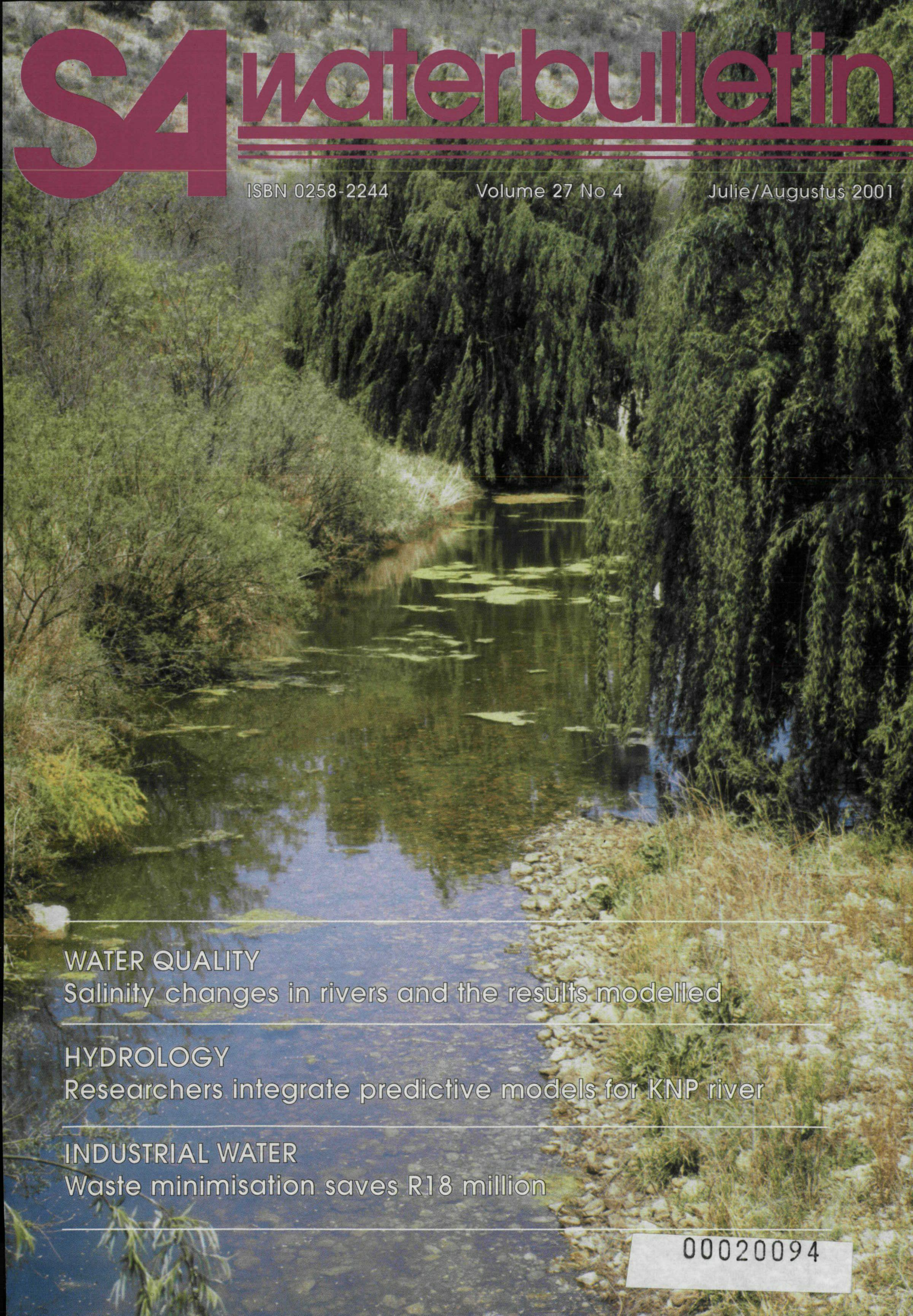




S4 waterbulletin

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WATER QUALITY

Salinity changes in rivers and the results modelled

HYDROLOGY

Researchers integrate predictive models for KNP river

INDUSTRIAL WATER

Waste minimisation saves R18 million

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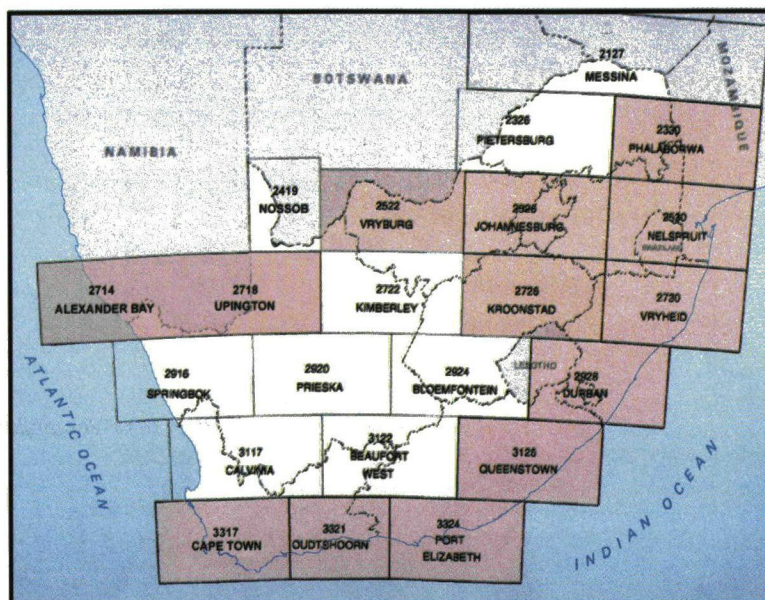
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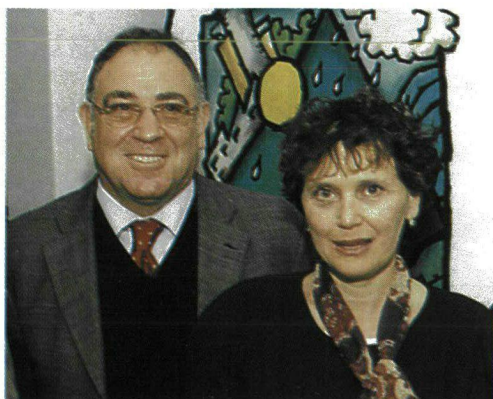
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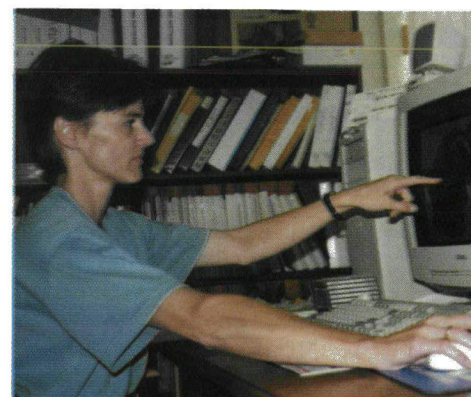
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Cover: A tributary of the Vaal River near Venterskroon. (Photo: Jan du Plessis)

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Agricultural Water Management - Forum discusses problems and priorities

The Water Research Commission (WRC) held the fourth in a series of discussion forums on agricultural water management in June 2001 at White River in Mpumalanga. A number of farmers, agriculturalists and researchers representing various organisations attended the two-day workshop.

The purpose of the discussion forum was to obtain input and comments from the participants, in order to identify practical problems as experienced by irrigation farmers and to determine research priorities.

Dr David de Waal (Afrosearch) welcomed the participants and explained the objectives and process of the workshop, thereafter Dr Gerhard Backeberg (WRC), by way of introduction, gave the participants some brief background information and perspectives. He mentioned the WRC's motto of "advancing water management through excellence in research", and the mission and role of the WRC, which is to improve the quality of life of people in South Africa, by initiating and promoting water research, as well as supporting the application of the research findings. He then looked at some statistics with regard to water and land use suitable for irrigation, and crop production under irrigation, and listed the key considerations taken into account in the strategic plan regarding irrigation.

STRATEGIC RESEARCH PLAN

Dr Backeberg acquainted participants with the Strategic Research Plan (SRP) of the WRC which focuses on determining in advance what needs to be done, and to achieve objectives through applied research that will create knowledge with which to solve problems. Dr Backeberg pointed out the importance of making adjustments from time to time so that the SRP will be relevant and a "live" document.

He said the aim of the discussion forum was to invite comments and proposals regarding:



Mr Papi Nkosi (Mpumalanga African Farmers Union) and Dr Gerhard Backeberg (Water Research Commission) discussing a document.

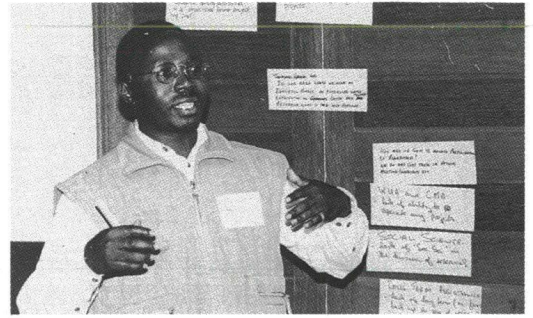
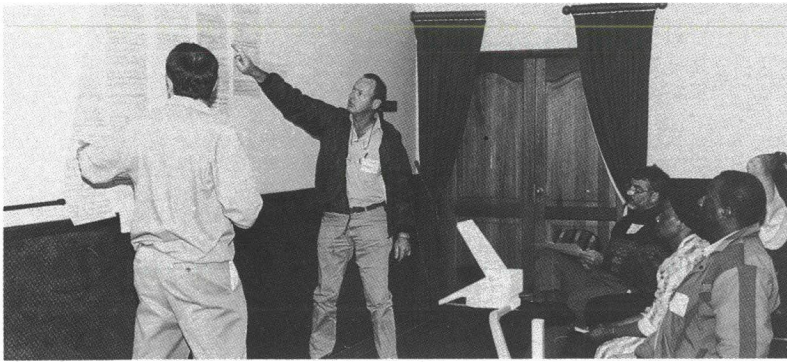


Dr David de Waal (Afrosearch) with Mr L Lötter (Agri Mpumalanga) and Miss I van der Stoep (University of Pretoria) having a chat during the tea break.

