Overview of the Situation and Challenges for Water Quality Monitoring and Reporting in South Africa

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ABSTRACT: South Africa has developed and promulgated a number of water environmental policies and legislation to manage its scarce water resources. These policies require excellent water quality information to report on the state of the nation's water resources. The country is reviewing its monitoring programmes to harmonize its approaches to monitoring and to respond to national and international information requirements and reporting. In defining monitoring requirements there is a major shift from individual data focus to integrated client-focused water resource monitoring approach.

1. INTRODUCTION

South Africa is richly endowed with mineral wealth which drives most of the country's economic development. However, with an average annual rainfall of 500 mm the country's water resources are limited with almost 60% of the country categorized as semi-arid to arid. The rapid industrialisation and high population growth has put enormous pressure on the limited water resources to an extent that almost all important rivers have been developed through building large and small reservoirs and interbasin transfer system.

The country has historically focused on controlling the natural water system in order to address the lack of water for agricultural and industrial development i.e. "let the desert boom" attitude. Very little attention was on the impact that these development activities caused the natural environment particularly the water environment (the environment and development nexus). The world-class hydrological monitoring programmes were focussed mainly on quantity rather quality, while the limited water quality monitoring networks and programmes were largely operated on voluntary basis for research purposes. It is well known that economic development has led to the continual degradation of the nation's water resources system but there are no clear indicators as to the rate of

degradation as the country has not been measuring the rate of water quality deterioration in any systematic way.

After 1994 and with South Africa becoming signatory to a number of international environmental conventions, there was recognition for sound water governance and a need to reform water policies and water institutions in order to implement sustainable water development. For example,

- ***Water Services Policy of 1994*** focuses specifically on the backlogs in water services provisions in South Africa and the institutions and mechanisms required to address these backlogs.
- access to adequate and sustainable water has become a human rights issue enshrined in the country's new ***Constitution (Act 108 of 1996)***. Therefore, the Department of Water Affairs and Forestry is required to report to the South African Human Rights Commission on the quality of water provided to the citizens of the country.
- ***Water Services Act of 1997 (Act 108 of 1997)*** ensures the right of access to basic water supply and sanitation, and also provides a regulatory framework for and establishment of water services institutions such as water boards, water services providers, etc.
- the ***National Water Policy of 1997 (DWAF, 1997)*** declares that all water wherever it occurs in the hydrological cycle is public water, and that the national government will act as a public trustee. The national Department of Water Affairs and Forestry, as the custodian of the country's water resources, should regularly report to Parliament on the **state of the nation's water resources**.
- the ***National Water Act of 1998 (Act 36 of 1998)*** is founded on two pillars: sustainability (long-term protection of the resource) and equity (sharing of scarce resource in terms of quantity and use of quality). The Act recognises the protection of the quality of water resources to ensure sustainability of the nation's water resources, and the Department of Water Affairs and Forestry has primary responsibility for managing and monitoring the water resources. For example, Chapter 14 of the Act spells out monitoring responsibilities of the national government using the hydrological cycle as a unit. The Act requires the establishment of a National Water Resource Strategy (NWRS) to set out a national framework for managing water resources.

- the ***National Water Resource Strategy (NWRS) (*DWAF, 2004a*)*** provides the implementation framework for the management of water resources in South Africa as required by the National Water Act of 1998. Published in September 2004 the NWRS divides the country into 19 Water Management Areas (WMA) in which quantitative information about the present and future availability of and requirements in each of the water management areas is provided, and propose interventions by which these may be reconciled.

  The NWRS recognises the need to implement and maintain different monitoring programmes to provide information on different aspects of water resource quality as there is no single monitoring programme that can lead to a comprehensive expression of the "state of the water environment"
- the ***National Environmental Management Act of 1998 (Act 106 of 1998)*** is an overarching legislation relating to the protection and management of the environment. This law requires regular **state of environment** reporting in which the Department of Water Affairs and Forestry reports on the **state of rivers** report and progress report regarding aquatic ecosystems such as wetlands and estuaries.
- On the international front, South Africa is required to contribute data and information to:

  ⇒ UN World Water Development Report

  ⇒ UN Millennium Development Goals

  ⇒ UNEP-GEMS Water

  ⇒ etc

All these national and international reporting obligations require strategic water quality information which has to be systematically collected over time. The Department of Water Affairs and Forestry (DWAF) is currently in the process of reviewing the country's water resources monitoring networks and programmes in order appropriately respond to these national and international water obligations. This paper will give an overview of the current attempts by DWAF to respond to the immediate reporting needs while it is harmonizing water quality monitoring networks and programmes.

