic flush urinals, use of smaller toilet cisterns, dual flush systems etc. DWA and WUC have relatively high water reticulation losses (see sections 3.4.2 and 3.4.3), which offer a good water saving potential. In Orapa, harvesting of storm water has been successful in terms of fresh water. Almost ten years after the publication of the NMPSWW (2003), the reuse of treated effluent remains low and much more effort is needed to achieve the NMPWWS' reuse target. These few examples show the excellent opportunities for WDM in Botswana. The challenge is to start the work!

The objectives of the strategic area are as follows:

- Accelerated reuse and recycling of treated effluent;
- Reduce WUC water losses to acceptable levels;

- Raise awareness about water saving practices and technologies among households and institutions;
- Promote proven water saving technologies for households and institutions;
- Develop sustainable conventional and non-conventional supply increase opportunities.

	Activity	Details
SA2.1	Increasing the reuse and recycling of treated wastewater and improvement of TWW outflow quality.	This requires the following: a. Determine suitable re-use and recycling destinations and practices for treated wastewater; b. Reuse and recycling plans need to be prepared and implemented for existing WWTW; c. All planned WWTW should have a reuse and recycling component; d. Treatment technologies with high outflow-inflow rations are preferred and their costs can be partly earned back from the revenues from the extra TWW available; and e. The inflows and outflows of WWTW works are measured. The feasibility of dedicated TWW pipelines to industrial sites with companies that do not require potable water or irrigation centres need to be assessed.
SA2.2	Carry out a feasibility study of small scale trade in TWW.	Focus on the impacts for economic diversification, gender, poverty eradication, environmental health and employment generation
SA2.3	Implementation of the WUC water loss reduction and IWRM-WDM Strategy.	WUC faces enormous water supply challenges during the implementation of the Water Sector Reforms and this poses the real risk that WDM measures, including water loss reduction, will receive less attention.
SA2.4	Development and implementation of the Botswana Water Efficiency License (BoWELS).	This is a water conservation certification system for products sold in Botswana, for plumbers and others involved in water related technologies (see annex C for details of the Australian and New Zealand WELS system). An added advantage is that WELS will stimulate the development of a local water conservation industry.
SA2.5	Establish and maintain a functional computerised water rights registry.	The registry should contain details about with GPS reading, ownership details, economic sectors, abstraction rates, water quality info etc. Annual water resources reports need to be prepared.
SA2.6	Strategic environmental assessment of water efficient technologies for wastewater conveyance and sewer infrastructure. (	The assessment should compare gravity sewer systems, vacuum sewer systems and possible other technologies. It will guide the design of new sewer systems
SA2.7	Negotiate WDM covenants with major water user sectors and major water users. Priority sectors: mining, irrigation, construction and industry. Priority individual users based on water consumption (e.g. KBL and BMC).	The activity needs to lead to water saving measures of heavy water users, as recommended in the NWMPR. WUC already has a programme to encourage WDM among major water consumers, but this programme needs to be made permanent and expanded.
SA2.8	Expansion of conventional water storage infrastructure development:	Feasibility studies of additional surface water storage opportunities and development of the viable storage opportunities. This is an adaptation to climate change, which will increase rainfall, river flow and run-off variability. The NWMPR mentions an investigation for the Nata River off-river storage system (with a possible capacity of 52.5 Mm^3). The potential of additional dam sites on Limpopo River also needs to be reviewed. Feasibility of small dam construction for agriculture. This activity should be preceded by an inventory of all small scale agricultural dams and a performance assessment. Infrastructure development and water resource management to increase and maximise safe yields of storage infrastructure by water transfer schemes. Water transfer schemes need to be rationalised to ensure that the length of pipelines and the pumping costs are minimised.
SA2.9	Expansion of non-conventional water sources: desalination; rainwater harvesting; storm water harvesting.	Study the future potential and best use of desalination plants. Most desalination plants have not performed satisfactorily (NWMPR). While the unit costs of desalination have decreased, energy costs are rising and the viability of desalination plants for domestic and other use (e.g. mining) needs to be assessed (through costs benefit analysis). Lessons could be learned from the Orapa desalination plant. The NWMPR recommends a campaign for rain water harvesting with at least three pilot sites. These should be rolled out to the entire country to enhance implementation of rainwater harvesting. In addition, an inventory

	Activity	Details
		and performance assessment should be made of the current public and private rainwater harvesting infrastructure. Run-down infrastructure needs to be rehabilitated and where rainwater is underutilised, use and management of harvested rainwater needs to be improved. Awareness raising campaigns are essential to achieve this. Establishment of storm water storage facilities based on run-off from roads, sidewalks and other paved areas. Road development and construction projects need to consider the water run-off, storage and productive use opportunities. Development of storm water strategy, guidelines and regulations for storm water management and storage for all planning areas.
SA2.10	Development of storm water strategy, guidelines and regulations for storm water management and storage for all planning areas.	

10.3 Strategic Area 3 - IWRM Mainstreaming in Development & Land-use Planning

Water resources management is integral part of development planning, and yet water management remains largely sectoral. While Botswana has a strong development planning tradition, the environment and IWRM are not yet systematically integrated into this process. As a result, some development projects have faced water constraints, which cannot be remedied or are remedied at great costs (e.g. drilling of blanks on ranches and schools without water). Water demand has escalated in south-eastern Botswana while water resources availability in north (eastern) Botswana are better, necessitating expensive and complex water transfer schemes. It may be better if water intensive enterprises are established close to water resources (subject to other costs and revenue factors). Water concerns should also be considered as part of the economic diversification drive. Achieving water savings through international trade should become a development goal.

While Botswana has made remarkable progress with water supply through the successive NWMPs and NDPs, water remains a major issue in lands areas, and more recently the socioeconomic impacts of the removal of public standpipes have raised concern. These impacts are not yet documented.

The objectives of this strategic area are:

- Full integration of water resources concerns and IWRM into economic growth and diversification policies and strategies as well as in land use and development planning at national and district levels;
- Full integration of IWRM and WDM in EIA and SEA requirement and ToR ;and
- Stimulate the development of a water-saving technology sector.

	Activity	Details
SA3.1	IWRM & WDM monitoring of implementation of the Water Sector Reforms.	This activity is meant to ensure that opportunities are seized (e.g. TWW reuse) and that IWRM and WDM are prioritised and do not suffer from the additional pressures during the transition phase. This activity will be carried out in close collaboration with the WSR project;
SA3.2	Incorporation of IWRM and WDM into Mid-Term Review and full integration in NDP11 preparation process.	Opportunities for water conservation and economic diversification and growth need to be seized. For example, WUC and BTO develop tourism development and management plans for the dam sites to promote multiple use while avoiding water pollution and damage or increased risks to the resource and infrastructure;
SA3.3	Integration of IWRM & WDM in land use planning i.	Integration of IWRM & WDM in District Land Use Plans; Transformation of District Land Use Planning Units (DLUPU) into District Land and Water Use Planning Units (DLWUPU) Integration of rangeland management and ranching with the provision of livestock watering to avoid high costs to farmers and development failures. Ranches should only be allocated after water resources have been assessed; Encourage industrial and institutional development near the water resources or storage facilities. This should in particularly apply to water intensive industries, for which water is a significant part of the production costs; Development of a strategy for the provision and management of water at the lands areas (as recommended by the NWMPR). There are several options that can be considered: 1. Establishment of a network of (Government drilled) boreholes to be operated and maintained by the local population. Such a system is used in Namibia; 2. Water trade from private boreholes without government interventions. This could create some employment opportunities (e.g. water delivery). This would be an improved version of the existing situation.
SA3.4	Development of IWRM & WDM guidelines and standards.	Development of IWRM guidelines and benchmarks for water service providers, end users and water resource managers; Design specifications of water reticulation systems to minimise losses; Develop and implementation of water efficiency guidelines for government building (design, construction and operation). These guidelines would also be useful for the EIA-SEA process; Full integration of TWW reuse or recycling and the construction of new wastewater treatment works as well as ; Water efficient building, including on-site wastewater treatment, vacuum sewer pipes, dual distribution systems and reuse/ recycling; Storm water harvesting Irrigation & water wise gardening.
SA3.5	Integration of IWRM in poverty eradication efforts.	Review water resources impacts of backyard gardening and options for improvement (e.g. other sources of water) Review the potential livelihood and poverty impacts of water (supply) management in the past and identification of opportunities to eradicate poverty through water management and supply: Review poverty and resource impacts of the phasing out of public standpipes and recommend amendments or alternatives if necessary.

10.4 Strategic Area 4 - Establishment of an IWRM Enabling Environment

The policy environment needs to facilitate the implementation of integrated water resources management and water demand management. The current policy framework is incomplete (e.g. water policy) and the Water Act is outdated. The on-going water sector reforms aim to provide a more conducive IWRM environment, among others by separation of responsibilities, combining operational responsibilities for wastewater treatment and fresh water supply and by the establishment of new institutions (Water Regulator and Water Resources Board). The IWRM-WE incorporates the implementation of these reforms and seeks to ensure that, especially during the transition phase, IWRM and WDM receive sufficient attention and priority. The risk exists that as a result of the pressure to meet the reform deadlines, particularly water demand management is neglected.

The sectoral orientation of water management may have bureaucratic reasons, but it is also due to the incomplete and outdated policy environment. The Water Act is outdated and the country has no approved water policy. Water standards are evolving but they are not yet comprehensive. While the EIA Act ensures coverage of water resources at the project level, the absence of the Environmental Management Act has delayed a holistic and comprehensive approach towards IWRM. IWRM implies that:

- Water is considered as an environmental, economic and social good;
- Water resources management is decentralised to local levels, e.g. catchment areas; and
- Stakeholders, especially women, participate in resource management.

Droughts are endemic in Botswana and this fact needs to be urgently recognised in the enabling environment. Climate change is expected to increase variability and extreme events. Water conservation and IWRM need to be fully incorporated in all development planning and environmental management frameworks, particularly in EIA and SEA procedures and studies, national and district development planning (NDP and DDP), disaster managements (e.g. droughts and floods), education and (environmental) health policies and management.

The objective of this strategic area is to establish a comprehensive policy environment supportive of IWRM.