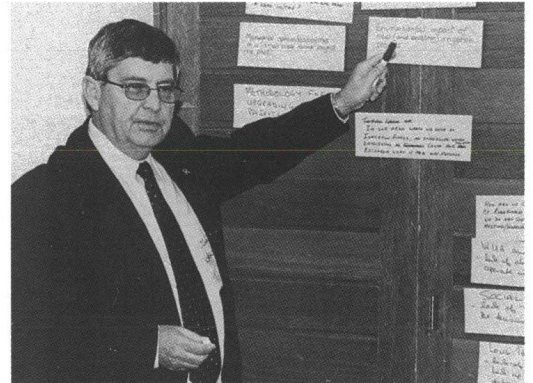
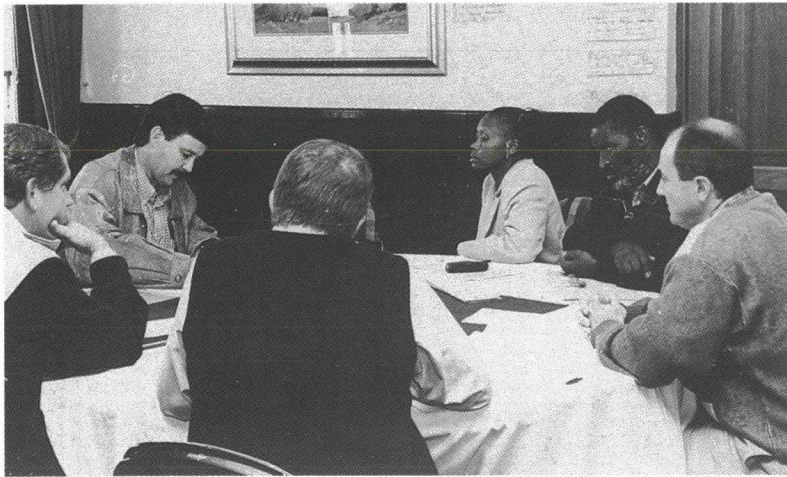


Mr Z Kabini (NHAFU) and Mrs J Nkosi, with Mr A Khoza and Mrs T Mokone (both from the Department of Agriculture, Conservation and Environment: Lowveld Region) participated in the deliberations.

Group discussions in progress...



Dr Sizwe Mkhize (Water Research Commission).



Mr Jan Volschenk (Chief Director: Department of Agriculture, Conservation and Environment, Mpumalanga).

- ❑ the strategic research plan
- ❑ gaps in knowledge in terms of research, extension and technology transfer, and
- ❑ to identify the priorities for research.

DISCUSSION GROUPS

Participants and facilitators were divided into four groups to identify practical problems in terms of agricultural water management. The problems were listed, integrated and then categorised under the following focus themes:

- ❑ Soil (eg. cultivation and drainage)
- ❑ Crops (eg. water needs, scheduling and climate)
- ❑ Engineering (eg. irrigation equipment), and
- ❑ Economics (eg. risk management).

After the groups had met for a plenary session, they were requested to prioritise the problems listed under the four focus areas.

The following issues were put forward as research and technology exchange priorities for the WRC:

- ❑ Crop water usage in traditional and new crops with commercial product potential.
- ❑ Basic scheduling approaches and methods for commercial and small-scale farmers.
- ❑ Methods to overcome the water quality influences and fluctuations on agricultural practices.
- ❑ The use and maintenance of farm irrigation equipment.
- ❑ The appropriateness of the designs of water distribution systems for upcoming irrigation farmers.
- ❑ Pumping problems at extraction points of rivers and ways to deal with silting, suspended solid and floodings.
- ❑ The economics of water efficient irrigation schemes, in particular the long-term economic viability of schemes.
- ❑ The environmental impact of new and

existing irrigation projects; and

- ❑ The development of a holistic water management approach that include a sociology, ecology, engineering and economics continuum.

At the workshop it became clear that there was a definite need for agricultural extension, technology transfer and information sharing on the lowest stakeholder levels. Research has already been done on several of these issues, and the focus should now be placed on the gathering of this information for agricultural extension and technology transfer. It was emphasised that international accreditation of research is very important, however, information distributed by means of popular publications is imperative.

A draft document of the discussion forum proceedings has been compiled and sent to the participants for their comments. Two more regional discussion forums are still to be held in KwaZulu-Natal and the Eastern Cape. Ultimately one integrated report will be made available, says Dr Backeberg.

Kasrils welcomes Kfir at WRC



Dr Rivka Kfir, new Chief Executive Officer of the Water Research Commission, presenting two new WRC reports to the Minister of Water Affairs and Forestry, Ronnie Kasrils. In the background are WRC Board and staff members looking on.



The Chairman of the WRC Board, Professor Kingston Nyamapfene and Water Affairs and Forestry Minister Ronnie Kasrils, with Dr Rivka Kfir, the new Chief Executive Officer, and Dr George Green, Deputy Executive Director of the Water Research Commission.

The newly-appointed Chief Executive Officer of the Water Research Commission (WRC), Dr Rivka Kfir, was officially welcomed at a function hosted by the Water Research Commission on 19 July 2001. The Minister of Water Affairs and Forestry, Mr Ronnie Kasrils, paid tribute to Dr Kfir for her past achievements which should stand her in good stead to propel the WRC into a new era to even better serve the people of South Africa.

In an impromptu speech Mr Kasrils also lauded the WRC for:

- the constructive role it is playing in

solving the water problems of South Africa

- its high international profile
- the excellent user-orientated communication of its research findings taking into account the scientific complexity of the research results
- its contribution to the African Renaissance and the SADC countries

Dr Kfir said that one of the core functions of the WRC is to create and direct new water-centred knowledge. The contributions of the WRC to the expansion and the diversification of research to various universities, Science Councils and the water industry, are well recog-

nised. Research projects funded by the WRC have always been of high quality, resulting in world-class research, and positioning South Africa as a forerunner in the international arena. She said that as chief executive officer of the WRC, it would be a great challenge to steer an organisation that has already made its hallmark in water research, to even greater heights.

Dr George Green, Deputy Executive Director of the WRC, was also acknowledged and thanked by the Minister for the hard work and extra load he had to carry during the ten months prior to the appointment of Dr Kfir.

South African lectures in Australia

"Leakage detection and pressure control can be one of the most effective demand management measures a water utility can undertake."

(Tim Waldron, CEO Wide Bay Water)



The team of seminar speakers (from left): Tim Waldron (CEO, Wide Bay Water), Ronnie McKenzie (WRP Consulting Engineers/Rand Water Academy), Russel Beatty (Department of Land and Water Conservation, New South Wales), Allan Mayne (Queensland Environment Protection Agency) and Pank Mistry (Wide Bay Water).

South African water expertise is highly regarded internationally, and the Water Research Commission has certainly contributed to this over the years by supporting water research as well as information and technology transfer. Dr Ronnie McKenzie of WRP Consulting Engineers recently had the opportunity to be part of technology and information transfer in Australia. He was part of a team of experts that gave presentations at a series of six one-day seminars held in Queensland, Australia. The seminars focused on leakage reduction and water demand management. Dr McKenzie says that research done by the Water Research Commission got excellent exposure at the seminars.

Minister announces the creation of a national award for women in water



Minister Kasrils, Minister of Water Affairs and Forestry, recently announced the establishment of a national annual award for women in water. This award has been jointly established by the Department of Water Affairs and Forestry and the Water Research Commission, and will recognise the important contribution of women in the management of South Africa's scarce water resources, from community level to

the highest levels. The award will be made for the first time on National Women's Day, 2002.

The Minister is hopeful that the award will contribute to enhancing the profile of women in the water sector, and that it will encourage more women to become involved in the water sector. He is also hopeful that a number of other institutions will support this innovative award.

Aquatic Scientists meet for science and fellowship



The SASAQS 2001 Conference delegates gathered at Aventura Eco Eiland, Northern Province.

The Southern African Society of Aquatic Scientists (SASAQs) recently had their biennial conference at Aventura Eco Eiland virtually on the Letaba river in the Northern Province lowveld. The week long conference and workshops were attended by some 135 delegates. Some of the delegates came from as far afield as Australia, Belgium and Switzerland. Zimbabwe, Zambia and Mozambique were also represented.

The regional organising committee put in much effort in organising the SASAQS 2001 conference and sponsorships from various organisations. The sponsorships made it possible for 19 students from the Northern Province universities and Zimbabwe to attend this gathering of aquatic scientists.

Dr Steve Mitchell, research manager at the Water Research Commission, gave the opening address. He reflected upon the issue of sustainable resource management, the complexity thereof, and the need for interdisciplinary teamwork.

He lauded the members of the society for their contributions to ensure that the aquatic ecosystem was recognised as an integral part of the resource in the new National Water Act. "Through a sequence of fortuitous events South Africa is the first country to have written the requirement for an ecological reserve into law."

"For this we are grateful, but this is no time to sit back. Rolling out the Act into implementation is complex and our ongoing efforts are needed to help ensure that this is successful. ...All this

has to be based on good science," said Dr Mitchell.

GOOD SCIENCE

"As scientists, we owe it not only to ourselves, but to those who invest in the work we do and also to society at large to produce good science. There is no justification for not doing so." He said the SASAQs conference presented a forum "where we are able to gauge the quality of our science".

He also emphasized the importance and



From left to right: Wynand Vlok (University of the North), Mick Angliss (Northern Province Environmental Affairs), Ben van der Waal (University of Venda), Freek Venter (Kruger National Park), Paul Fouche (University of Venda) and Stan Rodgers (Northern Province Environmental Affairs).

significance of fundamental research and new thinking.

He mention some of the new technologies and methodologies pioneered and developed by South African scientists in the water field

Dr Chris Dickens followed with his presidential address entitled Science: Fact and fantasy. He looked at some threats to science, such as: rejection of reasoning and sham-reasoning, rejection of facts and knowledge, political, racial and sexist motivated scholarships, as well as advocacy research and pseudo-inquiry amongst others. Then he discussed some of the requirements for good science, such as: holding the truth as the highest goal, having an incisive mind, a mind free to reason without prejudice, and an eye for principle. He concluded that a love of truth and a mind strengthened by a sound education need to be cultivated as the basis for good science.

