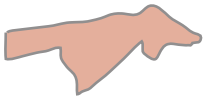


Integrated Water Resources Management

Zambezi-Kwando-Linyanti River Basin

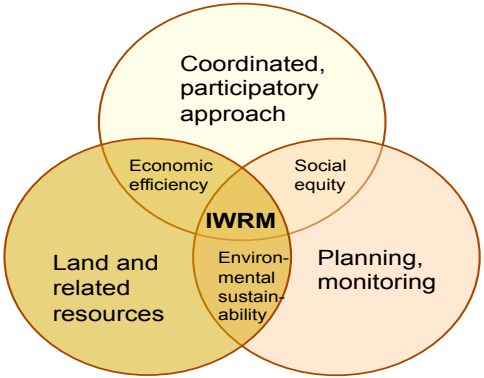
About this booklet

This booklet is intended for all water users to encourage awareness of the water sources, water use and its values, especially in a dry country as Namibia. There are no perennial rivers within the borders of Namibia and water resources are very unevenly distributed across the country. The water resources challenges in Namibia can only be addressed through efficient water resources management including development of an integrated framework and provision of infrastructure to ensure water security. In this regard, this booklet is compiled for the Ministry of Agriculture, Water and Forestry to introduce the concept of Integrated Water Resources Management (IWRM) and how it can be implemented with emphasis on stakeholder participation and decision making at the lowest appropriate level. The contents of the booklet includes:

What is IWRM and why is it important?

Integrated Water Resource Management (IWRM) is defined as a process that promotes the coordinated development, management and use of water, land and related natural resources (people, vegetation, animals and eco-systems) for economic, social and environmental sustainability. The IWRM process further involves participatory approaches which include discussions, planning and negotiations between stakeholders of the basin on important issues to achieve social equity, economic efficiency and environmental sustainability.

IWRM is implemented at a basin level in Namibia, linking all aspects of the basin, so that the users can understand the interactions between resource use, economic value and conservation, as well as the impacts of their activities on eco-systems and the goods and services they provide.



The Department of Water Affairs and Forestry (DWAF) in the Ministry of Agriculture, Water and Forestry (MAWF), assisted by a Steering Committee representing various sectors, formulated an IWRM Plan (IWRMP) for Namibia.

The knowledge gained from the IWRM process, enables the stakeholders to understand the threats, prescribe mitigation measures and predict changes, and then manage them accordingly.

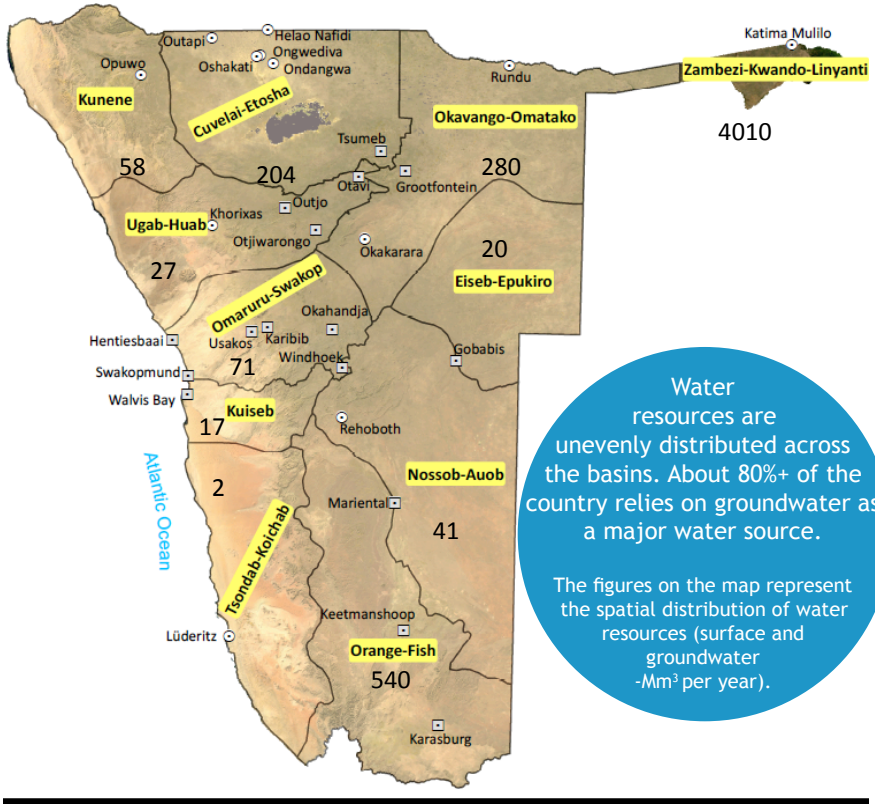
Welcome to the Zambezi-Kwando-Linyanti Basin!