2. NATIONAL WATER QUALITY MONITORING PROGRAMMES

South Africa has recognised the need for monitoring and assessment of the quality of water in order to determine the fitness for use and support the management of water resources. The DWAF is operating a number of national water quality monitoring programmes which include:

2.1 ***National Chemical Monitoring Programme (NCMP***), was initiated in the 1970s to assess the general water quality of South Africa's water resources in which samples were analysed for conservative water quality constituents such as pH, electrical conductivity (EC) and inorganic ions. However, the programme was later expanded to incorporate analysis for plant nutrients such as total and dissolved phosphate, ammonium and total nitrogen as the demand for information concerning eutrophication increased.

The majority of samples for the NCMP are collected at gauging weirs as the water quality monitoring network for this programme was simply superimposed on the surface water gauging programme that already existed.

2.2 ***National Aquatic Ecosystem Monitoring Programme (NAEMP)*** also known as the ***River Health Programme (RHP)*** is a multi-institutional monitoring programme whose overall goal is to deliver the ecological information for rivers and the broader aquatic ecosystems required to support the rational management of these systems. The RHP monitoring programme is designed to generate information required to report on the ecological state of South Africa's river systems (ie State of Rivers Report) and in future it will include wetlands and estuaries. It assists in distinguishing between aquatic ecosystems which are sustainably utilised and those experiencing ecological deterioration.

The first State of Rivers Report was published in 2001, and the RHP programme is rapidly increasing in importance because of the requirements of the National Water Act that all water resources must be classified before any water can be allocated for specific uses.

The RHP programme focuses on selected ecological indicators that are representative of the larger ecosystem and are practical to measure. For instance, resident aquatic communities reflect the effects of chemical and physical impacts in a time-integrated manner. The classification system used

to express the health of ecosystems and the associated assessment protocols ensure that the health of one river can be compared with the health of another river. The health categories are simply called natural, good, fair and poor using a simplified biological index (to simplify information for resource managers and general public) that integrates and summarises biological data within a particular indicator group. For example, fish community attributes need to be linked to measuring units or metrics that can be used to index ecological condition. Although the inclusion of physical and chemical indicators increases the information value, the RHP programme focuses mainly on the following biological indicators and indices:

- Aquatic invertebrates using South African Scoring System (SASS) index
- Fish Assemblage Integrity Index (FAII)
- Riparian Vegetation Index (RVI),
- Index of Habitat Integrity (IHI) and
- Geomorphological Index (GI)

2.3 ***National Microbial Monitoring Programme*** (NMMP) was designed to monitor faecal pollution in surface water resources of South Africa and it is currently targeting "hot spots" only. The programme is being implemented in 11 of the 19 Water Management Areas (WMA) and it is in the process of expansion to cover the rest of other WMAs (van Niekerk, 2004).

The main monitoring variables are *E. Coli* or Feacal Coliforms which are sampled approximately bi-weekly and analysed at the closest laboratory.

The main objective of this monitoring programme is to assess management effectiveness in the area of faecal pollution. Trend assessments over time will indicate failure or success of management efforts to improve conditions.

There is a number of other major national water quality monitoring programmes that are being designed in order to respond to information demands and the provisions of the national legislation. These include, amongst others:

2.4 National Eutrophication Programme (NEMP)

This monitoring programme was designed in response to demands for information concerning eutrophication of surface water, and the main purpose

of the data is to describe water quality status, detect trends in nutrient concentrations, and provide decision support for management efforts. Approximately 80 major reservoirs are used as sampling sites and the programme is being expanded to cover the entire country.

2.5 National Toxicity Monitoring Programme (NTMP) and National Radioactivity Monitoring Programme (NRMP)

These programmes are currently in the design stage and their objectives will be status and trends of the radionuclides, toxicants and toxicity.