	Activity	Details
SA4.1	Finalisation, adoption and implementation of the Water (and Waste Water) Policy.	The Policy needs to be approved by Parliament and subsequently implemented in order to guide IWRM implementation. The policy should offer financial and other incentives for water conservation reuse of treated effluent and use of non-potable water for mining and industrial processes (where feasible). The policy needs to deal with the following: • Environment, economic and social aspects of water resources; • Catchment area water resource management; • Different types of water resources: rainwater, storm water, surface and ground water, wastewater, saline water, domestic and shared water sources; • Demand prioritisation; • Balancing supply and demand measures; the policy should emphasise demand measures to increase water use efficiency; • Economic instruments: a consolidated WUC-water tariff for fresh and TWW, water charges for self providers (resource rent charge), possibly a WDM surcharge and water markets (e.g. for boreholes). Lower charges for TWW provide an incentive for reuse; • Legislative instruments: water abstraction permits, individual and sector quota (e.g. irrigation), quality standards, drought restrictions; • Consultative instruments: negotiated covenants between government and economic sectors such as mining, irrigation, tourism and industry).
SA4.2	Development and approval of a revised Water and Waste Water Act	The Act should include at least the following: • Full integration of fresh and wastewater resources; • Domestic and shared water sources management; • New institutional framework and responsibilities; • Demand prioritisation, especially of basic needs and ecological water requirements.
SA4.3	Completion of the water sector reforms process.	It is necessary to ensure that IWRM and WDM are prioritised during the transformation period (up to 2014). Modifications can be made based on lessons from the transformation phase (2011-2014).
SA4.4	Design economic and legislative instruments to stimulate the use of non-potable water and TWW	Incentives could include lower tariffs, additional water entitlements, quota, covenants etc. Water subsidies need to be reviewed and clearly targeted. This should be part of the policy and legislative development activities but its

	Activity	Details
	in irrigation and mining.	importance warrants a separate activity. Lessons from other (semi-) arid countries should be incorporated.
SA4.5	Full integration of IWRM and WDM in the development planning cycle, EIA/SEA procedures, environmental health and disaster management.	This involves a review of the current EIA/SEA guidelines, the development planning cycle, and environmental health and disaster management procedures.
SA4.6	Develop WWS Management Plans for major centres	This should ensure proper maintenance of WWTW, adequate water quality of the outflows and re-use/ recycling of TWW
SA4.7	Conclude, implement and monitor trade effluent agreements for all major discharges into the sewerage system.	This is an existing instrument that is infrequently used. The activity is suggested in the NMPWWS.

10.5 Strategic Area 5 - Implementation of the Catchment Area Management Approach

Botswana's water resources management issues differ from area to area. While some areas are water scarce (e.g. western, mid western and south eastern Botswana), more water resources are available in other parts of the country such as Chobe, Okavango and North East District. Differences in local water resource conditions can therefore be effectively addressed through decentralised management. This would also facilitate greater involvement and understanding of local institutions and water users, and there would be due consideration for water competition among economic sectors and the need to promote allocative efficiency. While decentralised water resources management has clear advantages, links need to be maintained with the national level (and other basins) to ensure that national interests are also optimally addressed. For example, water transfer schemes between basins can be in the national interest, while not serving the interests of the area/ basin itself.

In Botswana, the catchment management approach is not explicitly used unlike in neighbouring countries. The advantages of the catchment area approach may include the more explicit trade-offs that have to be made between competing water uses, better use of local knowledge and expressed needs, and greater opportunities for stakeholder involvement. In Botswana, the catchment areas could be restricted to around five areas (northern and southern Limpopo, Okavango, Chobe, central and south-western Botswana without a clear basin, and possibly the Nata-Makgadikgadi area separately from the Okavango).

The final draft water Policy advocates for catchment area approach towards water management. At the same time, water service provision and water resource management responsibilities have been centralised in WUC, DWA and WRB. However, their service regions can be synchronised with broad catchment areas. More work is needed as part of the WSR to develop an operational catchment area approach for Botswana.

The objective of this strategic area is to review possible catchment area management models and develop an appropriate model for Botswana given the on-going water sector reforms and the finalisation of the Water wastewater Policy and Acts.

	Activity	Details
SA5.1	Organise a forum to review catchment area water management approaches and identify the best one for Botswana	The forum should take into account the water resources situation (rivers and aquifers), the on-going water sector reforms, the new Policy (and Act) and international experiences. Questions need to be answered as to what are the main catchment areas, what are the benefits and costs of this approach and which roles should different stakeholders have? This activity would complement the water sector reform process. If the approach is judged feasible, implementation should follow. The current WUC and DWA regions could be aligned to the catchment areas. Formation of sub-catchment management councils or committees with representation of various stakeholder groups could follow.
SA5.2	Review different decentralised water institutions	This should be based on the results of SA6.1 and include the following options. 1. Catchment area sub Water Resources Board with mostly WRM advisory responsibilities and representation of WUC, DWA and major stakeholders. Sub WRBs report to the main WRB; 2. Fully fledged catchment area councils (CAC) such as in South Africa and Zimbabwe.

10.6 Strategic Are 6 - Management of Shared Water Resources

Botswana will increasingly rely on shared water courses (surface and ground water), whose management is governed by the revised SADC Protocol on Shared Water Courses. According to BNMP2, Dikgatlhong dam is the last large dam site that can be developed. Botswana will therefore need to use shared water courses. These transboundary water resources include:

- *Orange-Senqu River,* its tributaries (Nossop/Molopo Rivers) form part of the southern border between Botswana and South Africa. The river is shared with Lesotho, South Africa, Namibia and Lesotho;
- Limpopo River in the eastern part of the country is shared with South Africa, Mozambique and Zimbabwe;
- Zambezi River in northern Botswana is the fourth largest river in Africa and the largest river basin in southern Africa. The river together with its tributaries extends through Angola, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe; and
- Okavango *River,* which comprises mainly the Okavango Delta and its outlets as well as portions of Boteti River into the Makgadikgadi pans. The basin extends into Zimbabwe through the Nata River. Botswana shares this river with Namibia and Angola.

River basin organisations have been established for all four basins, but they are at different development stages. Some have carried out a Transboundary Diagnostic Analysis (e.g. Okavango and Orange) and have a Strategic Action Plan for the basin (e.g. Okavango). Some have an IWRM Plan (e.g. Zambezi). Water use differs significantly from basin to basin. The Okavango River is still hardly used, whilst the Orange and Limpopo are already heavily used. In cases where Botswana lies downstream of the river basins, developments in the upstream basin could have detrimental impacts on Botswana (e.g. Okavango). For example, large scale water withdrawals in Angola and Namibia may affect the integrity of the Okavango delta and the country's tourism sector, which is highly reliant upon the delta.

Botswana's shared water resources require transboundary diagnostic analyses to develop full understanding of the quality and state of the resources to ensure sustainable utilisation in future.

Countries therefore need to develop standardised assessment methods that could be applied elsewhere within a particular basin. Such standardised methods could include methods for environmental flow requirements which seem to be marginal particularly in Botswana.

Withdrawals from shared waters are clearly regulated in the Protocol and subject to approval and negotiations with other basin countries. It is therefore good practice to request use of shared resources after utilising domestic alternatives of comparable value efficiently first. In other words, WDM for domestic resources is important to support requests for withdrawals from shared water courses.

The current national water policy framework does not provide for management of transboundary water resources. Policy and legislation need to incorporate the use and management of shared water resources. There is also need to build institutional capacity for equitable use, allocation and management of shared waters as well as sharing of benefits derived from these resources.

The objectives of this strategic area are to:

- Ensure implementation of and compliance with SADC Protocol on Shared Water Courses;
- Obtain fair, sustainable and equitable access to shared water among the member states and encourage sharing of benefits; and
- Promote cooperative planning and development of shared water resources (both surface and groundwater systems).

	Activity	Details
SA6.1	Review and harmonise Botswana Water Policy and New Water Act with other member states and with SADC Shared Water Courses Protocol.	Botswana has developed a draft National (waste) Water Policy (2011) that is yet to be approved by Parliament. The resulting new policy needs to fully integrate shared water issues and comply with the requirements of the SADC Protocol on Shared Water Courses. This also requires harmonisation of the policy and act with those of other riparian countries to enhance sustainable and equitable use as well as management of shared waters.
SA6.2	Assessment of alternative domestic water resources of comparable costs to shared water resources withdrawals in each shared river basin.	This is a Protocol requirement prior to applying for use of shared water and needs to be assessed for each shared river basin. This includes opportunities for reuse and recycling of treated effluent in agriculture and mining, rain water and storm water harvesting, etc.; ensure efficiency of alternative water resources, it is important for government and relevant stakeholders to promote appropriate and affordable technologies. Additionally, stakeholders need to be made aware and have access to adequate information regarding the use of alternative sources of water.
SA6.3	Contribute to and participate in the development of TDAs, SAPs and development of guidelines for water allocation and benefit sharing.	The documents and guidelines need to be based on the IWRM perspective and provide clarity about water entitlements and responsibilities. The SADC Protocol calls for equitable allocation and fair distribution of benefits from international water courses. As an interim step pending basin-wide agreement and rules, Botswana should develop interim rules for the management and use of each shared water course. NWMPR argues the need to get shared water allocations and maximise the basin benefits.
SA6.4	Support for all RBOs, involving Botswana.	Botswana is a member state of four RBOs and needs to support these RBOs to efficiently implement their mandates. This includes: develop and implement IWRM in the basins; enhance data and information exchange so as to support the activities of RBOs in promoting regional cooperation and integrated water resources management within these shared water courses.
SA6.5	Strengthen the capacity of the International Waters Unit (IWU).	The IWU has been established in MMEWR to coordinate transboundary water activities and advise government on international water related issues, conflict management and resolution. There is need to build capacity and strengthen the unit to manage transboundary water resources, negotiating skills and conflict resolution skills.

	Activity	Details
SA6.6	Initiate and conclude agreements for shared ground water courses	This is part of the part of the SADC Protocol. The major shared aquifers need to be identified and prioritised.
SA6.7	Finalise the revised water allocation entitlements from Molatedi Dam.	The agreement provides for a change in water entitlements in view of changes in dam yields. Recently, South Africa has proposed to reduce Botswana's annual water entitlement from the dam to 5.7 Mm^3 per annum based after a review of the dam's water yields.

10.7 Strategic Area 7 - Institutional Capacity Building in IWRM & WDM

Botswana's water sector is currently undergoing a paradigm shift towards IWRM. This also requires changes in institutional and human capabilities. A broader range of disciplines are required than institutions such as DWA and WUC have. Moreover, the institutional structures for the water sector are fragmented and there is lack of integrated planning across sectors (for example, agriculture is often left out of water sector planning). Until recently, water resources development, management and use have been carried out on sectoral basis and there was minimal coordination, if any, among sectors. For instance, allocation of land for ranches and cattle posts is often not based on the availability of groundwater because of lack of synergies between the land authorities and water surveyors. Little consultations occur between sectors when planning and developing projects as well as making decisions that would otherwise impact on the use and management of water resources. Integrated planning, development and management of water resources are therefore still lagging behind.

The on-going water sector reforms seek to address the above institutional challenges through filling institutional gaps (e.g. responsibility for water resources planning) and clearer division of tasks (e.g. separate service delivery from water resources management). New institutions are created (Water Resources Board) and the Water Regulator while old ones are abolished (e.g. Water Apportionment Board). Caution is required that the water sector reforms become such a burden to institutions that IWRM and WDM are neglected in the transition process. This risk exists in particular for WUC and may require extra support.

