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WATER RESOURCE QUALITY POLICY: THE APPROACH ADOPTED BY THE DEPARTMENT OF WATER AFFAIRS AND FORESTRY UNDER THE WATER LAW PRINCIPLES

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ABSTRACT

An intensive review of existing Water Law has just been conducted by the Department of Water Affairs and Forestry. The review was motivated by the need for preparation for new legislation to support water resource management with a goal of "some for all, forever." The development of a water resource protection policy was begun in that review. This paper describes the major aspects of the policy at one point in a process of rapid development. Initial proposals are to use the concept of ecological integrity as an indicator of sustainable use of the resource. While management's goal is to ensure all water users will benefit from access to the water resource, ecological integrity provides a good indication of sustainability in the use of the resource. More discussion in this paper is, therefore, centred on ecological integrity than on individual water users under the assumption that the resource will only be able to provide for long term water uses if ecological integrity is assured. A water Reserve has been defined that is intended to protect water resources, so basic human needs can be met and ecological functions and processes can be sustained. Components of ecological integrity, that is, the chemical and physical characteristics of water, the quantity and assurance of water, the habitat (instream and riparian), and the structure and function of the associated biotic communities would be assessed through the use of a resource classification system. The approach integrates resource-directed measures for protection (such as resource quality objectives) with source-directed measures (such as effluent standards).

KEYWORDS

Classification; ecological integrity; policy; resource protection; source directed controls; South Africa; sustainability.

INTRODUCTION: THE CONTEXT FOR POLICY DEVELOPMENT

Management of natural resources and the environment has progressed rapidly in South Africa in recent years. This progress has followed a global trend of increasing knowledge about the environment and the need to protect it, but is also due to an enormous change in political perspectives in the country.

The Department of Water Affairs and Forestry has reviewed water law, in South Africa and other countries, as preparation for new legislation that will reflect democratic principles and equitable access to the resource

by all - symbolized by the Department's slogan, "some for all, forever" (DWAF, 1997). The development of a water resource protection policy was begun in that review.

Water quality policy development has been an ongoing process, with notable milestones of the existing Water Act (Act 56 of 1954), the General and Special Effluent Standards in 1962, Water Act amendments in 1984, and a policy statement in 1991 that described a receiving water quality objectives approach.

The development of new legislation presents an ideal opportunity to achieve the objectives of providing more equitable access to water resources and to consolidate much of the recent development in water resource management thinking.

SOME, FOR ALL, FOREVER

The goal for water resource management and service provision in South Africa is captured in the succinct statement "Some, for all, forever". It provides the context and motivation for the protection of water resources.

Some Indicates a recognition that water is an essential, finite resource. We must limit our demands on water resources to remain within the resource capacity to sustain the demand and we must ensure careful and efficient use of water resources.

For all Indicates a fundamental commitment to equitable allocation. It is intended that water resources will be used for basic human needs, for development and production in industry and agriculture, and for recreation - to benefit all the people of South Africa.

Forever Acknowledges the commitment to manage for the goal of sustainable use. It implies a willingness to balance the needs for long term access to the resource against the needs for short term access. This commitment brings the responsibility to protect water resources' ability to sustain long term use. Because maintenance of adequate ecosystem functioning is necessary for sustainable resource use, the physical, chemical and biological integrity of aquatic ecosystems must be protected.

The policy, therefore, rests on three legs - water demand management, equitable allocation practices, and protection of ecological integrity. This document addresses the protection of ecological integrity.

ECOLOGICAL INTEGRITY

Natural hydrological, chemical, biological, and ecological processes are variable, and subject occasionally to extreme events such as floods and droughts. Ecosystems have an inherent recovery capacity in response to variable conditions, but that capacity is finite. Since the maximum recovery capacity is assumed to exist in a natural, unmodified system, the degree to which a specific part of the water resource differs from natural conditions is important in estimating its ability to recover. The degree of modification of a particular part of a water resource can be assessed by measuring components of its ecological integrity.

