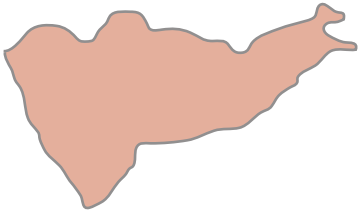
# Integrated Water Resources Management



## Ugab-Huab River Basin

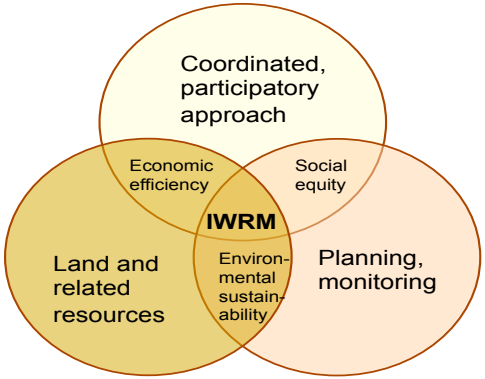
# About this booklet

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.

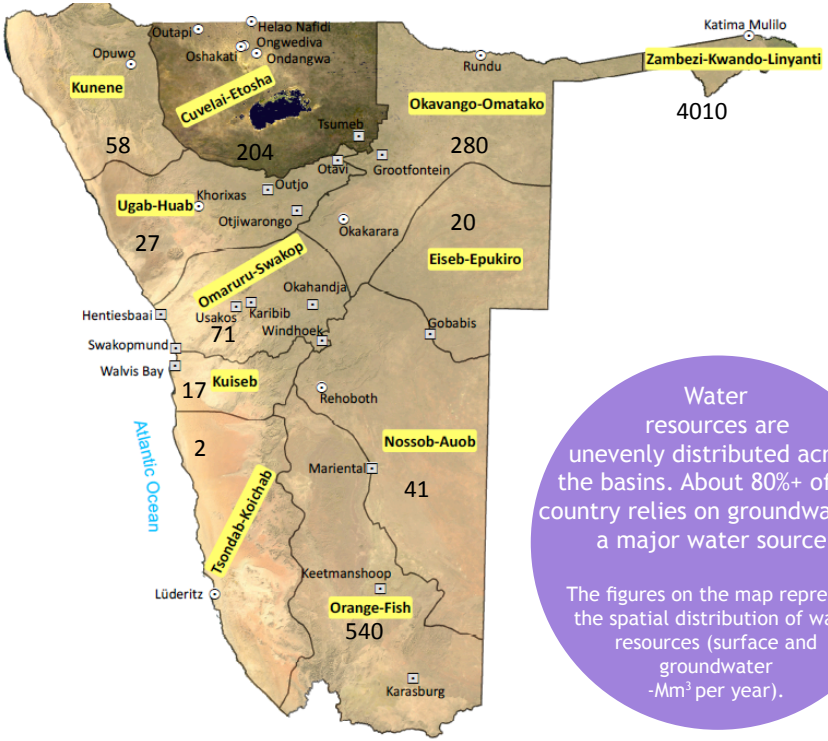
The knowledge gained from the IWRM process, enables the stakeholders to understand the threats, prescribe mitigation measures and predict changes, and then manage them accordingly.

# Welcome to the Ugab-Huab River 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 **Ugab-Huab River Basin** is located in the north-western part of Namibia, stretching across parts of the Kunene, Erongo and Otjozondjupa Regions. The basin includes the popular Skeleton Coast Park.



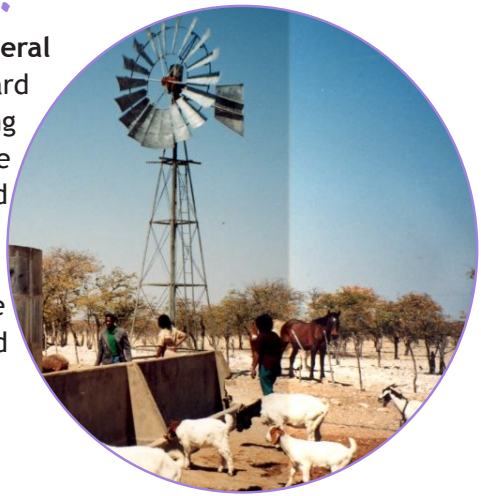

Map provided by **Uazukuani Uazukuani,** National Planning Commission – *Central Bureau of Statistics, February, 2010*

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).