There is a shortage and an imbalanced distribution of human resources within the water sector especially at district level. This is exacerbated by limited formal training and education in IWRM thus resulting in limited knowledge and experiences in IWRM, limited knowledge of available opportunities in the sector, lack of incentives to fully implement IWRM and lack of awareness of opportunities to collaborate and cooperate with organisations offering training in IWRM. Education opportunities and training programmes to enhance knowledge and skills are necessary. This could be short and long term programmes offered by local institutions as well as international capacity building organisations such as the UNDP Capacity Building Network (Cap-Net), WaterNet and Stockholm International Water Institute (SIWI).

The specific objectives of this strategic area are to:

- Facilitate the institutionalisation of IWRM and WDM in WUC, DWA and lead water use institutions;

- Ensure adequate planning and implementation capacity in WUC, DWA and WRB as well as in the private sector;
- Incorporation of IWRM is in relevant training programmes in Botswana; and
- Intensify the use of regional capacity building opportunities from WaterNet, GWP and Cap-Net.

	Activity	Details
SA7.1	Review of IWRM training opportunities and market needs, including E-learning opportunities.	Based on selected priorities from the needs assessment, a capacity building strategy needs to be developed. Training opportunities locally and internationally as well as electronically supported learning. IWRM & WDM training could be offered at University of Botswana (UB), Botswana College of Agriculture (BCA), Botswana International University of Science and Technology (BIUST) Ba-Isago College and/or Limkokwing University. They could collaborate with institutions such as Cap-Net, WaterNet, UNESCO-IHE and SIWI for short term professional training opportunities. E learning and on-line knowledge exchange systems like the on-line GWP Tool Box provide valuable support for capacity building.
SA7.2	Development of IWRM and WDM champions in major water sector institutions (e.g. DWA and WUC)	Selected staff members of WUC, DWA and WRB need to be trained in IWRM and WDM. They should become the core of the IWRM-WDM units. Continuous professional development in IWRM and WDM within these institutions is essential. Creation of short courses on water management for policy-makers, aimed specifically at senior managers without technical water backgrounds is also essential. Training should also be offered to major end users to enhance IWRM and WDM knowledge among users. Short and long term courses could be offered while staff exchange opportunities should also be created. Once formal training is completed, the concepts can be reinforced through a range of training activities (e.g. on-the-job training, remote learning, sabbaticals and international short courses, etc.). IWRM and WDM training needs to be implemented across the country. Water challenges differ spatially and require attention at different levels of interventions. There is need to build capacity within these institutions and close the knowledge gap that exists between urban centres and districts. Regular training is necessary and the trainees should be kept in their designated districts so as to avoid multiple training of the same discipline.
SA7.3	Establishment of IWRM & WDM units in WUC, DWA and in major end-user institutions	IWRM requires adequate attention and human resources. Government and major water stakeholders should therefore establish IWRM units.
SA7.4	Establishment of a IWRM and WDM Research Fund to promote IWRM and WDM related research	Currently, very little non consultancy research is done on IWRM and WDM in Botswana. Research could provide valuable new data and strengthen IWRM and WDM expertise. Therefore, Government, NGOs, research institutions as well as higher educational institutions should engage in IWRM research. This is in particular to areas of resource conservation, alternative water resources, water reuse and recycling technologies. Government in collaboration with other stakeholders should establish and manage an IWRM research fund to promote research and develop (young) water professionals. This can be done in collaboration with international institutions such as UNESCO-IHE and WaterNet.

10.8 Strategic Area 8 - Stakeholder Participation in IWRM

IWRM requires that stakeholders participate in water management through collaboration between and commitment of water users, planners, developers and decision makers. Participation has many potential advantages such as use of all information, data and experience to inform strategic water management decisions, a better and shared understanding for the required interventions, efficiency gains and cost savings.

At present, stakeholder participation is weak and haphazard, especially at basin level. Furthermore, there is lack of effective representation of stakeholders at decision levels particularly at local level

exacerbated by weak capacities to understand and implement principles of IWRM. Botswana does not have water user platforms for enhanced awareness, participation and engagement. Participation of other stakeholders such as private companies and non-governmental agencies is important to realise IWRM.

The objectives of this strategic area are to:

- Ensure stakeholders participation and engagement in water resources management;
- Enhance IWRM knowledge and understanding among stakeholders; and
- Improve access to and share information on IWRM, including WDM.

	Activity	Details
SA8.1	Development of IWRM awareness programmes for different stakeholder groups	Stakeholders include water users, communities, development and land use planners, decision makers, NGOs. IWRM and WDM information should focus on the need for and benefits of IWRM. Information needs to be regularly updated and documented to enhance understanding and knowledge among stakeholders. Information could be disseminated through booklets, leaflets and the media and where necessary should be translated into the local language to enhance understanding of local communities. Outreach and education programme particularly for local communities should be developed. Creation of awareness and exposure on IWRM and related matters at higher levels of government, across affected or involved ministries and/or departments, civil society and the private sector is also essential;
SA8.2	Production of booklet and best IWRM & WDM practices	The booklet should cover experiences from Botswana and abroad. The document can be used to show the benefits of IWRM and WDM and should be regularly up-dated.
SA8.3	Adoption of informative water billing system by WUC	Bills showing water consumption patterns and expenditures in time and compared to best practices. This should provide incentives for water conservation;
SA8.4	Establishment of IWRM and WDM dialogues with women, youth, poor and other vulnerable groups	There is need for budgetary allocations for supporting structures and programmes that foster gender mainstreaming activities;
SA8.5	Review the operation of (the few) existing water use associations, who actually manage and maintain water sources at the local level.	The review should result in recommendations for better operations of the existing WUAs, and inform the formation and operations of new WUAs. One of the review questions would be whether CBOs could become designated local WUAs (as is practised in Namibia). This could also be piloted in some CBOs (based on Namibian experiences).

10.9 Strategic Area 9 - Maintaining Water Quality and Pollution Control

The water quality is determined by both natural processes and human activities. The natural processes include a situation whereby the water may dissolve minerals in rocks and soil, percolate through organic material such as roots and leaves, and react with algae, bacteria, and other microscopic organisms. The human activities include sewerage discharge, discharge from industries, as well as agricultural fields (e.g. fertiliser and pesticides) and polluted urban run-offs. Floods and droughts also affect water quality. Each of these processes may change the water quality and its suitable use.

Water pollution is generally still a modest and mostly local problem in Botswana. Groundwater salinity is a common problem in western Botswana. Moreover, groundwater pollution occurs in Ramotswa and Lobatse largely due to seepage from pit latrines and septic tanks. Pollution is likely to increase in future with economic growth and diversification, and therefore control measures

need to be taken now to prevent pollution and/or expand water treatment facilities (e.g. sewerage and desalination).

The objectives for this strategic area are to:

- Maintain an adequate water quality to meet potable drinking water standards for both domestic and livestock requirements and
- Maintain adequate water quality to meet the standards for environmental disposal.

	Activity	Details
SA9.1	Development of a national water quality monitoring network (ground and surface water)	Existing sampling points need to be integrated into the network and be monitored regularly (e.g. quarterly or monthly). The sampling results should be compared with the available BOBS water quality standards. Where the water quality does not meet the standards, remedial actions need to be taken by DWA and the WRB.
SA9.2	Establishment of an appropriate water analysis laboratory infrastructure in Botswana	Lab facilities at WUC need to ensure quality of potable water and monitor the quality of the TWW. Measurement of inflows and outflows of WWTW (quantity and quality) and improved management of Waste Water Treatment Works to produce water of acceptable standards for reuse and recycling. The NMPWWS (2003) found that management of WWTW was generally poor. Moreover, inflows and outflows were not recorded nor was the quality regularly assessed. The wet lab capacity of DWA and DWMPC need to be rationalized and options such as their merger or decentralization should be considered (provided that this enhances efficiency and performance).
SA9.3	Water quality awareness building campaigns and education.	Campaigns are needed to instill community knowledge and support for the importance of protecting water quality and environmental health. Moreover, acceptance of reuse and recycling of TWW needs to be promoted (NMPWWS).
SA9.4	Implementation of WWTW investment program of the NMPWWS	Due to the high costs of WWTW and sewerage systems and government's financial constraints, the NMPWWS investment plan in WWTW and sewerage system is behind schedule. When the financial position of government improves, development funds need to be earmarked for investments in sanitation programmes. In the mean time, priority should be given to making existing WWTW work better and more efficiently. Develop re-use and recycling projects for TWW to ensure 96% reuse of treated effluent by 2030.

10.10 Strategic Area 10 - Ecological Water Requirements & Environmental Degradation

Increased water withdrawals for human activities may leave too little water for the environment, adversely affecting ecosystems and biodiversity. In addition, poor sanitation management can cause poor water quality. Therefore, water resources need to be protected, and conservation and sustainability of ecosystems must be ensured. Inadequate water for the environment and poor water quality may degrade ecosystems and loss of natural capital, which would in time affect economic activities such as agriculture and tourism that largely depends on the integrity of the ecosystems. Guidelines for liquid waste have been developed to regulate sanitation practices in the Ngamiland area. The Guidelines will be implemented by DWMPC and be adapted to all parts of the country.

EWR is described as the water requirements for maintenance of existing ecosystems in an acceptable state (ecosystems are inherently dynamic). It refers to water resources in perennial and ephemeral rivers and ground water. With respect to rivers, EWR represent the required river flow to maintain the ecosystem of the catchment area. This is also referred to as environmental flow

requirements (EFR). With respect to groundwater, EWR refers to keeping the groundwater level such that the vegetation can regenerate. EWRs are however not yetformally recognised and protected in Botswana's environmental policies and legislation. The draft Water Policy therefore intends to rectify that by prescribing that EWRs need to be assessed and protected (after the basic human needs).

The NWMPR 2006 recommends environmental flow assessments for the following river: Okavango River; Chobe River, Nata River, Thune River downstream of the dam, Shashe River downstream of Dikgatlhong Dam and at 34 small to medium dam sites To-date, only a few environmental flow assessments have been undertaken in Botswana for: Okavango River, new dams and tributaries such as Mosetse and Tati Rivers. According to the NWMPR, numerous EIA studies have been undertaken, which raised concerns about downstream ecological requirements. However, the implementation and effectiveness of proposed mitigation measures is unknown. Therefore, monitoring of mitigation measures should be intensified and EWRs need to be fully prioritized in legislative and policy frameworks.

EWR are usually understood to refer to surface water. The assessment of ecological groundwater requirements is, however, also important, particularly because groundwater mining occurs in many well fields. A draw-down of the groundwater table may affect the vegetation and biodiversity of terrestrial ecosystems.

Rangeland degradation is one of the environmental concerns that affect water resources. Bush encroachment is widespread in Botswana, and it is documented for Namibia that this has a negative impact on groundwater recharge. Botswana has however, not yet acted on the link between bush encroachment and groundwater recharge. Exotic species such as Eucalyptus consume large amounts of water and lower the groundwater table, thereby reducing water availability for indigenous vegetation. Such species therefore need to be controlled to ensure that the EWR of the indigenous vegetation are met.

The objectives of this strategic area are to:

- Maintain and protect the natural quantity and quality of Botswana's water resources; and
- Ensure that adequate water (quantity, quality and variability in both) is allocated to and available for the environment.

