WORKING PAPER 90

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# Summary

The World Water Assessment Programme (WWAP) published its 2003 inaugural report in which a list of proposed indicators was presented for participating countries to consider for monitoring and reporting within 11 priority themes. It is recognized that these indicators will require evaluation and testing in terms of their relevance and practicality, and consequently, the WWAP has embarked on a phase of developing and evaluating indicators.

This present study forms part of this evaluation phase and makes use of South Africa as an African Continent case study to assess and provide feedback on the proposed WWAP indicators. The main objective of the study has been to evaluate the proposed WWAP indicators in terms of their relevance and practicality to South Africa. Carried out in collaboration with the South African Department of Water Affairs and Forestry, this has also provided an opportunity to assess the status of current indicators and reporting initiatives in South Africa, as well as to comment on the process by which indicators might be further developed and used.

The WWAP list of indicators, as it stands, does not provide adequate descriptions of the proposed indicators from which any detailed indicator evaluation can be made. The list is however of value in providing examples of potential priority issues of interest to decision makers and stakeholders and, hence, providing a framework for indicators to be developed and used for monitoring and reporting. There is a high level of relevance and linkage between the 11 WWAP challenge areas and the 15 Key Focus Areas (KFAs) that form the core components of the South African water resources management policy and strategy. The main categories of water-sector stakeholders in South Africa include all tiers of government and legislatures, the general public, community organizations, industrial sectors, international organizations, investment institutions, enabling organizations, service organizations, and neighboring countries. There is evidence that many of these stakeholders are not yet aware of WWAP and the process of indicator development and reporting. There is thus a need for an awareness program aimed at securing cooperation and participation of key stakeholders.

There are numerous indicator initiatives that have taken place in South Africa, all of which have developed and described indicator sets for use at national, provincial, catchment and local levels. Although most of these have focused on indicators for reporting the general state of the environment, they have included water-sector indicators and, more importantly, those that are relevant to the achievement of the Millennium Development Goals.

The further development of indicators and the successful publication of water-sector reports by South Africa and other African countries should be founded on national strategies for water-resources management and the targets and objectives, which emanate from the strategy. Indicator sets should therefore include indicators that measure resource condition as well as those that measure performance in reaching targets (e.g., targets and objectives of the Millennium Development Goals). There is also a need to develop appropriate indicators that link the water sector with the goal of poverty alleviation. Indicator development and reporting should be treated as an essential ongoing long-term cyclical process that is incorporated into the business component of government and the water-sector stakeholders.

## Introduction

Over the last decade, there has been a major global initiative aimed at promoting the concept of sustainable development through implementing actions recommended by Agenda 21 (UN 1992). In the case of water resources, this has largely been effected through the establishment and convening of international meetings known as the World Water Forums, which regularly debate and discuss issues relating to water and its management (see www.worldwatercouncil.org; www.world.water-forum2; www.world.water-forum3). An important feature of these World Water Forum meetings has been the agreements by participating countries to implement specific targets and objectives, which not only improve the status of water resources, but also ensure that the resource is optimally utilized to the benefit of humankind (e.g. the Millennium Development Goals: see UN 2000). Such international forums require that there is feedback from all countries on the achievement of agreed targets and objectives. This feedback is being promoted and implemented under the auspices of a cooperative United Nations programme, known as the World Water Assessment Programme (WWAP- www.unesco.org/water/wwap).

It has been recognized that feedback and reporting to these World Water Forums, require, firstly, an agreement on the common topics and priority issues, which are of international concern, and secondly, that there should be an accepted method of monitoring and reporting. One of the prerequisites to meaningful reporting is developing and agreeing on indicators that should be monitored and reported on (Bakkes et al. 1994). The WWAP has recently published an inaugural report containing a list of proposed indicators that participating countries might use for monitoring and reporting within 11 priority themes (UNESCO 2003). It is recognized however that these indicators will require evaluation and testing in terms of their relevance and practicality, and consequently, the WWAP has embarked on an initial phase of developing and evaluating indicators. Such an evaluation will require feedback and agreement from participating countries (Neupane 2003).

This study forms part of this evaluation phase and makes use of South Africa as an African Continent case study to assess and provide feedback on the proposed WWAP indicators. The main objective of the study has been to evaluate the proposed WWAP indicators in terms of their relevance and practicality to South Africa. Carried out in collaboration with the South African Department of Water Affairs and Forestry, this has also provided an opportunity to assess the status of current indicators and reporting initiatives in South Africa, as well as to comment on the process by which indicators might be further developed and used. The evaluation is intended not only to provide feedback to WWAP but also to give other participating African countries an insight into the process of developing water resource indicators.

## Background

Over the last decade there have been numerous international meetings organized by the United Nations to debate and determine how countries can manage and improve specific social, economic and environmental conditions relating to water resources (UNESCO 2003; www.world.water-forum3). Of particular note was the UN General Assembly meeting in 2000 at which country leaders adopted the Millennium Development Goals and resolved, amongst others, “to halve, by the year 2015, the proportion of the world’s people who are unable to reach, or to afford, safe drinking water,” and “to stop the unsustainable exploitation of water resources.” Water resources also featured prominently at the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa in 2002 (www.un.org/esa/sustdev/documents/wssd). Concern was expressed at the widening of the “poverty gap” and how water resources management approaches could be utilized to reduce this gap. The Plan of

Implementation adopted at the WSSD reinforced the Millennium Development Goals on water and set a new target for halving the proportion of people who do not have access to basic sanitation by 2015 (www.johannesburgsummit.org/html/documents). The UN has responded by initiating an ongoing freshwater-assessment process known as the World Water Assessment Programme (WWAP: www.unesco.org/water/wwap; UNESCO 2003) that serves to coordinate and report on information dealing with international freshwater assessments. The WWAP consists of the following coordinated elements:

- A *World Water Development Report (WWDR)*, involving the preparation of triennial reports.

- A *Water Information Network and Water Portal* comprising a global-scale meta-database, knowledge-management systems to facilitate the assessment and dissemination of information, an online library, website and newsletter. The network allows for communication with governments and water-related nongovernment groups.

- A *capacity-building component*, the prime purpose of which is to promote the ability of governments to conduct their own assessments through human resources development, education and training, provision of methodologies, institution and infrastructural development, development of data and information networks.

- A series of specific applications (e.g., on conflict resolution).

A first edition of the WWDR has provided an initial assessment of progress since the Rio Summit in 1992 (UNESCO 2003). It has proposed some possible directions for developing appropriate assessment and information-collection methodologies, to be further explored in subsequent reports. The WWAP has based its 2003 report on monitoring the progress in 11 specific challenge areas:

1. *Meeting basic needs:* to recognize that access to safe and sufficient water and sanitation is a basic human need and is essential to the health and well-being, and to empower people, especially women, through a participatory process of water management.

2. *Securing the food supply:* to enhance food security, particularly of the poor and vulnerable, through more efficient mobilization, use and equitable allocation of water for food production.

3. *Protecting ecosystems*: to ensure the integrity of ecosystems through sustainable water-resources management.

4. *Sharing water resources:* to promote peaceful cooperation and develop synergies between different uses of water at all levels, whenever possible, within and, in the case of boundary and trans-boundary water resources, between the states concerned, through sustainable river-basin management or other appropriate approaches.

5. *Managing risks*: to provide security from floods, droughts, pollution, and other water-related hazards.

6. *Valuing water:* to manage water in a way that reflects its economic, social, environmental, and cultural values for all its uses, and to move towards pricing water services to reflect the cost of their provision. This approach should take account of the need for equity and the basic needs of the poor and the vulnerable.

7. *Governing water wisely:* to ensure good governance, so that the involvement of the public and the interests of all stakeholders are included in the management of water resources.

8. *Water and industry:* to not degrade water and take account of the needs of competing sectors focusing on the needs of industries and the responsibility of industry.

9. *Water and energy:* to use water for various forms of energy production in a sustainable manner.

10. *Ensuring the knowledge base:* to make quality knowledge available to decision makers for good water policies and management.

11. *Water and cities:* to address distinctive challenges of water management in urban areas, which are the foci of human settlements and economic activities.

The preparation of the triennial reports is intended to be a joint effort by the UN and its member states in the collection and preparation of data that describe the state of the world's water resources. It is envisaged that data and information used in these reports would come from official sources such as national authorities and basin agencies, as well as from water-sector stakeholders (e.g., national and local governments, institutions and universities, user associations, the private sector, nongovernmental organizations and national consultants).

The WWAP is therefore supporting and encouraging countries that are interested in strengthening their monitoring and information management systems for the *assessment, monitoring and reporting of progress* in their national water situation. The immediate goal is for each country to develop and publish its own "*National Water Development Report*" on the basis of the "*World Water Development Report.*" The general objective is to assist these countries in the measurement of their progress towards meeting the Millennium Development Goals, as well as their own national objectives on water-related issues.

A key component of the WWAP reporting system is the need for developing a set of indicators that can describe the status of the water resources in each of the countries, as well as in regions where there are international basins and shared water bodies (e.g., The Nile, The Great Lakes Area of Africa, etc.). These indicators are intended to present the complex phenomena of the water sector in a meaningful and understandable way to decision makers, as well as to the public to allow for comparison between countries and monitoring of trends over time.

Developing and evaluating indicators can be a complex and time-consuming process that involves both technical and stakeholder evaluations based on opinions and feedback from stakeholders and decision makers who use the indicators (Bakkes et al. 1994; Hammond et al. 1995; IISD 2002; UNESCO 2003). Table 1 illustrates the "Bellaglio Principles" and the requirements for indicators that are advocated by the International Institute for Sustainable Development for use in the development and evaluation of indicators.

*Table 1. The Bellaglio Principles for the development and assessment of sustainability indicators (see http://www.iisd.org/measure/).*

| Principle | | Requirements/Criteria for sustainable development indicators |
|---|---|---|
| 1. Guiding vision and goals | 1. | Be guided by a clear vision of sustainable development and goals that define that vision. |
| 2. Holistic perspective | 2. | Include a review of the whole system as well as its parts. |
| | 3. | Consider the well-being of social, ecological, and economic subsystems, their state as well as the direction and rate of change of the state and of their component parts, and the interaction between parts. |
| | 4. | Consider both positive and negative consequences of human activity, in a way that reflects the costs and benefits for human and ecological systems, both in monetary and nonmonetary terms. |
| 3. Essential elements | 5. | Consider equity and disparity within the current population and between present and future generations, dealing with such concerns as resources use, overconsumption and poverty, human rights, and access to services, as appropriate. |
| | 6. | Consider the ecological conditions on which life depends. |
| | 7. | Consider economic development and other, nonmarket activities that contribute to human/social well-being. |
| 4. Adequate scope | 8. | Adopt a time horizon long enough to capture both human and ecosystem time scales thus responding to needs of future generations as well as those current to short-term decision making. |
| | 9. | Define the space of study that is large enough to include not only local but also long-distance impacts on people and ecosystems. |
| | 10. | Build on historic and current conditions to anticipate future conditions. |
| 5. Practical focus | 11. | An explicit set of categories or an organizing framework that links vision and goals to indicators and assessment criteria. |
| | 12. | A limited number of key issues for analysis. |
| | 13. | A limited number of indicators or indicator combinations to provide a clearer signal of progress. |
| | 14. | Standardizing measurement wherever possible to permit comparison. |
| | 15. | Comparing indicator values to targets, reference values, ranges, thresholds, or direction of trends, as appropriate. |
| 6. Openness | 16. | Make the methods and data that are used accessible to all. |
| | 17. | Make explicit all judgments, assumptions, and uncertainties in data and interpretations. |

*Table 1. Continued.*

| Principle | | Requirements/Criteria for sustainable development indicators |
|---|---|---|
| 7. Effective communication | 18. | Be designed to address the needs of the audience and set of users. |
| | 19. | Draw from indicators and other tools that are stimulating and serve to engage decision makers. |
| | 20. | Aim, from the outset, for simplicity in structure and use of clear and plain language. |
| 8. Broad participation | 21. | Obtain broad representation of key grassroots, professional, technical and social groups, including youth, women and indigenous people to ensure recognition of diverse and changing values. |
| | 22. | Ensure the participation of decision makers to secure a firm link to adopted policies and resulting actions. |
| 9. Ongoing assessment | 23. | Develop a capacity for repeated measurement to determine trends. |
| | 24. | Be iterative, adaptive and responsive to change and uncertainty because systems are complex and change frequently. |
| | 25. | Adjust goals, frameworks and indicators as new insights are gained. |
| | 26. | Promote development of collective learning and feedback to decision making. |
| 10. Institutional capacity | 27. | Clearly assign responsibility and provide ongoing support in decision making. |
| | 28. | Provide institutional capacity for data collection, maintenance and documentation. |
| | 29. | Support development of local assessment capacity. |

Indicator development and report writing of the nature envisaged by WWAP will thus require considerable awareness-raising, and consultation between the numerous water-sector stakeholders within each of the countries. In addition, proposed indicators will have to be tested and modified in the light of feedback from the reporting and decision-making processes. Consequently, the inaugural 2003 edition of the WWDR has proposed a methodological approach to water-indicator development and has identified a range of indicators that countries should evaluate, test and develop.

In the "*World Water Development Report*" issued by WWAP in March 2003, 176 indicators are proposed for covering the previously mentioned eleven challenge areas. However, it is acknowledged that the indicators identified and used in the first WWAP report must be qualified, using both scientific and political processes. It is recommended that an evaluation of these indicators should be carried out by participating countries in order to establish which indicators are relevant and applicable (UNESCO 2003). There is therefore an ongoing initiative by WWAP participating countries aimed at developing indicators that might be used for monitoring progress against targets of water resources management at both the national and international level (Neupane 2003).

In the context of this current project (with its time and resource constraints, as well as the stage of development of both WWAP and South African water-sector indicators), it was deemed impractical to evaluate the WWAP or South African water resource indicators to the depth of detail advocated by the Bellaglio Principles. This project has therefore focused on a rapid practical approach to provide answers to the following key questions:

1. How useful is the WWAP list of indicators published in the UNESCO report (UNESCO 2003) in the South African context?

2. What water resource indicator development initiatives are currently taking place in South Africa and what is the status of the South African WWAP?

3. How well do South African water resources management policies and strategies relate to the WWAP challenge areas?

4. How well do the WWAP indicators relate to the KFAs of the South African water resources management strategy?

5. Who are the main stakeholders that should be involved in the development and use of national water resources management indicators?

6. What processes and activities should be put into place by African countries to meaningfully contribute to, and participate in, the WWAP?

## Methodology

### *General Methodological Approach*

The methodological approach to this study consisted of the following elements:

1. A review of the literature, documentation and Internet websites to obtain information on water-sector indicator sets. This included previous work by UN and other international agencies (e.g., Commission for Sustainable Development, International Institute for Sustainable Development, and the OECD).

2. The setting up of a small Task Team comprising the lead consultant and personnel from IWMI and DWAF. The inclusion of DWAF personnel was considered particularly important in view of South Africa's regional involvement in WWAP, as well as DWAF's own leading role in managing water resources information and the publication of numerous water-sector reports. In course of the project, the Task Team convened four working sessions to discuss and debate the project and its findings.

3. Consultation with certain key stakeholders involved with national indicator development and State of the Environment Reporting. Because of the time constraints, as well as the diversity and size of the South African water sector, it was conceded that it would not be possible to contact all parties. Focus was therefore placed on key agencies and persons involved in international indicator initiatives (see list of names of persons contacted in annex 1).

4. Examination of relevant reporting approaches, projects, indicator sets and databases that are currently being developed, used, or tested within the context of national water resources management in South Africa. The objective was not to conduct a comprehensive study of all indicator sets, but rather to seek and present examples that are most applicable to describing achievements of sustainable development in the water resources management sector of South Africa.

5. An examination of the WWAP report and indicator list (UNESCO 2003) to evaluate the WWAP framework and the published list of indicators for relevance and applicability.

### *Evaluation of WWAP Indicators*

The list of indicators, as published in the first WWAP report (UNESCO 2003), was scrutinized to understand its scope in detail, and to decide on the best way to effect a meaningful evaluation. The project team comprehended that the existing list, as it stands, does not provide adequate descriptions enabling any detailed indicator evaluation (as per the Bellaglio Principles). The list is however of value in providing examples of potential priority issues of interest to decision makers and stakeholders, hence providing a framework for issues and areas where indicators should be developed and used for monitoring and reporting. For the purposes of this document, these potential priority issues will be referred to as *indicator issues* rather than indicators.

Although there is a considerable amount of legislation that reflects the South African policy on water resources, management of the water sector in the country hinges predominantly on two important pieces of legislation, the National Water Act (No. 36 of 1998) and the Water Services Act (No. 108 of 1997) (see www.dwaf.gov.za). In addition, the South African government recently promulgated a National Water Resources Strategy (see www.dwaf.gov.za) that describes how these two acts will be implemented. The Strategy defines 15 KFAs on

which DWAF, as the main government facilitator of the water sector, will focus its activities and programs. These KFAs refer to national objectives over a medium-term (3 to 4 years) time horizon, some of whose activities are already underway, and others are to be undertaken during the 2004/5–2006/7 periods. These include:

*KFA 1:* Ensure the sustainable development and management of plantation forestry to optimize equitable economic benefit, particularly in rural areas.

*KFA 2:* Ensure the sustainable development and management of indigenous forests to optimize their social, economic and environmental benefits.

*KFA 3:* Ensure Sustainable Forest Management (SFM) in South Africa by developing effective oversight of the sector and facilitating cooperative government.

*KFA 4*: Promote sustainable forest management in Africa and internationally.

*KFA 5:* Ensure that communities and disadvantaged groups are empowered to make use of trees and forest resources to support sustainable livelihoods.

*KFA 6:* Ensure reliable and equitable supply of water for sustainable economic and social development including the eradication of poverty.

*KFA 7:* Ensure the protection of water resources.

*KFA 8:* Develop effective water management institutions.

*KFA 9:* Align staff, stakeholders and the general public to a common vision for Integrated Water Resources Management (IWRM) and develop, capacitate and empower them in related best practices.

*KFA 10:* Ensure provision of basic Water Supply and Sanitation for improved quality of life and poverty alleviation.