Professor Christopher Cook from Zurich

University, Switzerland, was the guest speaker. He is a world renowned aquatic botanist. He fascinated his audience with an excellent slide show on aquatic plants in his presentation entitled: "Numbers and kinds of aquatic plants".

PRESENTATIONS

Six plenary sessions were held and some 66 papers were presented in the parallel sessions. The plenary session presentations included subjects such as: "The diversity and conservation of fishes in the Limpopo River system", "Science, politics people and ecosystems", "Should we rethink our approach to the environmental reserve?", and "Aquatic invertebrates and biomonitoring in the Zambezi basin". The main themes of the parallel sessions were: catchment management, management philosophy, geomorphology, aquatic plants, ecotoxicology, algae and phytoplankton, biomonitoring, conservation, and wetland rehabilitation.

International delegates subsequently

remarked that presentation standards were exceptionally high and that the interdisciplinary nature of the SASAqS conference is rarely seen elsewhere in the world.

OTHER ACTIVITIES

The conference programme also included some workshops, for example on ecotoxicology and on research project proposal writing. The work sessions were well received and attended.

The mid-week excursion to the Kruger National Park and the Phalaborwa Mining Company was a welcome break from the formal proceedings. It afforded delegates the opportunity to view some of the river modifications in the Letaba river, caused by the floods of February 2000. Seeing some big game added to the delight of the field trip.

The next SASAqS conference is scheduled for July 2002 and will be held in Bloemfontein in the Free State.

An Update on Waste Minimisation Clubs in South Africa - R18m saved

Susan Barclay and Chris Buckley

Pollution Research Group, School of Chemical Engineering, University of Natal, Durban

Waste minimisation is a set procedure that any company can implement to identify sources of waste and work towards reducing, or eliminating these losses before they occur. A waste minimisation club is a group of companies getting together to exchange information and ideas on waste minimisation. In this way, they encourage one another to reduce waste at source, resulting in financial benefits to themselves and a reduction in their emissions to water, land and air. As a Club, these companies can benefit from one another's experiences and receive assistance from outside consultants at a reduced cost. It is a concept that has been successful in Europe and the United Kingdom and it was felt that this approach could be applicable in South Africa.

The Pollution Research Group undertook a 3-year research project, sponsored by the South African Water Research Commission (WRC), to determine the feasibility of establishing waste minimisation clubs in South Africa to promote sustainable industrial development. Two Pilot clubs were formed in KwaZulu-Natal, one in the metal finishing sector in the Durban region, and the second, a cross-sectoral club in the Hammarsdale area. The formation of these clubs was described in SA Waterbulletin, Volume 26, no 3 (May/June 2000).

Table 1: Status of waste minimisation clubs in South Africa.

Club Name	Location	Date Initiated	Status
Metal Finishing	Durban	June 98	Closed ¹
Hammarisdale	Hammarisdale	Nov 98	Closed ¹
Cape Metal Finishing Association ²	Western Cape	August 2000	Running
Waste Minimisation Club for Large Industries	Western Cape	November 2000	Running
Pietermaritzburg Waste Minimisation Club	Pietermaritzburg	February 2001	Running
PE Metal Finishing Waste Minimisation Club	Port Elizabeth	Sept 2000	Running
Gauteng Surface Finishers Association ²	Gauteng	July 2000	Initial Planning stages
In-house	Secunda	October 2000	Initial planning stages
Durban Metal Finishing Club	Durban	August 2001	Starting
Large Industries	Western Cape	Not known	Starting soon

Notes

1. These pilot clubs are no longer running as Clubs, but the activities continue under associations such as the KZN Metal Finishing Association (MFA) and the Hammarisdale Industrial Conservancy.
2. While these are called Associations, they are run as waste minimisation clubs, where club meetings are held in conjunction with association meetings. This is possible due to the small number of members. In the case of Gauteng, it may develop that only a core group of the members of the association form a waste minimisation club.

PROJECT RESULTS

This project came to a close at the end of December 2000, and the results from this study are being used to prepare guidelines for the establishment of future waste minimisation clubs in South Africa.

A summary of the headline results are provided below:

- In total, 1 280 Mℓ of water was saved by 17 companies over the 3 years, leading to a reduction of 1 230 Mℓ of effluent discharged to drain;
- A total of 65.7 GWh of energy was saved by 10 companies over the 3 years, resulting in a reduction of 45 000 tons of CO₂, 425 tons of SO₂ and 190 tons of NO_x being emitted to atmosphere (with related savings in water and coal);
- A total financial saving of R 18 million was made by 20 companies over the three years;
- The majority of the savings were achieved through improved house-keeping practices (no- or low-cost);
- The concepts of waste minimisation were transferred to the companies through club meetings, training and site visits;
- A total of at least 878 people were capacitated through the project;
- Training in waste minimisation is essential for the success of the project and should involve all employees, from management to shop-floor level;
- The main barriers experienced were a lack of time, finance, resources and



Industries are encouraged to reduce their waste emissions to water, land and air. Such waste reductions also bring about financial benefits for the companies.

commitment;

- The main drivers identified were cost savings, pressure from local authorities and to reduce pollution;
- Both the stick and carrot approach is necessary for companies to take on waste minimisation; and
- On average, savings accounted for between two per cent and five per cent of the annual turnover of the companies.

NEW WASTE MINIMISATION CLUBS

During the course of this project, further waste minimisation clubs have been formed in other regions of the country. As of July 2001, there are four clubs operating, two clubs in the first stages of initiation, and a further two clubs planned. These are listed in Table 1.

SUMMARY

The waste minimisation club concept is growing in South Africa. It has shown to be successful in promoting the concepts of waste minimisation to industry with the result that the companies involved made financial savings and reduced their environmental impact. A second WRC sponsored project is currently underway to promote the establishment of further clubs in the country through the preparation of a facilitator's manual and training material.

Further information on the waste minimisation club concept is available from the Pollution Research Group on barclay@nu.ac.za

A model developed for speeding up capacity building in water and waste management

"Training and education is only one factor in building capacity - building capacity also includes other factors such as the ability to access funding, technology, administrative resources, equipment, information, support and collaborative partnerships. Without the accompaniment of these factors training and education, which forms an important basis for capacity building, may only frustrate." This is said in a report released by the Water Research Commission entitled **Rapid capacity building for water and waste management at local authority and district council level** (WRC report 982/1/00).

Copies of the report are available (free of charge in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 15, via surface mail).

In response to an invitation from the Water Research Commission, a research project was designed to address the challenge of seeking a model which made rapid capacity building possible for the management of water and waste services at community level.

According to the researchers charged with the project, AMM Rossouw and PC Crous from the Health and Development Research Institute at the University of Port Elizabeth, a basic assumption was made that rapid capacity building would be possible once the core competencies for the task were known and these competencies could be instilled through ensuring optimum staff components and the necessary training of staff regarding these competencies.

METHODOLOGY

The research was conducted by means of semi-structured interviews with staff at a number of towns, a postal questionnaire which targeted staff responsible for water and waste management and maintenance, interviews with specialists in the field and a workshop with senior officials of district councils.

FINDINGS

The final results showed that the question of capacity is a much wider issue than core competencies and optimum levels of staffing, although these were also of importance.

"What became clear is that optimum staffing levels and the training of staff to have the required competencies is a medium to long term aim and cannot be part of a rapid capacity building approach.

"It became clear that the approach should rather be to consolidate and muster existing competencies and expertise and make these accessible to communities."

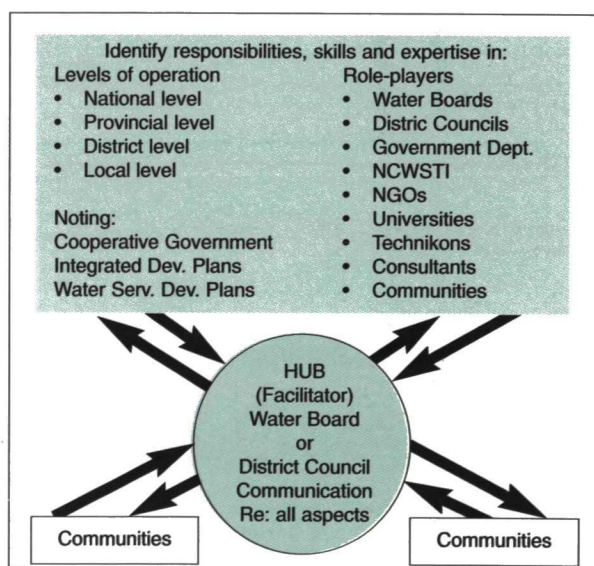
The researchers say the competencies required for management of water and waste services under normal circumstances are rather basic and menial.

"A problem occurs when systems are faulty and need to be corrected and advanced expertise is required."

These factors refer to technical capacity. However, in addition to technical capacity, communities require administrative capacity and financial capacity.

MODEL

The model for rapid capacity building suggested by the researchers in their report focuses on the formation of a "hub"



A macro system network for capacity building.

or a centre where all kinds of information are held, such as contact information of experts and organisations in the area as well as guidelines for certain procedures.

This centre needs to be established within existing structures. The researchers say the most appropriate location for such a centre would probably be a district council or a water board depending on which exists and is best suited for the establishment of the centre. They say for the centre to function optimally, a communication system needs to be in place so that communities within the service area of the centre can have ready access to the centre. The ultimate vision is to have all communities linked to the centre by computer.



The Sabie River on the eastern boundary of the Kruger National Park.

Integrating predictive models used in the Kruger National Park rivers research programme

During the past two decades the world has seen an increasing emphasis on the need to conserve natural systems in such a manner that they may yield the greatest sustained benefit to present generations, whilst maintaining their potential to meet the needs of future generations. This has led to a change in the way that natural systems are managed worldwide.

The most important outcome of these evolving approaches to management of natural resources is the belief that these systems must be managed in a holistic manner. In other words, the “interconnectedness” of all components of natural systems, including the anthropogenic effects, is recognised. The result of this is the recognition that changes in one component may bring about changes in a range of others. Components of natural systems should not be managed in isolation. Thus, in order to manage any component of the natural system, an under-

standing of how changes in other components will affect the components under consideration is required. The management of water is no exception, and often the catchment presents a sensible boundary within which to attempt to manage a water-related natural system. One product of this transition is the concept of Integrated Catchment Management.