	Activity	Details
SA10.1	Conduct EWR & EFR studies for all major river basins.	This is a recommendation of the NWMPR. The results need to be incorporated into management of river and dams. Compliance with the EWR/EFR should be ensured through the water monitoring network. Environmental flows should be integrated in future water resources modeling;
SA10.2	Carry out studies of EWR for heavily used aquifers and well fields, particularly those near valuable ecosystems	For example, Dukwi well field, Ngamiland and Ramotswa well fields. This would inform the sustainable abstraction rate of well fields. It would inform sustainable use of groundwater resources (e.g. through resting when surface water is abundant).
SA10.3	Formalisation of environmental water requirements in policy environment	Incorporation of EWR in the Water Policy, Water Act and EIA process and guidelines. This includes EWR incorporation in the diagnostic analysis, action plans and management plans for shared water courses (as required under the Revised Protocol on Shared Watercourses). Incorporation of EWR in all EIAs/ SEAs and ensure that EIAs are carried out for all

	Activity	Details
		major water infrastructure projects. Ensure (where possible) that water outlets are established in all major dams to facilitate water releases for the environment.
SA10.4	Environmental rehabilitation campaigns:	Develop and implement a strategy and plan campaign to reduce bush encroachment to improve groundwater recharge and the rangelands carrying capacity for the livestock sector. Develop and implement a strategy and plan to curb the spread of exotic tree species. Develop and implement campaign to curb water hyacinth and salvinia molesta.

11 Institutional Structure for Plan Implementation

In line with the water sector reforms, the WRB and DWA should drive and coordinate the Plan's implementation. While DWA is being restructured based on its new mandate, its staff is relieved from water supply responsibilities and has good opportunities for the immediate implementation of this plan. It is not desirable to wait for the outcome of the on-going reorganisation project to start implementation. In fact, it is essential that some activities are immediately implemented to maintain the momentum generated by the Plan preparation. However, a wide range of stakeholders (more than hitherto) need to participate in the implementation of parts of the plan and should regularly assess the progress with the implementation. Overall features of the institutional structure are:

- Inclusiveness and participatory;
- Holistic with close linkages to development and land use planning;
- Decentralised, catchment area institutions linked to national institutions;
- Separation of water sector tasks, such as water delivery, water resources management, regulatory and controlling tasks;
- Full integration of transboundary water management;
- Based on current institutional capabilities, and realistic capacity building efforts;
- Integration of fresh and wastewater planning and management.

The institutional arrangements for the implementation of the IWRM-WE Plan will be aligned with the water sector reforms. This is meant to ensure that the implementation does not result in additional institutional and financial burden to the nation, but rather effects efficiencies and cost-savings to all the interested and affected parties.

11.1 Institutional Arrangements for the Water Sector

The IWRM-WE Strategy acknowledges the institutional changes that have been agreed upon in the water sector reform process. The Strategy does not seek to create entirely new water institutions. The institutional responsibilities are as follows.

11.1.1 Water Utilities Corporation (WUC)

The Water Utilities Corporation is responsible for water supply and waste water collection and treatment to domestic, government and commercial customers country-wide. This role is acknowledged in this Plan and continues to inform its means of implementation. WUC also manages infrastructure related to (i) water storage, transfer, treatment and retailing, and (ii) waste-water collection and treatment.

Additional capacity is required to strengthen WUC's role in catchment management and in the management of dams in a more integrated way – beyond just water storage.

11.1.2 The Water Regulator

A Water Regulator has been proposed and agreed during the water sector reform process. The institution is still yet to be established. The role of the Water Regulator is to ensure financial sustainability across the water sector, reduce wastage by facilitating the streamlining of operations and determining revenue requirements to inform regular tariff adjustments. The Water Regulator is also to oversee compliance of service standards to ensure efficiency and protect consumer and environmental rights.

11.1.3 Department of Water Affairs

The role of the Department of Water Affairs (DWA) is to assess, plan, develop and maintain water resources for domestic, agricultural, commercial, industrial and other uses country-wide. DWA also assists and advises on the formulation of water resources development and management policies and legislation, including in its role as the secretariat of the Water Resources Board.

The DWA needs to develop institutional capacity in setting standards and inspectorate actions. These will increasingly become DWA's main areas of work as the policy arm of government. In the context of implementation the IWRM-WE Plan, DWA plays an important role in creating (or requiring the creation of) a conducive environment for stakeholder participation, economic efficiencies, redressing of gender imbalances and other IWRM principles.

11.1.4 Water Resources Board

The Water Resources Board (WRB) is responsible for overseeing and allocating Botswana's scarce water resources. The Board is also responsible for resource monitoring and development of water-related policies. All major sectors and stakeholders will be represented in the WRB. The WRB needs to develop institutional capacity in each water catchment. These would effectively become catchment area councils. They will advise on and engage in water resource management in their respective catchments.

The role of stakeholders outside government has been limited in the past. The exception is the role of self providers, i.e. institutions or persons responsible for their own water supply (mostly livestock, irrigation and mining). Self providers require a water withdrawal permit. The private sector, communities and water users in general need to participate more in water resources management through WRB and/ or directly.

Specific to the IWRM-WE Strategy, its implementation should be the responsibility of the WRB and DWA. It is proposed that an IWRM Unit is established within DWA to drive and monitor implementation of the plans. This unit will also provide for the establishment of a stakeholder participation committee or forum comprised of stakeholders from government, civil society, private sector, local communities, researchers and academic institutions. The IWRM unit will coordinate capacity building initiatives for relevant stakeholders. The Unit will, in association with relevant stakeholders, develop IWRM

outreach and awareness material to enhance capacity on IWRM.DWA and WRB will further provide for development, review and harmonisation of water related policies to support plan implementation.

WUC also needs an IWRM unit and it needs to implement its existing IWRM and WDM plan. It is imperative that the opportunities of integrated wastewater and fresh water management are exploited by WUC.

11.1.5 Central & Local Government Departments

Central Government departments are to be responsible for formulation and implementation of natural resources management policies, enforce laws and facilitate the sustainable use of natural/water resources. As the agricultural sector is the largest water user, the Ministry of Agriculture needs to establish a capability/ unit that will ensure efficient and productive water utilisation in agriculture and maximise the re-use of available treated effluent. Local government entities will facilitate coordination and implementation at district level and should be linked to local communities, private sector and national levels as well. Local government departments and local authorities will also provide guidance to local communities, assist in capacity building of communities and provide for interactions between locals and private sector. They will also oversee monitoring and evaluation of local level activities.

Some water user associations already exist but their performance is poor. WUAs need to be strengthened where possible and new WUAs formed at local level. They will be responsible for transferring information from higher levels to local community members. They will also actively participate in development, maintenance and management of water supply systems including alternative water supply systems such as rainwater harvesting, reuse and recycling of treated effluent. Farmer associations will take responsibility for irrigation schemes. This provides a better chance for end-users to develop a sense of ownership hence improved and sustainable management of resources. CBOs could assume water management responsibilities in the areas where they possess user rights. This approach should be piloted with more successful CBOs, and can be rolled out after it has proved to be effective.

Non-governmental organisations (NGOs) act as a link between communities and government and their major role will be to *facilitate institutional development and capacity building* in water platforms. NGOs will facilitate the formation of multi stakeholder or water user groups for sustainable water management and also facilitate stakeholder participation and dialogues on water use and management. NGOs personnel would therefore train and strengthen capacity among end users and create the much needed awareness on IWRM and WDM. Additionally, NGOs will also act as watchdogs in that they will monitor and evaluate implementation of the plan and identify shortcomings for immediate action.

11.1.6 Private Sector

The role of private sector in sustainable development, planning and management of Botswana's water resources is important for IWRM. They are particularly critical for infrastructure development, supporting communities through partnerships on certain projects, for instance, and investment so as to boost development. Private sector participation (e.g. through independent water suppliers) will also reduce burden on government in terms of funding, infrastructure development and capacity building.

11.1.7 Academic & Research Institutions

Tertiary education institutions should offer IWRM and WDM training activities for graduates and professionals for IWRM and WDM. Training institutions will (in partnership with DWA/IWRM unit- in some cases) develop curricula and training materials for target groups. Primary and secondary school teachers need to be trained to enable them to better and adequately teach and instil knowledge on IWRM and WDM. Researchers will increase the IWRM and WDM knowledge base in the country and need to ensure that the findings are disseminated to WRB, WUC, DWA, the private sector and communities. Research on new or alternative water resources utilisation and technology is important. Pilot programmes with potential to be scaled up will be assessed as well as best practices that could be shared with end users. Information documentation and dissemination pathways should be established to communicate results of research and enhance their full utilisation. Existing regional and international research funds and the National Environmental Fund (with an IWRM window) could also be used to facilitate IWRM research.

11.1.8 Media

Media resources such as newspapers, radio, television and use of internet will further disseminate information on the IWRM Plan and hence help in raising awareness to reach a wide array of stakeholders.

11.2 Capacity Building

The capacity of water sector stakeholders needs to be strengthened for the effective implementation of the IWRM-WE Plan. The activities will be better implemented and the performance is likely to be better. It is therefore a means of enhancing performance of stakeholders within the water sector and related IWRM activities. According to GWP TEC (2000):

> *"Capacity building in IWRM is the sum of efforts to nurture, enhance and utilize the skills and capabilities of people and institutions at all levels –locally, nationally, regionally and internationally – so that they can make better progress towards a broader goal. At the basic conceptual level, building capacity involves empowering and equipping people and organizations with appropriate tools and sustainable resources to solve their problems, rather than attempting to fix such problems directly."*
>
> Source: GWP TEC, 2000: pp.50

Existing capacity needs within major water sector institutions as well as local level user groups need to be assessed. Where organizational structures are in place, existing staff must be trained and retained and where necessary new employees should be recruited. Retention of existing staff would reduce setbacks in the implementation of the plan. Institutions should therefore develop

staff retention strategies that clearly outline what the organizations intend to do to motivate employees to remain on board.

12 Monitoring & Evaluation System

Monitoring and Evaluation (M&E) is essential to ensure that plan implementation is on track, to measure short and long term impacts and to evaluate the impacts in order to modify the plan or its implementation (if necessary) (GWP, 2004). Key components of the M&E system should be the selection of the indicators, participation of stakeholders (to foster support for implementation and add to different perspectives of the assessment) and ensuring feedback of the results into the decision-making and implementation processes. In simple terms, M&E is necessary to ensure that implementation takes place with the intended results and impacts. A proper M&E system, whose results are shared among stakeholders, also fosters accountability and transparency, and is likely to generate broad-based support for the plan implementation.

It is essential that there is full consistency between the goals, objectives, activities and the chosen indicators; moreover, performance and implementation targets need to be formulated. In addition, the baseline situation needs to be described for the selected indicators.