*KFA 11:* Ensure effective and sustainable delivery of water services to underpin economic and social development.

*KFA 12:* Ensure effective Water Services Institutions.

*KFA 13:* Ensure effective local-level operations and management of DWAF water-services schemes.

*KFA 14:* Promote and support sound policy and practice of Water Services to achieve millennium targets in Africa.

*KFA 15:* Promote IWRM in Africa in support of NEPAD.

An evaluation of the WWAP list of indicator issues was carried out by screening for their relevance to, or linkage with, the South African KFAs at, firstly, the challenge-area level, and secondly the individual indicator-issue level. Altogether there are 164 indicator issues pertaining to 11 WWAP challenge areas and 15 South African KFAs. The 164 indicator issues were listed under 11 WWAP challenge areas along the vertical axis of a matrix, while 15 KFAs

formed the horizontal axis. The project team first discussed and assessed the linkage of the 11 WWAP challenge areas with the 15 South African KFAs and assigned the intersecting matrix cell a score of 1 wherever a linkage was agreed on, else it was left blank. Similarly, by screening through the indicator issues (164), their linkages with the KFAs were also score-marked. The two matrices were then summed both horizontally and vertically to provide overall scores on the linkages: a) between the 11 WWAP challenge areas and 15 KFAs; and b) between 164 indicator issues and 15 KFAs. In this way, four sets of scores were computed: a) horizontally added scores for 11 WWAP challenge areas indicating their linkages with South African KFAs (15 max); b) vertically added scores for 15 KFAs indicating their linkages with the WWAP challenge areas (max 11); c) horizontally added scores for 164 individual indicator issues indicating their linkages with South African KFAs (max 15); and d) vertically added scores for 15 KFAs indicating their linkages with WWAP indicator issues (max 164). These scores essentially reflect the level of linkage and hence the relevance. The higher the score the greater the linkage (and hence, the greater the relevance).

Although this is a rough and somewhat subjective method of screening, it helped provide a rapid assessment of relevance and priorities of the WWAP indicator issues.

A similar assessment was carried out at the WWAP challenge-area level for other indicators sets, including:

- The indicator set developed by the Department of Environmental Affairs and Tourism (DEAT) for National State of the Environment Reporting (see www.environment.gov.za/soer).

- An indicator set proposed by the North West Province for State of the Environment Reporting (see www.nwpg.org.za/soer).

- An indicator set developed and used by the City of Cape Town for State of the Environment Reporting at the local level (see www.capetown.gov.za).

- An indicator set developed by the country's largest water utility (Rand Water) for the analysis of the sustainability of water resources in catchments (Rand Water 2002).

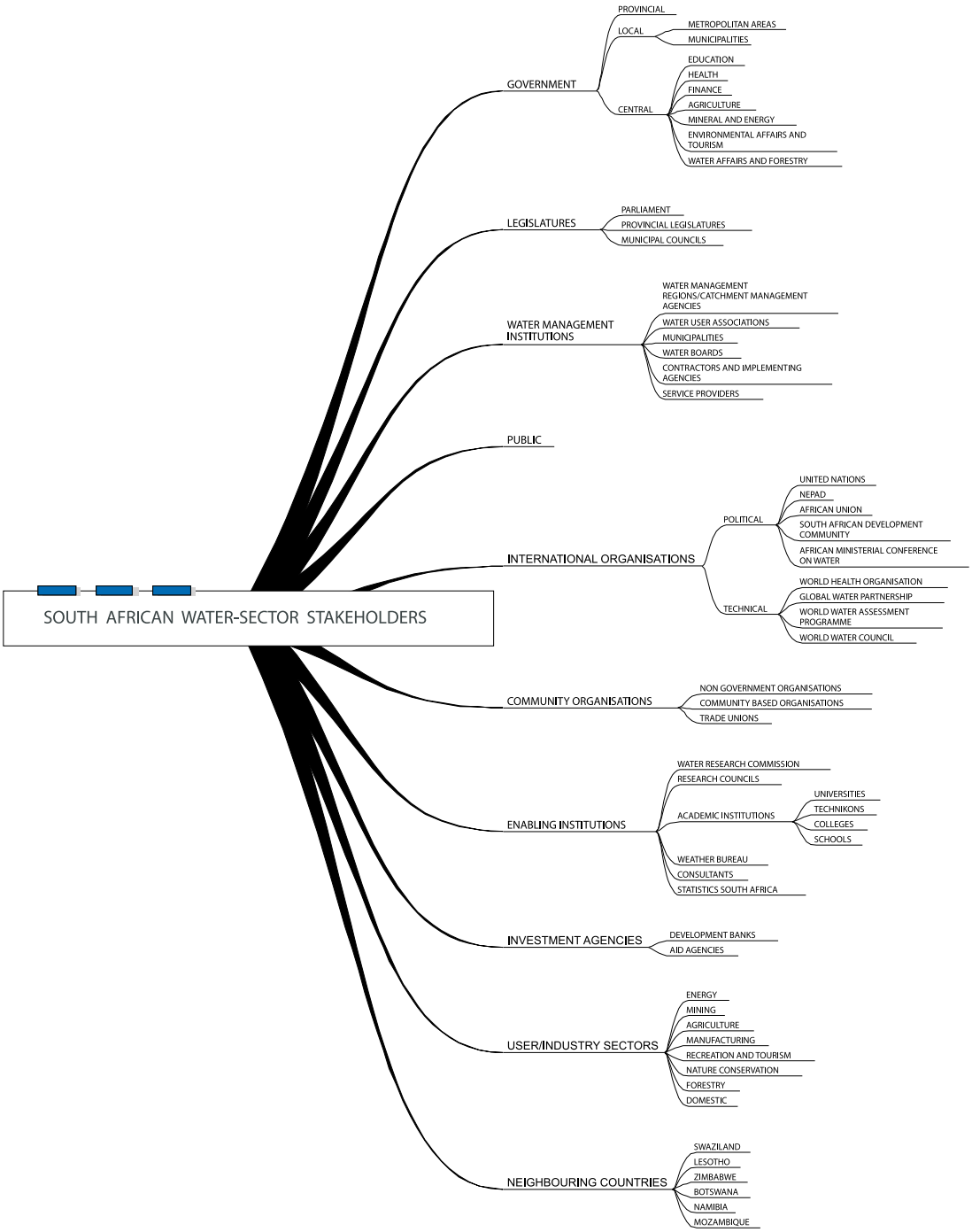
- An indicator set that has been developed through consultation with stakeholders, and is currently being evaluated for monitoring and assessing the sustainability of catchments (Walmsley 2003).

## Findings and Results

### *Stakeholders in the South African Water Sector*

In South Africa, with its arid climate and limited natural surface water systems, water is an extremely precious resource that has a wide variety of stakeholders all of whom have concerns about social, political, economic and environmental issues relating to water. It is not the intention of this report to present an exhaustive analysis of the country's water-sector stakeholders, but rather to accentuate their magnitude and diversity (see figure 1). Stakeholders were separated into the following categories listed not in any order of priority:

*Figure 1. Schematic outline of South African water-sector stakeholders (not in any order of priority).*



- The general public with the emphasis on the "person in the street," and comprising the entire population of the country that considers water as an everyday requirement.

- Government institutions at all levels (central, provincial and local) that deal with, or are influenced by, any aspect of water management or its regulation.

- Legislatures (central, provincial and local) as represented by political parties, which are involved in setting policies and the allocation of resources (human and financial) for implementation of societal programs.

- Community organizations that act at the local level to represent the interests of specific communities.

- Enabling institutions that provide support services particularly in the form of technical support, monitoring, communication, capacity building and technology transfer.

- International organizations involved in both political and technical decision making.

- Water management institutions responsible for the management and delivery of water services.

- Investment agencies that provide financial support for the implementation of water-development projects.

- Industry/User sectors that make use of water and impact on the resource and the environment.

- Neighboring countries that share boundaries or watercourses with South Africa.

In each of these categories, numerous individuals and organizations are interested in receiving (and contributing) relevant information on water resources and their management. Hence, individual indicators, indicator sets and related reporting processes must address the needs and requirements of these stakeholders.

### *Water-Sector Indicator Initiatives in South Africa*

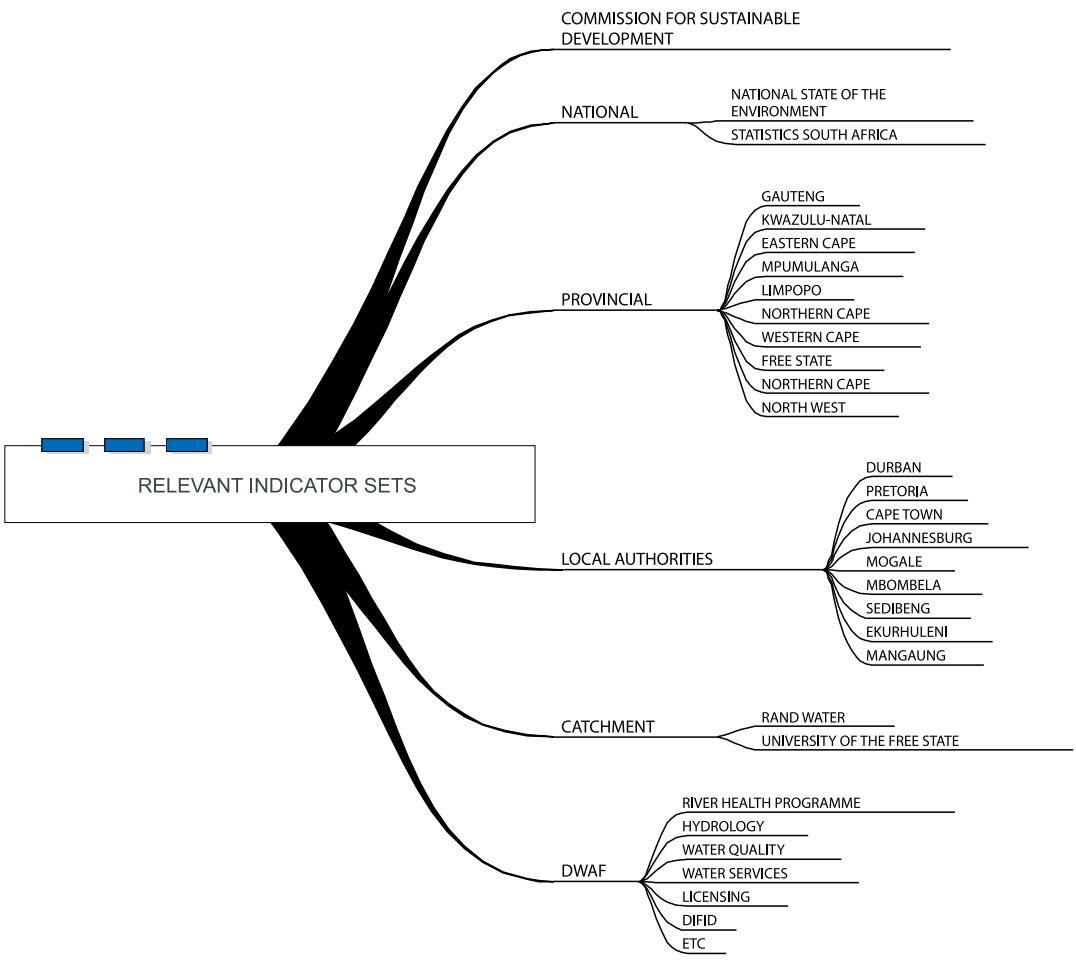
Over the last decade in South Africa, several projects were initiated to develop suitable indicator sets for establishing an improved reporting system on sustainable development and the state of the environment in the country. Several of those indicator sets are applicable to the water sector (see figure 2).

It has not been possible to examine all of these initiatives in the limited available time. However, some important ones have been investigated in-depth considering them as representative examples, enabling a demonstration of underlying principles and progress with regard to developing pertinent indicator sets and the corresponding reporting process. They include:

- Documentation to promote the concepts of sustainable development indicators and national State of the Environment Reporting (Walmsley and Pretorius 1996).

- An assessment of an indicator set proposed by the United Nations Commission for Sustainable Development (CSD) for use in national reporting on progress towards implementing Agenda 21 (DEAT 1998).

*Figure 2.Some relevant indicator sets developed and used for reporting on the status of South African water resources at different spatial scales.*




- Preparation and publication of the country's first State of the Environment Report in 1999 (see www.environment.gov.za/soer). This contained a chapter dedicated to water resources.

- Preparation and publication of State of the Environment Reports for some of the major metropolitan areas (Durban, Johannesburg, Pretoria, Cape Town), as well as some municipalities (www.environment.gov.za/soer).

- Preparation and publication of State of the Environment Reports for each of the country's nine provinces (www.environment.gov.za/soer).

- Development of a core set of national indicators for State of the Environment Reporting in South Africa (www.environment.gov.za/soer/indicator/neip).

The findings indicate that most of the above activities have been very general and not focused on any specific sector, but all have had extensive stakeholder involvement and included a set of indicators for monitoring and reporting on water resources. However, some recent initiatives have particularly focused on the water resources sector. Examples include, amongst others:

- The River Health Programme, which has developed, and is monitoring, ecological indicators to describe the status of several important river and catchment systems (www.csir.co.za/rhp).

- The Rand Water Catchment Diagnostic Framework that developed a set of indicators for use in catchment monitoring and assessment (Walmsley 1999; Walmsley 2000; Rand Water 2002).

- A University of the Free State research project sponsored by the South African Water Research Commission to test a core set of 40 sustainability indicators for use in monitoring and assessment of catchments in South Africa (Walmsley 2003).

- A major initiative by DWAF to update its approach to information management vis-à-vis departmental reporting requirements (see also section under DWAF Indicator Sets) and the development of indicators that allow for the assessment of DWAF performance (van Zyl, personal communication, October 2003).

- DWAF's own involvement in WWAP, which is also playing a leading role in the development of a reporting framework for African countries (van Zyl, personal communication, October 2003).

- An ongoing DWAF project supported by the United Kingdom's Department for International Development (DFID), which is aimed at developing systems for monitoring the benefits of water reallocation to the rural poor (DWAF and DFID 2003; Quibell, personal communication, October 2003).

- A series of long-term monitoring programs undertaken by the national agency, Statistics South Africa, aimed at households and the labor force, which focus on the Millennium Development Goals, specifically on achievements in the water supply and sanitation subsectors (Statistics South Africa 2003; Titi, personal communication, October 2003).

## Evaluation of WWAP Indicators

### *Relevance of the WWAP challenge areas to national KFAs*

The matrix of linkage among the 11 WWAP challenge areas and the 15 South African Water Strategy KFAs is presented in figure 3.

The findings, although subjective, indicate that there is a high level of linkage between the WWAP challenge areas and the South African water resources management strategy KFAs. KFAs for the forestry sector (KFAs 1–5) have the lowest level of linkage with WWAP challenge areas. This is mainly because forestry KFAs relate more to the management of forestry resources than to water, which is a common theme to all of the WWAP challenge areas. The South African policy and strategy for water resources management is therefore highly associated with the goals and objectives of the WWAP. This is not surprising in view of the policies and approach that South Africa has taken for achieving sustainable development of its water resources.

*Figure 3. Linkages between WWAP challenge areas and KFAs of the African water resources strategy (linkage denoted by gray shading).*

| WWAP challenge areas | KFA 1 | KFA 2 | KFA 3 | KFA 4 | KFA 5 | KFA 6 | KFA 7 | KFA 8 | KFA 9 | KFA 10 | KFA 11 | KFA 12 | KFA 13 | KFA 14 | KFA 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Meeting basic needs | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | |
| 2. Securing food supply | | | | | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ |
| 3. Protecting ecosystems | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 4. Sharing water resources | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 5. Managing risks | ■ | | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 6. Valuing water | ■ | | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 7. Governing water wisely | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 8. Water for industry | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ |
| 9. Water for energy | | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | ■ | | ■ |
| 10. Ensuring the knowledge base | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| 11. Water and cities | | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

***Relevance of the WWAP indicator issues with the South African KFAs***

The detailed matrix illustrating the relative level of linkage among each of the WWAP indicator issues and the KFAs is presented in annex 2. Summaries of the scores are presented in figures 4 and 5. The scores (max 164) represent the levels of linkage that each of the 15 KFAs has with the WWAP indicator issues.