Integrity generally refers to a condition of being unimpaired, that is, corresponding with an original condition (e.g. Weber's Third International Dictionary). Karr and Dudley (1981) defined **biological integrity** as the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organisation comparable to that of the natural habitats within a region.

Kleynhans (1996) defines **habitat integrity** as the existence of a balanced, integrated composition of physico-chemical and habitat characteristics on temporal and spatial scales that are comparable to the characteristics of natural habitats within a region. Essentially the habitat (physical and chemical) integrity of a river provides the template for a certain level of biotic integrity to be realised. Habitat integrity and biotic integrity together make up ecological integrity.

Given the above definitions, **ecological integrity** of a river is its ability to support and maintain a balanced, integrated composition of physico-chemical habitat characteristics, and biotic components, on a temporal and spatial scale, that are comparable to the natural characteristics of ecosystems of the region. Ecological integrity implies ecosystem structure and functions are unimpaired by anthropogenic stresses. While management's goal is to ensure all water users will benefit, ecological integrity provides the best single indication of sustainability of the use of the resource. More discussion in this paper is, therefore, centred on ecological integrity than on individual water users under the assumption that the resource will only be able to provide for long term water uses if ecological integrity is assured.

In many cases in South Africa, water resources have already been modified by use and development and are no longer in their natural state; however, a water resource does not have to be pristine or untouched to be sustainable. We need to identify the effects of uses and recognise those that can be sustained by a water resource so that its integrity remains at an acceptable level. The level that is "acceptable" should be determined by local residents and the national interest. The process to select an acceptable level of protection must include integration of the social and economic issues related to existing and proposed water use.

In recognition of the commitment to the sustainable use of water resources, the Water Law Principles identify a "Reserve". The Reserve is intended to protect the integrity of water resources, so basic human needs can be met and ecological functions and processes can be sustained. Components of ecological integrity, that is, the chemical and physical characteristics of water, the quantity and assurance of water, the habitat (instream and riparian), and the structure and function of the associated biotic communities should be measured to ensure the reserve does indeed protect the ability to meet basic human needs and sustain ecological functions.

To reflect this new and broader perspective of meeting basic human needs and preserving ecological functions, the term "water resource quality" has been selected to replace simply "water quality". This is a reminder that all components of aquatic ecosystems must function properly if we are to ensure effective water resource use and reach the goal of "some for all, forever".

AN INTEGRATED CATCHMENT APPROACH

In adopting an ecological integrity approach, coordination between land-use planning and water resource management is essential, using the catchment as the basis for management decisions. Coordination and integration of many separate functions, offices and institutions will be necessary, even if one official body is assigned responsibility for all water-related activities. Development of the necessary institutional arrangements is an enormous task and is likely to continue for several years. Devolution of management functions to as local a level as possible is the stated policy. Details for specific cases are typically not available and implementation is likely to be responsive to local or regional initiatives.

Catchment management plans are proposed as the main tool to facilitate management. The plans would contain details of water allocations, requirements for the Reserve, international obligations, major issues of water quantity and physico-chemical characteristics which require intervention, management goals, strategies, and responsibilities. Financial arrangements will also be an important component of the plans.

MONITORING AND ASSESSMENT

Understanding of the processes in water resources is essential to conduct effective management and protection. The understanding must be based on adequate information. Ongoing monitoring and assessment of the condition of water resources, their response to impacts, and the state of the Reserve is critical to our ability to manage and protect those resources. The vision for the future is one in which management decisions will be made on the basis of sound scientific and technical information and understanding.

POLICY FOR PROTECTING WATER RESOURCES

While prevention of all pollution is the Department's long-term ideal, it will not be possible in the short to medium term. Neither the emission of waste nor the impacts of land uses on the water resource can be prevented entirely. However, they can and must be managed and regulated to achieve adequate long term protection of water resource quality.