M&E systems can be costly[20] and often require significant data, human and financial resources. It is therefore necessary to develop an efficient, effective and sustainable system, which can be implemented with existing or planned for resources. The results of M&E need to lead to a higher success rate of projects in all strategic areas. In Botswana, monitoring and evaluation tend to be neglected and available data are under utilised for M&E purposes. DWA should ensure that the plan implementation is properly monitored and evaluated, and modified where necessary.

The Organisation for Economic Co-operation and Development (OECD) defines *monitoring* to be "a continuous function that uses the systematic collection of data on specified indicators, to provide management and the main stakeholders of an ongoing development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds" (quoted in Namibia's IWRM Plan, theme report 5). An *evaluation* is an exercise undertaken at regular intervals to 'provide information that is credible and useful, enabling the incorporation of lessons learnt into the decision making process' (OECD, 2002 quoted in Namibia's IWRM Plan, theme report 5). A detailed M & E scheme with impact and process indicators is provided in Annex 5, page 153.

The implementation of the plan involves a wide range of activities, stakeholders and economic sectors. Therefore, monitoring needs to occur at multiple levels as listed below:

- Individual activities and Plan themes;
- Economic sectors (e.g. mining, irrigation, livestock, tourism, government and domestic use);
- Water sector (service providers, planners and managers); and
- Overall plan level.

The monitoring and evaluation should focus on the implementation issues (are activities implemented according to plan) and the results (are activities achieving the intended results).

[20] The costs of no M & E may be considerably higher when plan implementation is ineffective and inefficient.

Each major institution should have its own M&E strategy and the plans together should be integrated into the overall M&E plan, which should be monitored by DWA and the Water Regulator. All stakeholders should contribute to the DWA data base, which provides the basis for the comprehensive M& E framework. In this way, the M & E framework would be efficient and the extra costs would be modest. The results of the M&E system need to be discussed by the WRB and the Water Regulator.

The evaluation is based on the monitoring results and possible additional data collection and provides feedback into the decision making process and may lead to adjustments in the plan and its implementation. Good targets and indicators, stakeholder participation in M&E as well as good feedback mechanisms are essential for effective M&E.

M&E is a step wise process, which needs to cover the key goals, objectives and activities of the IWRM-WE Plan. In addition, targets need to be developed and agreed upon. For each target or activity indicators need to be developed to assess the performance; indicators need to be selected based on transparent and agree criteria such as relevance, reliability data availability and cost effectiveness. The human and financial resources required for monitoring and evaluation need to be assessed together with the institutions responsible for monitoring. There needs to be financial and staff capacity to monitor and evaluate. Finally, the monitoring data need to be evaluated and channelled back into the policy and decision making process to ensure that implementation is accelerated and/or that better results are achieved in terms of the targets and objectives.

The goal, objectives and activities have been articulated in chapters 9 and 10. These form the start of the M&E system. The targets, indicators, baseline sources and institutions involved are developed below.

Annex 5, page 153 lists suggested indicators for monitoring of the implementation and performance of the IWRM-WE Plan. It is important that the IWRM-WE Plan sets clear targets to be achieved as insufficient targets have been established for water resources management to-date.

The monitoring results need to be annually evaluated and the findings should be discussed in the WRB and by the WR. The WRB and WR need to ensure that implementation remains on schedule and yields good results. The findings of the evaluation need to be incorporated in the country's development planning cycle (mid-term review and national and district development plans) and in the plans of the WRB, DWA and major stakeholders such as WUC. Evaluation may lead to modification of the IWRM-WE Plan or its implementation. For example, if necessary new priorities will be set for negotiations of IWRM-WDM covenants. M&E will involve all stakeholders and the data and findings will be accessible to all stakeholders.

13 Funding and Costs of the Implementation Plan

13.1 IWRM-WE plan funding requirements

The capital expenditures for the water and sanitation sector are significant. In settlements, capital expenditures are incurred by government through DWA (water infrastructure) and DWMPC (sewerage and wastewater treatment works). Government is also responsible for water transfer schemes between settlements and dams. Outside settlements, the private sector (i.e. water users) are currently responsible for their own water infrastructure. Given the huge investments required and the current budget constraints of government, it is unlikely that government will increase its involvement in water infrastructure outside settlements and development of transfer schemes.

The NMPWWS has a detailed investment and partial cost recovery plan. The capital investments associated with the NWMPR are significant; particularly for water transfer schemes (phase 2 of the NSC, the pipeline from Kazungula to the NSC and the construction of more dams. Significant private sector investments are expected in the mining sector and possibly irrigation.

The expansion of water and sanitation infrastructure will increase the operation and maintenance costs too. These costs will be largely born by WUC. As WUC's mandate is to break even, these costs will be recovered from the water consumers, with likely cross subsidisation among water consumers. It is expected that an integrated water and wastewater treatment charge will be developed under the water tariff policy. Government currently subsidises other water users by payment of a super tariff, but this situation is likely to end.

Plan implementation requires additional funding for specific project activities. Some do not require extra funding (e.g. policy and legislative development are provided for under the WSR programme and water accounting is provided for under the WAVES project). Others do require funds and need to be budgeted for.

Funding mostly refers to financial resources but it may also include in-kind resources. For example, community participation involves in kind contributions such as time and transport.

13.2 Funding Sources

The plan activities can be financed from various sources, both domestically and internationally. Domestic funding sources include the government budget (NDP10, the annual government budgets and specific funds such as the National Environmental Fund), the private sector (e.g. mines, farmers, tourist and operators) and communities. Some plan activities can be immediately be funded under the collaborative UNDAF programme (joint programme of GoB and UNDP).

Importantly, successful implementation of the plan may lead to considerable financial savings, which can be used to implement other plan activities. For example, savings from reduced WUC-water losses could be used to finance WUC M&E and stakeholder consultation efforts. Furthermore, the Water Regulator should contribute towards more efficient operation of water service providers associated with monopolies, and the resulting financial savings can be reinvested

by water consumers and WUC. Finally, effective awareness raising campaigns and stakeholder participation should lead to water and costs savings.

International funding sources include the Global Environmental Fund, the new Green Fund and multilateral and bilateral ICPs. Further funding opportunities exist, for example through GWP-Southern Africa, Cap-Net and WaterNet, in particular for training and research. In the past, Botswana has made limited use of such funds and efforts to access international funding need to be intensified. The status as an upper middle-income country poses a challenge, which needs to be discussed and overcome (e.g. through participation in regional and international projects). The draft Water Policy envisages the establishment of a Water Research Fund that will be largely supported by government allocations, royalties and water user fees.

13.3 Financing Strategy

In order to develop a detailed financial strategy, the estimated capital and O&M expenditures need to be estimated and compared with current expenditure levels and sources. The expected rise in expenditures requires the identification of additional financial resources. It should also be an incentive to review possible savings. The choice of activities determines the costs and the NWMPR concluded that a supply-oriented WRM would be excessively costly. The IWRM approach with increased WDM component was found to lead to the lowest expenditure increases. One of the cost savings is the postponement of large scale water infrastructure projects.

The financing strategy needs to ensure that the plan's activities need to be financially sustainable on the short and long term. This implies that:

- Operation and maintenance costs need to be met from domestic sources;
- Water service providers need to be efficient and minimise their O&M costs, while ensuring delivery;
- Capital investments can be met by domestic and international loans and grants, seeking to minimise total loan and repayment costs; and
- Grants should be used for specific one-time expenditures or projects, while provision is made for meeting future extra O & M costs.

Furthermore, the finance strategy needs to contribute to social equity and sustainability. This can be achieved by:

- Cross-subsidisation of access to basic water needs by other users or government. This currently happens and is expected to be continued in the water tariff policy;
- An even and fair distribution of the implementation costs; and
- Social acceptance of willingness to pay for adequate water supplies and for reuse and recycling of adequately treated wastewater.

Finally, the financing strategy needs to conform to the overall government governance framework. This implies that the user-pays principle and the polluter pays principles are implemented and the financial revenues are be made available for IWRM – including payment for the resource rent (i.e.

the intrinsic resource value). It also implies that effective management of financial resources is prioritised and considered as even more important than the actual availability of funds and financial instruments.

14 Road Map for Implementation

The road map for implementation of the plan is outlined in this chapter. The prioritisation and phasing is based on the following criteria:

- Importance of the activity for IWRM in Botswana;
- Incorporated into a mandate of existing organisations;
- Current institutional capacity and commitment of those institutions; and
- Funding availability & opportunities.

In terms of phasing, some projects such as WAVES and the WSR programme are currently being implemented; land use planning and policy development are on-going and all these need to be integral parts of the IWRM-WE Plan. Other projects planned for in NDP10 will also support future sustainable development goals and the road map for the implementation of the 2012 Gaborone Declaration. Medium term activities target NDP11 and the preparation of NDP12. Long term activities are meant beyond 2024 to encourage the completion of long term water strategies and the NMPWWS.

The road map shown below (Table 27 to Table 30) indicates the priority of the activity, the timing, the responsible institution and other organisations that should participate. Activities that need to be implemented immediately or in the short-term are listed with cost-estimates in Table 31, page 140.

Table 27: Activities envisaged or the attainment of Strategic Areas 1 and 2.

Strategic Area	Activity	Priority	Implementation	Resp. institution	Other institutions
SA1.1	Establishment of demand categories in the Water Policy.	H	Immediate: 2012-13	DWA	
SA1.2	Sectoral water use & conservation target setting.	H	Short term: 2013- 2015/6	DWA & WRB	Sectoral organisations
SA1.3	Development of water allocation efficiency guidelines	H	Short term	DWA & WRB	
SA1.4	Water accounting capability development at DWA	H	Immediate	DWA	WUC & major users; World Bank
SA1.5	Carry out of sectoral IWRM assessment and an economic cost benefit analysis.	M-H	Short term: 2013 – 2015/6	DWA & WRB	Sectoral organisations, GWP Botswana, acad. institutions
SA2.1	Increasing the reuse and recycling of treated wastewater and improvement of TWW outflow quality.	High	Short and medium term for existing WWTW Immediate for new WWTW	DWA	WUC, DWMPC
SA2.2	Carry out a feasibility study of small scale trade in TWW in terms of re-use and poverty eradication.	Medium	Short to medium term	WUC	Acad. Institutions, DWMPC, DWA and GWP-Botswana
SA2.3	Implementation of the WUC water loss reduction and IWRM-WDM Strategy.	High	Immediate	WUC	DWA & WRB
SA2.4	Development and implementation of the Botswana Water Efficiency Label System	Medium	Short term: feasibility study Medium term: implementation Long term: expansion to SADC	DWA	BIUST, UB, DBES, BOCCIM, Engineering associations
SA2.5	Establish and maintain a functional computerised water rights registry.	Medium to High	Short term: review of WAB & DGS registry Medium term: upgrading to integrated functional data base	DWA	UB,
SA2.6	Strategic environmental assessment of water efficient technologies for wastewater conveyance and sewer infrastructure.	Medium to High	Short term: SEA Medium term: incorporation of SEA results in sewer project designs (NDP11)	MMEWR	DWA, WRB, DEA, BIUST, UB and engineering groups
SA2.7	Negotiate IWRM & WDM covenants with major water user sectors and major water users. Priority sectors: mining, irrigation, construction, government and industry. Priority individual users based on water consumption (e.g. KBL and BMC).	Medium	Short term: mining and irrigation Medium term: other sectors Medium (to long) term: covenants with individual users	DWA & WRB	BOCCIM, sector associations, and large companies.
SA2.8	Expansion of conventional water storage infrastructure development:	Medium to high	Short term: identification of opportunities Medium term: feasibility studies Medium & long term: implementation (NDP12)	DWA	MFDP, MEWT, member states RBOs
SA2.9	Expansion of non-conventional water sources: desalination; rainwater harvesting; storm water harvesting.	High	Immediate: identification of opportunities Short term: feasibility studies Medium term: development of non-conventional resources (NDP11)	DWA	Large users, DTRP,
SA2.10	Development of storm water strategy, guidelines and regulations for storm water management and storage for all planning areas.	Medium	Short term: storm water strategy Medium term: implementation of storm water projects (NDP11)	DWA	DTRP, local authorities, mines.