*Figure 4. Scores for linkage of the WWAP indicator issues with 15 KFAs in DWAF strategy.*

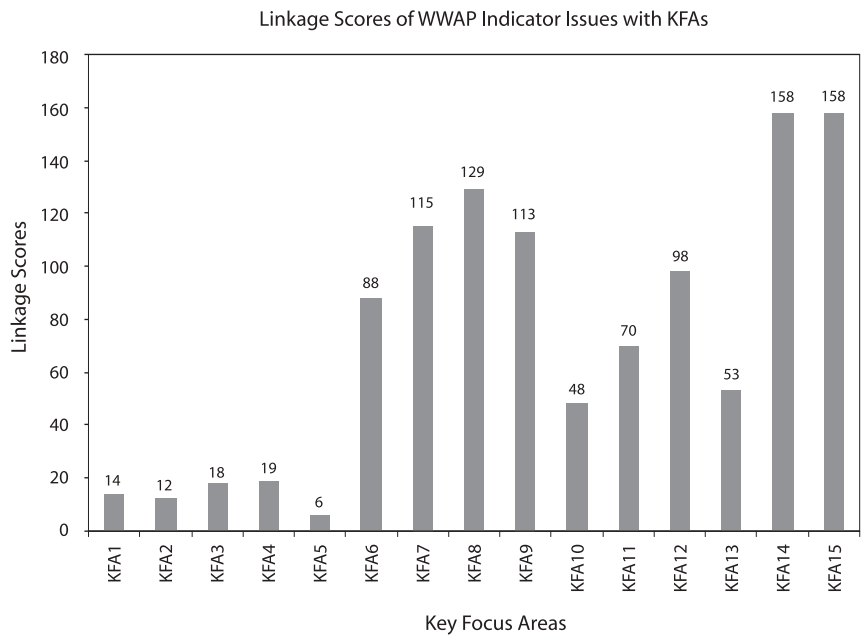
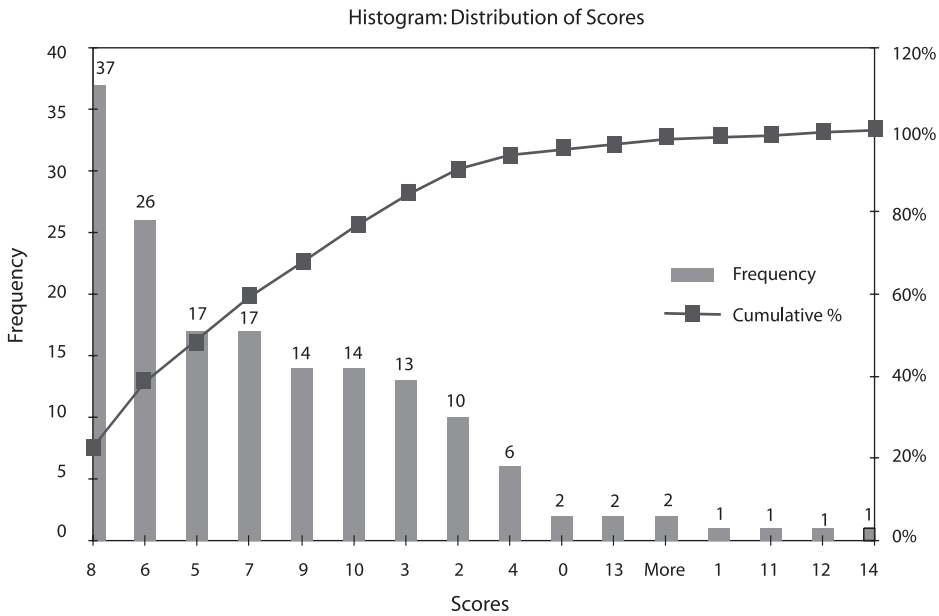



*Figure 5. Distribution of linkage scores.*



The results indicate that:

- The levels of linkage with the WWAP indicator issues are highest for KFAs 14 and 15, which represent the objectives of meeting the Millennium Targets and promoting IWRM in Africa.

- KFAs 6 through 15, which represent the main body of strategic actions in South African water resources management, have relatively higher levels of linkage with WWAP indicator issues.

- The levels of linkage for the Forestry KFAs are relatively low, that of KFA 5 being the lowest, which deals with empowerment of communities in forestry.

- Two WWAP indicator issues corresponding to "defined roles of government (central and local)" and "urban ecological footprint" show 100 percent linkage with the South African KFAs, i.e., having horizontally added scores of 15.

- There are only two WWAP indicator issues that exhibit zero levels of linkage— "water policy accounts and statements" and "regional- and country-level breakdown of values" under the challenge areas of "Sharing Water Resources" and "Water and Cities" (this could be partly because the project team was unclear about the essence of these indicator issues).

- Considering the issues that score values greater than 10 (i.e., to disregard any distortion caused by the five KFAs for Forestry) on the horizontal axis of the matrix as priority ones, 21 out of 164 are priority indicator issues in South Africa (see figure 5).

- Similarly, considering the ones scoring in the range of 6 to 10 as significant ones, 94 water indicator issues are significant for South Africa.

The above findings are based on a screening process that represented the opinions of the project team and it is likely that any other group of persons would perhaps present a different linkage pattern. The values presented in this text should therefore be viewed as being relative and not absolute. It does however accentuate that there is a need for further processing (based on interaction with relevant stakeholders and scientific evidence) in order to confirm and develop indicators that could be used by South Africa for future WWAP reporting. This might mean repeating the process carried out by the project team using a wider group of stakeholders.

***Relevance of the WWAP themes to some existing South African indicator sets***

Several indicator sets have already been developed for monitoring and reporting of certain water-sector characteristics at different spatial scales (see figure 2). Most of these sets have been developed through extensive stakeholder involvement and all of their indicators are well described in terms of their characteristics (e.g., the rationale for including them, methods for calculation, shortcomings, sources of information, etc.). Because of the characteristics of these indicator sets (diversity of topics, differing levels of scale, number of indicators, etc.), and the lack of details on the WWAP indicator issues, it was impractical to undertake a detailed matrix approach to assess their comprehensive relevance. These South African indicator sets have therefore only been screened for their linkage/relevance to the 11 WWAP challenge areas.

### *National state of the environment indicators*

A list of 102 indicators was developed by DEAT through a comprehensive stakeholder consultation process (see annex 3). This indicator set is intended for future obligatory reporting processes on the National State of the Environment (DEAT 2002). More than half of the indicators in the list (56) have linkages to various WWAP challenge areas, out of which 18 belong to subthemes (categories) of "water quantity" and "quality." Also included are two indicators within the South African subtheme of "vulnerability" that aim to monitor access to water and sanitation, thus relating to the attainment of the Millennium Goals. However, this indicator set does not cover all 11 WWAP challenge areas.

### *Provincial state of the environment indicators (Northwest province)*

The North West Province State of the Environment Report, published in 2002 (see www.nwpg.org.za/soer; Mangold and Sabiti 2002), has a list of 68 indicators, many of which are similar to the national SOER list (see annex 4). Although half of the list (34) relates to some of the WWAP challenge areas, there is no specific section on water in the North West Province list. Nevertheless, the list does include "access to water and sanitation" under a subtheme on "vulnerability."

### *Local government—City of Cape Town*

The City of Cape Town has an indicator set of 163 indicators (annex 5) used for State of the Environment Reporting (see www.capetown.gov.za). The set has taken almost 5 years to evolve. The first State of the Environment Report for Cape Town appeared in 1999. The indicator set has a subtheme on inland waters with 20 indicators, all of which are relevant to the WWAP challenge areas, mainly covering "governing water wisely," "protecting ecosystems" and "meeting basic needs." Overall, about 40 indicators in the set show linkage to various WWAP challenge areas. The indicators on water supply and sanitation that relate to the Millennium Goals are included in a subtheme on "Environmental Health." The indicators in the set would have expected more relevance with the WWAP challenge area of "Water and Cities."

### *Catchment indicator sets*

The Rand Water Catchment Diagnostic framework has 31 indicators, all of which link with several elements of the WWAP challenge areas (see annex 6). This diagnostic framework was developed in order to provide a means of assessing the overall sustainability level of a catchment and comparing the condition of catchments over time (Walmsley 1999; Walmsley 2000; Rand Water 2002). The main WWAP themes that are relevant include "protecting ecosystems," "governing water wisely," and "meeting basic needs," Indicators on sanitation and water supply are included in a category of socio-economic indicators. This overall profile is compatible with Rand Water's role as one of South Africa's largest water-service providers.

Another catchment indicator set, which is currently undergoing testing, is that developed by Walmsley (2003) as part of a University of the Free State research program supported by the South African Water Research Commission (see annex 7). These 40 indicators were developed through interactions with water-sector stakeholders and represent the main issues, which the stakeholders felt, should be monitored for a generic catchment area of South Africa. The set covers most of the WWAP challenge areas, although not all of them.

### *DWAF indicator sets*

DWAF has an extensive number of diverse monitoring programs, all of which make use of indicators to monitor numerous aspects of water quality, water quantity and social, financial, environmental, water licensing, project implementation, procurement, etc. These are spread throughout the organization and it has not been possible during this study to analyze all these programs with regard to their indicators and reporting systems.

DWAF has recognized that there is a need to consolidate its management of information and, in 2003, it underwent an important organizational restructuring. With the envisaged devolution of water resources management functions to Catchment Management Agencies, the remaining functions of the national government would have to be redefined. Within this new thrust of the policy and regulations, institutional support and information-management components have been established. At its core is the traditional hydrological service, now combining surface water, groundwater, water quantity and quality. This has been combined with the other key corporate information systems relating to demography, socioeconomic and poverty data, land and geographical information. Added to this has been a new subcomponent that will work towards an integrated information service across functional boundaries in the whole DWAF through a programmatic approach. This is to include integrated monitoring, assessment and information systems. This integrated information service is essential to underpin a more IWRM and the corresponding reporting requirements. However, the drive for such integration cannot materialize only from the information management side, but it would also need to be responsive to clearly expressed requirements from the business side of water resources management.

DWAF has recently undertaken a review of all reports that are regularly produced in order to meet the Department's reporting obligations. These were found to number at least 70 and cover a wide range of topics (see annex 8). The DWAF's Water Services Section has identified at least 1,300 indicators that need to be monitored (Tony Roberts, personal communication, October 2003) of which 322 indicators are currently being monitored and reported on (see annex 9). Examination of the list shows that many indicators are too detailed for the purposes of national and international reporting. Clearly, these many indicators will require an exhaustive process of screening by internal and external DWAF stakeholders in order to reach a practical number. DWAF is therefore currently examining its array of indicators and databases within the context of WWAP in order to produce a core indicator set for national and international reporting purposes.

A recently launched pilot project to progressively implement the National Water Act concerns Compulsory Licensing. Supported by the United Kingdom's Department for International Development (DFID), DWAF will apply this legal tool, explicitly designed to contribute to poverty eradication in water-stressed basins. One of the first tasks of the project will be to identify and test suitable indicators for monitoring the impacts and tangible benefits of the project's water reallocation on the rural poor (DWAF and DFID 2003; Gavin Quibell, personal communication, October 2003).

## Discussion

The approach followed by this project has allowed for a general evaluation of the WWAP indicators in the South African context. The WWAP 2003 first edition report is an exceedingly valuable and illuminating document on the state of global water resources. The list of indicators within 11 Challenge Areas, as published in the 2003 edition of the WWAP report (UNESCO 2003), is extremely useful in providing countries with an international framework in which to develop indicators and report on the state of their national water sectors. However, several

key issues need to be addressed in order to increase the usefulness of WWAP indicators to participating countries.

Some specific comments on the WWAP indicator list and the framework include:

- The 11 challenge areas have been adopted by WWAP as a general framework for future reporting and there is a need to develop indicators for each challenge area. However, a considerable overlap exists between many of the challenge areas and therefore the framework will need to recognize that one indicator might be relevant to reporting in one or more WWAP challenge areas. This comment applies particularly to the crosscutting themes "Water and Cities," "Water and Energy," "Ensuring the Knowledge Base," and "Water for Industry." Else, it would be difficult to develop generally separate indicator sets for these crosscutting issues unless they form parts of specific case studies.

- It is not clear whether the WWAP framework is being proposed as a framework that all countries should subscribe to or whether it is a means for international reporting to take place. There is a need to avoid any conflict between national and international reporting activities. The ideal situation is to achieve harmony between the two. In the case of South Africa, it is evident that there is considerable harmony between the WWAP challenge areas and the South African KFAs, thus avoiding such conflict. This might not be the case for other African countries.

- For countries that have not yet developed their own water resources management strategies (and their own challenge areas), the WWAP framework is extremely useful in getting the ball rolling on indicator development and reporting. However, such countries will need to develop and make use of their own strategies with challenge areas (KFAs) and associated indicators. This point conforms to one of the resolutions made at the 2002 Johannesburg World Summit on Sustainable Development, notably that all countries will have completed water resources strategies by the year 2005 (see www.johannesburgsummit.org/html/documents).

- The WWAP list, which only provides a title for each indicator, does not provide an adequate description of each of the indicators, leaving the meanings of specific indicators unclear. For the purpose of this evaluation, it was only possible to treat the list as representing the issues for which indicators need to be developed. There is therefore a need to have further stakeholder discussions on the list, as well as technical inputs into developing indicator descriptions.

- At the onset to the project, it was difficult to get ready access to a copy of the WWAP report and the indicator list. Discussions with stakeholders have also revealed that very few parties, outside of persons involved in World Water Forum activities, have any knowledge of the WWAP and its objectives. There is thus a need for the WWAP report to be better promoted and made more accessible to stakeholders.

There are currently several indicator initiatives at national, provincial, catchment and local levels. They have already developed indicator and reporting systems and, consequently, can provide useful lessons. These national, provincial and local initiatives are based on general State of the Environment Reporting and have a water resources component in them. Importantly, they have independently included elements of the Millennium Development Goals. Though operating at different spatial scales, many common water-sector indicators in these indicator

sets can be used at the national and international levels. However, although these initiatives on the state of the environment have involved extensive stakeholder interactions, there is still a need for additional input from the water sector to collectively agree on indicators to be used at the respective levels.

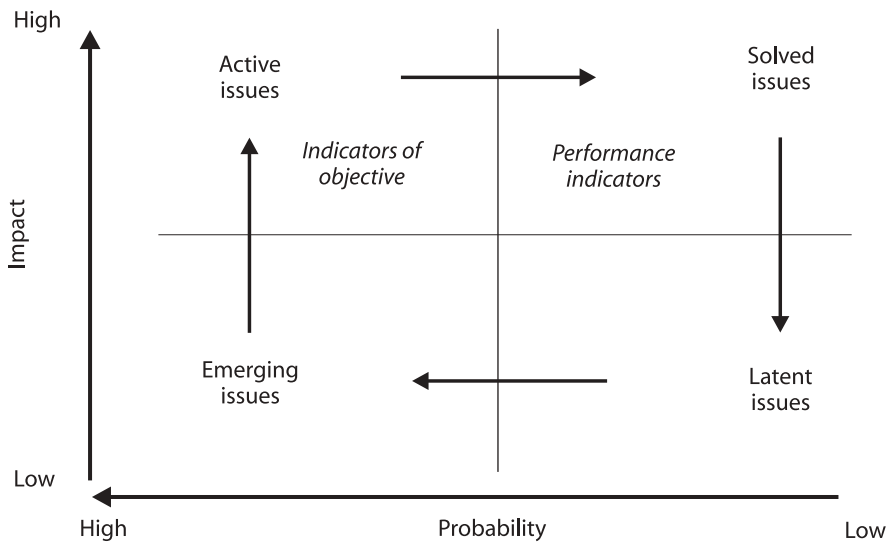
South African water resources management policies exhibited in relevant legislations (Water Act of 1998; Water Services Act of 1997) and the South African National Water Resource Strategy (DWAF 2002) have a remarkably close alignment with the WWAP challenge areas. This is clearly evidenced by a high level of linkage between the country's KFAs and the list of WWAP indicator issues. This is not surprising in view of the country's policy of redressing previous inequity and its active participation in Agenda 21 initiatives as well as in the World Water Forums and WWAP.

This evaluation has allowed a brief snapshot of the South African water stakeholders (see figure 1). It demonstrates that an extremely diverse group of stakeholders have an interest in both receiving and contributing to information related to the South African water sector. There are however indications that many of these stakeholders have not been greatly involved in either indicator development or state of the sector reporting. The main challenge to South Africa will therefore be in promoting a meaningful stakeholder participation in the required information-exchange processes.

Discussions with some of the stakeholders raised a major issue of concern: despite the development of numerous indicator sets, there is no concomitant production of meaningful information (reports) applied in subsequent improved decision-making processes. This has created a general impression that many indicator-development initiatives in South Africa were made in a rather rushed fashion, without adequate preparation for developing the indicators and their usage. In this regard, it is important that in the context of indicators, the process of indicator development and usage should receive greater attention. There are two concepts that this report wishes to highlight.

The first involves the context of indicators in terms of their role in minimizing risk in the management of water resources, and the other concerns the actual preparation and process of developing and using the indicators. In the management of any resource, there is a need to examine issues in terms of their potential level of impact, as well as the probability that an impact will take place (risk). The situation can be represented graphically as in figure 6, in which there are four quadrants, representing categories of issues that require indicators for monitoring. These include:

*Figure 6. Impact-probability framework.*



*Latent issues* that have a low impact and low probability (hence a low risk of causing a problem). However, these issues are of concern because they are important as part and parcel of long-term management. Because impact and risk at present are relatively low there is only a need for monitoring to ensure that the status quo is maintained.

*Emerging issues* are those in which the status quo begins to shift as a consequence of a change in environmental conditions (or policy such as the current government's emphasis on coordination of poverty eradication) that result in increasing impact and increasing probability (hence increasing risk and level of the problem). These are issues that have the potential to emerge as problems or are beginning to emerge as problems. There is, therefore, a need to have them monitored as a priority.

*Action issues* are those of high impact and high probability (hence are continually causing problems) and occupy most management time, as they require immediate solutions. These impacts require monitoring but also there is a need to introduce objectives and interventions to reduce the risk as well as performance indicators to monitor how well these objectives are being met through management interventions.

*Solved issues* are those of potential high impact but whose probability has reduced due to actions and interventions taken by management. These issues should theoretically revert to the "latent issue" quadrant if interventions had been effective. Monitoring of performance is ongoing to ensure that the intervention has been successfully implemented (performance indicators).

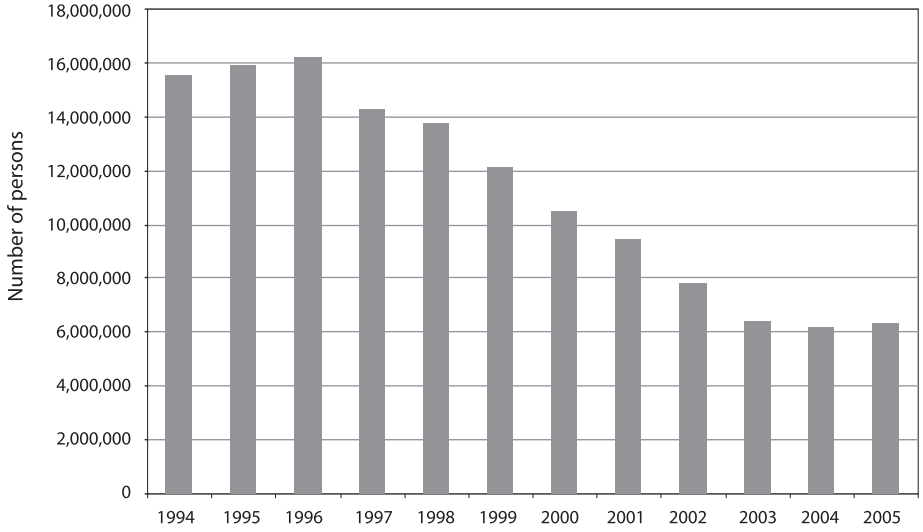
Selection of indicators should therefore be used as a tool by management to minimize the risk of problems, as well as to measure the effectiveness of interventions for those that have high risk and high impact. This is best illustrated by giving comments and figures on two key water-sector-management issues related to the Millennium Development Goals: drinking water supplies and sanitation services in South Africa. Throughout the apartheid era (i.e., prior to 1990), the government largely ignored these basic needs, and there was little monitoring of these issues. In this historic context, these could be regarded as *latent issues* because they were not regarded as a national priority problem. However, with the transition of the country to a democratic government (1990 to 1994) the water supply and sanitation issues moved rapidly from being latent to active because they were included in the African National Congress's manifesto for action (ANC 1994). Monitoring of the two issues therefore only started in 1994 (Kobus Kuhn, personal communication, October 2003—see figures 7 and 8).