# Where does the water in the basin come from?

The water comes from ephemeral rivers, boreholes and wells. The **ephemeral rivers** only flow after heavy rain in the basin. There are two major westward flowing rivers, the Ugab and Huab, as well as other smaller west flowing rivers (which only flow after exceptionally high rainfall events) such as the Uniab, Koigab, Messum and Orawab. The water courses are all characterized by dry, sandy or rocky riverbeds.



The major water supply source in the basin is groundwater. Some of the largest groundwater sources are the aquifiers (an aquifer is an underground geological formation that can store water for abstraction and use) on Braunfels, which supply Khorixas and the Damara Marble aquifer supplying Otjiwarongo town with water.

Most of the groundwater is provided through **boreholes** (mainly diesel powered, but some are solar or wind powered) and **pipeline schemes**. Some settlements receive water from **springs** (where groundwater water runs out on the surface), especially at Fransfontein and Gainatseb. Hand-dug **wells** along the rivers are also quite common in the basin.

The Rainfall of the basin is very unreliable with high evaporation rates. Rainfall ranges from less than 30 mm to a maximum of 550 mm per year across the basin.

Several excavation/earth dams are found in the basin 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.

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

Tel: 061-208 7259

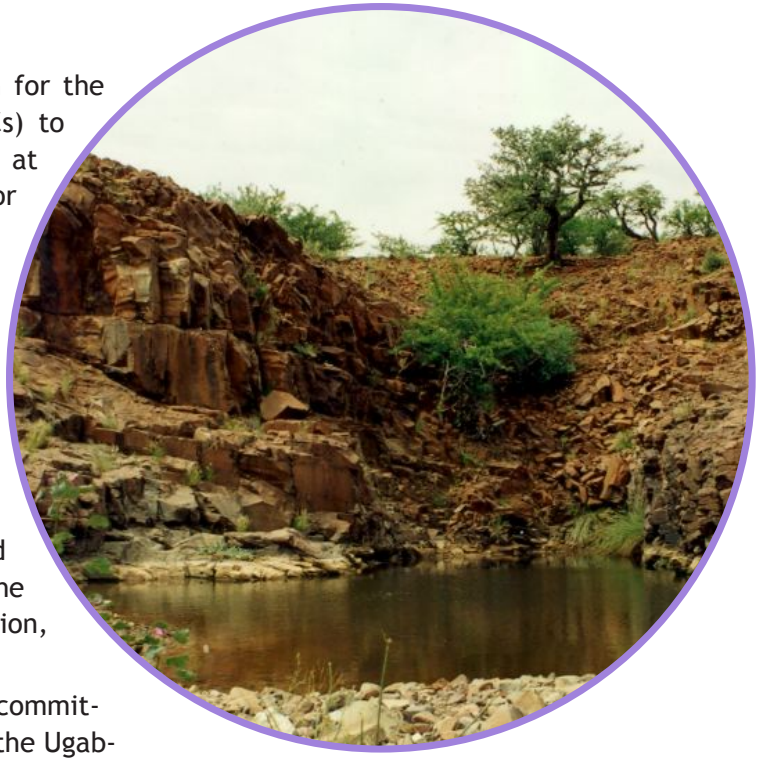
# Who supplies and manages the water in the basin?

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 water from own boreholes (such as Outjo) 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.

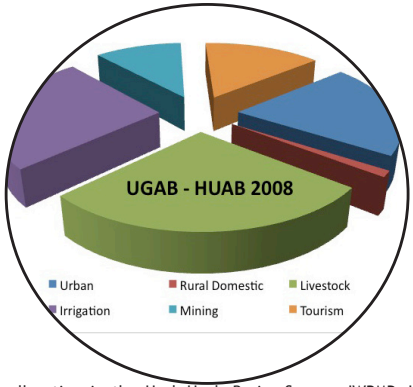


The aim of such a committee (encouraging gender equality where possible) is to equip basin communities to take full ownership of their own development (through developing a strategic basin management plan) with strong support from the relevant service providers. The committee is ideal for knowledge and experience sharing to realize a common vision for the basin, through principles such as stakeholder participation, transparency and information sharing.

However the process of establishing basin management committees is currently being implemented in phases and thus the Ugab-Huab Basin Management Committee is still pending, based on demand and priority assessments.

