# Integrated Water Resources Management

# Omaruru-Swakop River Basin

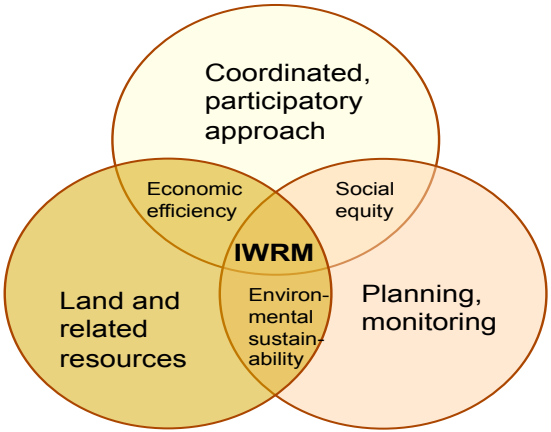
# About this booklet

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.

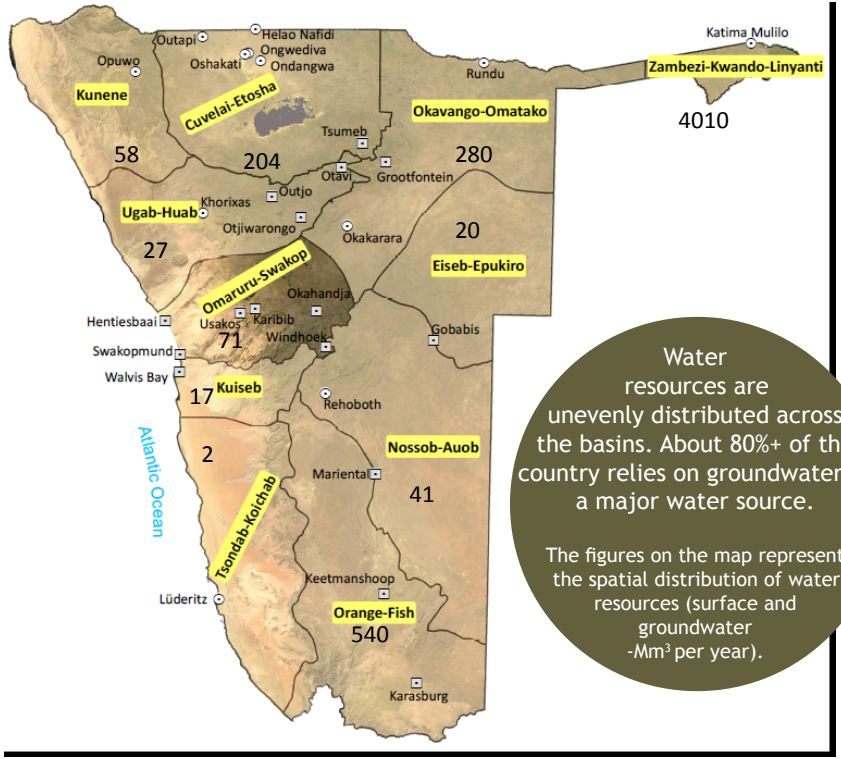
# Welcome to the Omaruru-Swakop River Basin!

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 **Omaruru-Swakop River Basin** is located in the central western part of Namibia and stretches over the Khomas, Erongo and Otjozondjupa Regions.

This basin is one of the most urbanized and popular tourist destinations in the country.




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?

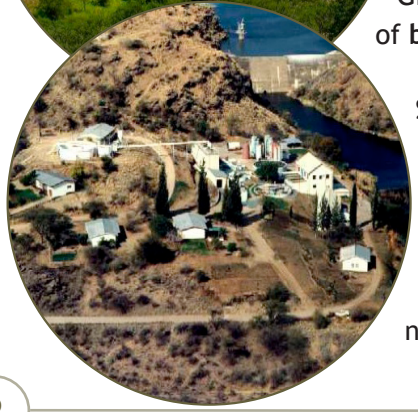
The water comes from ephmeral surface water flow and groundwater.