From the available information on water supply and sanitation, it is possible to set indicators for the following objectives (e.g., based on the Millennium Development Goals which were agreed on in the year 2000), notably:

- To reduce by 2015 by one half the proportion of people without access to sanitation (VIP toilets). From the data collected, this target indicator for South Africa is from the base year 2000 equals 701,504 persons per annum.

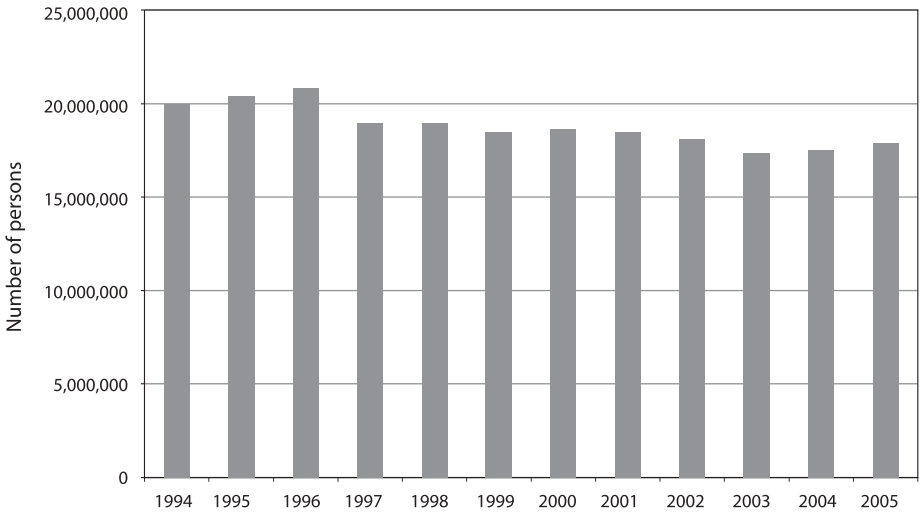
- To reduce by 2015 by one half the proportion of people without access to safe water (taps within 200 m). The data collected show that this target indicator for South Africa from the base year 2000 equals 1,241,218 persons per annum.

*Figure 7. Plot of water for needy persons in South Africa with projections to 2005.*




*Note:* Indicator is based on nationwide delivery of taps (within 200 m, of acceptable quality water and 10 liters per minute). The reference baseline population estimate was done in 1994 (data provided by DWAF).

*Figure 8. Plot of sanitation for needy persons in South Africa with projections to 2005.*



From the data, it is also possible to have indicators of performance, i.e., the level to which the objective has been reached each year (expressed in %). The performance indicator evaluation is illustrated in table 2. In this example, it is evident that South Africa has had a high relative performance in the delivery of water-supply units, but its performance in sanitation units requires review. It should be emphasized that the above examples and figures have only been used in a simplistic way to illustrate the model and these figures should not be regarded as absolute. In reality and practice, there will obviously be complications about population growth, population estimates, standards and specifications of the units, etc.

*Table 2. Example of performance for the delivery of water and sanitation units for South Africa, based on Millennium Goals.*

| Period | Water units delivered | Performance of water delivery (%) | Sanitation units delivered | Performance for sanitation delivery (%) |
|---|---|---|---|---|
| 2000–2001 | 1,080,491 | 154 | 157,498 | 12 |
| 2001–2002 | 168,098 | 234 | 358,109 | 28 |
| 2002–2003 | 1,399,041 | 199 | 773,189 | 62 |

A second concept is that the process of indicator development should be seen within a wider context of management planning and particularly as a process, which is iterative. In the model presented in this report, indicator development is only step 5 in the cycle. The steps to the process can be described as:

*Step 1.* An examination of the drivers which govern water resources, particularly policy, legislation, economics, and the stakeholder requirements.

*Step 2.* The development of a strategy on how water resources are to be managed and actions implemented to meet stakeholder requirements.

*Step 3.* The setting of targets and objectives with an associated performance framework. This should also define the institutional arrangements, the issues which are of importance, and identify reporting requirements.

*Step 4.* The setting up of an information management system including aspects such as software and hardware to be used, personnel, database management, partnerships, communication system and reporting methodology.

*Step 5.* The indicator-development process itself which should include the following elements:

- A stakeholder program
- A project team
- A desk study of existing indicators
- Testing of relevance and feasibility
- Development and description of new indicators
- Securing information sources and partnerships

- Piloting projects on specific sectors
- Reporting and evaluation
- Expanding the process to other sectors

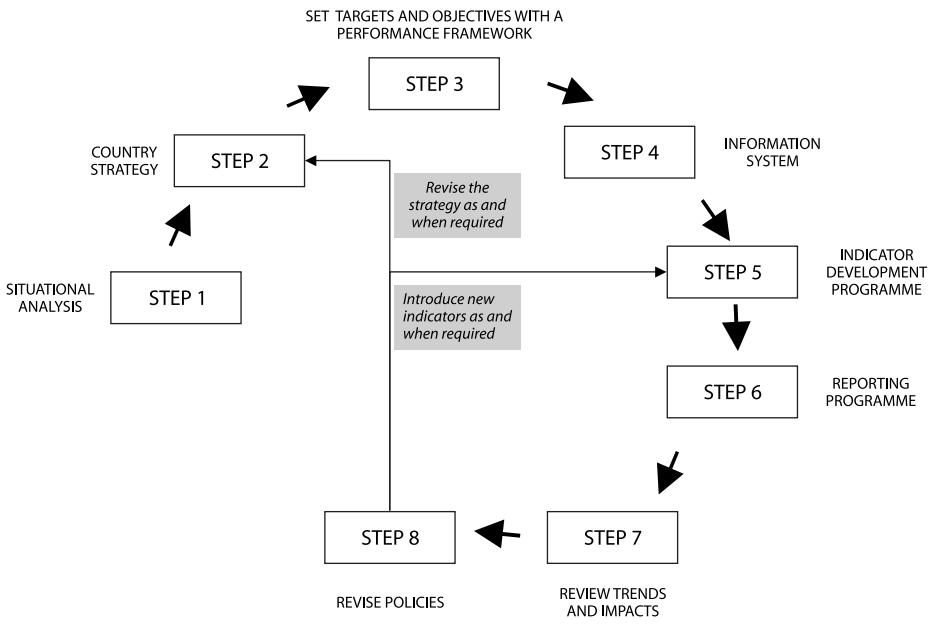
*Step 6.* Implementing a reporting program that meets the needs of the stakeholders and includes feedback and evaluation.

*Steps 7 and 8.* Review of reports and revision of policies and programs.

South Africa has completed steps 1 and 2 and is currently involved in firming up the elements of steps 3, 4 and 5. The key however will be to consolidate and reduce indicators to a practical number that can be assimilated and reacted on by decision makers.

One final comment concerns the process of developing a set of national indicators and their linkage with WWAP. It might be useful for the South African stakeholders firstly to develop a set based on the national strategy's KFAs, and secondly to fit these same indicators into the WWAP Framework of Challenge Areas. An example is given in annex 10 where indicators from the one KFA framework have been transposed on to the WWAP framework. This approach will facilitate harmonization of national and WWAP reporting.

*Figure 9. Steps in the process of developing indicators.*



## Conclusions and Recommendations

This study has the objective of evaluating the list of indicators that has been proposed by the World Water Assessment Programme (UNESCO 2003) for use by South Africa in international water-sector reporting. The main findings are as follows:

1. The WWAP list, as its stands, does not provide sufficient descriptions of the proposed indicators from which any detailed indicator evaluation can be made. The list is however of value in providing examples of potential priority issues of interest to decision makers and stakeholders, hence providing a framework where indicators could be developed and used for monitoring and reporting purposes. For the evaluation, the WWAP indicator list has been treated as representing issues for which indicators might be developed.

2. There is a high level of relevance and linkage between the 11 WWAP challenge areas and the 15 KFAs that form the core components of the South African water resources management policy. A higher level of linkage was observed in two focus areas that promote and support sound policy and practice of water services to achieve the millennium targets and to promote IWRM in Africa. The lowest level of linkage was in the focus areas that support and promote forestry activities.

3. The main categories of water-sector stakeholders that would be interested in receiving and contributing information to WWAP and national reporting have been identified. These include all tiers of government and legislatures, the general public, community organizations, industrial sectors, international organizations, investment institutions, enabling organizations, service organizations and neighboring countries. There is evidence that many of these stakeholders are not aware of WWAP and the process of indicator development and reporting. There is a need for an awareness program aimed at securing cooperation and participation of key stakeholders.

4. There are numerous indicator initiatives that have taken place in South Africa, all of which have developed and described several indicator sets for use at national, provincial, catchment and local levels. Although most of these have focused on indicators for general State of the Environment Reporting, they have included water-sector indicators, and more importantly, those that are relevant to the achievement of the Millennium Goals.

5. The further development of indicators and the successful publication of water-sector reports by South Africa and other African countries should be founded on national strategies for IWRM and the targets and objectives that emanate from the strategy. Indicator development and reporting should thus be treated as an essential ongoing long-term cyclical process that is incorporated into the business component of the government and the water-sector stakeholders.

6. Presently, South Africa is engaged in activities that contribute to steps 3 to 5 of the process outlined in figure 9. A useful national water-sector indicator set will be dependent on completing the ongoing efforts related to: a) setting targets and objectives with a performance framework; b) institutionalizing an information system; and c) the indicator-development process based on interactions with the stakeholders and technical evidence.

# Annexes

*Annex 1. List of names of persons consulted.*

| Name | Institution |
|---|---|
| At van Coller | Department of Agriculture, Pretoria |
| Bhanu Neupane | World Water Assessment Programme, UNESCO |
| Craig Haskin | City of Cape Town |
| Dirk Roux | River Health Programme, CSIR, Pretoria |
| Elizabeth Muller | Environmental, CSIR, Pretoria |
| Fred van Zyl | Department of Water Affairs and Forestry, Pretoria |
| Gavin Quibell | DFID Water and Forestry Support Programme, DWAF, Pretoria |
| Heather Mackay | South African Water Research Commission, Pretoria |
| Jean-Marie Barratt | World Water Assessment Programme, UNESCO |
| Keith Taylor | Department of Agriculture, Pretoria |
| Kobus Kuhn | Department of Water Affairs and Forestry, Pretoria |
| Mandisi Titi | Statistics South Africa, Pretoria |
| Marc De Fonteine | Rand Water, Johannesburg |
| Nozipho Shabalala | Statistics South Africa, Pretoria |
| Pieter Bossert | Statistics South Africa, Pretoria |
| Rudi Pretorius | Department of Environmental Affairs and Tourism, Pretoria |
| Steve Mitchell | South African Water Research Commission, Pretoria |
| Tony Roberts | A Roberts Consultancy, Pretoria |
| Wilma Strydom | River Health Programme, CSIR, Pretoria |

*Annex 2. Matrix of linkages between WWAP indicator issues and DWAF KFAs.*

| Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 1 Meeting basic needs** | | | | | | | | | | | | | | | | |
| Access to basic sanitation infrastructure | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Affordable access to water | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Capital expenditure on water and sanitation | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Operating expenditure on water and sanitation | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Service providers meeting reliability requirements | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Service providers meeting water-supply quality requirements | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Actual and total sanitation coverage, global, urban and rural breakdown | | | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Actual and total water-supply coverage, global, urban and rural breakdown | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Distribution of unserved people: sanitation | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Distribution of unserved people: water supply | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Incidence of cholera in the world | | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 8 |
| Access to improved drinking-water sources and extension of piped water supply | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Burden of water-associated diseases (expressed in DALYs) with comparative risk assessment | | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 8 |
| Fraction of the burden of ill-health resulting from nutritional deficiencies, attributable to water-scarcity impacts on food supply | | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 8 |
| Investment in drinking-water supply and sanitation | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Percentage of health impact assessments (HIA) of water-resources development and compliance with HIA recommendations | | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 8 |

Indicator: 1 = KFA1: SDMPF; 2 = KFA2: SDMIF; 3 = KFA3: SFM; 4 = KFA4: SFMA; 5 = KFA5: ECDGF; 6 = KFA6: RESW; 7 = KFA7: PWR; 8 = KFA8: DEWMI; 9 = KFA9: CV IWRM; 10 = KFA10: BWSS; 11 = KFA11: SDWS; 12 = KFA12: EWSI; 13 = KFA13: LLO of DWAFS; 14 = KFA14: AMT; 15 = KFA15: IWRM in Africa for NEPAD; 16 = Degree of Linkage

*Annex 2.* Continued.

| Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 2 Securing food supply** | | | | | | | | | | | | | | | | |
| Agricultural water use by country | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 13 |
| Area equipped for irrigation vs. total arable land by country | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | | 1 | 1 | 1 | 12 |
| Area of arable land (whole world) | | | | | | | | | 1 | | | | | 1 | 1 | 3 |
| Average food price (whole world) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Average grain yields (whole world) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Average per capita food consumption (whole world and regions) | | | | | | | | | | | | | | 1 | 1 | 2 |
| Consumption of livestock products (regions) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Cropping intensity (whole world) | | | | | | | | | 1 | | | | | 1 | 1 | 3 |
| Fish consumption (marine, inland and aquaculture [whole world]) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Irrigated area (regions) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Lending for irrigation and drainage (whole world) | | | | | | | | | 1 | | | | | 1 | 1 | 3 |
| Number of chronically hungry people by country | | | | | | | | | 1 | | | | | 1 | 1 | 3 |
| Water used for irrigation: net and gross (whole world) | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Agricultural subsidies | | | | | | 1 | | 1 | 1 | | | | | 1 | 1 | 5 |
| Breakdown of food consumption into cereals, oil crops, livestock and fish | | | | | | | | | | | | | | 1 | 1 | 2 |
| Food imports/exports between regions | | | | | | | | | | | | | | 1 | 1 | 2 |
| Productivity: $ or vol./$m^3$, efficiency, jobs per drop | | | | | | 1 | | 1 | 1 | 1 | | | | 1 | 1 | 6 |
| Proportion of crops marketed at government-controlled prices | | | | | | | | | | | | | | 1 | 1 | 2 |
| Total investment (private, state, development agencies) in irrigation and drainage | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Water used for irrigation (net and gross, groundwater and surface water); informal (supplemental, spate, local water harvesting) | | | | | | | | 1 | 1 | 1 | 1 | | | 1 | 1 | 6 |

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*Annex 2.* Continued.

| Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 3 Protecting ecosystems** | | | | | | | | | | | | | | | | |
| Area of wetland drained | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Biological assessment (perturbation from reference condition) | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Biological water quality (based on community response) | | | | | | | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 7 |
| Commercial or other fisheries catch | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Compliance with water-quality standards for key pollutants | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Degree of river fragmentation | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Emissions of water pollutants by sector | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Food production trends | | | | | | | | | | | | | | 1 | 1 | 2 |
| Hydrological indicators (flow, etc.) | | | | | | 1 | 1 | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Land converted to agriculture | | | | | | | 1 | | | | | | | 1 | 1 | 3 |
| Levels of endemism | | | | | | | 1 | | | | | | | 1 | 1 | 3 |
| Living Planet Index | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | | | | 1 | 1 | 9 |
| Numbers or presence/absence of nonnative (alien) species | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | 1 | 1 | 8 |
| Numbers/proportion of threatened species (critically endangered) | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | 1 | 1 | 8 |
| Rapid Biodiversity Inventory - Conservation International/Field Museum AquaRAP | 1 | 1 | 1 | 1 | | | 1 | | | | | | | 1 | 1 | 7 |
| Terrestrial Wilderness Index | 1 | 1 | 1 | 1 | | | 1 | 1 | | | | | | 1 | 1 | 8 |
| Formation and empowerment of regulatory or other institutions | | | 1 | 1 | | | | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Reporting procedures in place at the national level | | | 1 | 1 | | | | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Restoration schemes | | | 1 | 1 | | | | 1 | | | | 1 | | 1 | 1 | 6 |
| Sites/species afforded protection by legislation | | 1 | 1 | 1 | | | 1 | 1 | | | | 1 | | 1 | 1 | 8 |
| Uptake of strategies/legislation uptake for environmental protection | | | 1 | 1 | | | 1 | 1 | 1 | | | 1 | | 1 | 1 | 8 |

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*Annex 2.* Continued.

| Indicator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 4 Sharing water resource** | | | | | | | | | | | | | | | | |
| Annual flows to the world's oceans | | | | | | | 1 | | 1 | | | | | 1 | 1 | 4 |
| Basins of high/medium water stress (abstraction as proportion of river flow) | | | | | | | 1 | | 1 | | | | | 1 | 1 | 4 |
| Countries using the largest quantities of desalinated water and treated wastewater | | | | | | | 1 | | 1 | | | | | 1 | 1 | 4 |
| Country data on water resources | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Dependence of country's water resources on inflow from neighboring countries (inflow as ratio of total water availability) | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Global hydrological network | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Groundwater use for agricultural irrigation | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Largest rivers in the world by mean annual discharge with their loads | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Long-term average water resources | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Mean annual precipitation | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Number of international basins | | | | | | | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 7 |
| Number of treaties/cooperative events for international rivers | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Shared aquifers: number/resource volume/conflicts relating to changes that might suggest international basins where there is a shared aquifer | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Water availability versus population | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| World maximum point rainfalls for different durations | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| World's largest groundwater systems | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Biological contaminants (E. coli/thermo-tolerant coliform) | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Demand changes (sectoral) and distribution | | | | | | 1 | | 1 | 1 | | 1 | 1 | | 1 | 1 | 7 |
| Existence of law for judicious distribution of water | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | | | 6 |