# 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. **The water in this basin is largely used for domestic and livestock farming, however it also supports great numbers of wildlife and natural vegetation.**




Water-use allocation in the Ugab-Huab Basin. Source: IWRMP Joint Venture, Theme Report 2. 2010

Specific water intensive activities in the basin are:

- **Domestic purposes:** The urban population of the basin is estimated at 46 000. Towns in the basin include Outjo; Otavi, Otjiwarongo and Korixas. Surrounding settlements supports approximately 3 600 people, while the rural population is estimated at 22 000.
  Although Terrace Bay is part of the Kunene River Basin, it receives groundwater from the Uniab River through a water supply scheme operated by NamWater.
- **Subsistence and small-scale farming:** the predominant stock found in this area is goats, but also includes a large number of cattle and a small number of sheep and donkeys. The number of stock in the basin totals to 385 300.

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

o One person uses on average 15 litres (one and half bucket) per day

o One goat/sheep/kudu/zebra/oryx drinks on average 12-45 litres (about one to four buckets) per day o 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).

- **Large-scale commercial farming:** The basin is a prime farming area, dominated by cattle and goats.
- **Mining:** Okuruso Fluorspar mine near Outjo makes use of groundwater resources.
- The river system supports large trees, bushes and grasses which can be used by livestock and wildlife as fodder. The **vegetation** along the major rivers in the basin forms a linear oasis (a strip of dense vegetation growing along a watercourse) across the Namib desert.

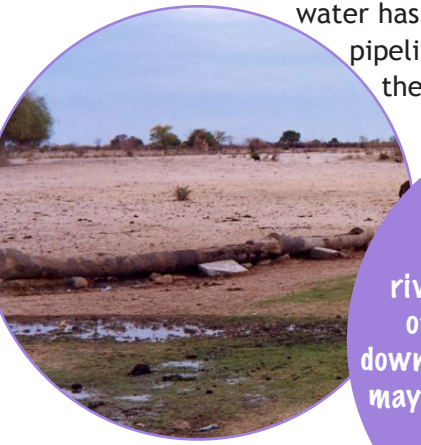
The Uniab River ends in a delta (mouth or end of river, dividing into several streams) with a large wetland area. The delta supports several permanent vegetation-fringed pools and a waterfall.

# 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 financial principles; water pricing and tariff policies (eg. rising block tariffs) and technical measures.

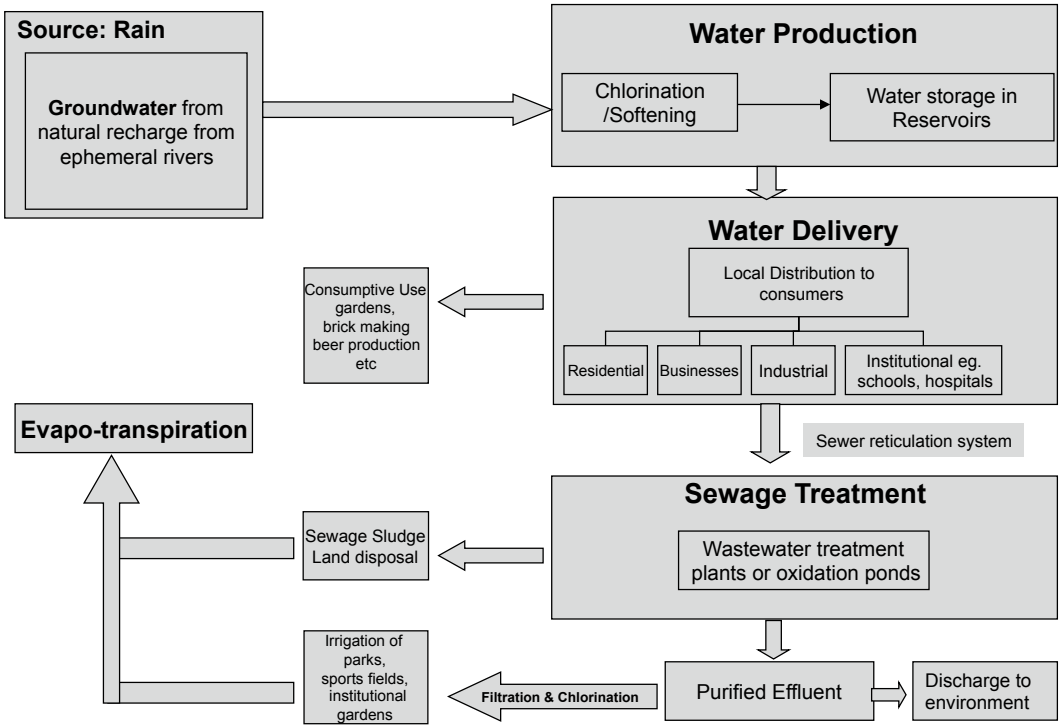
The price of water supply services are determined by the cost to develop a water source; the distance the water has to be transported by pipeline/canal, the treatment costs, storage of treated water, pipelines to the consumer and the topography which determines the pumping cost to supply the water.