The implication of understanding how change of one component may bring about changes in another, is that some form of predictive capacity may be generated. The development of models which provide the ability to predict the response, for example, to different development scenarios, is required to provide managers and stakeholders alike with some means of assessing the impact of potential change in a component of a natural system, and has been the focus of many research programmes world-wide.

These are the views of researchers GPW Jewitt and AHM Gorgens from the Department of Civil Engineering at the University of Stellenbosch, expressed in their report to the Water Research Commission on integrated water resources management for rivers of the Kruger National Park.

This document is the final report of the Water Research Commission and the Kruger National Park Rivers Research Programme project entitled: An integrated modelling system for predicting the impacts of changes in water quantity and quality brought about by upstream development.

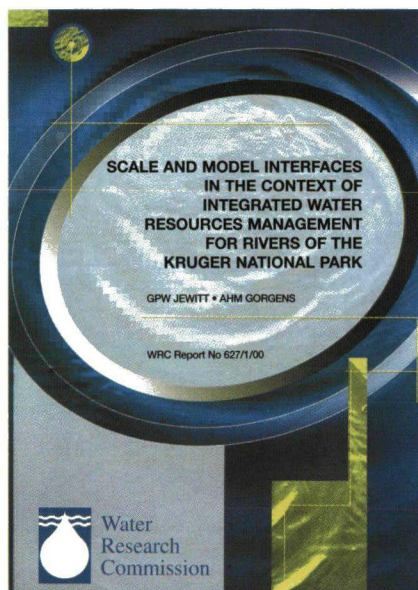
The goal of the project was to develop a computer based system in which predictive models used by different scientific disciplines involved in the Kruger National Park Research Programme could be integrated.

The Kruger Park research programme is an interdisciplinary and co-operative endeavour aimed at contributing to the conservation of the natural environment of rivers, through developing skills and methodologies required to predict responses of the systems to natural and anthropogenic influences, and to improve the quality of the advice to resource managers and stakeholders.

The research reported in the document was performed under the auspices of

the Kruger Park research programme, using the Sabie River, one of six important rivers flowing through the Kruger National Park, as the pilot study area.

Much of the research in the Kruger Park research programme has focused on the flow requirements of aquatic ecosystems, in particular fish and riparian vegetation, the effect that changing hydrology and geomorphology have on them and the development of models to predict this response.



CHALLENGE

Universally, the ability to predict the impact of changes in catchment landuse on the flow in rivers is not a new skill. Many models have been developed that have this ability. The challenge is in linking these models to the complex interrelationships between abiotic (physical/chemical) and biotic (biological) processes. The limited understanding of biological processes makes this an extremely difficult task which is further compounded by the fact that these processes have different rates of change and operate at different scales. This need to be able to predict changes of both the abiotic and biotic components of the river system formed a core component of phase 2 of the Kruger Park research programme by way of a research project known as the KNPRRP Biotic-Abiotic Links project.

The aim of this research has been the development of a hydrologically driven computer based modelling system

which will enable the integration of the predictive methods used by different water related disciplines. The word "integration" is used in a broad sense in the report and is used to describe both the linking of simulation models and their output as well as the generic process of scientists from different disciplines or stakeholders in a catchment linking their ideas.

An important focus of the study has been to answer the question: "How can one most efficiently link predictive models from various disciplines, when these may operate in differing and varying spatial and temporal dimensions?" The most difficult technical issue in developing and using these models has been the cross-scale linkage between physical/chemical and ecological processes. A methodology to assist in resolving this vexing problem is presented in the report and an integrated modelling system which includes hydrology, hydraulics, geomorphology, fish and riparian vegetation components of the Lowveld section of the Sabie River is used as a case study.

SABIE RIVER

The Sabie River drains a catchment area of over 6 000 km² at the international border between South Africa and Mozambique on the eastern boundary of the Kruger National Park. The river flows throughout the year and is fed by two major tributaries in the Lowveld zone, viz., the perennial Marite River and the seasonal Sand River.

Vegetation and land use are varied, with much of the upper reaches of the catchment afforested with exotic tree species. Large-scale irrigation, chiefly of citrus crops, is found in the mid-regions of the catchment. The catchment also contains six game or nature reserves, several small towns and a number of rural settlements.

Flow in the Sabie River is subject to discharge extremes similar to other semi-arid systems in the area. The Sand River contributes significant amounts of sediment to the Sabie River.

The researchers say that catchment management has been identified as an important need in all of the rivers of the Kruger Park, however, it is generally felt that it is in the Sabie-Sand system that this is most critical.

The Sabie catchment is unique in that it has no serious water quality problems, and it is, prior to the construction of the Injaka Dam, the only perennial river of the six rivers flowing through the Kruger Park, that is unregulated by any dam.

The researchers say more than 90 per cent of the water flowing through the park rises in the catchments to the west of the reserve and that it is imperative to develop modelling systems to aid in understanding the hydrological system dynamics outside of, as well as inside the Kruger Park. In addition, the management of the new environmental reserve is going to require ongoing and dynamic systems to assist the process of day-to-day management of the river systems in the catchment and the conflicts that will inevitably arise over environmental allocations of water.

MODELS

Given the dependence of aquatic habitat on flow and sediment conditions, the simulation of catchment hydrology and sediment production on a daily basis were considered critical to the success of the project. Thus, the required modelling system should include robust physically meaningful hydrological modules to provide information for all other predictive models incorporated in the system.

The researchers say the following hydrology models, readily available in South Africa and which operate on a daily or finer time step, were considered in the Kruger Park research project: the Agricultural Catchments Research Unit (ACRU) model, the Hydrological Simulation Program - Fortran (HSPF) and the Variable Time Interval (VTI) model.

Simulation of water quality outputs from the surface area of the catchment, in particular sediment, is a major function of this project. The ACRU model has the ability to generate daily sediment output and is therefore preferred to the VTI model. One of the HSPF model developers suggested that runoff components, such as quickflow, baseflow, etc. simulated by ACRU, could be used to "drive" water quality simulations in HSPF.

Given the apparent unavailability of an appropriate integrated modelling system from international sources, and following

the potential benefits of an ACRU-HSPF link, an ACRU-HSPF linkage for the Kruger Park research project was accepted by the project management and development committee. The focus of this integration is the interface between catchment and river channel, with ACRU simulating the land surface processes and HSPF the in-channel hydraulic and water quality processes.

The ACRU model was used to simulate the catchment hydrology for the period 1937 to 1995 inclusive. Due to a lack of data, the channel hydraulics were only simulated for the period 1967 to 1995 with HSPF.

Hydrological simulations of surface runoff and sediment yield were performed by the School of Bioresources Engineering and Environmental Hydrology and results are included in the form of an appendix in this report.

The link between ACRU and HSPF is made in series. Daily streamflow and sediment values computed at each subcatchment are produced by the ACRU model in its native binary time series storage format and then converted into the Watershed Data Management (WDM) file format for use by HSPF. A HSPF user control input file was then created for the HSPF components of the simulation. A reach of river was established for each of the 56 ACRU subcatchments to represent the channel component of each subcatchment. The HSPF model was used to simulate hydraulic properties of the river represented by the reaches as well as water temperature and the transport of sediment in each reach.

SIMULATION RESULTS

Only occasional water temperature readings are available from the Department of Water Affairs and Forestry's national water quality monitoring database and therefore the temperature simulation cannot be verified. However, typical results of the water temperature simulation are judged to be poor as large and rapid fluctuations in water temperature associated with flow variability are simulated.

No time series of sediment data is available for calibration of the HSPF simulations. As expected, there is a strong relationship between streamflow and estimated sediment transport through

the reaches. The ACRU-HSPF link does seem to fulfil the requirement of routing peripheral ACRU generated sediment input downstream.

The researchers say that despite the many apparent merits of linking two models so that the best features of either serve the objective at hand, it remains somewhat of a "forced marriage". Consequently, the simulation represents a river that is "Sabie-like" in many respects, but cannot be considered a true representation of the Sabie River.

The researchers recommend that future linkages of hydrology and hydraulic components of models follow the embedded option described in their report to the Water Research Commission and that a single, appropriate hydrodynamic component is included in the ACRU model by its developers. Alternatively, where suitable input and calibration data are available, the HSPF model could be used in its entirety.

Qualitative rule-based models representing the change in geomorphology, riparian vegetation and fish of the Sabie River have also been developed and are driven by input simulated by the ACRU model. The researchers say these models form an important component of the Integrated Modelling System.

The models are all operated from the Sabie integrated catchment information system and several new tools for the display and presentation of data in a colourful, user-friendly format were developed during the course of this project.

Copies of the final report on the project entitled **Scale and model interfaces in the context of integrated water resources management for rivers of the Kruger National Park** (WRC report 627/1/00) are available free of charge (in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 35 - via surface mail).



Water Analysis: Guide now available

Volume 3 of the guide series on the Quality of Domestic Water Supplies has been published. The Volume 3 : Analysis Guide follows on the highly acclaimed Volume 1: Assessment Guide and Volume 2: Sampling Guide.

The purpose of this series of guides is to provide the information on sampling, analysis, assessment and interpretation of the quality on domestic water supplies, in a clear and user-friendly format. The series is the result of a joint venture of the Water Research Commission, the Department of Water Affairs and Forestry, and the Department of Health.

The newly-published Analysis Guide aims to provide information and explain the basic concepts related to water quality analysis, the analytical process, and the various methods (suitability and limitations). Attention is also given to the matter of analytical quality assurance.

The sixty page guide gives information in a concise manner, and should prove to be a useful educational tool. However, the guide does not give the technical details of the analytical methods or of the statistical analysis of results. The authors say such details are available in handbooks - a list of reference books is given.

The contents are set out in three parts.

Part 1 looks at the concept of water quality, fitness for use, domestic water and the need for water quality information. A subsection is devoted to the properties of water and characteristics of substances of concern in water, as well as the units in which these substances are expressed.

Part 2 discusses the analysis process in four subsections, namely:

- the various methods for physical/chemical analysis, and for microbiological analysis,
- the planning for analysis
- execution of analyses, and
- reporting of results.

Part 3 deals with analytical quality assurance aspects (including concepts of measurement and accuracy) and the uncertainty factor of analysis results.