Table 28: Activities envisaged or the attainment of Strategic Area 3.

Strategic Area	Activity	Priority	Implementation	Resp. institution	Other institutions
SA3.1	IWRM & WDM monitoring of implementation of the Water Sector Reforms.	High	Immediate (2012 – 14)	GWP-Botswana & KCS	
SA3.1	IWRM & WDM monitoring of implementation of the Water Sector Reforms.	High	Immediate (2012 – 14)	GWP-Botswana & KCS	
SA3.2	Incorporation of IWRM and WDM into Mid-Term Review and full integration in NDP11 preparation process.	High	Immediate: MTR Short term: NDP11	DWA	MFDP, OoP, NSO
SA3.3	Integration of IWRM & WDM in land use planning.	Medium to high	Immediate: with new plans Short term: existing plans	DLWUPU & DTRP	MoA, MMEWR, MEWT
SA3.4	Development of IWRM & WDM guidelines and standards.	Medium	In phases: 1 per annum starting in 2013.	DWA	DBES, BIUST, UB, GWP, BOCCIM.
SA3.5	Integration of IWRM in poverty eradication efforts.	High	Short term: poverty impacts of phasing out standpipes (PEI) and study of water resources and poverty impacts of backyard gardening Medium term: study overall linkages between poverty & water access and use	PEI-MFDP	DWA, WRB, OoP, NSO, DEA-MEWT, UB.
SA4.1	Finalisation, adoption and implementation of the Water (and Waste Water) Policy.	High	Immediate: Policy (2012- Q1 2013)	DWA-MMEWR	MFDP, MEWT, GWP Botswana
SA4.2	Development and approval of a revised Water and Waste Water Act	High	Short term	DWA-MMEWR	MFDP, MEWT, AGChambers, GWP Botswana
SA4.3	Completion of the water sector reforms process.	High	Short term (2014)	DWA-MMEWR	WUC
SA4.4	Design economic and legislative instruments to stimulate the use of non-potable water and TWW in irrigation and mining.	Medium	Short term	DWA	DWMPC, BOCCIM, BIUST, UB, GWP-Botswana
SA4.5	Full integration of IWRM and WDM in the development planning cycle, EIA/SEA procedures, environmental health and disaster management.	Medium	Short term	DWA	DEA-MEWT, OoP, MoH, NSO
SA4.6	Develop WWS Management Plans for major centres	Medium	Short term: cities Medium term: large villages	WUC	DWA, MFDP, local authorities
SA4.7	Conclude, implement and monitor trade effluent agreements for all major discharges into the sewerage system.	High	2 per annum starting in 2013 with most important ones.	DWMPC	DWA, WUC, BOCCIM

Table 29: Activities envisaged or the attainment of Strategic Areas 5 to 7.

Strategic Area	Activity	Priority	Implementation	Resp. institution	Other institutions
SA5.1	Organise a forum to review catchment area water management approaches and identify the best one for Botswana	Medium	Short term: 2013 - 2015	DWA	WUC, DTRP, BOCCIM,
SA5.2	Review different decentralised water institutions	Medium	Short term: 2013 - 2015	DWA & WRB	WUC, DTRP, BOCCIM,
SA6.1	Review and harmonisation of Botswana Water Policy and New Water Act with other member states and with SADC Shared Water Courses Protocol.	Medium	Short term	DWA-MMEWR	MFDP, MEWT, GWP-Botswana
SA6.2	Assessment of alternative domestic water resources of comparable costs to shared water resources withdrawals in each shared river basin.	High	Short term	DWA-MMEWR	MFDP, MEWT, GWP-Botswana, UB, BIUST.
SA6.3	Contribute to and participate in the development of TDAs, SAPs and development of guidelines for water allocation and benefit sharing.	High	Continuous	DWA-MMEWR	NGOs, Academic Institutions & Private Sector
SA6.4	Support for all RBOs, involving Botswana.	High	Continuous	DWA	DWMPC, BOCCIM, BIUST, UB, GWP-Botswana
SA6.5	Strengthen the capacity of the International Waters Unit (IWU).	Medium	Continuous	DWA	DEA-MEWT, UB, BIUST, GWP-Botswana, NSO
SA6.6	Initiate and conclude agreements for shared ground water courses	Medium	Medium and long term	DWA	WUC, DEA-MEWT, MFDP, NSO.
SA6.7	Finalise the revised water allocation entitlements from Molatedi Dam.	Low to medium	Short term	DWA	MFA&IC
SA7.1	Review of IWRM training opportunities and market needs, including E-learning opportunities.	Medium	Short term	DWA - MMEWR	MoE, GWP-Botswana, BOCCIM, DEA MEWT, NSO, MFDP.
SA7.2	Development of IWRM and WDM champions in major water sector institutions (e.g. DWA and WUC)	High	Short term: DWA, WUC & Debswana Medium term: all other major stakeholders and users	DWA-MMEWR	WUC, DBES, BOCCIM, GWP-Botswana, Chambers of Mines and major water sector institutions
SA7.3	Establishment of IWRM & WDM units in WUC, DWA and in major end-user institutions	High	Short term: DWA, WUC & Debswana Medium term: all other major stakeholders & users	DWA-MMEWR	WUC, DBES, BOCCIM, GWP-Botswana, Chambers of Mines and major water sector institutions
SA7.4	Establishment of a IWRM and WDM Research Fund to promote IWRM and WDM related research	High	Medium term: NDP11 (linked to NEF?)	DWA	DEA-MEWT, WUC, Mines, acad. Institutions.

Table 30: Activities envisaged or the attainment of Strategic Areas 8 to 10.

Strategic Area	Activity	Priority	Implementation	Resp. institution	Other institutions
SA8.1	Development of IWRM awareness programmes for different stakeholder groups	Medium	Medium term	DWA - MMEWR	WUC, DEA-MEWT, MoE, GWP-Botswana, Academic Institutions, KCS
SA8.2	Production of booklet and best IWRM & WDM practices	High	Short term	DWA-MMEWR	WUC, GWP-Botswana
SA8.3	Adoption of informative water billing system by WUC	Medium to High	Medium term	WUC	
SA8.4	Establishment of IWRM and WDM dialogues with women, youth, poor and other vulnerable groups	High	Medium term	DWA	WUC, Dep. of Youth & Culture, BNYC, BOCONGO (Env & Agric Sector), Dept of Gender, Botswana Council of Women.
SA8.5	Review the operation of (the few) existing water use associations, who actually manage and maintain water sources at the local level.	Medium	Short term	DWA	MoA, MEWT
SA9.1	Development of a national water quality monitoring network (ground and surface water)	Medium to high	Design: short term Implementation: medium & long term	WRB/DWA & DWMPC, WUC	WUC, DWMPC, acad. Institutions, GWP-Botswana mines
SA9.2	Establishment of an appropriate water analysis laboratory infrastructure in Botswana	High	Short term	DWA-MMEWR	WUC, DWMPC, acad. Institutions, MFDP, NSO
SA9.3	Water quality awareness building campaigns and education.	High	Short term and beyond	DWA-MMEWR	WUC, MEWT, GWP-Botswana, educ. Institutions, media, KCS
SA9.4	Implementation of WWTW investment program of the NMPWWS	High	Medium and Long term	DWMPC	MFDP, WRB-MMEWR, MEWT,
SA10.1	Conduct EWR & EFR studies for all major river basins.	Medium to high	Short and medium term (1-2 per annum)	DWA - MMEWR	MEWT, GWP-Botswana, acad. institutions
SA10.2	Carry out studies of EWR for heavily used aquifers and well fields, particularly those near valuable ecosystems	High	Short term: heavily used ones Medium & long term: other well fields	DWA-MMEWR	MEWT, GWP-Botswana, acad. Institutions.
SA10.3	Formalisation of environmental water requirements in policy environment	High	Immediate: Policy Short term: Act & SEA/EIA	DWA-MMEWR	MEWT, GWP-Botswana, acad. Institutions.
SA10.4	Environmental rehabilitation campaigns:	Medium	Short term: exotics and bush control Medium term: siltation of dams	DWA	DEA& DFRR-MEWT, DTRP, MoA, Mines, BOCONGO (Env & Agric Sector)

Table 31: Implementation Plan targeting activities for immediate and short-term implementation.

Strategic Area	Activity	Estimated cost
SA1.1	Establishment of prioritisation of demand categories in the Water Policy (***immediate).***	No monetary costs
SA1.3	Development of water allocation efficiency guidelines. ***Short term***	BWP 750 000
SA1.4	Water accounting capacity development ***(immediate)***	In kind inputs from DWA, WUC and support organizations Rest funded by WAVES (partnership GoB & WB)
SA2.1	Increasing the reuse and recycling of treated wastewater and improvement of TWW outflow quality: ***immediate for new WWTW.***	No extra costs if incorporated into the design and ToR.
SA2.3	Implementation of the WUC water loss reduction and IWRM-WDM Strategy. ***immediate***	No costs to DWA; limited costs and also benefits for WUC.
SA2.5	Establishment and maintenance of a functional computerized water rights registry (***short term)***	BWP 1 500 000 with significant inputs from DWA staff
SA2.9	Expansion of non conventional water sources: desalination; rain water harvesting; storm water collection: opportunities identification ***immediate***	BWP 100 000 000 (immediate costs are lower at possibly BWP 5 000 000 100 million mostly for NDP11.
SA2.10	Development of storm water strategy, guidelines and regulations for storm water management and storage for all planning areas (***medium term***)	BWP 2 000 000
SA3.1	IWRM& WDM monitoring of implementation of the Water Sector Reforms. ***immediate and continuous***	BWP 1 000 000
SA3.2	Incorporation of IWRM And WDM into mid-term review (***immediate***) and full integration in NDP11 preparation (***short term***)	BWP 2 000 000
SA3.3	Integration of IWRM & WDM in land use planning. Immediate in new plans	No or small costs if included in the ToR.
SA3.4	Integration of IWRM in poverty eradication efforts (***short term***)	BWP 800 000 (standpipes impacts and backyard gardening) with involvement of MoA and DWA
SA4.1	Finalisation, adoption and implementation of the water (and waste water) policy	BWP 1 500 000
SA4.2	Development and approval of a revised water and waste water Act	BWP 2 500 000
SA4.3	Completion of the water sector reforms process	BWP 2 000 000
SA4.4	Design economic and legislative instruments to stimulate the use of non potable water and TWW in irrigation and mining	BWP 1 000 000