Water and land resources management in Namibia is carried out at the lowest management level, known as the basin level, to broaden the management process.

Hence, Namibia is divided into 11 water management areas referred to as "water basins" according to the common drainage flows of major water sources such as rivers, groundwater systems (aquifers), water supply canals and pipelines.

The **Zambezi-Kwando-Linyanti River Basin** is located in the north-eastern part of Namibia stretching across the entire Caprivi region.

The basin rivers form borders with Angola, Zambia, Zimbabwe and Botswana in the north and east respectively.

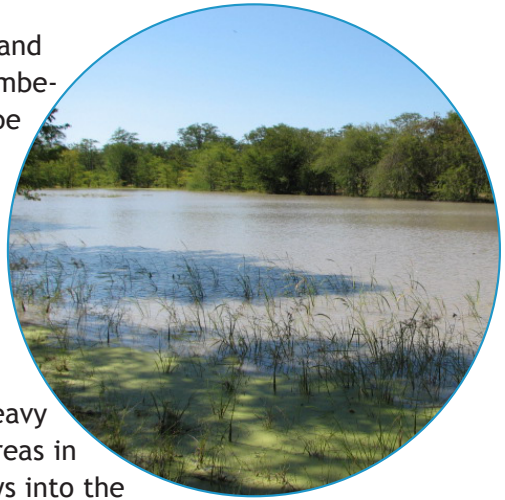


Water resources are unevenly distributed across the basins. About 80%+ of the country relies on groundwater as a major water source.

The figures on the map represent the spatial distribution of water resources (surface and groundwater -Mm^3 per year).

Map provided by **Uazukuani Uazukuani,** National Planning Commission - *Central Bureau of Statistics, February, 2010*

Where does the water in the basin come from?



The water comes from perennial rivers, ephemeral water courses (mulapo's) and groundwater sources.The **perennial** (rivers that flow throughout the year) Zambezi River forms the northern border of the basin and the Kwando-Linyanti-Chobe tributary (smaller rivers, which flow into larger rivers) of the Zambezi, forms the eastern and southern borders of the basin in Namibia. During high floods the Zambezi pushes water through the Chobe into Lake Liambezi and water can also flow from the Kwando-Linyanti river system into Lake Liambezi. The Zambezi river system is fourth largest in Africa and drains into the Indian Ocean.

The Kwando River (is an **ephemeral watercourse** which only has water after heavy rains), originates out of floodplains in Zambia and overflows from swampy areas in Southern Angola. It forms the Kwando-Linyanti-Chobe river system which flows into the Zambezi.

The basin obtains more rain than other basins in Namibia. The annual average exceeds 700 mm, creating a green grassland and woodland area with numerous waterways.

Most of the **groundwater** is provided from **boreholes** (mainly diesel powered), however **hand-dug wells** are also commonly used. A **pipeline** supplies water along the Kongola-Katima Mulilo road. Several excavation/earth dams are found in the Cuvelai area. The dams are constructed in oshanas and collect seasonal surface water, which are primarily used for livestock water supply. Although the dams are expensive to build, the water is free for people and livestock to use. The major disadvantages of earth dams are that it can only recharge water in one place and it is not good for storing water because they loose most of the water through evaporation.

Who supplies and manages the water in the basin?

The institutions responsible for water resources are divided into the following categories for ensuring efficient and effective management thereof:

- **Overall water resource inventory, monitoring, contol, regulation and management**: Directorate of Resources Management within the Ministry of Agriculture, Water and Forestry (MAWF).
- **Bulkwater supply:** Namibia Water Corporation (NamWater) abstracts water from primary sources (eg. rivers, aquifers or dams) and supplies to some end-users directly.
- **Self-providers:** These are commercial farmers, tour operators, mines and nature conservation parks), subject to appropriate agreements and licences, supply their own water.
- **Water supply to rural areas**: Directorate of Water Supply and Sanitation Coordination in the MAWF.
- **Water supply to urban areas**: Local Authorities and Regional Councils buy water from NamWater or supply their own water from boreholes for delivery to end users.