The Omaruru and Swakop Rivers are the major **ephemeral rivers** (they only flow after heavy rain) in the basin. The Okondeka and Khan Rivers are respectively their main tributaries (smaller river flowing into the larger river). Both rivers flow westward towards the Atlantic Ocean. The Omaruru River recharge several underground river channels that form the Omaruru Delta at the river mouth.

Water from the Swakop River is stored in two major dams, the Von Bach and Swakoppoort Dam from where it is pumped to various large centres such as Windhoek, Okahandja, Karibib, the Otjihase Mine and the Windhoek Airport. The Von Bach Dam is part of the Eastern National Water Carrier (ENWC) system, which also gets water from the Swakoppoort Dam, the Omatako Dam and groundwater sources near Grootfontein in the north.

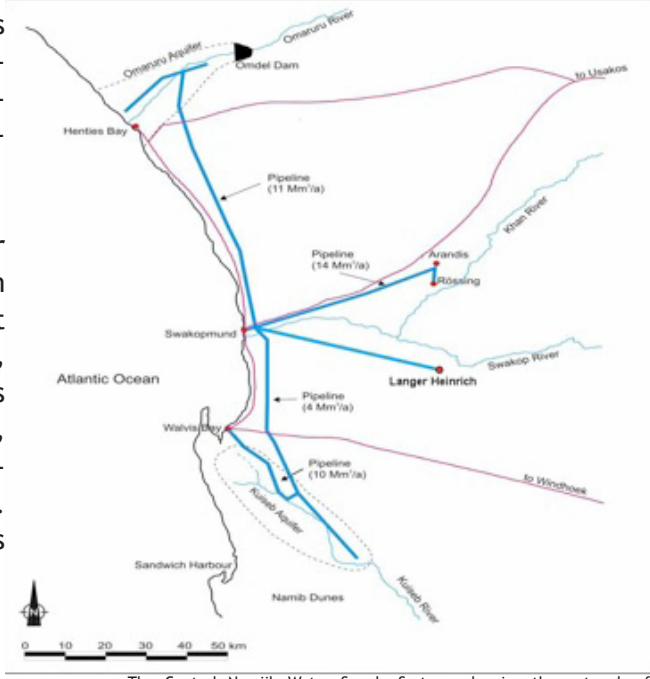
The Omdel Dam was built on the lower Omaruru River about 40 kilometers east of Henties Bay, to artificially recharge the groundwater sources in the Omaruru Delta.

The rainfall of the basin is low and variable with high evaporation rates (10 times more than rainfall). Rainfall ranges from less than 30 mm to a maximum of 590 mm per year across the basin.



Other dams in the basin include the Avis and Goreangab, where most of Windhoek's runoff is collected. The water supply schemes in this basin are interlinked and supply water to one of the economically most important parts of Namibia.

The basin has several **groundwater** sources and **springs**, recharged from **floodwaters**, from the rivers. Important aquifers are at the Omaruru Town, Okombahe, Neis-Neis and Henties Bay on the Omaruru River; at Karibb, Usakos and Otjimbingwe on the Swakop River and the Windhoek aquifer. Groundwater is abstracted by means of **boreholes** and wells.




The Central Namiib Water Supply System, showing the network of pipelines connecting groundwater sources to major water demand centres. Source: IWRMP Joint Venture, Theme Report 2. 2010

Several excavation/earth dams are found in the basin. The dams 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 in the communal areas. 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 alot of 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, subjected 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 for delivery to end users (with the exception of Omaruru town, which supplies its own water from the Omaruru River aquifer).

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.