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*Annex 2.* Continued.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 4 Sharing water resource** | | | | | | | | | | | | | | | | |
| Mechanisms for sharing within country (allocations/priorities) both routinely and at times of resource shortage | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Naturally occurring inorganic contaminants: fluoride and arsenic | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Organic pollutants load | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| PDSI or aridity index (moisture index) | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Proportion of water use by industry, agriculture, and domestic sector | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| UNESCO/IAEA/IAH/ECE Groundwater Index | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Use/yield {Yield = f (Q, variability in both space and time, storage)} | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Water policy accounts and statements | | | | | | | | | | | | | | | | 0 |
| Water stress threshold map | | | | | | | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 7 |

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*Annex 2.* Continued.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 5 Managing risks** | | | | | | | | | | | | | | | | |
| List of severe natural disasters since 1994 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | | | | | | 8 |
| Major drought events and their consequences in the last century | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | | 1 | | | | 9 |
| Trends in causes of food emergencies, 1981–1999 | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| Trends in great natural catastrophes | | | | | | | 1 | | | | | | | 1 | 1 | 3 |
| Budget allocation for mitigation of water risk (total and % of total budgets/yr.) | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Legal and institutional provisions for risk-based management (established/not established) | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Losses: country and basin level data, by region and globally, in human life (number/yr.), in real and relative social and economic conditions | | | | | | 1 | | | 1 | | | 1 | | 1 | 1 | 5 |
| Number of people living with 100-year flood. Vulnerability map based on the proportion of land within 1 km of river with slope | | | | | | | 1 | 1 | 1 | | | 1 | | 1 | 1 | 6 |
| Other than water-related risks (% of losses from seismic, fire, industrial and civil-stability risk) | | | | | | | 1 | 1 | 1 | | | 1 | | 1 | 1 | 6 |
| Population exposed to water-related risk (number of people/yr., income groups) | | | | | | | 1 | 1 | 1 | | | 1 | | 1 | 1 | 6 |
| Risk reduction and preparedness action plans formulated (% of total number of countries) | | | | | | | | | 1 | | | | | 1 | 1 | 3 |
| Risk reduction in flood plains (% of total flood plain populations) | | | | | | | 1 | 1 | 1 | | | | | 1 | 1 | 5 |
| Risk-based resource allocation (country, international organizations [yes/no]) | 1 | | | | | | 1 | 1 | | | | 1 | | 1 | 1 | 6 |

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*Annex 2.* Continued.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 6 Valuing water** | | | | | | | | | | | | | | | | |
| Water tariffs | | | | | | | | 1 | 1 | | | 1 | | 1 | 1 | 5 |
| Annual investment in urban and rural sanitation | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Annual investment in water for agriculture, water supply and sanitation, environment and industry | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Comparison of the price of water from the public utilities and informal water vendors | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Level of cost recovery for urban water supplies | | | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Level of cost recovery for water supplies for agriculture | | | | | | 1 | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 8 |
| Price of water from municipal water-supply systems | | | | | | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Sources of investment funds | | | | | | 1 | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Average price of water in rural water- supply systems | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Price of water charged to farmers for irrigation | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Sewerage charges | | | | | | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 8 |

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*Annex 2.* Continued.

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 7 Governing water wisely** | | | | | | | | | | | | | | | | |
| Existence of defined water rights | | | | | | 1 | 1 | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Existence of institutions (water- resources authorities) responsible for management (including issuing abstraction and discharge permits) | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | | |
| Existence of water-quality standards, for effluent discharges, minimum river- water-quality targets | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Asset ownership properly defined | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Defined roles of government (central and local) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 |
| Existence of legislation advocating Dublin principles | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 |
| Existence of participatory framework and operational guidelines | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 13 |
| Financial commitment for IWRM adoption | | | | | | 1 | 1 | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Institutional strengthening and reform (post-1992) | | | | | | | | 1 | 1 | | | 1 | | 1 | 1 | 5 |
| Numbers of instances when water- service providers experience a raw water shortage | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Private-sector involvement and stakeholders' responsibility established and implemented | | | | | | | | 1 | | | | 1 | | 1 | 1 | 4 |
| Water quality in rivers, lakes, etc. | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 8 Water for industry** | | | | | | | | | | | | | | | | |
| Competing water uses for main income groups of countries | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Contribution of main industrial sectors to BOD production in high income OECD countries and in low income countries | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Economic value (in US$) obtained annually by industry per cubic meter of water used | | | | | | 1 | 1 | | 1 | | 1 | 1 | | 1 | 1 | 7 |
| Industrial water efficiency | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Industrial use of water per capita by total developed water per capita | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Pollution from industry | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |
| Reuse/recycling | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | 1 | 8 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 9 Water for energy** | | | | | | | | | | | | | | | | |
| Deployment of hydropower | | | | | | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 6 |
| Distribution of households with access to electricity in 43 developing countries | | | | | | | | | | | | | | 1 | 1 | 2 |
| Installed hydro capacity | | | | | | 1 | | | | | | 1 | | 1 | 1 | 4 |
| World's electricity production | | | | | | | 1 | 1 | | | | 1 | | 1 | 1 | 5 |
| Access to electricity: rural and urban coverage for the whole world | | | | | | | | | | | | | | 1 | 1 | 2 |
| Efficiency/Productivity (output per $m^3$) | | | | | | 1 | 1 | 1 | | | | 1 | | 1 | 1 | 6 |
| Per unit cost of renewable and nonrenewable energy sources | | | | | | | | | | | | | | 1 | 1 | 2 |
| Use of water in thermal towers and competition with other uses | | | | | | 1 | 1 | 1 | | | | | | 1 | 1 | 5 |

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*Annex 2.* Continued.

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| **WWAP challenge areas: 10 Ensuring the knowledge base** | | | | | | | | | | | | | | | | |
| Density hydrological monitoring stations worldwide, by region | | | | | | 1 | 1 | 1 | 1 | | | 1 | | 1 | 1 | 7 |
| Expenditure on ICT | | | | | | | 1 | 1 | 1 | | | | 1 | 1 | 1 | 6 |
| Gross enrolment at primary school | | | | | | | | | | | | | | 1 | 1 | 2 |
| Illiteracy rate | | | | | | | | | | | | | | 1 | 1 | 2 |
| Number of hydrological monitoring stations, by World Meteorological Organization (WMO) regions | | | | | | | 1 | 1 | | | | | | 1 | 1 | 4 |
| Number of television sets and radio receivers per 1,000 persons | | | | | 1 | | | | | | | | | | | 1 |
| Research and development expenditure for selected countries | | | | | | | | 1 | 1 | | | 1 | | 1 | 1 | 5 |
| Newspaper circulation per 1,000 inhabitants | | | | | | | | 1 | | | | | | 1 | 1 | 3 |
| No. of water-resources institutions | | | | | | | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | 7 |
| No. of water-resources scientists | | | | | | | | 1 | | | | | | 1 | 1 | 3 |
| Number of websites with available information on water-resources countries xx | | | | | | | | 1 | | | | | | 1 | 1 | 3 |
| Water topics in school curriculum | | | | | 1 | | | | | | | | | 1 | 1 | 3 |

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| **WWAP challenge areas: 11 Water and cities** | | | | | | | | | | | | | | | | |
| Child mortality rates: deaths per 1,000 live births | | | | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Children < 5 years: diarrheal diseases linked to inadequate water and sanitation | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Industry and commercial: $m^3$ per day | | | | | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 9 |
| Mega cities around the world | | | | | | | | 1 | | | | | | 1 | 1 | 3 |
| Proportion of urban populations with access to “improved” water supply and sanitation | | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Sanitation: access to “improved” sanitation - %, sanitation: sewer connections - %, solid waste collection - % | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| Water consumption levels: Domestic: liters per capita per day (lpcpd), water meter tariff (punitive structure aimed at reducing water thefts) | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 | |
| Water-impounding reservoirs (dams): supply volume $m^3$ per year | | | | | | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| Water source (river) distance from demand center: % > 8 km, interbasin transfer: % | | | | | | 1 | 1 | 1 | | 1 | | 1 | 1 | 1 | 1 | 8 |
| Water supply cost per liter | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 9 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WWAP challenge areas: 11 Water and cities** | | | | | | | | | | | | | | | | |
| Water supply: access to "improved" water supply - %, type by %; house connection, yard tap, public tap, unserved | | | | | | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| Water supply: unaccounted for water - % of distribution input, community-supported upgrading programs: numbers of persons/house | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| Access to "safe, convenient" sanitation - % | | | | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| Access to "safe, sufficient" water supply - % | | | | | | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| Regional and country-level breakdown of values | | | | | | | | | | | | | | | | 0 |
| Urban ecological footprint | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 15 |
| Degree of linkage | | 14 | 12 | 18 | 19 | 6 | 88 | 115 | 129 | 113 | 48 | 70 | 98 | 53 | 158 | 158 |

Indicator: 1 = KFA1: SDMPF; 2 = KFA2: SDMIF; 3 = KFA3: SFM; 4 = KFA4: SFMA; 5 = KFA5: ECDGF; 6 = KFA6: RESW; 7 = KFA7: PWR; 8 = KFA8: DEWMI; 9 = KFA9: CV IWRM; 10 = KFA10: BWSS; 11 = KFA11: SDWS; 12 = KFA12: EWSI; 13 = KFA13: LLO of DWAFS; 14 = KFA14: AMT; 15 = KFA15: IWRM in Africa for NEPAD; 16 = Degree of Linkage

*Annex 3. National state of the environment indicator set (see www.environment.gov.za/soer/neip).*

| Theme/Subtheme | National SOER Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Climate change | Greenhouse gas emissions (carbon dioxide, nitrous oxide and methane) | Water for energy |
| | Energy use (fossil fuels vs. nonfossil fuels) | |
| | Size of the national net carbon sink | |
| | Malaria: morbidity and mortality | Managing risks |
| | Mean annual temperature | |
| | Cost of carbon abatement | |
| | Cost of natural-disaster relief | Managing risks |
| | Energy intensity | Water for energy |
| Stratospheric ozone | Consumption of ozone-depleting substances | |
| | UV-B trends | |
| | Stratospheric ozone level | |
| Air quality | Ambient sulphur dioxide concentration | |
| | Ambient nitrogen dioxide concentration | |
| Species diversity | Threatened and extinct species per taxonomic group | Protecting ecosystems |
| | Endemic species per taxonomic group | Protecting ecosystems |
| | Alien (nonindigenous) species per taxonomic group | Protecting ecosystems |
| | Population trends of selected species | Protecting ecosystems |
| | Distribution and abundance of selected alien species | Protecting ecosystems |
| Habitat change | Extent of natural areas remaining | |
| | Extent of conserved areas | |
| | Disturbance regimes: fire frequency | |
| | Disturbance regimes: flood and drought | Managing risk |
| Resource value | Contribution to job creation: conservation areas | |
| | Contribution to job creation: eradication of alien species | |
| | Economic contribution of commercially utilized indigenous species | Securing food supply |
| | Economic contribution of commercially utilized freshwater species | Securing food supply |
| | Economic contribution of commercially utilized marine, coastal | and estuarine species |
| | Economic contribution of commercially utilized terrestrial species | Securing food supply |

*Annex 3.* Continued.

| Theme/Subtheme | National SOER Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Natural heritage resources | Status of natural-heritage resources | Protecting ecosystems |
| | Investment into natural-heritage resources | Protecting ecosystems |
| | Visitors to natural-heritage resources | |
| Environmental management | Multilateral environmental agreements | Governing water wisely |
| | Budgetary allocation to natural-resources management | Ensuring the knowledge base |
| | Budgetary allocation to environmental education | Ensuring the knowledge base |
| | Budgetary allocation to environmental research | Governing water wisely |
| | Inclusion of Integrated Environmental Management (IEM) into Integrated | Protecting ecosystems |
| | Development Plans and Spatial Development Initiatives | Governing water wisely |
| | Conciliation cases | Governing water wisely |
| | Voluntary adoption of environmental management systems | Governing water wisely |
| | Voluntary use of environmental accounting and reporting | Protecting ecosystems |
| | Government capacity for environmental management | Ensuring the knowledge base |
| | Environmental reporting by government departments | Ensuring the knowledge base |
| Human settlements | Green space per settlement | Managing basic needs of cities |
| | Contaminated land per settlement | |
| | Housing density | Managing basic needs of cities |
| | Urban/Rural population | |
| | Proportion of urban area in South Africa | |
| Vulnerability | GDP/capita | Ensuring the knowledge base |
| | Life expectancy | |
| | Adult literacy rate | Energy |
| | Employment rate | Managing basic needs of cities |
| | Population growth rate | |
| | HIV/AIDS incidence | Managing basic needs of cities |
| | Household energy use | |
| | Access to water | |
| | Access to sanitation | |

*Annex 3.* Continued.

| Theme/Subtheme | National SOER Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Land use | Land cover | Securing food supply |
| | Land productivity versus potential | |
| Land condition | Desertification | Securing food supply |
| | | Protecting ecosystems |
| | Soil loss | Securing food supply |
| | | Protecting ecosystems |
| | Soil acidification | Securing food supply |
| | | Protecting ecosystems |
| | Soil salinization | Protecting ecosystems |
| | | Securing food supply |
| | Land degradation | Protecting ecosystems |
| | | Securing food supply |
| | Persistent organic pollutants | Protecting ecosystems |
| Marine resource management | Catches and maximum sustainable yield per fishery sector | |
| | Distribution and abundance of resource species | |
| | Catch per unit effort per fishery sector | |
| | Commercial fishing rights supporting small, medium and micro-enterprises (SMME) development | |
| Resource quality | Estuarine Health Index (State of South African estuaries) | |
| | Pollutant loading entering the seas from land-based sources | Protecting ecosystems |
| | Blue flag beaches | |
| | Concentrations of heavy metals in sediments or biological tissues | |
| | Oil-pollution accidents along the coast | |
| | Land cover change in the coastal zone | |
| | Population density change in the coastal zone | |

*Annex 3.* Continued.

| Theme/Subtheme | National SOER Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Waste generation | General waste produced per income group per year | |
| | General waste produced per capita per year | |
| | Hazardous waste produced per sector per year | |
| Waste reduction | Waste recycling | |
| | Value of waste recycled | |
| | General waste correctly disposed through landfill | |
| | Hazardous waste correctly disposed | |
| | Available landfill lifespan | |
| | Provincial expenditure on waste management | |
| | Provincial waste-collection capacity | |
| Water quantity | Intensity of use of surface-water resources | Meeting basic needs; energy; cities; securing food supply |
| | Intensity of use of groundwater resources | Meeting basic needs; water for industry; securing food supply |
| | Total surface water used per sector | Water for industry; meeting basic needs; cities; securing food supply |
| | Total groundwater used per sector | Water for industry; meeting basic needs; securing food supply |
| | Total surface water resources per capita | Meeting basic needs; water for industry; securing food supply; energy |
| | People dependent on groundwater resources | Meeting basic needs |
| | Securing food supply | |
| | Surface water affordability | Meeting basic needs |
| Water quality | Surface water salinity | Protecting ecosystems |
| | | Securing food supply |
| | Groundwater salinity | Securing food supply |
| | | Meeting basic needs |
| | Surface-water nutrients | Protecting ecosystems |
| | Groundwater nutrients | Protecting ecosystems |
| | Surface-water microbiology | Meeting basic needs |
| | | Water for industry |
| | Groundwater microbiology | Meeting basic needs |
| | Surface-water toxicity | Protecting ecosystems |
| | | Water for industry |

*Annex 3.* Continued.

| Theme/Subtheme | National SOER Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Freshwater ecosystem integrity | Riparian vegetation | Protecting ecosystems |
| | Aquatic macro-invertebrate composition | Protecting ecosystems |
| | Health of fish community | Protecting ecosystems |
| | Integrity of aquatic habitat | Protecting ecosystems |

*Annex 4. Northwest province state of the environment indicator set (see www.nwpg.org.zal/soer).*

| Issue | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Climate change | Greenhouse gases emissions (carbon dioxide, nitrous oxide and methane) | |
| | Energy use (fossil fuels vs. nonfossil fuels) | |
| | Mean annual temperature | |
| | Cost of natural-disaster relief | Managing risks |
| | Energy intensity | Water and energy |
| Stratospheric ozone | Consumption of ozone depleting substances | |
| | UV-B trends | |
| Air quality | Ambient Sulphur Dioxide Concentration | |
| | Ambient Nitrogen Dioxide Concentration | |
| Species diversity | Threatened and extinct species per taxonomic group | Protecting ecosystems |
| | Endemic species per taxonomic group | Protecting ecosystems |
| | Alien (nonindigenous) species per taxonomic group | Protecting ecosystems |
| | Population trends of selected species | Protecting ecosystems |
| | Distribution and abundance of selected alien species | Protecting ecosystems |
| Habitat change | Extent of conserved areas | |
| | Extent of natural areas remaining | |
| | Disturbance regimes: fire frequency | |
| | Disturbance regimes: flood and drought | Managing risk |
| Resource value | Contribution to job creation: conservation areas | |
| | Contribution to job creation: eradication of alien species | |
| | Economic contribution of commercially utilized indigenous species | Securing food supply |
| | Economic contribution of commercially utilized freshwater species | Securing food supply |
| | Economic contribution of commercially utilized marine, coastal and estuarine | |
| | Economic contribution of commercially utilized terrestrial species | Securing food supply |

*Annex 4.* Continued.