The Constitution of the Republic of Namibia is the primary law for sustainable resource management and equal distribution of water to the people. Specific documents dealing with water management include the: Water and Sanitation Policy of 1993; Namibia Water Corporation (NamWater) Act of 1997; National Water Policy White Paper of 2000; Water Act 54 of 1956 and Regulations, soon to be replaced by the Water Resources Management Act (2004) [which has not yet entered into force and is currently under revision] and the Water Supply and Sanitation Sector Policy of 2008.

The Water Resources Management Act makes provision for the establishment of basin management committees (BMCs) to make sure that integrated management takes place at the basin level. The role of a BMC is to provide scope for addressing various issues affecting water resources in the basin, ranging from efficient water use to monitoring the health of the basin.

The aim of such a committee (encouraging gender equality where possible) is to equip basin communities to take full ownership of their own development (through developing a strategic basin management plan) with strong support from the relevant service providers. The committee is ideal for knowledge and experience sharing to realize a common vision for the basin, through IWRM principles such as stakeholder participation, transparency and information sharing. However, the process of establishing basin management committees are currently being implemented in phases and thus the Zambezi-Kwando-Linyanti Basin Management Committee is still pending based on demand and priority assessments.

For further information contact:
Ministry of Agriculture, Water and Forestry,
Department of Water Affairs and Forestry,

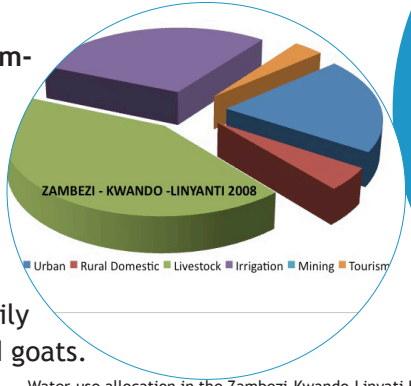
Tel: 061- 208 7696

Who uses water and how?

The supply of water from surface and groundwater resources to competing demands is prioritised in Namibia. The first is water for domestic purposes (including livestock water for both subsistence and commercial farming) and the second is water for economic activities such as mining, industries and irrigation. Flood patterns of the river system determine how water is used in the basin. The majority of the rurally based people (estimated 53 000) survive on fish and crop and stock farming, while the urban population, with Katima Mulilo as the only urban centre (estimated 27 400) and surrounding settlements (estimated 5 000) mainly use water for domestic and gardening (vegetables) purposes. There are several irrigation projects in the basin, which include rice and sugar cane farming. The basin is rich in wildlife and game. The Caprivi Game Reserve is protected from uncontrolled hunting. The Caprivi is also home to several wetlands, floodplains and swamps such as the Linyanti Swamps, Lake Liambezi and the Chobe Swamps. As a result tourism activities are increasing.

70% of the people in the basin depends on the perennial river system, while 30% makes use of groundwater sources.

Large-scale communal farming is the biggest water user in the basin with several communal farmers farming primarily with cattle and goats.



Water-use allocation in the Zambezi-Kwando-Linyati Basin
Source: IWRMP Joint Venture, Theme Report 2. 2010

How much water do we require? (in terms of 10- litre buckets):

- One person uses on average 15 litres (one and half bucket) per day
- One goat/sheep/koedoe/zebra/oryx drinks on average 12-45 litres (about one to four buckets) per day
- One cow drinks on average 30 litres (three buckets) per day

*An average household of four people thus consumes 60 litres per day (6 buckets).