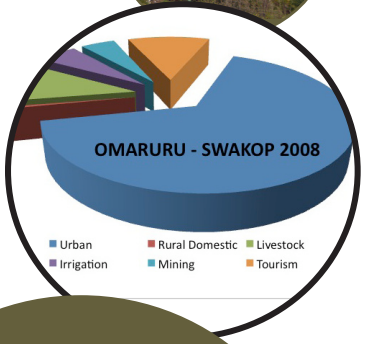
The aim of such a committee (encouraging gender equality where possible) is to equip basin communities to take full ownership of their own development (through developing a strategic basin management plan) with strong support from the relevant service providers. The committee is ideal for knowledge and experience sharing to realize a common vision for the basin, through principles such as stakeholder participation, transparency and information sharing. For this purpose, the process of establishing the Omaruru-Swakop Basin Management Committee started in 2003 with the focus on water management (institutional arrangements) and health (water quality and groundwater monitoring) aspects.

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.




Urban water demand is by the far biggest in this basin, with livestock, tourism, irrigation and mining the other main consumers. The City of Windhoek uses domestic sewage effluent from the Gammans Wastewater Treatment Plant to produce potable water at the New Goreangab Water Reclamation Works. Since 1968 this is still the only direct potable reuse system in the world and provides approximately 25%+ of the potable water supply to Windhoek.

Specific water-use activities in the basin are:

- **Domestic purposes**: Towns in the basin include Swakopmund, Hentiesbaai, Omaruru, Usakos, Arandis, Windhoek; Okahandja and Karibib with an estimated total population of 380 000. Surrounding settlements supports approximately 6 000 people, while the rural population is estimated at 30 000.
- **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 495 000.

**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/kudu/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).

- **Large-scale commercial farming:** Commercial farmers in the basin farm mostly with cattle and goats. Game farming is also practiced on a commercial basis.
- **Mining**: Navachab, Rossing and Langer Heinrich Mines uses its water for its gold (Navachab) and uranium production.
- **Environment**: The river system supports large trees, bushes and grasses which can be used by livestock and wildlife as fodder. In addition, the coastal wetland areas support a wide variety of birds and other wildlife.

Reused water, through a dual pipe system, is used for irrigation of parks, sports fields and cemetries in Windhoek, Swakopmund, Walvis Bay, Arandis, Tsumeb and Otjiwarongo.

The environment is a silent water user, thus ecological water requirements should also be considered. They are necessary to support the river itself to maintain the eco-systems dependent on the river water.

# 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".

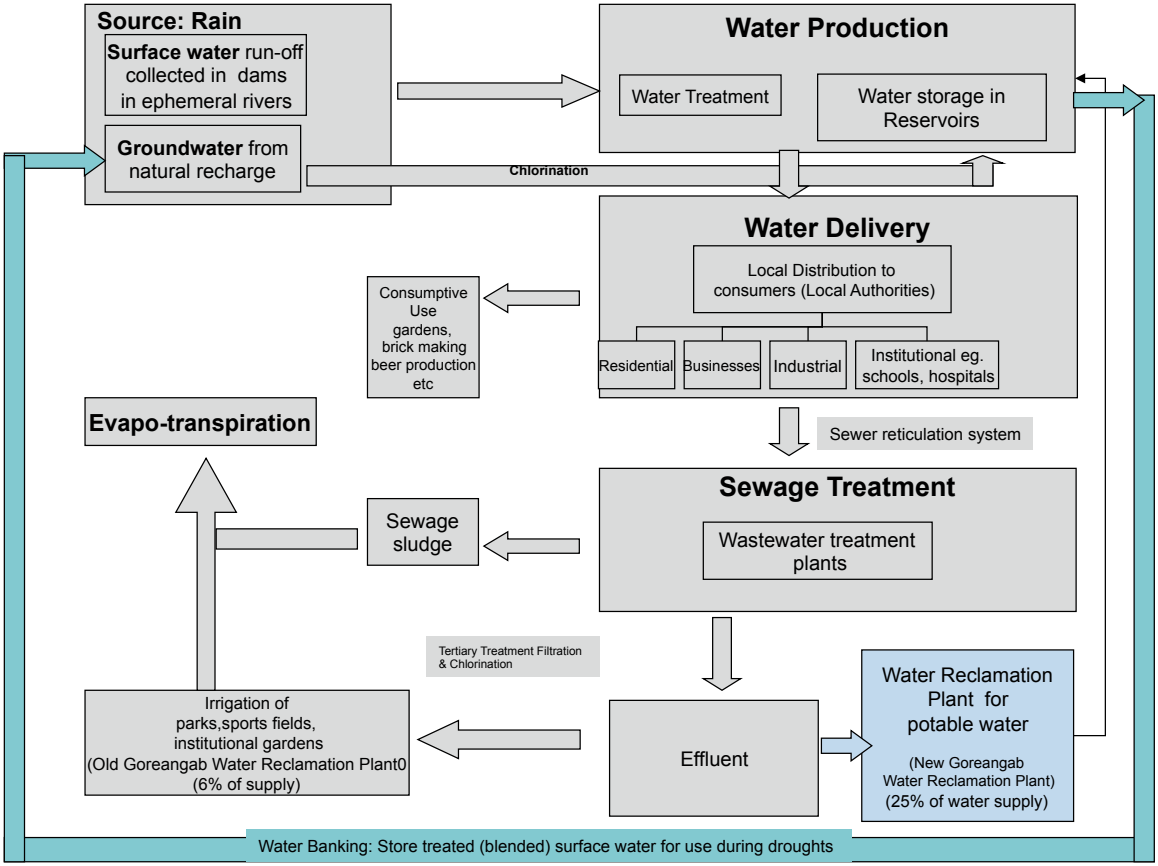
WDM is implemented through education and information; training; using economic and finanical principles; water pricing and tariff policies (eg. rising block tariffs) and technical measures.