| Issue | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Natural heritage resources | Status of natural-heritage resources | Protecting ecosystems |
| | Investment into natural-heritage resources | Protecting ecosystems |
| | Visitors to natural heritage resources | |
| | Budgetary allocation to natural resource management | Governing water wisely |
| | Budgetary allocation to environmental education | Ensuring the knowledge base |
| | Budgetary allocation to environmental research | Ensuring the knowledge base |
| | Inclusion of Integrated Environmental Management (IEM) into Integrated Development Plans (IDPs) and Spatial Development Initiatives (SDIs) | Governing water wisely |
| | Conciliation Cases | Protecting ecosystems |
| | Voluntary adoption of environmental management systems | Governing water wisely |
| | Voluntary use of environmental accounting and reporting | Protecting ecosystems |
| | Government capacity for environmental management | Governing water wisely |
| | Environmental reporting by government departments | Protecting ecosystems |
| | | Ensuring the knowledge base |
| | | Ensuring the knowledge base |
| | | Ensuring the knowledge base |
| Human settlements | Green space per settlement | |
| | Contaminated land per settlement | Managing basic needs |
| | Housing density | |
| | Urban/rural population | |
| | Size of urban area | Water and cities |
| Vulnerability | GDP/capita | |
| | Life expectancy | |
| | Adult literacy rate | Ensuring the knowledge base |
| | Employment rate | |

*Annex 4.* Continued.

| Issue | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| | Population growth rate | |
| | HIV/AIDS incidence | |
| | Household energy use | Water and energy |
| | Access to water | Managing basic needs |
| | Access to sanitation | Managing basic needs |
| Land use | Land cover | |
| | Land productivity versus potential | Securing food supply |
| Land condition | Desertification | Securing food supplyProtecting ecosystems |
| | Soil loss | Securing food supplyProtecting ecosystems |
| | Soil acidification | Securing food supplyProtecting ecosystems |
| | Soil salinization | Securing food supplyProtecting ecosystems |
| | Land degradation | Securing food supplyProtecting ecosystems |
| | Persistent organic pollutants | Securing food supplyProtecting ecosystems |
| Waste generation | General waste produced per income group per year | |
| | General waste produced per capita per year | |
| | Hazardous waste produced per sector per year | |
| Waste reduction | Waste recycling | |
| | Value of waste recycled | |
| | General waste correctly disposed | |
| | Hazardous waste correctly disposed | |
| | Available landfill lifespan | |
| | Municipal waste management expenditure | |
| | Municipal kerb-side collection capacity | |

*Annex 5. City of Cape Town state of the environment indicator set (see www.capetown.gov.za).*

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Air quality and atmosphere | Annual average levels for key atmospheric pollutants: $SO_2$, $NO_2$, $PM_{10}$, $O_3$ and Pb | |
| | Exceedance of WHO and UK guidelines for $SO_2$, $NO_2$, $PM_{10}$ and $O_3$. | |
| | Number of complaints registered. | |
| | Number of notices served. | |
| | Number of successful prosecutions. | |
| | Number and intensity of air pollution days per annum. | |
| | Number of air-pollution events | |
| | Levels of $PM_{10}$ (visibility measurement). | |
| | Tonnage of emissions in the City of Cape Town (CCT.) | |
| Inland waters | Ecological Status Class of selected rivers and wetlands | Protecting ecosystems |
| | Algae blooms in Unicity Vleis | Protecting ecosystems |
| | Proportion of treated effluent reused | Governing water wisely |
| | Water quality summary statistics for key parameters (total nitrogen, total phosphorus, chlorophyll -a and fecal coliforms) | Protecting ecosystems |
| | Water demand per annum ($m^3$) | Water and citiesWater and industry |
| | Percentage of full supply capacity of the dams supplying the CCT with raw water for treatment | Sharing water resources |
| | Household water source | Meeting basic needs |
| | Percentage population served with safe and adequate water supply | Meeting basic needs |
| | Health of selected rivers based on South African scoring systems (SASS4) for monitoring invertebrates | Protecting ecosystems |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| | Total water inflow as a proportion of total storage capacity | Governing water wisely |
| | Rate of infrastructural development (meters and monitoring) | Governing water wisely |
| | Water-balance determinations | Governing water wisely |
| | General water quality of inland aquatic ecosystems | Protecting ecosystems |
| | Assessment of the fitness for use of inland aquatic ecosystems | Governing water wisely |
| | Bacteriological status of rivers and vleis in the CCT | Governing water wisely |
| | Capacity of wastewater treatment works | Governing water wisely |
| | Qualities, types and dilution ratios of industrial effluent entering sewage works and ocean outflows | Protecting ecosystems |
| | Sludge and by-product management | Governing water wisely |
| | Water use by sector | Water and industry |
| | Annual demand as proportion of available resources | Governing water wisely<br>Water and industry;<br>Water and cities;<br>Sharing water resources |
| Coastal waters | Area of coastline conserved (% of total) | |
| | Contaminant levels of heavy metals in mussels (at 35 sampling points) | |
| | Exceedance of DWAF guidelines for fecal coliform counts in coastal waters (at 47 sampling sites) | Protecting ecosystems |
| | Area of dune or other coastal habitats disturbed or lost each year | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Environmental | Percentage of population with safe and accessible drinking water | Meeting basic needs |
| Health | Percentage of population served with safe and adequate sanitation | Meeting basic needs |
| | Percentage of population with adequate sanitation | Meeting basic needs |
| | Tobacco smoke: complaints, notices and prosecutions | |
| | Noise pollution | |
| | Infant mortality rate (per 1 000 births) | |
| | Meningoccal meningitis rate | |
| | Tuberculosis rate | |
| | HIV/AIDS | |
| | Teenage births | |
| | Environmental pollution | |
| | Food safety (with particular reference to chemical sampling) | |
| | Exceedance of WHO guidelines for Pb, $SO_2$, $NO_2$ and UK guidelines for $PM_{10}$ | |
| | Exceedance of WHO guidelines for *E.coli*. | |
| | Number of toxic algal blooms | Governing water wisely |
| | Exceedance of the bacteriological standards as specified in the foodstuffs, cosmetics and disinfectants (1972) for packaged milk and milk sold in bulk tanks | |
| | Percentage of population living with adequate housing | |
| | Percentage of the population with access to public health-care facilities | |
| | Number of reported respiratory problems due to air pollution | |
| | Industrial health rating (formal and informal sector) | |
| | Awareness campaign measurements | |
| | Bacteriological monitoring of prepared foods | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Biodiversity and soil | Area of land within the CCT having formal conservation status | |
| | Number of conservation areas proclaimed vs. number of conservation areas managed | |
| | Loss of habitat and biodiversity | |
| | Number of extinct species | |
| | Number of children exposed to environmental education through conservation areas | Ensuring the knowledge base |
| | Number of hectares cleared of alien vegetation by the city's open space and nature conservation branches | |
| | Current status and number of Red Data Book species | |
| | Area remaining for each habitat and/or vegetation type | |
| | Presence and change of selected indicator species | |
| | Loss of arable land (ha/annum) | Securing food supply |
| | Soil loss through development (ha/annum) | Securing food supply |
| | Area of mining activities in a given area (ha/annum) | |
| | Cumulative area mined (ha/annum) | |
| | Urbanization, urban form and housing | |
| | Percentage population without housing | |
| | Urban housing type profile | |
| | Average travel distance for all commuter trips | |
| | Total person trips in km per day per head of the population | |
| | Public housing availability (proportion eligible who are not in public housing) | |
| | Annual population growth (absolute number and percentage) | |
| | Number of amendments beyond the urban edge: change of land use from open space, agricultural rural to other) | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| | Expansion of urban edge (in $km^2$) | |
| | Number of constructions completed | |
| | Average distance per capita to key amenities and facilities | |
| | Number of mixed-use rezoning approvals | |
| | Percent of nonurban land in the CCT | |
| | Green area per capita (ha/person) | |
| | Area of CCT that has formal status as Metropolitan Open Space System (MOSS) | |
| Infrastructure | Households receiving refuse-removal services | |
| | Sanitation availability (type) | Meeting basic needs |
| | Water availability by source | Meeting basic needs |
| | Telephone availability (as a %) | |
| | Number of dwellings that do no have access to drinking water within 50 m of the dwelling | Meeting basic needs |
| Transport | Vehicles per 1, 000 persons | |
| | Number of private motor vehicles entering the Cape Town Central Business District (CBD) | |
| | Modal split percentages (public vs. private transport) | |
| | Modal split percentages (road vs. rail-based transport and public vs. private transport) | |
| | Passenger kilometers traveled divided by seat-kilometer per mode | |
| | Transport to/from work by mode | |
| | Public subsidies for public transport for all modes | |
| | Safety and security of public transport | |
| | Total number of accidents | |
| | Number of fatalities | |
| | Percentage of casualties and fatalities involving pedestrians | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| | Total tonnage of cargo moved per annum | |
| | Number of containers (Twenty Foot Equivalent Unit - TEUs) moved as a proportion of capacity | |
| | Number of international flights arriving per annum | |
| | Million passengers per annum (mppa) | |
| | Public transport seats per 1, 000 persons | |
| | Percentage income spent on public transport | |
| | Number of commuters using public transport to schools | |
| | Inadequacy of public-transport network (using demand and supply ratio) | |
| | Commuters by public transport for private purposes | |
| | Average daily traffic (ADT) volumes per selected point | |
| | Time-volume of private vehicles proportional to capacity at selected points on the road | |
| | Air traffic movement per annum as a proportion of capacity | |
| | Total passengers per annum as a proportion of capacity | |
| Energy | Percentage of (un) electrified homes | |
| | Cost of electricity (in cents/kWh) | |
| | Safety rating for the Koeberg Nuclear Power Station | |
| | Number of reported leakages of radioactive material per annum | |
| | Type and quantity of fuel sold | |
| | Proportion of electricity used that was supplied by Koeberg | Water and energy |
| | Amount of radioactive waste generated by Koeberg Nuclear Power Station | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Waste | Volume of waste received at the landfills (t/a) | |
| | Available air space in existing landfill sites | |
| | Space available in hazardous waste disposal facilities | |
| | Percentage of waste recycled and reused | |
| | Amount of nuclear waste generated by Koeberg | |
| | Volume of waste received at the incineration facilities (t/annum) | |
| | Volume of medical waste received at the incinerators as a percentage of estimated medica waste generated | |
| | Capacity of wastewater treatment works | Protecting ecosystems |
| | Quantities, types and dilution ratios of industrial effluent entering sewage works and ocean outflow | Protecting ecosystems |
| | Percentage of sewage sludge reused | |
| | Number of complaints from a known sample of residents in an area | |
| | Total number of waste complaints | |
| | Hazardous waste generation compared to amount being disposed through formal facilities | |
| | Number of incidents associated with medical waste | |
| | Illegal dumping cleared per administrative area | |
| | Tonnage of illegal dumping | |
| | Illegal dumping cleared per administrative area (t) | |
| | Ratio of reports to convictions | |
| | Cost of remediation by each administrative area per annum for street sweeping and litter collection (R) | |
| | Social surveys to find out litter problems | |
| | Quantity and type of litter in seven catchment areas | |
| | Number of schools involved in litter projects | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Economy | Total output as Gross Geographic Product (GGP) by sector | |
| | Annual growth in real output by sector | |
| | Percentage of labor force: professional, skilled, semiskilled and/or low-skilled | |
| | Percentage of labor force: unemployed, formally employed or in the informal sector | |
| | Total number or percentage of people unemployed | |
| | Percentage of the population in poverty (household- subsistence level) | |
| | (Un) employment in formal and informal sectors (number and percentage) | |
| | Number of new registered businessesNumber of international tourists visiting the CCT | |
| | Vulnerability index (composite of individual indicators relating to infrastructure, poverty, | |
| | welfare, jobs, space and livelihoods) or levels of living per suburbsAverage per capita income in the | |
| | CCTTotal value of imported and exported good (trade balance)Number of micro-, small- and | |
| | medium-sized businesses | |
| Education | Number of schools per 1, 000 persons | |
| | Pupil: teacher ratiosLiteracy rates | |
| | Expenditure on infrastructure and instruction personnel per student | |
| | Enrolment rates for primary, secondary and tertiary educational institutions | |
| Safety and security | Incidence of violent crime (murder, attempted murder and robbery with aggravating circumstances) | |
| | Incidence of property-related crime (all forms of burglary and theft, including stock theft and car theft) | |
| | Incidence of social fabric crimes (rape, assault causing grievous bodily harm and common assault) | |
| | Vehicle theft (including carjacking) | |

*Annex 5.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Environmental Governance | Number of EIA applications (scoping reports) per year | Governing water wisely; protecting ecosystems |
| | Number of reports up to full EIAs per year | Governing water wisely<br>Protecting ecosystems |
| | Number of people committed by local government to environmental management | Governing water wisely; protecting ecosystems |
| | Amount allocated by local government to environmental awareness raising (R/annum) | Ensuring the knowledge base |
| | Percentage of Council's budget allocated to environmental management | Governing water wisely |
| | Total number of persons committed (employed) for environmental management purposes | Governing water wisely |

*Annex 6. Rand water catchment diagnostic framework indicator set.*

| Theme/Subtheme | Catchment diagnostic indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Resource condition | 1DWAF reservoir capacity as a percentage of total water available | Sharing water |
| | 2Integrity of the indigenous fish species assemblage (%) | Protecting ecosystems |
| | 3Total suspended solids (TSS) loading at the downstream point as a percentage of catchment sediment yield | Protecting ecosystems |
| | 4Percentage of DWAF- regulated reservoirs with chlorophyll-a exceeding 30 ìg $l^{-1}$ | Protecting ecosystems |
| | 5Algal growth potential at the downstream point (mg $l^{-1}$) | Protecting ecosystems |
| | 6SASS4 at the downstream point (SASS score; ASPT) | Protecting ecosystems |
| | 7 Daphnia toxicity test at the downstream point (% survival) | Protecting ecosystems |
| Socioeconomic | 8Population density (persons/$km^2$) | Meeting basic needs |
| | 9Urbanization (%) | Water and cities |
| | 10 Catchment population as a proportion of the maximum sustainable population (%) | Meeting basic needs |
| | 11Proportion of households earning less than R6, 000 per annum (%) | Meeting basic needs |
| | 12Households without access to piped water on site (%) | Meeting basic needs |
| | 13Households without access to toilet facilities (%) | Meeting basic needs |
| | 14 Water services index (WSI) | Meeting basic needs |
| | 15 Sanitation service level index (ssi) | Meeting basic needs |
| | 16Health-related index for potable water (% score) | Meeting basic needs |
| | 17 Recreational index for raw water (% score) | Meeting basic needs |

*Annex 6.* Continued..

| Theme/Subtheme | Catchment diagnostic indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Water quantity | 18 Total water available per capita ($m^3$ $cap^{-1}$ $annum^{-1}$) | Meeting basic needs |
| | 19 Anthropogenic supply as a proportion of total supply (%) | Meeting basic needs; governing water wisely; sharing water resources |
| | 20 Change in flow at the downstream point (% difference from MAR) | Protecting ecosystems |
| Water quality | 21Conductivity at the downstream point (mS $m^{-1}$) | Protecting ecosystems |
| | 22Chemical oxygen demand at the downstream point (mg $l^{-1}$) | Protecting ecosystems |
| | 23 Fecal coliforms at the downstream point (no. $100ml^{-1}$) | Meeting basic needs |
| | 24Phosphates at the downstream point (mg $l^{-1}$) | Protecting ecosystems |
| | 25Nitrates at the downstream point (mg $l^{-1}$) | Protecting ecosystems |
| | 26Total liquid waste discharged as a proportion of supply (%) | Governing water wisely |
| | 27Hydraulic capacity index of water-care works ($HCI_{wcw}$) (%) | Governing water wisely |
| | 28Organic load capacity index of water-care works ($OLI_{wcw}$) (%) | Governing water wisely |
| | 29Effluent compliance index of water-care works ($ECI_{wcw}$) (%) | Governing water wisely |
| Management | 30Number of active hydrological monitoring stations per 100 $km^2$ (100 $km^{-2}$) | Governing water wisely |
| | 31Number of water quality monitoring points per 100 $km^2$ (100 $km^{-2}$) | Governing water wisely |

*Annex 7. Generic catchment water resource sustainability indicator set (Walmsley 2003).*

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Socioeconomic indicators | Population density | Driver |
| | Urbanization | Driver |
| | Gross geographic product per capita | Driver |
| | Human development index | Driver |
| | Water equity coefficient | Sharing water resources |
| | Percentage of households without access to water within 200 m | Meeting basic needs |
| | Percentage of households without access to sanitation | Meeting basic needs |
| | Percentage area under different economic land uses | Driver |
| Water balance indicators | Mean volume of precipitation on to the catchment | Driver |
| | Total water available per capita | Sharing water wisely |
| | Demand as a proportion of total available | Sharing water wisely |
| | Proportion of groundwater utilized | Governing water wisely |
| | Water requirements per sector as a percentage of total available | Sharing water wisely;water and industry |
| Waste and pollution indicators | Amount of solid waste generated per square kilometer | Protecting ecosystems |
| | Proportion of waste generated per sector | Protecting ecosystems |
| | Liquid waste discharged from point sources as a proportion of total available | Protecting ecosystems |
| | Loading of P, N, POPs and TDS from agricultural runoff | Protecting ecosystems |
| | Loading of P and N from dense settlements | Protecting ecosystems |
| | Loading of TDS and $SO_4$ from mine drainage | Protecting ecosystems |
| | Conductivity at the lowest point in the geographical catchment | Protecting ecosystems |
| | P and N concentrations at the lowest point in the geographical catchment | Protecting ecosystems |
| | Fecal coliforms in the major water resource for domestic and recreational use | Managing risk |
| | Daphnia toxicity test at the lowest point in the geographical catchment | Protecting ecosystems |
| | Turbidity at the lowest point in the geographical catchment or the inflow to the main reservoir | Protecting ecosystems |
| | Proportion of boreholes contaminated | Protecting ecosystems |

*Annex 7.* Continued.