	Activity	Estimated cost
SA4.5	Full integration of IWRM & WDM in the development planning cycle ,EIA/SEA procedures, environmental health and disaster management **(*short term*)**	BWP 200 000
SA5.1	Organise a forum to review catchment area water management approaches and identify the best one for Botswana (***short term***)	BWP 2 000 000.
SA6.3	Contribute to and participate in the development of TDAs, SAPs and development of guidelines for water allocation and benefit sharing. ***Continuous effort***.	Part of DWA new structure and budget
SA6.4	Support for all RBOs, involving Botswana. ***Continuous effort***	Part of DWA new structure and budget
SA6.5	Strengthen the capacity of the International Waters Unit (IWU). ***Continuous effort***	Part of DWA new structure and budget
SA7.1 & 2	Establishment of IWRM & WDM units and champions in WUC, DWA and in major end-user institutions such as Debswana ***(short term)***	No or little extra costs. Integral part of Water Sector Reforms
SA7.3	Review of IWRM training opportunities and market needs, including E-learning opportunities (***short term).***	BWP 750 000
SA8.1	Development of IWRM awareness programme for different stakeholders ***(short term)***	BWP 3 000 000
SA8.2	Production of booklet best IWRM &WDM practices	BWP 3 000 000
SA9.2	Establishment of an appropriate water analysis laboratory infrastructure in Botswana (short term)	BWP 15 000 000
SA9.4	Water quality building campaigns & awareness (***short term)***	BWP 3 000 000
SA10.1	Carry out studies of EWR for heavily, used aquifers and well fields, particularly those near valuable ecosystems ***(short term)***	BWP 3 000 000
SA10.3	Formalisation of environmental water requirements in policy environment ***(immediate)***	No costs

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Annexes

Annex 1: Gaborone Declaration on Sustainability for Africa.

The declaration can be down loaded from www.gov.bw and www.conservation.org.

We, the participants at the Summit for Sustainability in Africa, meeting from 24 to 25 May 2012 in Gaborone, Botswana, Reaffirm our commitment to implement all conventions and declarations that promote Sustainable Development, in particular:

- The African Convention on the Conservation of Nature and Natural Resources (1968);
- The Declaration of the United Nations Conference on the Human Environment (1972);
- The Rio Declaration on Environment and Development (1992), its principles and its programme of action also known as Agenda 21;
- The United Nations Convention to Combat Desertification, the United Nations Framework Convention on Climate Change and the United Nations Convention on Biological Diversity (1992);
- The United Nations Millennium Declaration and the Millennium Development Goals (2000);
- The Johannesburg Plan of Implementation (JPOI) of the World Summit on Sustainable Development (Johannesburg, 2002);

Welcome the upcoming United Nations Conference on Sustainable Development "Rio+20" as an important opportunity to urgently reaffirm commitments from governments, private sector, civil society and community leaders to sustainable development that provides for the economic, social and environmental security of current and future generations, building upon the outcomes of this Summit for Sustainability in Africa;

Reaffirm our commitment to the Africa Consensus Statement to Rio+20 and the Malabo Decision on Africa's Preparations for the Rio+20 Conference;

Are concerned that:

- The historical pattern of natural resources exploitation has failed to promote sustained growth, environmental integrity and improved social capital;
- Economic growth and human well-being in Africa will be threatened if we do not undertake concerted action to halt and reverse the degradation and loss of healthy ecosystems and biodiversity, and to enhance society's ability to adapt to climate change and environmental risks and scarcities;

Recognize that:

- • Current development decisions are driven by fundamental human needs for food, water, energy, and health security as well as employment and economic growth;
- • The abovementioned development needs must be addressed with sufficient concern for each other, for their impact on our peoples' quality of life and our countries' ecological health and productivity, and for the eradication of poverty and inequality;
- • Watersheds, forests, fisheries, coral reefs, soils, and all natural resources, ecosystems and biodiversity constitute our vital natural capital and are central to long-term human well-being, and therefore must be protected from overuse and degradation and, where necessary, must be restored and enhanced;

Are in agreement that:

- Urgent, concerted actions be undertaken to restore and sustain the ability of the Earth to support human communities, to ensure the long-term integrity of biodiversity and ecosystem services in

effective protected area networks, to mitigate environmental risks and scarcities, and thereby to contribute to the prosperity of future generations;
- These actions must be led by countries as a tenet of their sovereign self-interest and in alliance with the community of nations, respecting common but differentiated responsibilities;

Recognize that:
- The abovementioned actions must increase our knowledge, technology, tools, and capacities to value and manage natural capital and to sustainably improve our citizens' economic and social well-being;
- Effective governance and equity are essential to achieving these goals of sustainable development;
- Disparities in economic growth and development priorities are evident between the developed and developing countries;
- The engagement of governments and citizens along with the dedicated support of the private sector and other investors, donors and advisors is vital to the success of this collective vision;
- This vision must translate into actions that are specific, targeted, and timely;

Hereby undertake to pursue the following overarching objective and concrete actions, in cooperation with other countries and partners, and to share information on progress on these actions on an annual basis:

To ensure that the contributions of natural capital to sustainable economic growth, maintenance and improvement of social capital and human well-being are quantified and integrated into development and business practice; Through:
- Integrating the value of natural capital into national accounting and corporate planning and reporting processes, policies, and programmes, in agreed efforts, including the appended Communiqué on Natural Capital Accounting,
- Building social capital and reducing poverty by transitioning agriculture, extractive industries, fisheries and other natural capital uses to practices that promote sustainable employment, food security, sustainable energy and the protection of natural capital through protected areas and other mechanisms,
- Ecosystem restoration measures, as well as actions that mitigate stresses on natural capital,
- Building the knowledge, data, capacity and policy networks to promote leadership and new models in the field of sustainable development, and to increase momentum for positive change,
- Effective communication and public education.

Each of us, no matter our stage of development, will start to implement this agreement, consistent with our respective capacities and resources;

In recognition of the many encouraging steps being taken towards sustainable development across the African continent, We hereby encourage other nations to endorse this Gaborone Declaration and agree to join in these initiatives.

Communiqué on Natural Capital Accounting
Recognizing the limitations of GDP as a measure of well-being and sustainable growth that values environmental and social aspects of progress;
Underscoring the importance of natural capital accounting as a tool for mainstreaming natural capital into informed economic decision-making;
Recognizing the adoption by the UN Statistical Commission of the 2012 System of Environmental-Economic Accounts (SEEA) central framework as the initial version of the international standard for environmental-economic accounts, subject to further revision, acknowledging that further improvements on measurement are necessary on specific issues;

Noting the challenge to build national institutional capacity to implement the SEEA, including the organization and collection of data, and to demonstrate its benefits to policy makers;
Appreciating that there are many successful experiences and best practices on natural capital accounting and that a key challenge we face is how to scale up, replicate and adapt what we know works;
Welcoming that Rio+20 offers an important opportunity for the international community to mobilize support for the implementation of previously stated commitments to implementing natural capital accounting.

Hereby:
Invite Governments, their respective accountancy standards bodies, and the United Nations system, including international financial institutions, and other international organizations, as appropriate, working in partnership with Major Groups and other stakeholders to take action as follows:
1. Develop institutional arrangements to strengthen the implementation of natural capital accounting;
2. Develop science-based methodologies on an experimental basis for ecosystem accounting as a complement to GDP and corporate performance;
3. Pilot and demonstrate the economic, social and environmental aspects of scaled up and integrated approaches to natural capital accounting.

Further invite the United Nations Statistical Commission to assist in the implementation of the SEEA and to provide support for the training of national accountants, environmental statisticians and national technical staff.

National Representatives and Signatory Countries

His Excellency Lt. Gen. Seretse Khama Ian Khama, President of the Republic of Botswana
Her Excellency Ellen Johnson Sirleaf, President of Liberia
His Excellency Hifikepunye Pohamba, President of Namibia
His Excellency Mohamed Gharib Bilal, Vice President of Tanzania
His Excellency Aires Aly, Prime Minister of Mozambique
Hon. Stanislas Kamanzi, Minister of Natural Resources of Rwanda
Hon. Emmanuel Issoze Ngondet, Minister of Foreign Affairs, International Cooperation and Francophony of Gabon
Hon. Njeru Githae, Minister of Finance of Kenya
Hon. Edna Molewa, Minister of Water and Environmental Affairs, South Africa
Hon. Sherry Ayittey, Minister of Environment, Science and Technology, Ghana

Representatives and Supporting Institutions

Government of Norway, Hon. Heikki Holmås, Minister of International Development
Conservation International, Peter Seligmann, Chairman, CEO and Founder
Emerson Collective, Laurene Powell Jobs, Chair and Founder
Wal-Mart Stores, S. Robson Walton, Chairman
Bill & Melinda Gates Foundation, Sam Dryden, Director, Agricultural Development
MacArthur Foundation, Barry Lowenkron, Vice President, International Programs
Rabobank, Gerard van Empel, Director Rabo Development and RIAS
ArcelorMittal Mining, Suresh Rajapakse, Vice President
African Iron Ore Group Ltd., Louis Greyling, Executive Director
Conservation South Africa, Sarah Frazee, CEO
East Africa Farmers Federation, Stephen Muchiri, Chief Executive
EcoAgriculture Partners, Sara Scherr, President
Food and Agriculture Organization of the United Nations,
Maria Helena Semedo, Assistant Director-General
German Development Institute, Dirk Messner, Director

GIST Advisory, Pavan Sukhdev, Founder and Chair
International Fund for Agricultural Development,
Kevin Cleaver, Associate Vice-President
Isithebe Trust, Loyiso Ndlovu, Executive Director
IUCN, Russell A. Mittermeier, Vice-President
IUCN, Ali A. Kaka, Regional Director
Nestlé S.A., Claus Conzelmann, Global Vice President of Safety, Health and Environment
Tanzania Forest Conservation Group, Charles Meshack, CEO
United Nations Environment Programme, Achim Steiner, Executive Director
Woolworths Holdings Ltd, Simon Susman, Chairman
The World Bank, Rachel Kyte, Vice President, Sustainable Development
World Vision East Africa, Charles Owubah, Regional Vice President

Annex 2: Forecasted water demand and resources by cluster in Botswana.