3. TOWARDS INTEGRATED WATER RESOURCES MONITORING

The National Water Act (NWA) of 1998 (Act 36 of 1998) requires that monitoring of water quality should be an integral part of water resources management in South Africa. Chapter 14 of the NWA specifically mandates the Minister of Water Affairs and Forestry to establish national monitoring systems to monitor, record, assess and disseminate information regarding, amongst others, the quality of water resources. To effectively implement this legislative requirement in an environment with so many diverse players performing monitoring activities, it was recognised that country should develop a holistic strategy to harmonize monitoring programmes and to ensure that they are compliant with the requirements of the National Water Act of 1998. A new framework called ***Strategic Framework for National Water Resource Quality Monitoring Programmes*** (DWAF, 2004b) within which all monitoring programmes will be developed was published. The basic dimensions of this framework are as follows:

3.1 Information user-centric approach

All monitoring should be justified by serving specified information users needs with information they need to perform their water resources management functions. This is to avoid or eliminate the problem of "data-rich but information-poor syndrome".

3.2 *Core functions of monitoring*

The shift in focus to information user-centric approach in designing monitoring programmes has led to a need to re-define the scope of the core functions of monitoring programmes (for which there are three) as follows:

- Data acquisition
- Data management and storage, and
- Information generation and dissemination.

These three core functions are supported by an IT support infrastructure.

3.3 Institutional set-up for monitoring governance

The framework has defined the institutional roles and responsibilities with respect to water resources monitoring in line with the three tiers of water resources governance in South Africa as follows:

- ***National Monitoring Programmes*** (mainly status and trends) are to be performed and maintained by the central government through Policy and Regulation Branch of the Department of Water Affairs and Forestry in order to provide information required for (amongst others):
  - ⇒ international and national level water resources strategic and development planning.
  - ⇒ its custodianship role, and other national government departments' reporting roles eg Department of Environmental Affairs on the State of the Environment
  - ⇒ in terms of international agreements eg WWAP, UNEP/GEMS, SADC, Incomati Maputo Tripartite Agreement, etc

- ***Regional or Catchment Monitoring Programmes***

  Water management institutions such as CMAs will be primarily responsible for:
  - ⇒ Status and trends monitoring at local catchments with resolutions finer than used by the national programmes
  - ⇒ Programmes to assess compliance of water users to water licence conditions

⇒ Programmes assessing impacts of water uses for purposes of issuing water use licenses.

- ***Local Monitoring Programmes***

  These monitoring programmes are the responsibility of such local institutions as Water Boards, local authorities and industries, and other water users.

The water quality monitoring of the country's water resources will only succeed if there is effective governance of the whole process., and to ensure information delivery at the three management tiers.

4. NATIONAL REPORTING INITIATIVES

There are three-tiers of water quality information needs with differing resolution levels as described in section 3 above. However, to ensure information delivery at these three management tiers an effective governance of the overall process is required. The Department of Water Affairs and Forestry is in the process of establishing a governance institution to coordinate and share resources, infrastructure, data and information across water management institutions and other role players. This governance process will ensure that:

⇒ common standards for data acquisition, management and storage and information dissemination are adopted,

⇒ common quality assurance criteria are implemented across tiers of monitoring

⇒ coordination of relevant stakeholder activities relating to water resources monitoring takes place

This reporting initiative will ensure that a 'single version of truth' about the status of the country's water resources is produced.

5. CONCLUSION

The recognition of the need to manage a scarce water resource in South Africa has led to the promulgation of such legislation as the National Water Act of 1998 (Act 36 of 1998) which demands excellent water quality monitoring focus. In response

to this political imperative and the need for effective reporting both at national and international levels, the following issues are identified:

- the need for good water quality information has increased as the water demand for a scarce resource is amplified, and the legislative requirements being tightened.
- National water monitoring programmes are being reviewed to comply with legislation.
- there is a major shift in focus from individual data collection programmes to integrated client-focused water resources monitoring approach
- the need for a 'single version of the truth' about the country's water resources demands an effective governance process and that
- the national and international reporting should be provided from a central point in future
- the role of international monitoring programmes such as UNEP-GEMS will play a pivotal role in reporting across national boundaries.

6. REFERENCES

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