| Theme/Subtheme | Indicator | Linkage to WWAP challenge areas |
|---|---|---|
| Resource condition indicators | Percentage of catchment area covered by natural vegetation and by alien vegetation | Protecting ecosystems |
| | South African scoring system (SASS) scores at selected sites | Protecting ecosystems |
| | Fish assemblage integrity index (FAII) in selected reaches | Protecting ecosystems |
| | Index of habitat integrity in selected reaches | Protecting ecosystems |
| | Riparian vegetation index in selected reaches | Protecting ecosystems |
| | Percentage wetland area | Protecting ecosystems |
| Management indicators | Index of level of CMA establishment in the catchment | Governing water wisely |
| | State of satisfaction | Sharing water resources |
| | Volume of water allocated as a proportion of total water available | Governing water wisely |
| | Water use efficiency for different sectors | Sharing water resources |
| | Percentage unaccounted for water in the catchment | Governing water wisely |
| | Ratio of sub-catchments for which the Ecological Reserve has been set to total number of sub-catchments | Protecting ecosystems |
| | Ratio of sub-catchments for which reliable hydrological data are available to total number of sub-catchments | Governing water wisely |
| | Ratio of sub-catchments for which reliable water quality data are available to total number of sub-catchments | Governing water wisely |
| | Number of official resource condition reports per annum | Ensuring the knowledge base |

*Annex 8. List of reports currently produced by DWAF.*

| Name of report | Description of report | Publisher | Contact details |
|---|---|---|---|
| State of the sector | A top-management-level report summarizing the main themes of interest across the water sector | WS | F van Zyl |
| SA water resources and services perspective | Water services perspective booklet | WS | F van Zyl |
| 4th Economic and social rights protocols: Environment | Everyone has the right to an environment that is not harmful to their health or well-being; and the right to have the environment | SAHRC | S van der Westhuizen |
| 4th Economic and social rights protocols: Access to sufficient water | Everyone has the right to have access to sufficient water. The state is obliged to respect, promote and fulfill this right | SAHRC | S van der Westhuizen |
| Executive visits to projects and schemes | From time to time, the top management of DWAF visits water schemes | WS | F van Zyl |
| National transfer plan | The overall plan of the transfer program | Transfers | |
| Masibambane quarterly report | A report on the performance of aspects of the water and sanitation sector, with particular focus on donor funding | | |
| Water services information system | The web site created by D: Macro Planning for the Water Services Chief Directorate of DWAF | WS | F van Zyl |
| A guide to groundwater in SA | Information on groundwater in SA | WS | F van Zyl |
| A guide to communities and their groundwater supply | Information on communities and their water needs | WS | F van Zyl |
| DWAF capital works monitoring and evaluation (M&E) report | Web-based M&E | M&E | DWAF home page |
| National WSDP submission summary | WSDP presented in graphics and tables | WS | F van Zyl |
| WSDP detailed report | Detailed report on WSDP | WS | F van Zyl |
| DWAF annual report | The annual report of DWAF to parliament | DWAF | DWAF home page |
| Working for Water Annual Report | Progress report for WFW | DWAF | Web page : WFW |
| Annual reports of parastatals with DWAF review comments | HSRC, CSIR, etc. | | |

*Annex 8.* Continued.

| Name of report | Description of report | Publisher | Contact details |
|---|---|---|---|
| Policies in preparation | Virtual | | |
| Briefings to parliament | Briefings to parliament on request | Local Government | |
| Briefings to provincial heads | Briefings to provincial heads on request | | |
| Briefings on topical issues - DWAF initiative | DWAF briefings | | |
| DWAF annual budget | DWAF's annual budget to be presented to parliament | | |
| Topical items of interest to the public | Virtual on request | | |
| International visit briefings: agenda, content, DWAF view | International visit report back | A Hugo | |
| Major capital works reporting | Major works reporting | Metsi Consultants | Dr. Jackie King |
| Review of levies and tariffs | Available on the web | Wessel Steyn | |
| HR reporting on senior management appointments | DWAF management appointments | | |
| Board appointments of parastatals | HSRC, CSIR etc. Appointments | | |
| DWAF strategic plan | Strategy | DWAF | F Van Zyl |
| Budget early warning system | Early warning expenditure | MC Maredi | National Treasury 3367241 |
| Public Service Commission Monitoring and Evaluation System | M&E | Public Service Commission | |
| Social cluster report to parliament | A report submitted to the Parliamentary Social Cluster [Standing Committee] | Social Sector Cluster Secretariat | |
| ISRDP monthly reporting | A report published on the ISRDP web page each month | DPLG | www.dplg.gov.za\speaches |
| Agenda 21 | United Nations' decisions in Rio De Janeiro | UN | |
| Government gazette (EIMP) | The first edition of the EIMP DWAF implementation and management plan of impact on environment | Government Gazette | No. 22929 |
| Water services operations monitoring | Monitoring to ensure that DWAF can meet its sectoral responsibility to monitor the operations of the water-services sector | | |

*Annex 8.* Continued.

| Name of report | Description of report | Publisher | Contact details |
|---|---|---|---|
| Water services exception monitoring | Incident reporting for early warning of any exceptional circumstances in water monitoring | | |
| WSP Reporting to DWAF regions | Reporting | | |
| WSA Reporting to DWAF | Authorities reporting to DWAF | DWAF | DWAF home page |
| Report on funding to local authorities as required by DORA | Sponsor on funding reporting | | |
| HR component of transfer package | The HR component of the reporting package that supports transfer | | |
| Asset component of transfer package | The asset component of the reporting package that supports transfer | | |
| Land component of transfer package | The land component of the reporting package that supports transfer | | |
| Legal component of transfer package | The legal component of the reporting package that supports transfer | | |
| DWAF quarterly report to Lekgotla | The report given by the minister to the quarterly Lokgotla, preceded by the discussion of the same report by the DG. | DWAF | Thiebaut x7635 |
| Annual report on [first edition] Environmental and management plans (EIMP) | Reporting in terms of the National Environmental Management Act (NEMA) against the Environmental Implementation and Management | DWAF | DWAF home page |
| DWAF annual reports on progress with the implementation of Agenda 21 to DEAT | Reporting in terms of the UN Commission for Sustainable Development (via DEAT) | | |
| Quarterly financial report | A report from Finance to MANCO giving an overview of DWAF's finances. | DWAF | www.pwv.gov.za.me |
| Annual financial report to Treasury Treasury.to the Treasury | The fourth quarterly report for each year is also the annual report to the Treasury. | DWAF | www.dwaf.go/finance/\to the |
| State of forestry | Top-level-overview report of the forestry sector | | |

*Annex 8.* Continued.

| Name of report | Description of report | Publisher | Contact details |
|---|---|---|---|
| Water-quality management series: quarterly status report: [Upper Vaal] water-management area | This report provides an overview of the Water Quality Objectives for the sub-catchments of the [Upper Vaal] water management area | DWAF | 012 392 1361 |
| Children's Report [Get actual name] | An overview of SA's children | Rights of children in the Presidency | 012 337 5216 |
| World Water Development Report | The main report of the World Water Assessment Programme | UN | www.unesco.org/water/wwap |
| National Water Development Report | A report requested from each country by the WWAP. In the case of South Africa, the first NWDR due in December 2003. | | |
| African Water Development Report | A continental version of the WWDR. | | |
| Estimates of national expenditure | A report summarizing the planned expenditure for the whole national-level government, with inputs from DWAF. | DWAF | Home page |
| Multiyear strategic framework | The planning framework, which drives the production of the MTEF. | DWAF | Home page |
| Measuring rural development | STATS SA's overview document. | Stats SA | www.statssa.gov.za |
| Auditor General's report | Each report of the Auditor General on an aspect of DWAF's work requires major analysis by DWAF, e.g., the Environmental Aspects report | DWAF | www.dwaf.gov.za/document/environmental |
| State of the Rivers report | Various reports on the state of SA's rivers | CSIR | www.csir.co.za/rhp |
| Masibambane Annual report | Normally produced on a CD as a set of components | DWAF | Home page |
| Covering letter to the submission [of options] to Treasury | This covering letter contains significant amounts of tabular information about budgets and related items | | |
| Child labor action plan | Green papers for departmental comments | Green Paper | |
| State of the environment | Environmental report | | |
| State of SA population | SA Population report | | |
| Water bill (England) | England's Water Bill | European Convention on Human Rights | www.defra.gov.uk/environment/water/legislation |

*Annex 8.* Continued.

| Name of report | Description of report | Publisher | Contact details |
|---|---|---|---|
| Guidelines for compulsory national standards | South African standards | DWAF | Home page |
| Overview of water resources in SA | An overview of water resources in SA | DWAF | 012 338 7500 |
| Final report: WaterDome World Summit on Sustainable Development | The World Summit On Sustainable Development Report | IWMI | |
| Position papers Water Summit | The planning of investment link infrastructure provision | | |
| Strategic framework for water services | The strategic framework sets out a comprehensive approach to the provision of water services in SA. | | |

*Annex 9. List of DWAF indicators.*

| Indicator | Source of data/information/report | Date |
|---|---|---|
| % of funds spent on community management costs | DWAF capital projects M&E | 2001/03/01 |
| % of funds spent on construction | DWAF capital projects M&E | 2001/03/01 |
| % of funds spent on project agent/consultant cost | DWAF capital projects M&E | 2001/03/01 |
| % of funds spent on training agent costs | DWAF capital projects M&E | 2001/03/01 |
| Acceptability of level of service and payment of O&M (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Access to basic sanitation infrastructure | DWAF annual report | |
| Account information vs. supply costs | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Actual construction cost | DWAF capital projects M&E | 2001/03/01 |
| Actual consumption (l/capita/day) | DWAF capital projects M&E | 2001/03/01 |
| Actual cost | DWAF PMISS | 2000/06/01 |
| Actual cost of transfers | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Actual expenditure vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Actual labor cost | DWAF capital projects M&E | 2001/03/01 |
| Actual no. of days (employment) | DWAF capital projects M&E | 2001/03/01 |
| Additional funds description | DWAF capital projects M&E | 2001/03/01 |
| Adequacy of reserve fund (no. of months) | DWAF capital projects M&E | 2001/03/01 |
| Adjustment budgets vs. original budget | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Administrative/financial training complete | DWAF capital projects M&E | 2001/03/01 |
| Affordable access to water | DWAF annual report | |
| Agreement approval progress per agreement type | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Amount (to be defined) | DWAF capital projects M&E | 2001/03/01 |
| Approval of transfer progress: DG, Minister, Council | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Asset register component evaluation: Numbers, age, condition | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Asset survey completed | DWAF capital projects M&E | 2001/03/01 |
| Availability of maps/geographic information | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Average cost of household contribution | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Average cost per upgraded toilet | DWAF capital projects M&E | 2001/03/01 |
| Baseline cost | DWAF Programme Management Information Support System (PMISS) | 2000/06/01 |
| Budget allocation per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Budgeted cost | DWAF PMISS | 2000/06/01 |
| Business area plan approved | DWAF capital projects M&E | 2001/03/01 |
| Business plan approved by DWAF | DWAF capital projects M&E | 2001/03/01 |
| Business plan approved by PSC | DWAF capital projects M&E | 2001/03/01 |
| Business plan conditionally approved | DWAF capital projects M&E | 2001/03/01 |
| Business plan submitted to DWAF | DWAF capital projects M&E | 2001/03/01 |
| Capital expenditure on water and sanitation | DWAF annual report | |
| Certified | DWAF capital projects M&E | 2001/03/01 |
| Certified cost | DWAF PMISS | 2000/06/01 |
| Collection vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Completion certified | DWAF capital projects M&E | 2001/03/01 |
| Conformance to level of service agreement | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Construction (training) | DWAF capital projects M&E | 2001/03/01 |
| Construction 100% completed | DWAF capital projects M&E | 2001/03/01 |
| Contract cost | DWAF capital projects M&E | 2001/03/01 |
| Contract summary: formulated | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Contract summary: signed with times | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Contractor/labor training complete | DWAF capital projects M&E | 2001/03/01 |
| Contractor appointed | DWAF capital projects M&E | 2001/03/01 |
| Course content vs. standards required (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Criteria formulated vs. met | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Current delivery (Ml/day) | DWAF capital projects M&E | 2001/03/01 |
| Demand (l/capita/day) | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Demonstration toilets constructed | DWAF capital projects M&E | 2001/03/01 |
| Design approved by IA / DWAF | DWAF capital projects M&E | 2001/03/01 |
| Designs complete | DWAF capital projects M&E | 2001/03/01 |
| Distribution/reticulation completed | DWAF capital projects M&E | 2001/03/01 |
| Duration of breaks (days) | DWAF capital projects M&E | 2001/03/01 |
| DWAF budget financial delegations vs. planned funding (for transfer) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Earned value | DWAF PMISS | 2000/06/01 |
| Effectiveness of Health & Hygiene Programme(1–5) | DWAF capital projects M&E | 2001/03/01 |
| Employment | DWAF PMISS | 2000/06/01 |
| Empowerment/Capacity-building | DWAF PMISS | 2000/06/01 |
| Environment impact assessment complete | DWAF capital projects M&E | 2001/03/01 |
| Estimated cost at completion (ECAC) | DWAF PMISS | 2000/06/01 |
| Estimated cost of staff required per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Estimated cost of water supplied (R/kl) | DWAF capital projects M&E | 2001/03/01 |
| Estimated vs. actual income | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Excess revenue | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Extent of project completion | Nodal level Monitoring, Evaluation and Reporting (ME&R) system document | 2001/04/01 |
| Final capacity (Ml/day) | DWAF capital projects M&E | 2001/03/01 |
| Forecasted estimates of a range of technical indices | DWAF PMISS | 2000/06/01 |
| Funds available for transfer vs. planned funding | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Funds delayed | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Funds withheld | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Health & Hygiene Awareness Campaign initiated | DWAF capital projects M&E | 2001/03/01 |
| Identification of cost-recovery system (yes/no) | DWAF capital projects M&E | 2001/03/01 |
| Identification of manpower and training requirements | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Implementing agent appointed | DWAF capital projects M&E | 2001/03/01 |
| Institution responsible for delivery | DWAF capital projects M&E | 2001/03/01 |
| Issues affecting funding | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Labor desk established | DWAF capital projects M&E | 2001/03/01 |
| Land transfer vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Latrine building program 100% complete | DWAF capital projects M&E | 2001/03/01 |
| Latrine building program 25% complete | DWAF capital projects M&E | 2001/03/01 |
| Latrine building program 50% complete | DWAF capital projects M&E | 2001/03/01 |
| Latrine building program 75% complete | DWAF capital projects M&E | 2001/03/01 |
| Level of capacity of municipalities within node | Nodal level ME&R system document | 2001/04/01 |
| Level of community awareness (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of decision making at APF level (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of decision making at PSC level (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of decision making at TLC level (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of initiative and responsibility demonstrated by the community (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of representation of PSC (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Level of user commitment to pay (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Local management capacity (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Maintenance and admin. cost (R/kl) | DWAF capital projects M&E | 2001/03/01 |
| Maintenance costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Milestone actual date | DWAF PMISS | 2000/06/01 |
| Milestone baseline date | DWAF PMISS | 2000/06/01 |
| Milestone planned date | DWAF PMISS | 2000/06/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Monitoring of amount transferred vs. planned. | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| National: forecasted estimates of a range of cost indicators | DWAF PMISS | 2000/06/01 |
| Negotiation phase: per individual | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Negotiation phase: per receiving institution | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Negotiation phase: per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Negotiation phase: per union | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Planned and actual no. of employees redeployed | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Planned and actual no. of employees retrenched | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Planned and actual no. of employees seconded | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Estimated and actual no. of employees taking severance packages | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Planned and actual no. of employees transferred | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| No. of persons | DWAF capital projects M&E | 2001/03/01 |
| No. of persons (temporary employment) | DWAF capital projects M&E | 2001/03/01 |
| No. of persons served (sanitation) | DWAF capital projects M&E | 2001/03/01 |
| No. of persons served (water) | DWAF capital projects M&E | 2001/03/01 |
| No. of projects meeting/failing scope, etc. | DWAF PMISS | 2000/06/01 |
| No. of promotional meetings | DWAF capital projects M&E | 2001/03/01 |
| No. of courses | DWAF capital projects M&E | 2001/03/01 |
| No. of currently active projects in node | Nodal level ME&R system document | 2001/04/01 |
| No. of employed in job opportunities created in the node: full-time | Nodal level ME&R system document | 2001/04/01 |
| No. of employed in job opportunities created in the node: short term | Nodal level ME&R system document | 2001/04/01 |
| No. of existing toilets upgraded to VIP standard | DWAF capital projects M&E | 2001/03/01 |
| No. of full deposits received | DWAF capital projects M&E | 2001/03/01 |
| No. of household applications for NEW toilets | DWAF capital projects M&E | 2001/03/01 |
| No. of household applications for UPGRADE toilets | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| No. of households that receive basic services within node | Nodal level ME&R system document | 2001/04/01 |
| Monitoring of amount transferred vs. planned. | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| No. of local development plans prepared in node | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| No. of Phase A toilets completed (demo + pilot) | DWAF capital projects M&E | 2001/03/01 |
| No. of Phase B toilets completed | DWAF capital projects M&E | 2001/03/01 |
| No. of projects identified for implementation in current financial year | Nodal level ME&R system document | 2001/04/01 |
| No. of projects in initiation within the current financial year | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| No. of staff in key positions within node | Nodal level ME&R system document | 2001/04/01 |
| No. of Unemployed trained | DWAF capital projects M&E | 2001/03/01 |
| No. of Women trained | DWAF capital projects M&E | 2001/03/01 |
| No. of Youth trained | DWAF capital projects M&E | 2001/03/01 |
| O & M cost per family (% of average disposable monthly income) | DWAF capital projects M&E | 2001/03/01 |
| O&M administrative system in place | DWAF capital projects M&E | 2001/03/01 |
| O&M and tariff/cost recovery plan approved by PSC | DWAF capital projects M&E | 2001/03/01 |
| O&M fund set up | DWAF capital projects M&E | 2001/03/01 |
| O&M mentoring period complete | DWAF capital projects M&E | 2001/03/01 |
| O&M plan approved | DWAF capital projects M&E | 2001/03/01 |
| O&M program in place for continuous maintenance | DWAF capital projects M&E | 2001/03/01 |
| O&M training complete | DWAF capital projects M&E | 2001/03/01 |
| Ongoing institutional responsibilities approved | DWAF capital projects M&E | 2001/03/01 |
| Operating authority water services provider identified/ established | DWAF capital projects M&E | 2001/03/01 |
| Operating expenditure on water and sanitation | DWAF annual report | |
| O&M (training days provided) | DWAF capital projects M&E | 2001/03/01 |
| Operations costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Outcomes of negotiations: per individual | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Outcomes of negotiations: per receiving institution | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Outcomes of negotiations: per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Outcomes of negotiations: per union | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Overlap of complementary activities (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Participatory health assessment complete | DWAF capital projects M&E | 2001/03/01 |
| People served / impacted on in Phase A | DWAF capital projects M&E | 2001/03/01 |
| People served in Phase B by newly constructed toilets | DWAF capital projects M&E | 2001/03/01 |
| People served in Phase B by upgraded toilets | DWAF capital projects M&E | 2001/03/01 |
| People served index | DWAF PMISS | 2000/06/01 |
| People served total | DWAF PMISS | 2000/06/01 |
| People to be served in Phase B by newly constructed toilets | DWAF capital projects M&E | 2001/03/01 |
| Personnel costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Phase A evaluation completed | DWAF capital projects M&E | 2001/03/01 |
| Phase B plan approved by PSC | DWAF capital projects M&E | 2001/03/01 |
| Phase B start | DWAF capital projects M&E | 2001/03/01 |
| Planned construction cost | DWAF capital projects M&E | 2001/03/01 |
| Planned cost | DWAF PMISS | 2000/06/01 |
| Planned cost of contractors | DWAF capital projects M&E | 2001/03/01 |
| Planned cost per capita | DWAF capital projects M&E | 2001/03/01 |
| Planned labor cost | DWAF capital projects M&E | 2001/03/01 |
| Planned no. of contractors | DWAF capital projects M&E | 2001/03/01 |
| Planned no. of days (employment) | DWAF capital projects M&E | 2001/03/01 |
| Planned no. of demonstration toilets | DWAF capital projects M&E | 2001/03/01 |
| Planned no. of toilets: Phase A (excluding demo) | DWAF capital projects M&E | 2001/03/01 |
| Planned no. of toilets: Phase B | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Planned O&M fund | DWAF capital projects M&E | 2001/03/01 |
| Planned total cost at allocation from RDP | DWAF capital projects M&E | 2001/03/01 |
| Population | DWAF capital projects M&E | 2001/03/01 |
| Post commissioning supply interruptions (No./month) | DWAF capital projects M&E | 2001/03/01 |
| Primary supply system (pumps/weir) | DWAF capital projects M&E | 2001/03/01 |
| Process status per contract | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in approval/authorization documentation | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in creating transfer documentation | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in describing movable assets | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in determining asset value: (O&M) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in determining asset value: current (per type of asset) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in determining asset value: refurbishment (as % of replacement cost) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in determining asset value: replacement (per type of asset) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: Evaluation of land subdivision/servitudes | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: existing | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: overall | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: servitudes | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: subdivision | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: supporting infrastructure on government land | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in identifying land for transfer: water-related infrastructure | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in legal documentation | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Progress in listing departmental assets: immovable | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in listing departmental assets: movable | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in listing departmental assets: O&M status | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in listing departmental assets: operational status | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in listing departmental assets: overall | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in listing departmental assets: refurbishment and replacement status | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in national transfer plan preparation | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in obtaining informal settlement information | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in obtaining land claim information | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in obtaining landowner information | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in obtaining proclamation information | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in obtaining Surveyor General documents | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in planning servitudes required | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing bulk water supplier agreements | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing DWAF-WSA agreements | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing indemnities | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing O&M agreements | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing transfer agreements | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in signing WSA-WSP agreements | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in transfer policy definition | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in transfer procedure manual preparation | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in transferring moveable assets | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress in valuing land | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress of capacity-building initiatives vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Progress of completion and registration of surveys | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress of completion and registration of title deeds | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Progress of completion of transfer documents | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Project administration (employment created) | DWAF capital projects M&E | 2001/03/01 |
| Project approved | DWAF capital projects M&E | 2001/03/01 |
| Project business plan approved amount and date | DWAF PMISS | 2000/06/01 |
| Project consultants appointed | DWAF capital projects M&E | 2001/03/01 |
| Project design phase: planned vs. actual dates | DWAF PMISS | 2000/06/01 |
| Project funds by source of funding in node | Nodal level ME&R system document | 2001/04/01 |
| Project implementation phase: planned vs. actual dates | DWAF PMISS | 2000/06/01 |
| Project management (employment created) | DWAF capital projects M&E | 2001/03/01 |
| Project management procedures established | DWAF capital projects M&E | 2001/03/01 |
| Project O&M phase: planned vs. actual dates | DWAF PMISS | 2000/06/01 |
| Project objectives | DWAF PMISS | 2000/06/01 |
| Project planning phase: business plans. planned vs. actual dates. Possibly, start and end dates. | DWAF PMISS | 2000/06/01 |
| Project planning phase: planned vs. actual dates | DWAF PMISS | 2000/06/01 |
| Project scope: people to be served | DWAF PMISS | 2000/06/01 |
| Project scope: people served | DWAF PMISS | 2000/06/01 |
| Project steering committee selected | DWAF capital projects M&E | 2001/03/01 |
| Project: actual cost per financial year (CPTD), (FMS) | DWAF PMISS | 2000/06/01 |
| Project: budgeted cost per financial year (BCTD) (= BCWP) | DWAF PMISS | 2000/06/01 |
| Project: cost certified to date per financial year (CCTD) | DWAF PMISS | 2000/06/01 |
| Project: forecasted estimates of above (note the ECAC is the forecasted final amount of the FMS curve) | DWAF PMISS | 2000/06/01 |
| Projected consumption (l/capita/day) | DWAF capital projects M&E | 2001/03/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Projected supply from source (Ml/day) | DWAF capital projects M&E | 2001/03/01 |
| Property registrations vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Property transferred vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Project Steering Committee approval of design | DWAF capital projects M&E | 2001/03/01 |
| Purification facilities completed | DWAF capital projects M&E | 2001/03/01 |
| Quality meets potable standard (yes/no) | DWAF capital projects M&E | 2001/03/01 |
| Reasons related to contract decisions | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Recipients of delivery | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Refurbishment costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Refurbishment funds: planned vs. allocation vs. actual | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Replacement costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Retention paid | DWAF capital projects M&E | 2001/03/01 |
| Revenue base in current financial year | Nodal level ME&R system document | 2001/04/01 |
| Schedule: people served index: actual | DWAF PMISS | 2000/06/01 |
| Schedule: people served index: planned | DWAF PMISS | 2000/06/01 |
| Service providers meeting: reliability requirements | DWAF annual report | |
| Service providers meeting: water-supply-quality requirements | DWAF annual report | |
| Shortfall revenue | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Social consultant appointed | DWAF capital projects M&E | 2001/03/01 |
| Solid waste and sullage disposal facilities complete | DWAF capital projects M&E | 2001/03/01 |
| Staff transfer vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Start of construction | DWAF capital projects M&E | 2001/03/01 |
| Start of training | DWAF capital projects M&E | 2001/03/01 |
| Steering committee training complete | DWAF capital projects M&E | 2001/03/01 |
| Stop/Go point 1: planned vs. actual dates, FMS | DWAF PMISS | 2000/06/01 |
| Stop/Go point 2: planned vs. actual dates, feasibility | DWAF PMISS | 2000/06/01 |