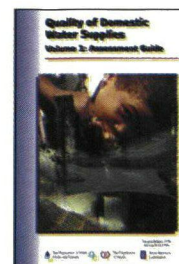
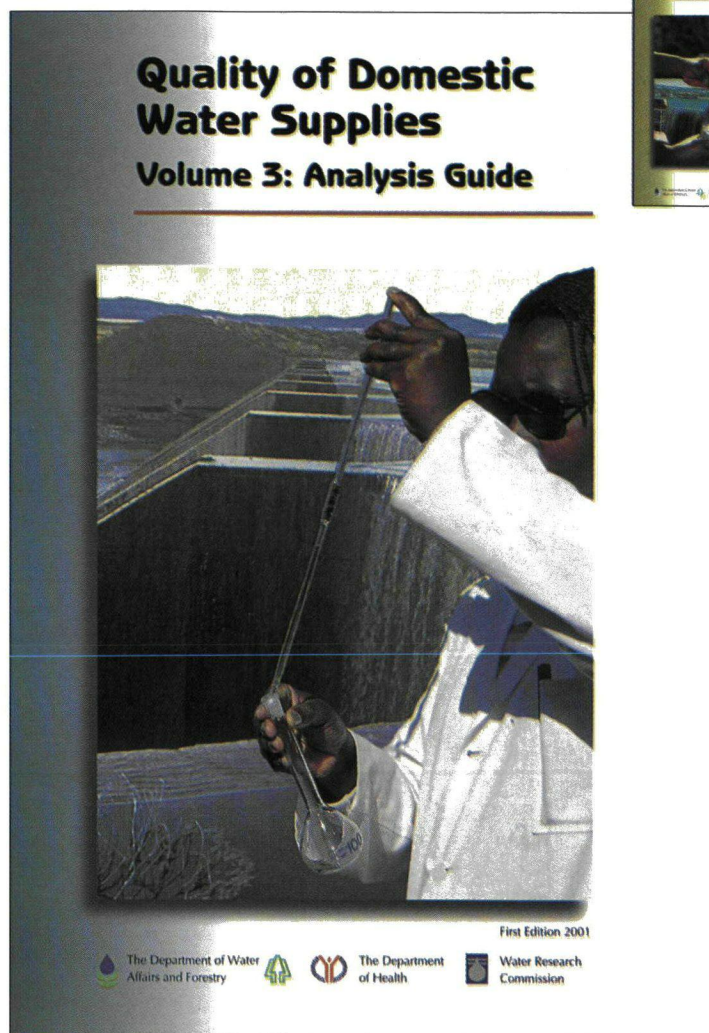
The guide is intended for use by

- water supply agencies
- laboratory analysts responsible for water analysis
- treatment plant operators, who have to do analyses to assess plant performance
- environmental health officers, who have to assess water quality for

domestic use

- field workers, who do inspections, take samples and do on-site analyses
- educators and students

Copies of **Quality of Domestic Water Supplies: Volume 3 - Analysis Guide** (TT 117/99) are available, free of charge in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. E-mail: orders@wrc.org.za Foreign orders: US \$20 per copy via surface mail.



A look at changes in the salinity of South Africa's water resources

The Water Research Commission and the Department of Water Affairs and Forestry commissioned an investigation into the economic, social and behavioural impacts that would result due to changes in the salinity of South Africa's water resources.

The aim of the study was, primarily, to develop a generalised methodology model to determine the generic impact of changes in the total salt concentration found in South African rivers and to interpret these impacts in financial, economic and social terms. The resultant model was required to be comprehensive with respect to addressing the salinity problems as well as being applicable to any salinity situation in any water sector in South Africa.

The project was carried out by consultants from the firm Urban Econ, assisted by researchers from Project Evaluation and Corrolec CC.

The researchers say a generic model, making provision for all possible conceptual elements applicable to salinisation has been successfully developed. The model comprises separate equations representing the different sectors of the economy as well as the natural environment and water feeder systems. An outstanding feature of the model is that it is a generalised model and as such is applicable to any salinisation situation in South Africa.

The value of the study lies in applying the findings in a policy environment. This means that the study results can provide motivation to formulate new policy directives for utilising water resources in a given area.

MANAGE

Prior to deciding how salinity in the water supply could be managed, it is necessary to determine the total cost of salinity to the economy, namely its direct, indirect and induced cost effects.

Costs borne by the various sectors in the economy have to be determined, including the identification of behavioural impacts. The study addresses the impacts of increased level of salinity throughout the economy.

The project was divided into two phases:

- The development of a generalised methodology for the determination of the generic impact of salt concentration of South African rivers and the interpretation of these impacts

Middle Vaal River

There has been a steady increase in the salt content of the Vaal River since 1935. This increase has accelerated markedly since 1965 with a further pronounced effect caused by the droughts prior to 1996. This increase in the salt content affects all water use components exposed to such water.

A major salinity problem exists in the Middle Vaal River area, between the Barrage and Bloemhof Dam. Various options for solving the problem have already been identified. All the options are, however, costly and it is important to quantify the benefits of a reduction in salt concentration in order to justify expenditure on measures to reduce the salinity.

- The application of the methodology to an investigation of the impact of increased salt concentration in the Middle Vaal River.

The approach followed with the study is based on economic theory by conceptualising sectoral behaviour within the

economy. The economy had been classified into different sectors and research was conducted separately for each sector. These results were integrated to determine the total economic effects on the economy. On account of the volume of research results, the sectoral research is presented in separate volumes to support the integrated results contained in the main report - Volume 1.

Each of the sectoral reports, combining its initial inputs for the generalised model with its findings in the case study, has been separately bound. These are individually available as:

- Volume 2 - Household sector
- Volume 3 - Agricultural sector
- Volume 4 - Mining sector
- Volume 5 - Industrial sector
- Volume 6 - Services sector
- Volume 7 - Water quality analysis, feeder systems and natural environment

APPROACH

In quantifying the conceptual formulae, surveys were undertaken in the Middle Vaal River study area to obtain the direct costs related to salinity. These direct costs represent only a partial estimate of the total costs of salinity. To determine the indirect costs and other spin-off effects, an integrated costing framework had to be set up. This was done by utilising the input-output technique and a combination of input-output applications.

Despite the inherent limitations of the input-output technique, it is a very versatile and flexible model to simulate real-world situations. Furthermore, its ability to determine the indirect and induced cost effects, renders the approach as well as the results unique and comprehensive.

Conceptual cost formulae were formulated to determine the direct costs and behavioural impacts on costs for different levels of salinity. Based on this back-

ground research to develop these formulae, the research results indicated that both the feeder systems and the natural environment would not incur significant (incremental) costs within the specified salinity range of 200 mg/ℓ to 1 200 mg/ℓ total dissolved solids (TDS). These two sectors were therefore not incorporated in the integrated model.

Upon conducting surveys in the study area to determine the direct sectoral costs, a variety of problems was encountered. The most important of these is the fact that many respondents (i.e. sectoral water users) are not aware of the costs of salinity and therefore assigning costs to behaviour becomes rather presumptuous. Behaviour does, however, play an important role in the household and agricultural sectors. With the other sectors, behaviour is driven by technology and production factors.

The survey results obtained in the Middle Vaal River study area were analysed and transformed where necessary, to be integrated into the input-output modelling framework.

The following approaches were followed:

- Conducting a multiplier analysis that provides a first approximation of the additional costs of salinity due to a change in the TDS and using this to rank sectoral sensitivities with respect to the impact of salinity.
- Setting up a pricing model that simulated the cost increases of different levels of salinity in terms of price changes being passed on as price increases. These price changes are passed on as price increases to all sectors of the economy and can be interpreted as proxies for changes in the consumer price index and producer price index.
- Running an augmented input-output model to estimate total additional resource usage as salinity rises. To cost this, a new industry was postulated to enter the economy to combat salinity. A new row and column representative of this industry was inserted into the input-output table.

Each of these approaches focused on a different aspect in determining the total cost effects of different levels of salinity.

RESULTS

□ Direct cost effects

The direct costs of salinity to the entire economy of the case study area are established from the mathematical combination of the survey area data collected within each individual sector. There are constraints with much of the data, since most interviewees were unable to supply data for any conditions other than those currently being experienced and were generally rather uninformed about salinity and its potential effects.

Despite the drawbacks, the data provided some indication of the direct economic effects of increased salinity. The collected data was centred around 500 mg/ℓ which is the average salinity level presently experienced in the study area. Data for salinity levels below 500 mg/ℓ implies a corresponding saving at these lower salinity levels. A 100 mg/ℓ increase in the TDS to 600 mg/ℓ is expected to effect a R26 million increase in annual direct costs in the study area. Increasing the TDS to the highest limit (1 200 mg/ℓ) is expected to result in a direct cost of R183 million/annum to the region. Conversely, a saving of R80 million/annum is anticipated should the salinity drop from current levels 200 mg/ℓ.

□ Indirect and induced effects

The models employed for the case study calculated the direct, indirect and induced costs to the economy. Since the input-output table was closed with respect to households, an allowance was made for the reciprocal relationships between income and consumption, as well as the impact on the economy, resulting from the interdependence of industries in their production process and the behaviour of households. The closing of the input-output table effectively added another industry to the economy. Households have a large impact on the economic processes in the region of the study, and wider, resulting in the expectation of larger impacts than would have been anticipated if the table had been in its open format, considering direct and indirect effects alone. Ratios of the direct, indirect and induced costs to the direct costs (direct cost multipliers) determined by means of the multiplier analysis, range from 1 to about 3.3. This implies that the spin-off effects of increased salinity are significant and

the direct costs alone are a poor reflection of the cost impacts of salinity.

The ranking of the sectors researched, based on the salinity multipliers, indicates that at relatively low levels of salinity it is the community and other service sectors which will be most adversely affected. At high levels of salinity the gold mining sector will have to incur the highest cost to combat salinity.

The results of the pricing model are expressed in terms of percentage changes in the consumer and producer price indices and essentially represent forward linkages. The impacts have been determined in terms of regional and national impacts. Considering only the impact of the productive sectors, results of the same order as the multipliers provided are found, but with less spread. The direct and indirect cost multipliers for the production price and the consumer price indicators are found to lie between 1.36 and 1.84, whilst the direct, indirect and induced cost multipliers are found to lie between 1.96 and 3.5. It should be noted that the pricing model results indicate variables for a base year expressed in percentages. This implies annual changes in costs or prices.