The proposed policy (DWAF, 1997) integrates resource-directed measures for protection (such as resource quality objectives) with source-directed measures (such as effluent standards). This policy includes:

- setting water resource-based objectives which clearly define acceptable values for water resources for each of the components (chemical, physical, biological) of ecological integrity,
- use of source-directed standards which clearly define acceptable values for waste discharge or impact generation and encourage movement towards minimisation of waste disposal and impacts, and
- where source-directed standards cannot be met in the short term, a temporary exemption from the standards could be considered if an impact assessment indicates the water resource-based objectives could still be met.

This use of resource-based objectives allows the variation in characteristics of the receiving environments and their protection requirements to be taken into account. At the same time, the administrative system of impact regulation and control can be streamlined by using sets of consistent standards where appropriate. However, the application of these standards should be tailored to the protection requirements of the individual water resource. Classifying water resources, as described below, is a method to achieve this tailoring.

The source-directed measures include the use of discharge or impact standards. These standards should be stringent enough to protect the specific water resource affected. The development of new standards, which should be more flexible and may be more strict than existing standards, is proposed. Waste discharge or impacts which can meet these national standards would not require an impact assessment, thus minimising the human and financial resources needed for administration. An alternate standard could be requested for impacts or waste discharges which do not meet the specified standards, and would be considered if an impact assessment shows that the requirements for protection of the water resource can still be met.

When the generic standards cannot be met by a discharger or impacter in the short term, a procedure to allow a temporary exemption will be specified. This concept has been part of water resources management in South Africa for a number of years, but is likely to become more formalised. Specific criteria will probably be developed to provide guidelines for impact assessment studies to determine allowable exemptions. Time frames for eventual compliance are likely to be important aspects of the temporary exemptions.

APPLICATION TO ALL WATER RESOURCES

The principle of protection to ensure sustainable use can be generally applied to all water resources, not just fresh surface waters, that is, to water that appears in rivers, lakes, reservoirs, wetlands, but also to ground water, estuaries, and the coastal marine zone. However, the hydrological, chemical and ecological processes may differ in different kinds of water resources, causing changes in emphasis in the application of the procedures.

Ground water resources are in special need of protection from the impacts of land use and over-abstraction. This is due to their "invisible" nature, the long delays that sometimes elapse before impacts are detected, and the expense and technology required to restore contaminated aquifers. The method for setting objectives for ground water may be somewhat different to that for surface waters. The components of the ground water resource required to ensure sustainability include its quality, its storage for future use, the aquifer matrix integrity, and the resource's contributions to spring flow, river base flow and other ecological features. The basis for setting objectives remains the protection of the ground water resource for sustainable use.

Estuaries form an essential link between fresh water resources and marine resources. They are tempting targets for waste disposal because of their closeness to the sea and apparent rapid transport processes that move wastes out of sight. Estuarine resources require special protection to maintain their hydrodynamic processes and their unique role in providing sites for human recreation, mariculture, and as nurseries for marine fish. Water resource management should protect those functions.

CLASSIFICATION OF WATER RESOURCES

Realising these dramatic changes in water resources management will demand considerable human and financial resources. One method to streamline the administration needed for management is to define a few protection classes and identify the appropriate class for delineated parts of the water resource. For example, small streams in the headwaters of large river systems would typically require quite strict levels of protection because these streams are often used for drinking water and join other small streams to create major rivers. Degradation of these headwater streams could seriously impair the suitability of downstream river reaches for many uses, including basic human needs. Defining a set of water resource quality objectives for this sensitive river class would eliminate the need for a separate analysis for each similar small river reach. The generic objectives for these highly protected reaches could be applied to each reach in that class. The class for a specific water body would identify the level to which local, and other national, stakeholders were prepared to move the reach. Movement would typically require that existing impacts be decreased, implying a decrease in development or an increase in costs to mitigate impacts.

Qualitative or quantitative measurements of certain chemical, physical, and biological characteristics of aquatic ecosystems could be used to classify ecological integrity status. These measurements may include:

- functional and/or structural measurements of biological communities (such as invertebrates or fish) which reflect the degree of modification of biotic communities from their undisturbed status, in response to changes in other factors;
- observation and measurement of changes in habitat integrity, for example the reduction of riffle habitats or increase in area of standing water, construction of impoundments, erosion of river banks, instream sedimentation;
- measurement of physical and chemical characteristics of water;
- measurement of geomorphological characteristics;
- measurement of water flows/quantity and the modification of flow regimes from natural conditions.