Water demand management – how to use water more efficiently

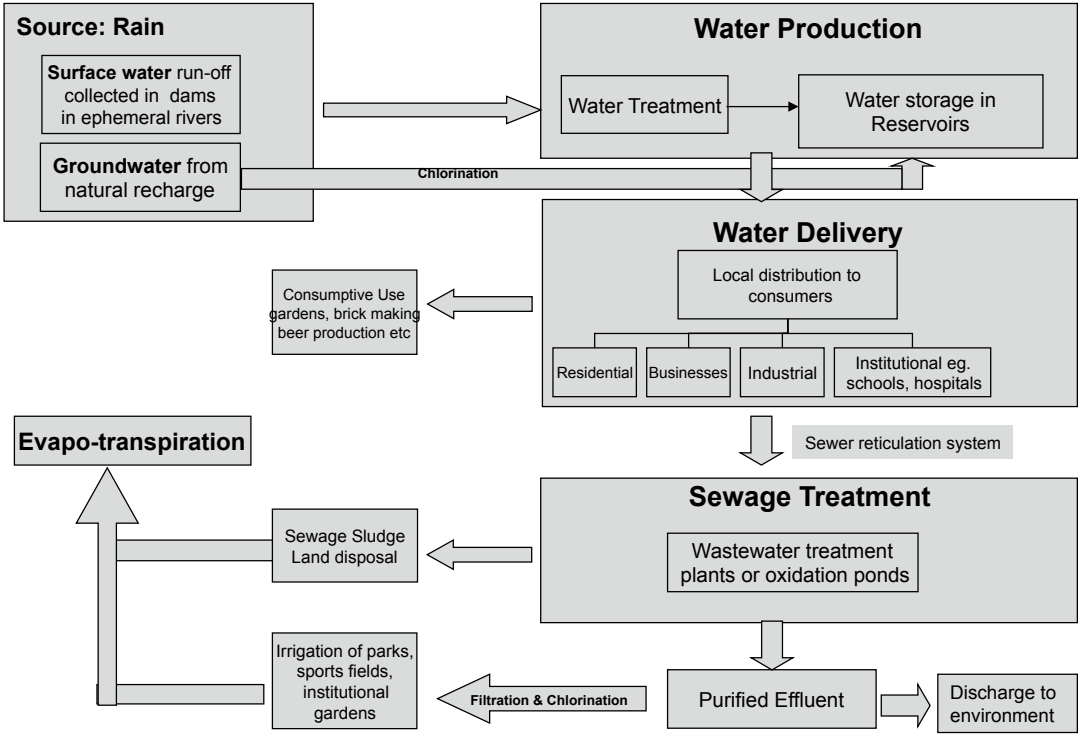
Water demand management (WDM) is a very important part of IWRM. WDM aims to improve water use efficiency by reducing water losses or changing the wasteful way people use water. WDM is an approach to achieve "water use efficiency".

WDM is implemented through education and information; training; using economic and finanical principles; water pricing and tariff policies (eg. rising block tariffs) and technical measures.

The price of water is determined by the cost to develop a water source; the distance the water has to be transported by pipeline to the consumer and the topography which determines the pumping cost to supply the water.

The consumer base and technology, i.e. household taps or pre-paid meters, that is affordable to various income groups, also have an effect on the cost of water.

The ability of Local Authorities to enforce credit control measures also influences water consumption.



Water supply chain, showing the process from source to the tap of a household, is the basis on which water services are charged.

Municipal costs to provide a household with water and sanitation services include charges for water collection from a source; water production (treatment of raw water to drinking water standards); water delivery to the consumer and wastewater treatment and disposal. Wastewater collection and treatment contribute to hygienic environments and form part of the water chain to prevent pollution in order to ensure that good water quality and sanitation is achieved. Therefore it is essential that water consumers PAY for water services to ensure continued quality and efficient service delivery.

In rural areas, the community based water management programme under the Directorate of Water Supply and Sanitation Coordination, established mechanisms for users to pay for water services. In addition, mechanisms for transparent and targeted subsidies for those who are unable to pay for water services are being considered. Local water point committees manage local aspects of water services, preventing issues such as illegal connections and vandalism to pipelines.

"The price of water should be set so that the price does not prevent consumers from obtaining sufficient quantity and quality to meet fundamental domestic needs"

Different ways to save water in urban households:

1. Schedule garden watering for early or late in the day (before 10 am and after 4 pm)
2. Avoid the use of hosepipes for cleaning pavements, floors or cars; instead use buckets
3. Make use of retrofits (replacement with equipment specifically designed to reduce water use) such as:
   3.1 Low flush and dual flush cisterns that are being used more and more. Reducing the vol ume of existing toilet cisterns can be achieved by:

* Placing a 1 to 2 litre plastic bottle filled with water, or a brick wrapped in plastic, inside the cistern. This will decrease the volume of water held within it.
* Bending the swimmer arm inside the cistern downwards so that the inflow valve is shut off when the water reaches a lower level than previously.