The percentage total increases in the consumer price and producer price indices for salinity levels increases from 600 mg/ℓ to 1 200 mg/ℓ can be summarised as indicated in Table 1.

Table 1:

Salinity abatement by	CPI: % change	PPI: % change
Productive sectors	-0.008 to 0.01	-0.01 to 0.015
Productive sectors & households	-0.1 to 0.22	-0.11 to 0.26

These changes seem to be small but are significant when related to rand values in regional and national context. This had been done and the regional and national annual impacts are summarised as indicated in Table 2.

Table 2:

Impacts	CPI	PPI
National increase		
600 mg/ℓ	R101.5m	R402.6m
1 200 mg/ℓ	R647.5m	R2 623.4m
Regional increase		
600 mg/ℓ	R7.4m	R18.0m
1 200 mg/ℓ	R47.1m	R117.3m

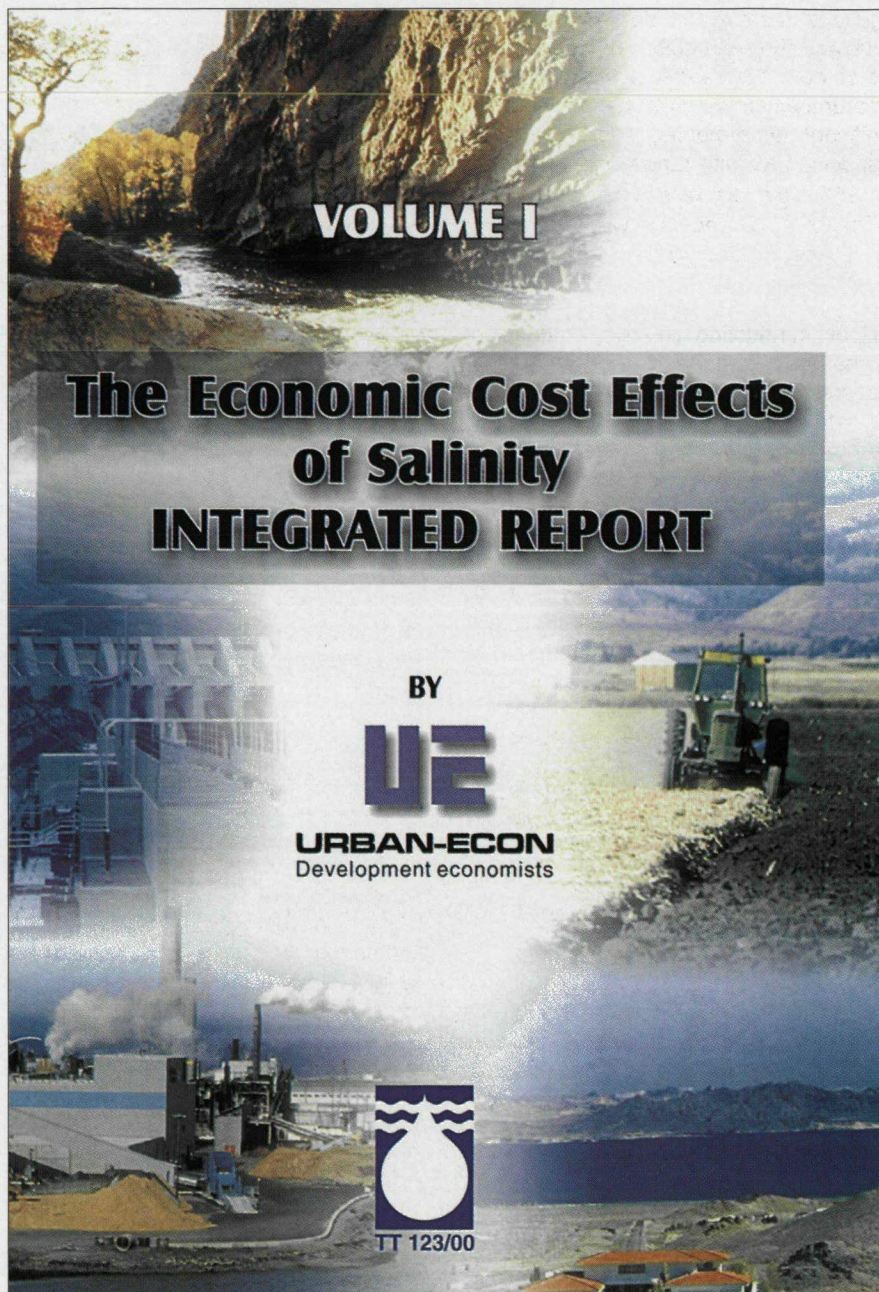
The augmented model was executed using both regional and national input-output tables to determine the total cost effects of salinity abatement. Multipliers were calculated for comparison with the other model applications.

The chief outcome was that the direct cost multipliers was 3.0 for the national case and 2.6 for the regional case. These figures did not change significantly over the salinity range of 600 mg/l to 1 200 mg/l total dissolved solids. The difference in the national and regional direct cost multipliers is due to the differences in structure between the national and the regional economies. Since the input-output analysis is based upon coefficients, the actual size of the economies has no influence on the direct cost multipliers. Only changes in the size of the input (or technical) coefficients (which in turn reflects a change in the structure of the tables) would influence the outcome.

□ Behavioural effects

The decisions regarding salinity changes made in the mining, business and services and the manufacturing sectors tend to be driven by technology and production regimes. These sectors are likely to make changes to combat the effects of salinity, based purely on the financial implications to the concern. As a result, there are few, if any, unexpected responses to salinity effects and the calculated costs can be accepted as reliable.

During the data collection in the agricultural sector, the cost effects of two possible scenarios, based on management decisions or behaviour, were established. These included a "best case" scenario where the farmer would maintain the current levels of production, regardless of cost, and a second scenario, where the farmer would choose to allow the crop yields to be reduced. This was only done for the hybrid model and the overall costs to the economy were found to be hardly affected by the two alternatives. At the 600 mg/l level, the total costs decrease by less than R0.3 million. The variations are found to be between 0.1 per cent and 0.3 per cent of the overall costs, which are less significant than the probable errors in the data. Thus, the different behavioural responses available in the agricultural sectors are unlikely to impact on the total costs to the economy.



The most significant behavioural effects are, however, from the household sector. The responses to increased salinity, while to some extent determined by the need to adapt to the changes, are largely driven by the availability of finances to maintain the status quo and overcome the problems arising from increased salinity. These behavioural responses are more likely to appear in those sectors of lower earning potential, and the informal household sector is far less likely to effect changes arising from increased salinity than suburban households. This is borne out by the variance in the data collected.

Copies of the report entitled **The economic cost effects of salinity - Integrated Report - Volume 1** (WRC report TT 123/00) are available free of charge (in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 20 - via surface mail).

State of the Rivers reports - a first for South Africa



Wilma Strydom of Environmentek, CSIR, describes the process and rationale behind the first State of the Rivers report.

The first report in a series of State of the Rivers reports, published this year, has been welcomed and well received by stakeholders. The report on the state of the Crocodile, Sabie-Sand and Olifants River Systems is a product of the River Health Pro-

gramme (RHP). The main purpose of the Programme is to serve as a source of information regarding the overall ecological state of river ecosystems in South Africa.

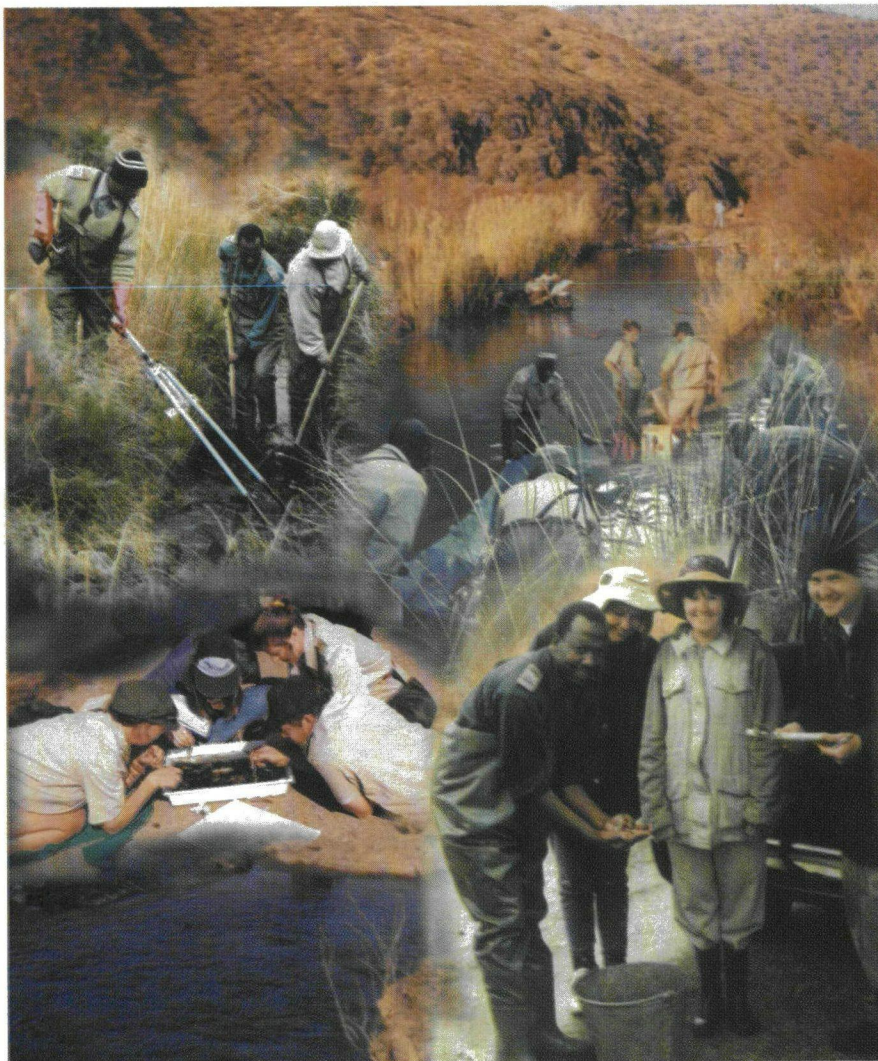
The Department of Water Affairs and

Forestry (DWAF) initiated the formal institution of the RHP in 1994. The RHP primarily makes use of in-stream and riparian biological communities (e.g. fish, invertebrates, vegetation) to characterise the response of the aquatic environment to multiple disturbances. The rationale is that the integrity, or health, of the biota inhabiting the river environment provides a direct and integrated measure of the health of the river as a whole.