The large amount of water used in the growing urban area of Windhoek poses a challenge because there is not much local water and imported water is expensive and limited.

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. Debt incurred by service providers (NamWater and local authorities) were estimated at N$400 million in 2009, due to non-payment of water bills, which will jeorpordise provision of services in the furture if consumers do not pay their bills.

"The price of the providing water supply and sanitation services must correspond to the investment and running costs thereof. Adequate pricing of water services is therefore essential for financial sustainability, to ensure service providers can maintain infrastructure and serve the demand with quality services."

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:

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 in a household.

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

NamWater laboratory makes use of Analytical Quality Control procedures complying with International Standards Organisation (ISO) requirements. Further water quality information can be obtained from NamWater, Water Quality Services, Tel: +264 61 71 2257

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 Omaruru-Swakop Water Basin is considered suitable for drinking. 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. Water that contains high concentrations of naturally occurring salts is called 'brackish' water. It can taste salty and can appear cloudy.

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.

Many people in the basin are exposed to “dirty” unsafe water from open wells and watercourses which contains bacteria and organisms which can cause diseases, such as bilharzia, cholera, typhoid and dysentery. 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.

# 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.

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

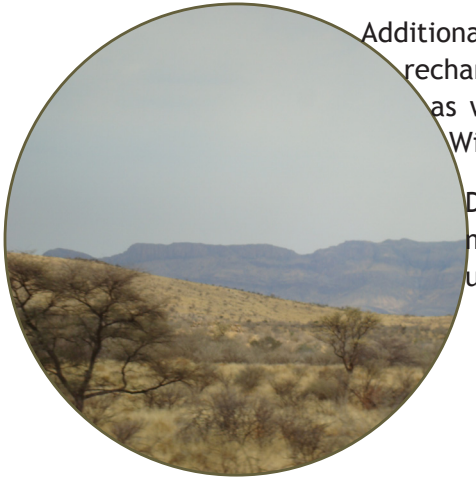
Washing hands with soap at key times such as after going to the toilet can reduce the occurance of diarrhoea

# 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:

- 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.



Additional challenges in the basin are the timely development of the Windhoek aquifer recharge project which is currently lagging behind its programmed milestone dates as well as the development of the infrastructure capacity from Von Bach to Windhoek.

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

In accordance with Namibia's Vision 2030, the urban population is predicted to increase three-fold, which will cause a major strain on water resources if not properly addressed.