4. Fix or report to the municipality any moisture or leak problems immediately. Most water leaks occur from toilet cisterns. A single leaking toilet cistern can lose up to 7 000 litres of water per day.

5. Explore rain water harvesting (collection and storage of rain from run-off areas such as roofs) options. Remember - the first flush of new rain should be run to waste, before collection starts

6. Keep track of water usage by regularly reading the water meters.

A Word of Caution:

It is important to seek good advice from a knowlegeable dealer as not all water-efficient fittings and devices are appropriate for every location. Also consider whether the fittings can withstand rough and frequent use.

Water quality

Hand-dug wells, which are not supported with concrete rings, often collapse because of sandy soils. Furthermore, the wells can be polluted if not fenced off from animals or distanced from toilets.

The quality of water is determined by its aesthetic (colour, smell, turbidity), the chemical and the bacteriological quality. There is a direct link between water quality and health and therefore it is important to be able to differentiate between safe and unsafe water sources. Water quality is determined by both natural and human-induced contaminants (pollutants) that may have found their way into the water supply.

Most of the groundwater within the Zambezi-Kwando-Linyanti River Basin is considered suitable for drinking. However some water quality concerns exist in this basin due to increasing chemical concetrations (mainly due to irrigation activities) in the river system. This increases the possibility of the Kariba weed growth which, if not controlled, might destroy aquatic habitats. Currently biological control (through using beetles that attack the growth tips of the plants) is used to control such infestation.

Human activities that cause water pollution include:

- In **urban** areas: rapid urbanization – unserviced informal settlements are a major threat due to untreated/uncollected human sewage dumped directly into rivers; seepage of unprotected rubbish dumps into ground water sources
- In **rural** areas: lack of serviced water and sanitation facilities; overgrazing and trampling results in excess removal of vegetation and leads to excess run-off when rainfall is high. This erosion causes topsoil to enter water sources, thus reducing water quality thereof.

Dirty water can have a colour (yellow, brown or black), but it can also be clear and contain invisible bacteria or chemicals that are harmful to humans and animals. Therefore it is advisable to "clean/ cook" water before drinking it. The following ways are used to clean water:

- **Step 1:** Remove dirt that you can see, through filtering by using a sieve wire or a dense cloth of material.
- **Step 2:** Boil water or keep water in a clean container in the sun for two days.
- **Step 3:** Store clean water in a clean container with a cover.

Safe water is treated (purified and disinfected) from a bore-hole or well or surface water from a river or dam.

Water sanitation and hygiene

Washing hands with soap at key times such as after going to the toilet can reduce the occurance of diarrhoea

Sanitation is vital for human health, generates economic benefits, contributes to dignity and social development, and protects the environment. Sanitation promotion focuses on stimulating demand for ownership and use of a physical good. Access to basic sanitation refers to access to facilities that hygienically separate human excreta from human, animal, and insect contact. Hygiene promotion focuses on changing personal behavior related to safe management of excreta, such as washing hands and disposing safely of household wastewater. Both are essential to maximize health benefits. Lack of sanitation facilities and poor hygiene cause water-borne diseases such as diarhoea, cholera, typhoid and several parasitic infections. Provision has been made for both urban and sanitation management objectives and principles in the Water and Sanitation Sector Policy of 2008, to contribute towards improved health and quality of life.

Considering that Namibia is a water-scarce country, in most (rural and urban) instances, the most affordable individual household or community sanitation option are ecological or dry sanitation facilties, however where possible it should be left to the individuals to decide on the most appropriate technological and payment options as well as maintenance responsibility allocation.

Communities have the right to determine which water and sanitation solutions are acceptable and affordable to them

The institutions responsible for water sanitation and hygiene are divided into the following categories:

- Public health issues and awareness: Ministry of Health and Social Services; Directorate of Water Supply and Sanitation Coordination within the MAWF; Regional Councils and Local Authorities
- Health policies and legislation: Ministry of Health and Social Services
- Advice and research on alternative sanitation options and development: Habitat Research and Development Centre

Challenges of IWRM in the basin

The IWRM challenges in the basin are linked with climate variability and associated changes. In particular, the basin is highly prone to the following challenges:

- Floods: It is predicted that flood plain areas would reduce due to decrease in annual perennial drainage, which could severely disrupt agricultural systems and wetlands in the basin.