A new and sophisticated template for river health reporting has been developed during the past year in collaboration with the Department of Environmental Affairs and Tourism (DEAT), the Water Research Commission (WRC) and Environmentek, CSIR. The template was designed to complement both the protection measures under the National Water Act and the specifications for national state-of-the-environment reporting. The specific objectives of this reporting format are:

- To provide information to Government and agencies for improved decision-making in river management;
- To compare environmental performances of different areas, through which the effects of different impacts or drivers will become evident;
- To increase public awareness of environment and development issues and therefore improve buy-in into sustainable development;
- To enhance the empowerment of people and organisations by providing the information that can improve their environment and quality of life for themselves and future generations.

The reporting template essentially makes use of a "Pressure-State-Response" framework. The ecological region of each of the mentioned rivers, the pressures on those the rivers, the present state and trends in river conditions, as well as the policies and management actions in place to manage the rivers, are described.



The biomonitoring process involves all types of skills and know-how, including sampling and the identification of species.

PROCESS

The process behind the first State of the Rivers report, can be summarised in brief as follows.

The RHP conducted surveys on three of the major rivers of Mpumalanga, namely the Crocodile, Sabie-Sand and Olifants Rivers including some of their tributaries, from 1996 to 1999. Aquatic scientists collected data on river habitats and biota at about 200 monitoring sites during field trips.

In July 2000 the editorial team consisting of Anna Balance, Dirk Roux, Wilma Strydom (all from Environmentek, CSIR) and Mike Silberbauer and Liesl Hill (both from DWAF) got together. They had their first discussions to decide on the way in which the information on the health of the abovementioned three rivers would be packaged. It was important to design a presentation format that would allow communication to multiple audiences (e.g. politicians, resource managers, the public at large) while at the same time reflecting the information needs of key stakeholders. It was decided to make use of both web-based technologies and conventional hard copy reporting.

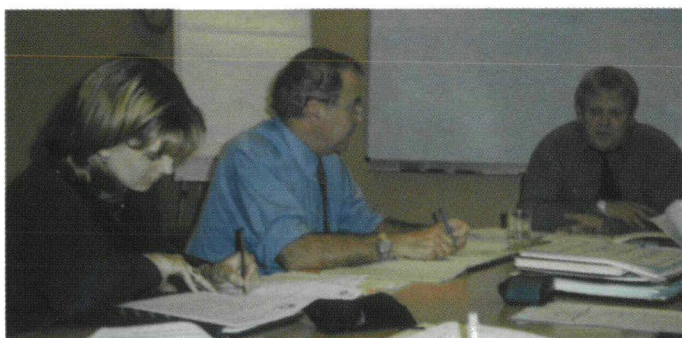
A number of workshops with scientists and resource managers from a number of participating institutions. These institutions included Mpumalanga Parks Board, Kruger National Park, the Working for Water Programme and Biomonitoring Services. The workshops served to gain site specific knowledge from specialists as well as to reach consensus on ecological assessments.

In parallel with the development of the hard copy report, a "state-of-rivers-in-progress" report was established on the RHP website www.csir.co.za/rhp/ where the process could be followed in real time. The internet version of the final report on the RHP website can be accessed through the link to "state-of-rivers reports".

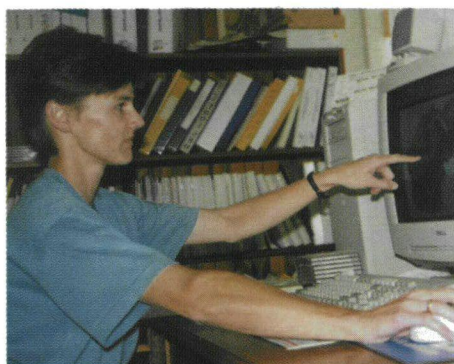
The RHP aims with the State of the River reporting to contribute to better understanding and management of river ecosystems. Two further reports have already been initiated for the Letaba and Levuvhu Rivers, and the Umgeni River respectively.



The Minister of Water Affairs and Forestry, Ronnie Kasrils, hands the first State of the Rivers report to the Deputy Minister of Environmental Affairs and Tourism, Joyce Mabudafhasi. Both the Minister and Deputy Minister welcomed the report and expressed their desire to see this type of reporting extended to all the major South African river systems over the next few years.



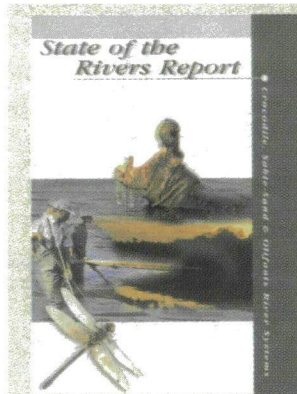
Understanding the information needs of stakeholders was an important element in the development of the State of the Rivers report.



GIS specialists compiled maps. Here, Dineke Vink of CSIR is working on the Olifants River.



The first State of the Rivers report in print.



The State of Rivers reporting is unique in the way in which scientific data is presented in an attractive and easy-to-read format.

Copies of the **State of the Rivers report: The Crocodile, Sabie-Sand and Olifants River Systems**, are available from the Water Research Commission, PO Box 824, Pretoria 0001. E-mail: orders@wrc.org.za

From the WRC Web site...
<http://www.wrc.org.za>

Electronic Atlas on Groundwater Quality available

An electronic atlas on the groundwater quality in South Africa is now available on the web site of the Water Research Commission (WRC). The atlas presents an assessment of the groundwater quality at a national scale. The electronic publication emanates from a research project funded by the WRC, in partnership with the Department of Water Affairs and Forestry (DWAF), to update groundwater quality knowledge in South Africa.

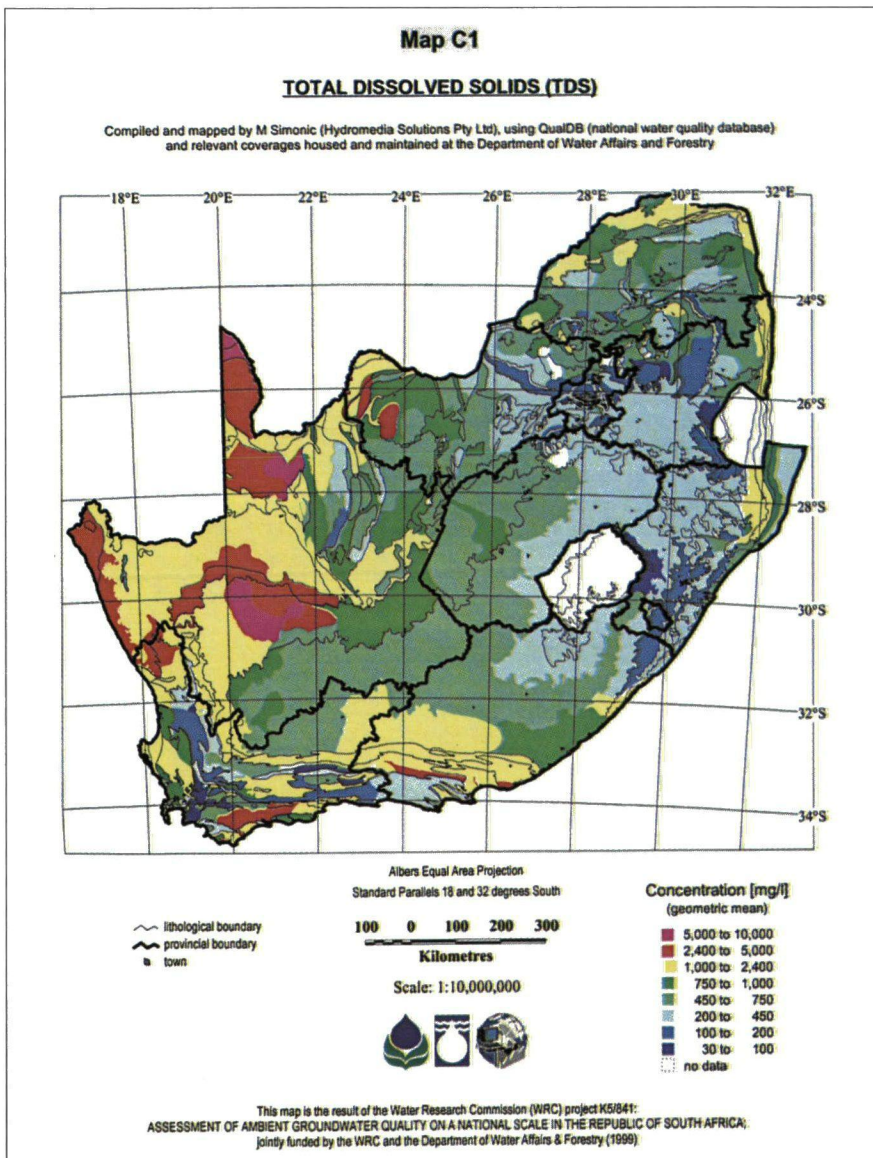
DWAF, for many years, has been gathering groundwater quality data from around the country as a part of ad-hoc groundwater resource investigations. However, very little national-scale investigation of the data took place, except for that depicted on the map of Groundwater Resources of the Republic of South Africa produced by Vegter in 1995. In recent years data gathering has intensified as a result of the regional groundwater mapping programme and the establishment of a national groundwater quality monitoring network.

Apart from re-evaluating the existing groundwater quality database, the main objective of the WRC - DWAF partnership project was to create an atlas of groundwater quality.

Water Quality information is essential in the planning and management of groundwater resources.

The information presented in the atlas should enable representatives from various sectors to efficiently plan their activities, and address important issues from a national health and environmental point of view.

Although local-scale variations may be



of importance for site-specific development of groundwater resources, the emphasis was placed on mapping broad, large-scale trends. No consideration was given to vertical variation of groundwater within the borehole - the available data set does not allow for such examination.

MAPS

A set of maps at scale 1:10 000 000 was compiled. All major water quality variables were mapped countrywide and their summaries are available on the CD-ROM. The maps are in Adobe PDF format, for easy, cross-platform viewing and printing, with Adobe Acrobat Reader viewer (available on CD) as well as in bitmap (bmp) format for easy importing into various documents.

