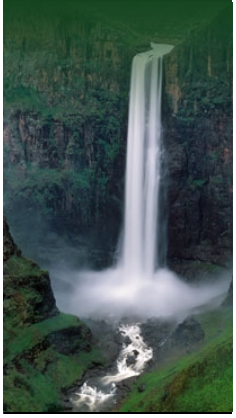

Resource Monitoring:

Importance of Monitoring

Monitoring plays a pivotal role in determining sustainable abstraction volumes, the feasibility of developments, and strategy for efficient overall management of the resource. Scientifically sound monitoring assesses groundwater, surface water (flow and quality) and atmospheric variables at carefully determined intervals. Though periodic monitoring provides some information, only long-term monitoring can provide data sufficient to determine trends and develop predictive models. Only these, in turn, can support informed decisions about sustainable and efficient use of water resources in the Orange-Senqu River basin.

The Revised SADC Protocol on Shared Watercourses and the ORASECOM Agreement obligate members to protect the aquatic environment. The ORASECOM Agreement specifically provides for a common monitoring system to be implemented in the basin.

Groundwater Monitoring

Groundwater quality monitoring is essential for assessing contaminants and suitability for use. It is also an important tool when generating data for water management. The data generated through the monitoring program may be used, by among others, national and local government, catchment management agencies, water boards and research institutions.

The objectives of a groundwater monitoring programme have to be clearly defined at the outset, to provide adequate data and information for the intended application. Generally, the aim is to determine the quantity and quality of groundwater, temporal changes and trends, sustainable yields, the impacts of groundwater abstraction, groundwater recharge mechanisms and recharge rates and various other hydraulic properties.

Groundwater monitoring is important:

- To develop an understanding of the regional and long-term groundwater quality and quantity which will allow for optimal management of groundwater resources
- To identify possible human impacts
- To identify and monitor major pollutant sources, including their locations and the movement of the pollutant in the aquifer
- To determine compliance with regulations and standards
- To assess the effectiveness of pollution control measures, such as groundwater protection zones
- To determine the quality of groundwater, particularly with respect to its possible use as a source of drinking water, industry, irrigation, etc.
- To understand recharge areas (zones), recharge mechanisms and recharge rates
- To develop an understanding of the hydraulic properties of the aquifer

A typical groundwater monitoring programme involves measuring both quantity (groundwater level fluctuations, borehole abstraction rates, and climatological data such as rainfall) and qualities such as radio-isotope (deuterium, oxygen 18, carbon 13 and 14 and tritium) and chloride content, in both rainfall and groundwater.

Groundwater is an important source of water in the basin, which is monitored by all four basin states.
Source:Kirchner 2008
(click to enlarge)

Surface Water Monitoring

Surface water monitoring tracks variables related both to **flow** and to **quality** components.

Overland flow monitoring relates to:

- Water chemistry at the soil surface
- Water flow volume
- Water volume and chemistry from groundwater return to the surface
- The impact land use change has on surface water
- To define the interaction between surface water and groundwater

Water quality monitoring and assessment can be informed by several different perspectives, which often define the programme's objectives:

Interactive

Basin Map

Explore the sub-basins of the Orange-Senqu River

enter

Water Management

Explore the water management systems around the basin - including intra-basin transfers and sectoral water requirements

enter

Dams

Investigate the dams and water infrastructure in the Orange-Senqu basin

enter

Video Tour

Tour video scenes along the Orange-Senqu River related to Meeting the Water Challenge

enter

Panel Discussion

Listen to a panel discussion about the history and challenges in the Orange-Senqu basin

enter

- Potential uses of water
- Influences on water quality from direct use or from other human activities or natural processes
- Impacts on water quality
- Spatial variation
- Temporal variations
- Transport and discharges
- Control and regulation of water quality

Water quality objectives can be determined only in terms of suitability for a purpose or set of purposes, or in relation to the control of defined impacts on water quality.

Objectives for surface water quality monitoring are generally site-specific:

- To identify, assess and mitigate potential hazards to human or aquatic health
- To gather water-quality data for pollution control
- To identify long-term trends
- To evaluate environmental impacts and interactions
- To determine the treatment required before the water can be used for the intended purpose

Surface water quality significantly influences aquatic ecosystem health; proper monitoring therefore contributes to aquatic ecosystem management. Hence, biological indicators must also be monitored, in addition to water quality, to determine the overall ecological status of river ecosystems. In fact, the integrity or health of the biota inhabiting the river ecosystem provides a direct and integrated measure of the health of the river as a whole.

The objectives of an aquatic ecosystem monitoring programme are:

- To measure and assess the ecological state of aquatic ecosystems
- To detect spatial and temporal trends in the ecological state of aquatic ecosystems
- To identify emerging problems
- To determine any water treatment required

Ecosystem monitoring is also important, as can measure the efficacy of measures to maintain environmental flows.

Atmospheric Monitoring

Hydrological models of a drainage region are frequently climate-dependent, making atmospheric monitoring data a critical input. Runoff measuring devices, water table fluxes, etc., are chosen based on the climatic parameters of a region.

To ensure statistical validity, a monitoring program must be reliable, well serviced, and supported by an evenly and appropriately distributed network of monitoring stations. The network must be dense enough to collect adequate, representative data. In southern Africa appropriate rainfall monitoring is very important, as rainfall data forms the basis of runoff calculations and groundwater recharge estimates, and is frequently incorporated into hydrological models used in decision-making.

Next: Water Quality Monitoring