The overuse of water from the upper reaches of ephemeral rivers decreases the amount of water available for the downstream systems. Thus there may be great need to implement demand management measures strictly.

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.

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:

"The price for water services should be set in such a way that the price does not prevent consumers from obtaining sufficient water (quantity and quality) to meet fundamental domestic needs."

3.1 Low flush and dual flush cisterns that are being used more and more. Reducing the volume 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.

In the absence of water, wild animals make use of waterholes and boreholes (especially elephants), used for domestic purposes, and damage the water points. They may also pose a threat to people. Therefore it is useful to separate waterholes for animals from those for human consumption (either use fences or pile big rocks around it).

A Word of Caution:

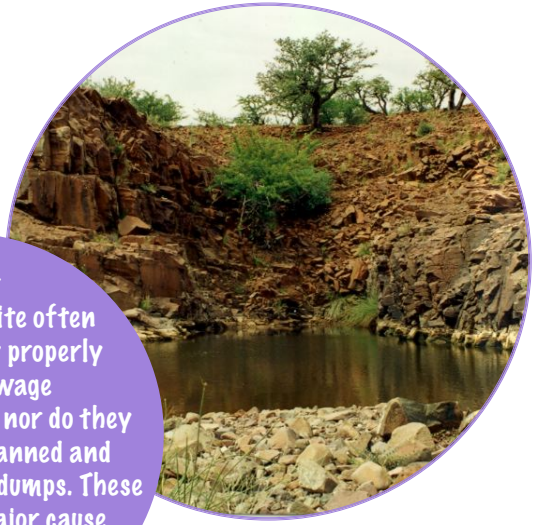
It is important to seek good advice from a knowlegeable dealer as not all water-efficient fittings and devices are appropriate for every location. Also consider whether the fittings can withstand rough and frequent use.

# Water quality

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. Naturally, water contains varying concentrations of dissolved oxygen and other gases, microscopic living organisms, tiny particles of dead decaying organic matter, inorganic salts and sediments. The water is described to be highly saline when the concentration of salts dissolved in the water is high. This includes nitrates, fluorides, sulphates as well as sodium chloride and carbonates. Water with high salinity tastes salty and is usually called 'brackish' water.

Many people in the basin are exposed to "dirty" unsafe water from open wells and oshanas.

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.



Larger settlements quite often do not have any properly planned sewage treatment plants, nor do they have any well planned and maintained refuse dumps. These are often the major cause of groundwater pollution.

Unused boreholes and wells should never be used as refuse tips. Their surface openings should be sealed when not in use.

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

The quality guidelines for drinking water have been set out by the Department of Water Affairs and Forestry, Water Environment Division.

Groundwater monitoring is considered very important, not only to understand and identify water quality trends and related indicators, but also to determine the availability of acceptable quality water sources. The Geohydrology division in the MAWF is responsible for groundwater investigation and monitoring.

# Water sanitation and hygiene

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.

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

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

# Challenges of IWRM in th 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:

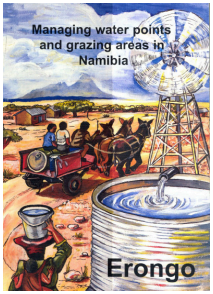
- Land degradation and deforestation: The topsoil of land contains valuable nutrients for vegetation to grow. When vegetation cover or trees are destroyed (either through high population growth or overgrazing due to high livestock concentrations in an area) the land becomes vulnerable and results in 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 availability of fodder.

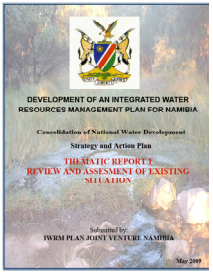
Due to the arid and highly variable climate in Namibia, water resource managers and users have to focus on improving efficiency of water resource use through improvement of water demand management practices.