*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Stop/Go point 3: planned vs. actual dates, WSA ownership | DWAF PMISS | 2000/06/01 |
| Stop/Go point 4: planned vs. actual dates, ECAC check. | DWAF PMISS | 2000/06/01 |
| Stop/Go point 5: planned vs. actual dates, BP | DWAF PMISS | 2000/06/01 |
| Stop/Go point 6: planned vs. actual dates, design. | DWAF PMISS | 2000/06/01 |
| Stop/Go point 7: Planned vs. actual dates, award contract. | DWAF PMISS | 2000/06/01 |
| Stop/Go point 8: Planned vs. actual dates, complete construction. | DWAF PMISS | 2000/06/01 |
| Storage reservoirs completed | DWAF capital projects M&E | 2001/03/01 |
| Summary of transfer options taken (transfer, secondment, retrenchment, redeployment) with final costing | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Supply (l/capita/day) | DWAF capital projects M&E | 2001/03/01 |
| Technical maintenance (employment) | DWAF capital projects M&E | 2001/03/01 |
| Tender documents completed and tender advertised | DWAF capital projects M&E | 2001/03/01 |
| Threat to ecosystems (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Total cost of operating system (R) | DWAF capital projects M&E | 2001/03/01 |
| Total grant and equitable share used vs. allocated | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Total income of operating system (R) | DWAF capital projects M&E | 2001/03/01 |
| Total planned toilets based on no. of households | DWAF capital projects M&E | 2001/03/01 |
| Total transfer costs: estimated vs. actual (multiple levels) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Total value of assets per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Training | DWAF PMISS | 2000/06/01 |
| Training agent appointed | DWAF capital projects M&E | 2001/03/01 |
| Training completed | DWAF capital projects M&E | 2001/03/01 |
| Training needs/plan approved | DWAF capital projects M&E | 2001/03/01 |
| Training plan finalized and approved | DWAF capital projects M&E | 2001/03/01 |
| Transfer allocations (quarterly) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |

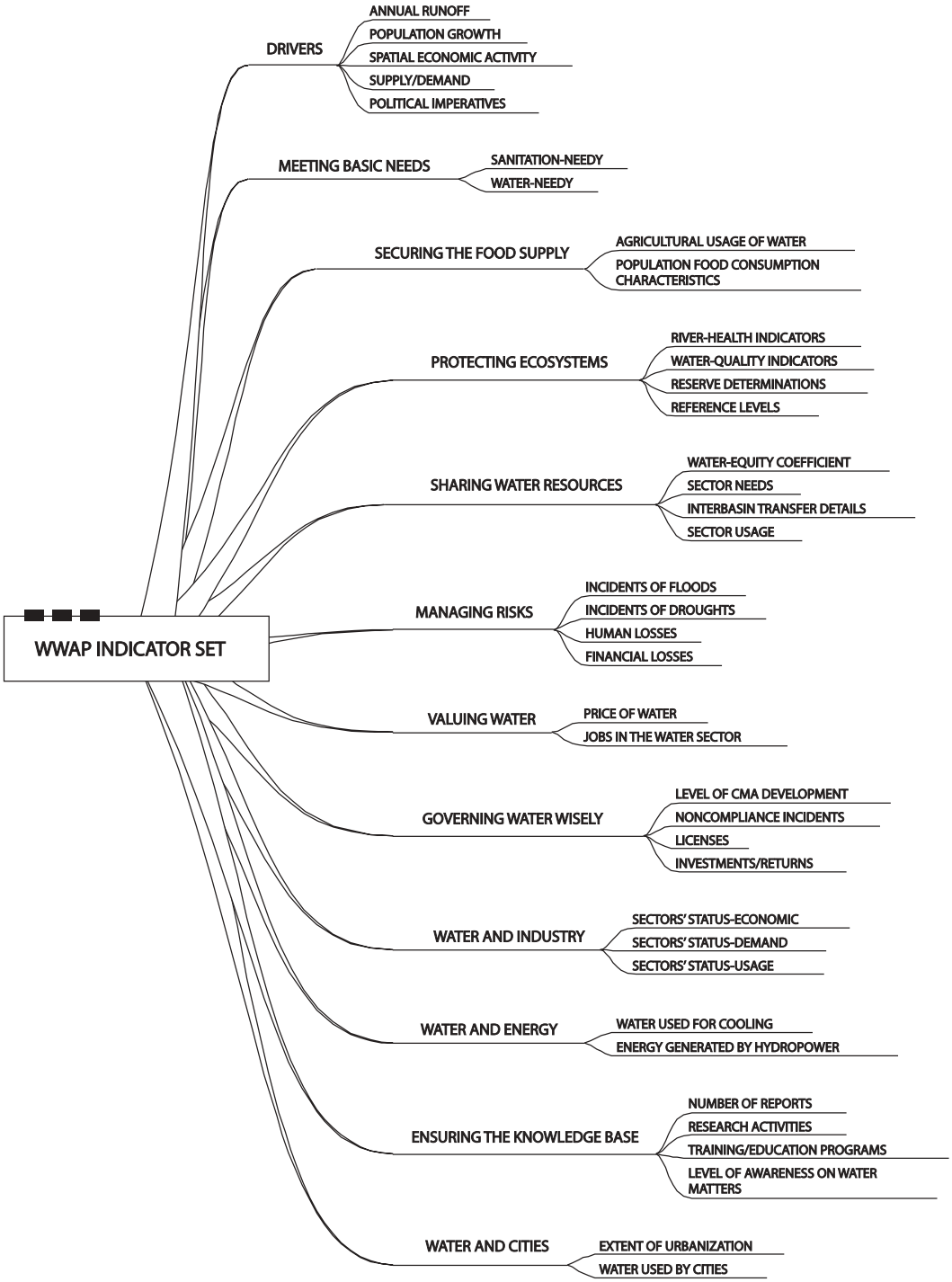
*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Transfer cost: actual vs. estimated: (multiple levels to be unpacked) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer expenditure vs. budget | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: asset assessment | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: business and info systems | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: capacity-building | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: communication | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: financial | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: HR | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: Land | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: legal | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer process readiness: yearly target | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer Status: entire program | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status: per DM | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status: per individual | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status: per receiving institution | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status: per scheme | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status of schemes vs. detailed plan (initiated negotiation, WSA contract) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Transfer status of schemes vs. national plan (initiated negotiation, WSA contract) | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Unit cost of water supplied (R/kl) | DWAF capital projects M&E | 2001/03/01 |
| Use of subsidies/finance vs. plan | Transfer of schemes: information requirements and performance indicators | 2001/04/01 |
| Utilization of conditional grant for institutional support and project initiation in node | Nodal level ME&R system document | 2001/04/01 |
| Volume delivered (Ml/month) | DWAF capital projects M&E | 2001/03/01 |

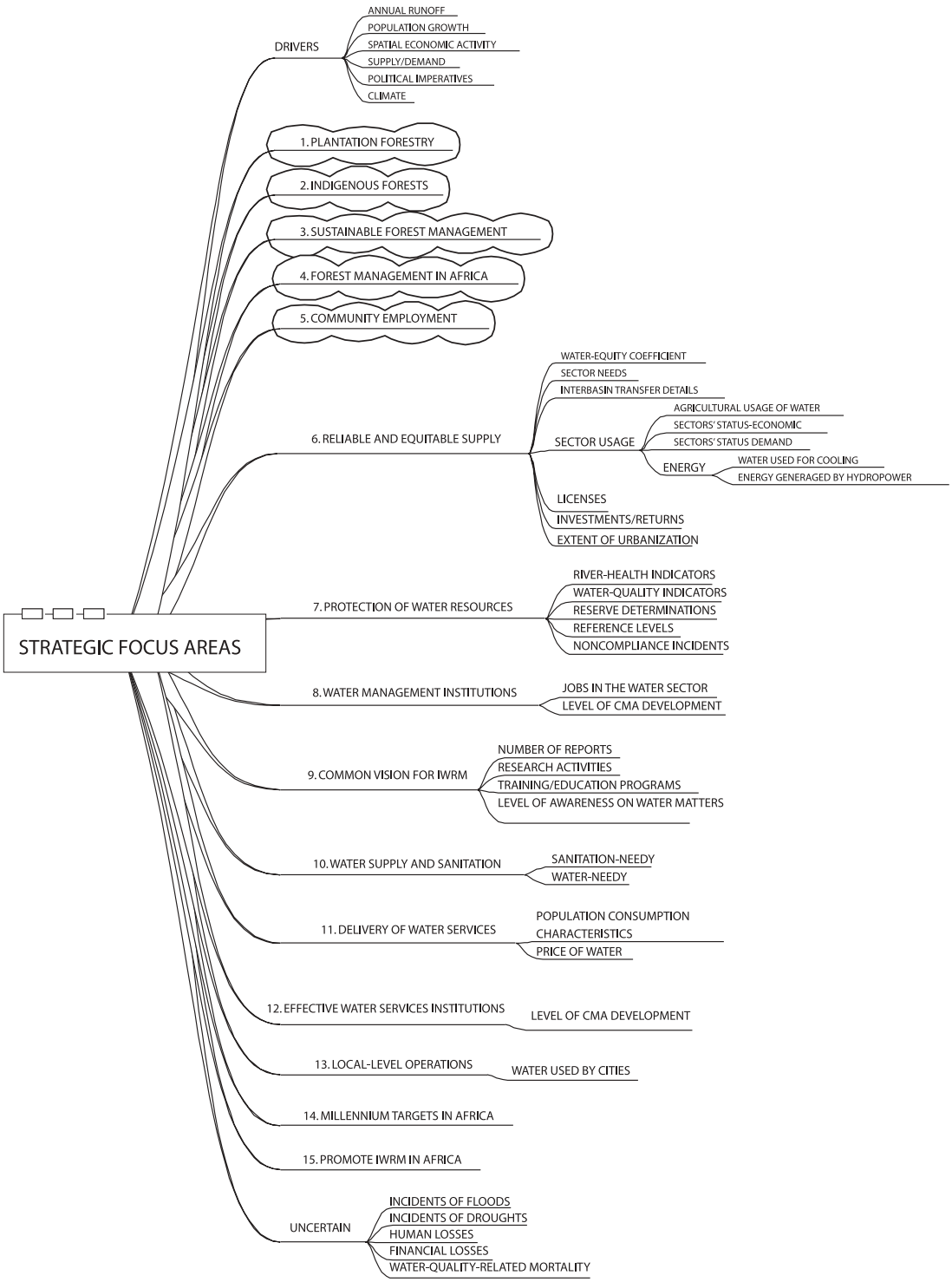
*Annex 9.* Continued.

| Indicator | Source of data/information/report | Date |
|---|---|---|
| Water loss (%) | DWAF capital projects M&E | 2001/03/01 |
| Water quality impact (1–5) | DWAF capital projects M&E | 2001/03/01 |
| Water source secured / completed | DWAF capital projects M&E | 2001/03/01 |
| Water tariffs in Rands | DWAF annual report | |
| Yield from source (Ml/day) | DWAF capital projects M&E | 2001/03/01 |

*Annex 10. Schematic outline of frameworks for WWAP and Souh African national indicators.*



*Annex 10.* Continued.



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