- Land degradation and deforestation: The topsoil of land contains valuable nutrients for vegetation to grow. When vegetation cover or trees are destroyed (either through high population growth or overgrazing due to high livestock concentrations in an area) the land becomes vulnerable and results in topsoil being easily blown away by wind; increased run-off (rainwater not infiltrating in the soil) and therefore causes loss of agricultural productivity (soil fertility).

- Bush encroachment: Invader bushes is the highest single consumer of groundwater, with detrimental long-term consequences on the sustainability of groundwater resources and fodder availability.

Due to the arid and highly variable climate in Namibia, water resource managers and users have to focus on improving efficiency of water resource use through improvement of water demand management practices.

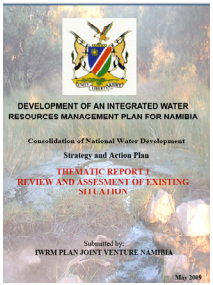
Future of water in the basin

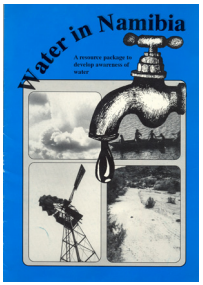
The basin has access to adequate perennial water sources in the Zambezi River and the Kwando-Linyanti-Chobe River system along the borders of Namibia in the basin, as well as groundwater in the interior. However, the biggest challenge is to transport water from the rivers to the users and to maintain water supply infrastructure to abstract, treat and distribute the water to the consumers, as well as to prevent pollution.

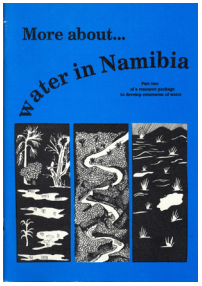
The future development of irrigation projects may require large quantities of water from the perennial rivers. The effect of tourism mentioned is negligible and can be regarded as part of population growth.

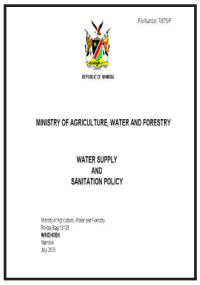
Overuse of fish resources poses a threat to the resource in the future and should be controlled, especially fishing with mosquito nets are prohibited because even the tiny fish are caught, which interferes with the breeding cycle.

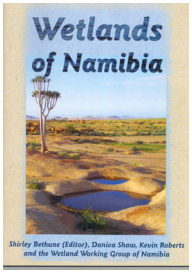
Basin management related information:

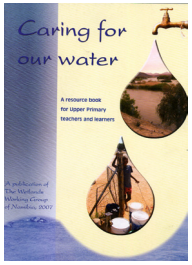


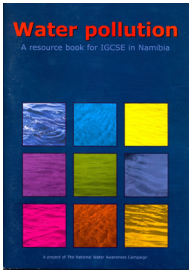


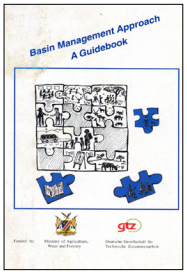


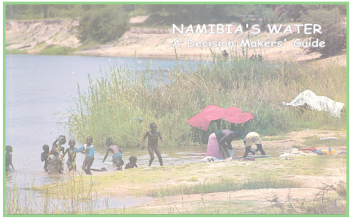












Note: some information used in this booklet is extracted from the above-mentioned material.

We must begin thinking like a river if we are to leave a legacy of beauty and life for future generations.

David Brower quoted by E-Wire, 7 Apr 2000

Dublin Principles adopted for IWRM in Namibia

I. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment

II. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels.

III. Women play a central part in the provision, management and safeguarding of water.

IV. Water has an economic value in all its competing uses and should be recognized as an economic good.

Source: International Conference on Water and the Environment in Dublin, 1992.

Acknowledgements

The booklet is compiled by the IWRM Joint Venture Consultants (Namibia) as part of the development of an **Integrated Water Resources Management Plan** for Namibia, on behalf of the Ministry of Agriculture, Water and Forestry.

This booklet was reviewed by the multi-sectoral Steering Committee of the IWRM plan.

The booklet is funded by **African Water Facility administered by the African Development Bank**.

Photo credit: Namibia Nature Foundation (NNF)