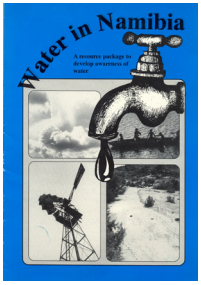
# Future of water in the basin

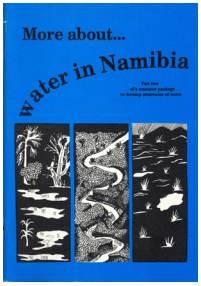
There are plans to build a dam at Zebraskop on the Ugab River to meet the water needs of a growing population at Khorixas and nearby communities, however this project is on hold pending an environmental assessment (investigating the environmental impacts of the proposed development and suggesting ways to avoid negative impacts as part of the planning process). Decentralisation of WDM in Khorixas could delay this requirement for a dam for decades.

There is great potential for tourism in the basin, due to the presence of numerous wildlife (including rhinos, elephants, lions and giraffes) wetlands, riparian forests and exposed mountainous geology. The Brandberg mountain, Doros Crater and the Vingerklip and Skeleton Coast Park are main attractions in this basin.

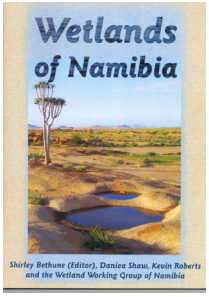


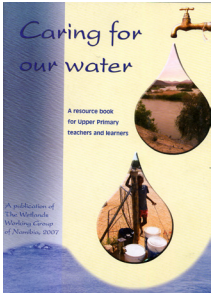



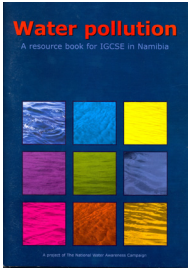



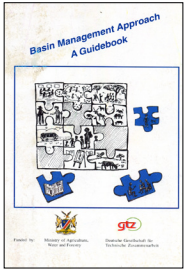



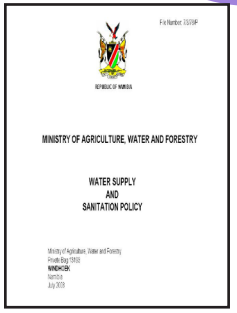

## Basin management related information:



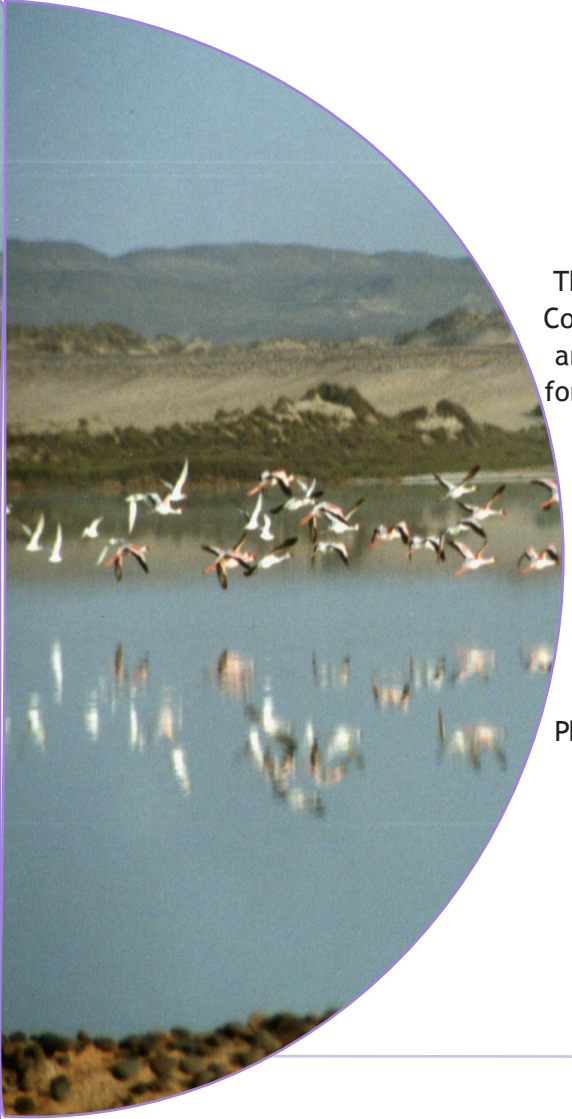






Note: some information used in this booklet is extracted from the above-mentioned material.

There is
nothing softer and
weaker than water, and
yet there is nothing better
for attacking hard and strong
things. For this reason there
is no substitute for it.

-Lao-Tzu (c. B.C. 550)



# 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: Desert Research Foundation of Namibia

## 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.