With the increase in mining, tourist and livestock farming activities in the basin, high demand is placed on current water resources. Currently desalination (removing salt from sea water) of sea water is being considered as an option to meet the demand. This process is very costly and other options such as water banking and water demand mangement should be employed to reduce demand on convetional water resources.

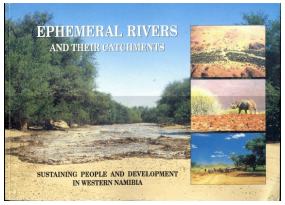
Although Windhoek is relying on three major dams, Omatako, Swakoppoort and Von Bach dams for its water supply, future plans are to “bank” groundwater in the Windhoek aquifer. Water banking was identified as the “best next” supply option to the central area of Namibia. This involves storing excess treated water from surface dams, as well as reclaimed water, in the Windhoek Aquifer for abstraction during periods of drought. Phase 1 of the project was completed in 2004 and a further phase, including drilling of 10 deep boreholes ,was completed in 2008. If completed in full (4 phases) it is estimated the stored water will be enough to supply Windhoek for approximately three years (about 60$Mm^3$).

No major concerns for water supply exist in the basin, provided that the planned Windhoek aquifer develops successfully and infrastructure of the Von Bach system is upgraded and well maintained to increase the rate of artificial recharge of the aquifer. The project is behind schedule and security of supply is a major concern with increased water demand.

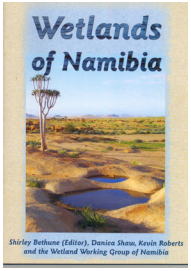
The Swakopmund saltworks has the potential to be selected as a Ramsar site (accoding to the Ramsar Convention of Wetlands of International Importance), but is not yet designated. When designated, the wetlands in the area of the saltworks will be protected against future loss and degradation.

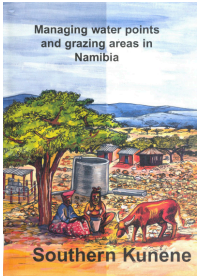
Wetlands are among the world's most biologically productive ecosystems and support a high diversity of species.

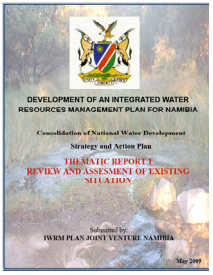
## Basin management related information:



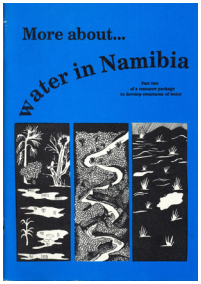




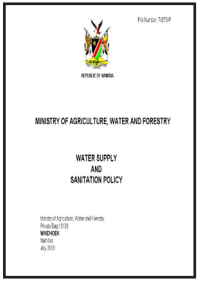



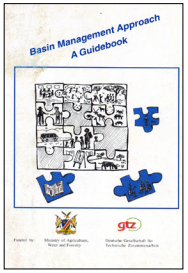



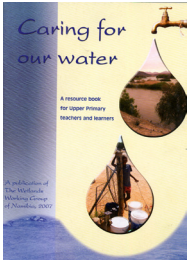


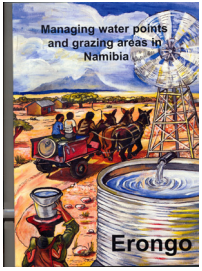


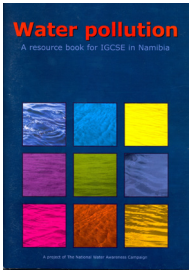





Note: some information used in this booklet is extracted from the above-mentioned material.

**We must treat water as if it were the most precious thing in the world, the most valuable natural resource. Be economical with water! Don't waste it! We still have time to do something about this problem before it is too late.**

*Mikhail Gorbachev, President of Green Cross International, quoted in Peter Swanson's Water: The Drop of Life, 2001*

## 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.

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Photo credit: Desert Research Foundation of Namibia; Ben van der Merwe; Anna Matros-Goreses; Eben Nowaseb