WATER QUALITY CONCEPTS

NB: This section uses concepts and definitions from the National Aquatic Guidelines - some may have been changed after their inclusion here.

Basic water quality concepts

To ensure that they effectively serve their purpose, water quality monitoring programmes need to be designed as management information systems. To support the design of a national programme to monitor the health of aquatic ecosystems, it is important to define some water quality and related concepts as they are used in South African water quality management policy and practice by the Department of Water Affairs and Forestry.

The term *water quality* is used to describe the physical, chemical, biological and aesthetic properties of water which determine its fitness for use and its ability to maintain the "health"/integrity of aquatic ecosystems. Many of these properties are controlled or influenced by constituents which are either dissolved or suspended in water.

The term *constituent* is used generically for any of the properties of water and/or the substances suspended or dissolved in it. In the international and local literature, several other terms are also used to define the properties of water or for the substances dissolved or suspended in it, for example water quality variable; characteristic; determinand; etc.

Fitness for use and related concepts

Part of DWAF's mission is to maintain the fitness for use of water on a sustained basis. The *fitness for use* of water is a judgement of how suitable the quality of water is for protecting of the health of aquatic ecosystems, or for its intended use. The concept of fitness for use is central to water quality management in South Africa and to the design and implementation of water quality monitoring programmes.

Water uses and aquatic ecosystems

The DWAF's mandate requires it to protect and maintain the health of aquatic ecosystems. It also has to ensure fitness of use for the four broad categories of water use are recognized in the South African Water Act, namely:

- domestic purposes
- industrial purposes
- agricultural purposes
- recreational purposes.

The water quality requirements of these water uses and those for the protection of the health of aquatic ecosystems, form the basis on which the overall fitness for use of water is judged.

Water quality characteristics and requirements

In order to determine the water quality requirements for aquatic ecosystems, it can be characterized in terms of those factors relating to water quality:

- Typical water quality problems which affect the health of aquatic ecosystems;
- The role that water quality plays in sustaining the health of aquatic ecosystems;
- The nature of the effects of poor water quality on aquatic ecosystems;
- The norms which are commonly used as yardsticks to measure the effect of water quality on aquatic ecosystems;
- The water quality constituents which are of concern;
- Any other site- or case-specific characteristics of aquatic ecosystems which may influence its water quality requirements.

Determining fitness for use

To be able to make judgements about the fitness of the water for protecting aquatic ecosystems, one needs to:

- Characterise the particular aquatic ecosystem from a water quality perspective;
- Determine the water quality required to protect aquatic ecosystems;
- Obtain information on the key constituents and other factors which determine the fitness of water for protecting the health of aquatic ecosystems;
- Establish, if possible, how the health of aquatic ecosystems will be affected by the prevailing water quality;
- Determine whether possible adverse effects of water quality can be mitigated for.

The fitness for use of water can range from being completely unfit for use to being 100% or ideally fit for a specific use.

Water quality can affect the health of aquatic ecosystems, or water uses, in many different ways. It is therefore necessary to use different norms, such as the effects on species loss; riparian zone degradation, etc. as yardsticks when making judgements about the fitness for use of water.

Water quality criteria

It is clear that water quality alone cannot be used as the basis for judging the health of aquatic ecosystems. Nonetheless, the use of predetermined guidelines or criteria for aquatic ecosystems can serve to ensure that the quality of water meeting such guidelines does not constrain ecosystem maintenance or development.

In South Africa, such guidelines are in the process of being developed ("Water Quality Guidelines for the Natural Aquatic Environment"), and are due to be published by the DWAF at the beginning of 1996.

Water quality criteria are scientific and technical information provided for a particular water quality constituent, expressed as chronic and acute adverse effects on aquatic ecosystems. They take the form of numerical values and/or narrative statements intended to provide long-term protection to the resource base. South African water quality criteria have been derived on the assumption of both long-term and continuous exposure to water of a given quality.

The *No Effect Range (NER)* and the *Target Water Quality Range (TWQR)* being developed in the guidelines are not water quality criteria *per se* but are rather management objectives which have been derived from numerical or narrative criteria. As a matter of policy the Department will strive to maintain the quality of South Africa's water resources within the No Effect Range. Therefore, the NER is referred to as the Target Water Quality Range (TWQR) in the South African Water Quality Guidelines. The Target Water Quality Range (TWQR) is thus the in-stream water quality required to protect aquatic ecosystems.