The overall degree of modification indicates the extent to which the resource capability has been retained or damaged by past activities in the catchment. A local procedure for classifying aquatic bioregions and river types (Brown *et al.*, 1996) has been developed and can be used to assist in this assessment. When assessing the degree of modification of an impacted or disturbed water body, its probable biophysical and ecological characteristics under undisturbed conditions can be inferred from observation of the characteristics of other currently undisturbed water bodies of the same type. Understanding the characteristics of less modified water resources of a similar type can allow us to envision what a disturbed system could be like if rehabilitated and managed appropriately.

The number of classes proposed has ranged from two through six. The number of classes should provide enough sensitivity to ensure the appropriate level of protection and enough robustness in measurement scales to differentiate resources. That is, there should not be so many classes that the measurement results could not distinguish between, for example, a highly protected class and a moderately protected class.

WATER RESOURCE OBJECTIVES WITHIN A CLASSIFICATION SYSTEM

In order to protect the ecological integrity and to maintain the capability of water resources to sustain use, it is necessary to manage and regulate the impacts of various activities within catchments. Adequate management and regulation can be accomplished by setting water resource objectives for each component of ecological integrity. Acceptable objectives must be quantifiable, measurable, verifiable, and enforceable.

Separate sets of acceptable objectives can be determined for each protection class. These generic objectives would apply unless special studies indicate they are inappropriate in specific instances.

SOURCE DIRECTED CONTROLS

Protection of water resources will be enforced through a system of source-directed measures, including the registration of sources of impact, standards for waste discharges, best management practices, permits and impact assessments. The use of directives and fines, and the ability to suspend or revoke permits and licenses, are suggested as effective options for dealing with pollution events. The use of regulatory measures to control forms of damage other than chemical input, such as habitat destruction, will be introduced where appropriate.

To encourage a reduction in waste emission, a system of economic incentives has been suggested, in which charges would be introduced for the discharge of waste into water bodies. This will encourage the development of low-waste and non-waste technologies. Funds raised in this way should be used for resource quality management and protection activities.

CLASSIFICATION OF SOURCES

Classification of the type of source allows for the selection of standards that are both technically and economically appropriate for the source. Classification of the type of source or effluent recognises that different effluents hold different risks for the water environment, but that different waste producers also differ in their economic ability to treat effluent. Source classifications could include, for example, domestic sewage, mining, chemical industry, dry land farming etc. If substantial uniformity exists within an industry, then this level of classification is viable. Sub-classification may be necessary for industries with substantial variation in waste-type production, for example large volume versus small volume domestic wastes. Emission standards based on classification of effluents are similar to a technology-based control approach, since they must take the technology available to treat types of waste into account.

Development of a successful source-based classification system for emission standards requires that stakeholders, who are interested and affected by waste discharge, participate in the development of the standards. A sector-based approach is advocated by the Department where wide participation of interested stakeholders within a specific sector, such as agriculture or mining, generates workable, acceptable codes of practice.

CONCLUSIONS

The approach to water resource quality policy adopted by DWAF is to ensure sustainable use in the long term by protecting ecological integrity through a system of classifying water resources. Use of the concept of ecological integrity has been proposed as the indicator of sustainable use of the resource. While management's goal is to ensure all water users will benefit, ecological integrity provides the best single indication of sustainability in the use of the resource. More discussion in this paper is, therefore, centred on ecological integrity than on individual water users under the assumption that water uses can only be sustained if ecological integrity is assured. Appropriate procedures are likely to take several years to develop sufficiently for widespread implementation, but local or regional implementation will proceed more rapidly. The goal is to help ensure a balance between short term access to the resource with the need to protect the resource so that access to its use is possible for the long term.

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