Cluster Number	Water Demand (All units m^3/day)	Water Resource (All units m^3/day)	Available for Export (m^3/day)	Comment
1 - Kgalagadi South	2,740	No regional water resources available	-2,740	Tsabong currently provided for by a sort of small 'wellfield' - series of spread out boreholes
2 - Greater Gaborone	70,800 - Gaborone Only 115,500 - Rest of Cluster 186,300 - in Total	74,400	-111,900	Assumes average inflow into both Gaborone and Bokaa Dam
3 - Jwaneng	34,00 - Jwaneng Mine 5,700 - Rest of Cluster 39,700	65,000	39,000	Assumes large operational wellfield developed at Botlhalotlau
4 - Mahalapye	42,700	40,000	-2,700	Assumes full high pumping resource from Masama expansion
5 - Serowe - Palapye	30,100	12,800	-17,300	
6 - Tswapong	Not part of study	Not part of study		
7 - Bobirwa	Not part of study	Not part of study		
8 - Phikwe	40,300 - BCL Mine 4,600 - Rest of Cluster 44,900 - in Total	53,300	8,400	Letsibogo Dam main resource
9 - Francistown	46,100	221,700	175,600	Assumes Lower Shashe Dam Completed - Lower Shashe Dam on boundary of Cluster 8 and 9
10 - North East	Not part of study	Not part of study		
11- Nata/Gweta	6,300	32,700	26,400	Assumes Mosetse Dam and Gweta developed
12 - Central East	No Longer a separate Cluster	No Longer a separate Cluster		This Cluster was amalgamated into Clusters 13 and 8
13 - Orapa	48,200 - Orapa Mine 3,200 - Rest of Cluster 51,400 - in Total	43,000	-8,400	Assumes Letlhakane Mine closed. Flat rate for Orapa - does not include Saline Option
14 - Kasane	2,900	Extensive from Chobe	Uncertain and not included in study	Potentially huge transfer from Congo and Chobe
15 - Maun	15,200	22,000	6,800	Assumes new wellfields Gomoti, Kunyere all developed
16 - Ngamiland	5,900	30,000	24,100	Extensive Groundwater available although not developed at all
17 - Ghanzi - Kang	5,400	22,900	17,500	Ncojane Basin fully developed

Source: Water Surveys & Bergstann, 2008.

Annex 3: Summary of Riverbasin Organisations in Southern Africa in which Botswana is a member.

Annex 4: Australia's and New Zealand's Water Efficiency Labelling and Standards Scheme (WELS).

The WELS Scheme aims to conserve water supplies by reducing consumption, promoting efficient water use and water saving technologies and ensuring consumers have access to rated and labeled water efficient products. The schemes targets domestic use and institutional buildings and six products: toilets, taps, showers, washing machines, dishwashers, urinals.

It operates primarily through product labeling and provision of information to households and those involved in building design, construction, and maintenance. In addition, minimum water efficiency standards for products can be established (only toilets in Australia).

The scheme has legal backing (through a specific Act (Australia) or WE regulations as part of the Fair Trading Act (New Zealand). In New Zealand water efficiency labeling is combined with energy efficiency labeling. The scheme is implemented by government institutions with participation and financial contributions from the private sector. WELS identifies offenses by retailers, importers and/ or producers, which may attract penalties or adverse publicity (through publication of the companies involved). WELS requires effective testing of the water efficiency of products.

For Botswana, the scheme would be particularly useful for toilets and urinals, but also for showerheads and washing machines. Demonstration projects have long shown the significant water and costs savings in these areas, but opportunities have not been used to-date. An adapted Botswana WELS scheme could become the vehicle for implementation, requiring the following:

- ✓ Incorporate water efficiency labeling in new Water Act together with provision for minimum water efficiency standards for products;
- ✓ BOBS should develop minimum water efficiency standards, initially for urinals, toilets washing machines, shower heads and taps and other relevant technologies and appliances;
- ✓ Develop of a water label showing water efficiency information and ranking (e.g. stars). Where appropriate water labeling can be combined with energy labeling;
- ✓ The scheme should be introduced phase Gradual introduction as in New Zealand;
- ✓ Encourage development of SADC wide WELS system.
- ✓ Develop WELS website to provide info to consumers, retailers, manufacturers and importers
- ✓ The scheme could be extended to neighbouring countries such as Namibia, South Africa and Zimbabwe and ultimately become SADC wide.

References and sources:

Guest,C (2010). Independent review of the water efficiency labelling and standards scheme (WELS).
Australian WELS website: www.waterrating.gov.au
New Zeland WELS website: www.mfe.gov.nz.

Annex 5: The IWRM Water Efficiency M & E system.

Act #	Activity	Indicators	Baseline value	Target value	Resp. institution	Data source
SA1.1	Establishment of prioritisation of demand categories in the Water Policy.	Demand prioritisation incorporated in Water Policy & Act	Prioritisation in draft Water Policy; not in Act	Prioritisation in Policy and Act	WRB & DWA	Check against policy and Act
SA1.2	Sectoral water use and conservation target setting.	Agrees sectoral targets	No targets	Conservation & use targets for irrigation, mining, construction etc.	DWA & WRB	Check agreements with sectors
SA1.3	Development of water allocation efficiency guidelines	Guidelines being monitored	No guidelines; Value added/m^3 available from Water Accounts	Increased overall water use efficiency (Value added/m^3)	DWA & WRB	Water accounts
SA1.4	Water accounting capability development at DWA	DWA full staff capacity	No dedicated staff at present	To be agreed upon: at least 2 staff trained members who can update the accounts	DWA	DWA organisation structure And regular water account up-dates
SA1.5	Carry out of sectoral IWRM assessment and an economic cost benefit analysis.	Assessment per sector determined Baseline per sector set	No sector studies available	To be agreed upon; sectoral studies should support greater water use efficiency by sectors	DWA & WRB	WUC, private sector, WRB

Act. #	Activity	Indicators	Baseline value	Target value	Resp. institution	Data source
SA2.1	Increasing the reuse and recycling of treated wastewater and improvement of TWW outflow quality.	% of TWW re-used & recycled % of outflow of acceptable quality	2001: 10% NMPWWS	96% by 2030; need to agree on intermediate targets All outflow to meet quality standards	WUC	WUC, BOBS, WRB
SA2.2	Carry out a feasibility study of small scale trade in TWW in terms of re-use and poverty eradication.	Feasibility study completed Recommendations made and implemented	No baseline information available	Based on the findings of the study		
SA2.3	Implementation of the WUC water loss reduction and IWRM-WDM Strategy.	% of water losses % of WUC's IWRM-WDM plan activities implemented	22% at present	15% nationally; 1 % reduction p.a. from 22%. IWRM-WE plan fully implemented	WUC, WRB	WUC
SA2.4	Development and implementation of the Botswana Water Efficiency Label System	WELS implemented and monitored Annual progress reports	No WELS at the moment	% of buildings with dual flush system % of buildings with AFU	DWA & WRB	
SA2.5	Establish and maintain a functional computerised water rights registry.	Registry established Registry accessible	No computerised registry	A computerised IMS and registry established at DWA	DWA & WRB	DWA
SA2.6	Strategic environmental assessment of water efficient technologies for wastewater conveyance and sewer infrastructure.	SEAs conducted and available			DWMPC, DEA &WUC	
SA2.7	Negotiate IWRM & WDM covenants with major water user sectors and major water users. Priority sectors: mining, irrigation, construction, government and industry. Priority individual users based on water consumption (e.g. KBL and BMC).	Sectoral agreements in place, implemented and monitored	No agreements in place	# of sectoral agreement # of agreements with large water users	DWA, WUC & WRB	
SA2.8	Expansion of conventional water storage infrastructure development:	Increased safe yields of surface water storage	Only known for large dams; small dams not monitored	Mostly development & rehabilitation of small dams	DWA	
SA2.9	Expansion of non-conventional water sources: desalination; rainwater harvesting; storm water harvesting.	Increased safe yields of non-conventional water storage	No base line data: to be collected	To be agreed upon	DWA & WRB	
SA2.10	Development of storm water strategy, guidelines and regulations for storm water management and storage for all planning areas.	Strategy, guidelines and regulations implemented			DWA & WRB	

Act. #	Activity	Indicators	Baseline value	Target value	Resp. institution	Data source
SA3.1	IWRM & WDM monitoring of implementation of the Water Sector Reforms.	Annual monitoring reports			DWA & GWP-Botswana	
SA3.2	Incorporation of IWRM and WDM into Mid-Term Review and full integration in NDP11 preparation process.	Plan activities included in MTR and NDP 11	Few projects already planned-on-going	To be agreed. All short term activities to be included in NDP10 implementation or NDP11 preparation	DWA, MFDP & NSO	
SA3.3	Integration of IWRM & WDM in land use planning.	% of households with access to water in settlements and at lands % of businesses settled near water			DWA & MLH	
SA3.4	Development of IWRM & WDM guidelines and standards.	Guidelines and standards developed, available and implemented	No guidelines and standards	Standards to be determined	DWA & GWP Botswana	
SA3.5	Integration of IWRM in poverty eradication efforts.	% of persons with access to piped water % of water costs of monthly income	Unknown	MDG & Vision 2016 Target to be set; water should not be more than 5% of monthly income.	DWA	Pop. Census; MDG status reports; core welfare indicators

Act #	Activity	Indicators	Baseline value	Target value	Resp. institution	Data source
SA4.1	Finalisation, adoption and implementation of the Water Policy.	Water policy implemented and reported on		Approved by 2012/13	MMEWR-DWA	
SA4.2	Development and approval of a revised Water Act	Act is revised and gazetted		Approved by 2013/4?	DWA-MMEWR	
SA4.3	Completion of the water sector reforms process.	Completion report			MMEWR & MLG	
SA4.4	Design economic and legislative instruments to stimulate the use of non-potable water and TWW in irrigation and mining.	Instruments in place and utilised	No instruments available	To set Number of instruments	DWA	
SA4.5	Full integration of IWRM and WDM in the development planning cycle, EIA/SEA procedures, environmental health and disaster management.	IWRM and WDM compulsory criteria of EIA/SEA procedures			WRB & DWA	
SA4.6	Develop WWS Management Plans for major centres	Plans completed and implemented Annual reports		All centres have plans by year20XX % of plans compared to all major centres	DWA & DWMPC	
SA4.7	Conclude, implement and monitor Trade Effluent Agreements for all major discharges into the sewerage system.	No of TEAs	Uncertain; at least 1 in place.	To be agreed upon	DWMPC	

Act. #	Activity	Indicators	Baseline value	Target value	Resp. institution	Data source
SA5.1	Organise a forum to review catchment area water management approaches and identify the best one for Botswana	CAM approach identified and recommendations implemented	No catchment area approach in place	Agreed relevant catchment area management approach	WRB & DWA	
SA5.2	Review different decentralised water institutions	Performance of decentralised institutions	Unknown	To be agreed upon	WRB & DWA	MoA, DWA

Annex 6: A list of Annexes in Volume 2 of the Botswana IWRM-WE Plan.

Appendix 1: Summary of IWRM-WE Plan consultations

Appendix B: Summary of selected SADC water policy documents

Appendix C: Review of Shared River Basins in SADC

Appendix D: Review of international IWRM-WE Plans

Botswana Water Partnership

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