Maps were developed to visualise the status of data quality and availability, eg. distribution of sampled sites, sampled site count per region, sample density expressed as number of km² per sample, sample cover for different time periods as well as sample ion balance error

in three classes.

The groundwater quality maps depict all major hydrochemical parameters as well as several derived and index parameters. Major ions include calcium, magnesium, sodium, potassium, alkalinity, sulphate, chloride, nitrate, fluoride as well as silica. In addition, other derived and index parameters include carbon dioxide activity, chloro-alkaline distribution index, saturation indices (calcite, dolomite, quartz) and total dissolved solids (TDS, TDS/EC correlation, TDS outliers).

DRINKING WATER

A set of maps to show compliance of groundwater for drinking water purpose was also generated. The classification was based on major ions, while other parameters such as minor elements or bacteriological quality was not taken into account. The following parameters, amongst others, were mapped: total hardness, drinking water compliance and drinking water prospects (i.e. the probability of striking water of either drinking or unacceptable water quality).

Unstable parameters such as pH and alkalinity were mapped using the analytical value determined in the laboratory.

Due to lack of historic data, very little information exists to define and separate temporal components from spatial variations. An example from the Springbok Flats was used to demonstrate the temporal variations in groundwater quality due to natural causes such as recharge. The national groundwater quality monitoring initiative is broadly considered to be a means to obtain the information necessary to extract the temporal components countrywide. Several maps depict the preliminary results obtained from national groundwater monitoring, but the relatively short life of national monitoring prevents the formulation of any authoritative statements in this regard.

To access the Electronic Atlas on Groundwater Quality, visit the WRC web site at: <http://www.wrc.org.za>

ITN Conference

"Learning opportunities for Water Management in Africa"

25-29 November 2001

Midrand, Johannesburg, South Africa

Organised by the National Community Water and Sanitation Training Institute

Themes at the conference will include: education and training, funding mechanisms to ensure sustainability, institutional structures to ensure delivery, water resources management, empowerment and community participation, as well as legislative framework.

The conference venue is Eskom Conference Centre at Midrand. The registration fee per person is R2000 before 15 October; or R2500 after 15 October 2001. Registration fees for the conference does not include accommodation. Accommodation at the Eskom Centre is available by prior arrangement.

For further information and registration, please contact Diane Kotze:

NCWSTI-ITN Conference

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Tel: (011) 706- 5010 • Fax: (011) 453-7195 • E-mail: diane @eventdynamics.co.za



New reports published by the Water Research Commission

The following reports are available free of charge (in South Africa) from the Water Research Commission in Pretoria. To order a copy, please contact the librarian, WRC, PO Box 824, Pretoria 0001. Tel: (012) 330-0340. Fax: (012) 331-2565. E-mail: orders@wrc.org.za

Report 348/1/00 - An investigation of the stem steady state heat energy balance technique in determining water use by trees.

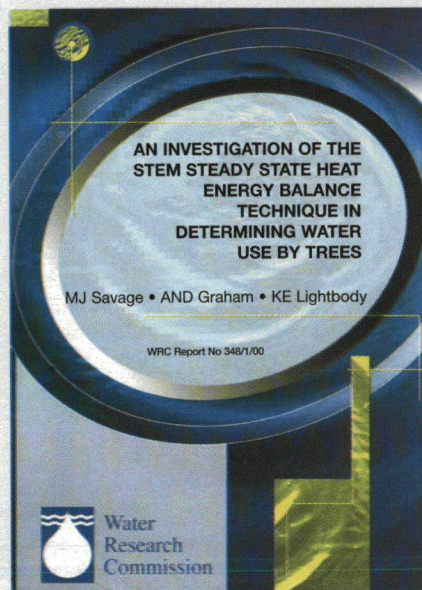
Report to the Water Research Commission by the School of Applied Environmental Sciences at the University of Natal.

Authors: MJ Savage, A Graham and KE Lightbody
Overseas Price: US\$ 25 (via surface mail)

Do trees use vast amounts of water? Can we accurately measure the water use by trees as the water is transpired? What techniques can be used to measure the water use of trees? The answers to some of these questions are addressed in this report.

South Africa is poorly endowed with natural forests and consequently relies heavily on man-made forests for timber products. In an attempt to meet the increasing demands for these, fast growing exotic tree species have often been selected due to their high adaptability, fast growth rate and wide range of end uses. Prognostic studies conducted in 1981 and 1982, which excluded fuel-wood requirements, indicated that an annual establishment rate of 39 000 ha per year was required until the year 2000 to meet South Africa's wood requirements.

Water deficits develop readily in forest trees, even in trees growing in wet soil, because of excess transpiration over



absorption of water. Water deficits adversely affect seed germination and cause tissue shrinkage (leaves, stems, roots, fruits and cones). On coastal sands, for instance, pine seedlings have been known to perish during mid-summer droughts. The importance of water deficits in trees is sometimes underemphasised when growth reduction or death of trees is attributed to such factors as plant competition, disease or insects. However, root diseases and insect injury to roots reduce water absorption, thereby inducing shoot water deficits. The dessication of tree crowns following occlusion of vessels after infection by fungi causing vascular wilt disease leads sequentially to growth reduction and death of trees. Water deficits may also predispose trees to onslaughts of fungus pathogens and insects.

Eucalyptus spp make up forty per cent of South Africa's commercial plantations (that is, 476 770 ha). These are

generally grown in the areas of Kwa-Zulu-Natal Midlands and Zululand coastal hinterland, Eastern Mpumalanga and South-Eastern Gauteng below the Drakensberg escarpment, both of which are situated mostly in a narrow belt along the east coast and eastern interior which receive summer rainfall in excess of 750 mm per annum.

In 1932 the South African State Department of Forestry decided to leave the banks of streams unplanted for 20 m on either side. Campaigns against forestry became so serious at the time of the British Empire Forestry Conference held in South Africa in 1935 that a committee was appointed to report on the effects of forests on climate, water conservation and erosion in South Africa. This committee recommended that a comprehensive scientific investigation be conducted on the effects of tree planting upon local water supplies. The State Forestry Department responded promptly and the Jonkershoek Research Station was established in the same year. In 1936 and in 1955 the Cathedral Peak and Mokobulaan research stations respectively were established.

To investigate whether the fears of voracious water use by *Eucalypts* are justified it is necessary to consider the processes which determine evaporation loss from vegetation, and to understand how these are affected by different climates, plant species, soil types and the availability of soil water. In this report, the researchers concentrate on the use of techniques to measure transpiration in trees and review some aspects, covered by available literature, on *Eucalyptus* plant-water interactions, in an endeavour to assess the potential of afforestation of marginal areas.

Report TT 126/00 - Managing rural water supply in South Africa.

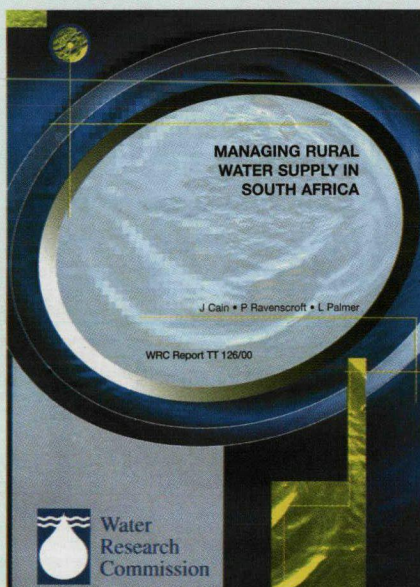
Report to the Water Research Commission by consultants from Mattcomm.

Authors: J Cain, P Ravenscroft and L Palmer

Overseas price: US\$ 15 (via surface mail)

This document is a condensed version the Water Research Commission report 895/1/99, titled "A case study of management systems for rural water supply in the Matatiele District".

The intention with this document is to provide a condensed and easy-to-read report for those involved and working in the field of rural water supply. The findings, models and recommendations put forward in this report are based on the assumptions that the reader is already aware of the current policy



framework related to rural water supply and has an understanding of the implementation procedures and post-implementation issues of community water supply.

For those interested in further details

regarding the methodology, background and findings of this research project, a copy of the full report (895/1/99) can be obtained directly from the Water Research Commission upon request.

The research was originally undertaken to develop appropriate operation and maintenance management arrangement options for rural water supply projects. The management options that were developed are based on grass-roots input from communities and local stakeholders involved in such projects and were developed within the framework set out by the Water Services Act.

An important part of this process was to assess existing management arrangements at completed rural water supply projects to improve the understanding of on-the-ground issues affecting project management and to draw lessons based on this analysis. A case study in the Matatiele district of the Eastern Cape was used for this purpose. 

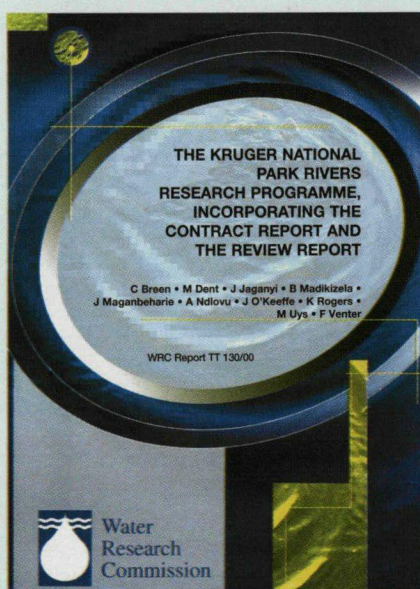
Report TT 130/00 - The Kruger National Park Rivers Research Programme, incorporating the contract report and the review report.

Report to the Water Research Commission by various individuals from different institutions and organisations.

Authors: C Breen, M Dent, J Jaganyi, B Madikizela, J Maganbehari, A Ndlovu, J O'Keeffe, K Rogers, M Uys and F Venter

Overseas price: US\$ 35 (via surface mail)

The Kruger National Rivers Research Programme is a co-operative undertaking by resource-use managers, funding agencies and researchers. It addresses the water quality and water quantity requirements of the natural environments of rivers, particularly those flowing through the Kruger National Park.



The Programme, envisioned at a workshop convened by the Department of Water Affairs in March 1987, was initiated in December 1988 jointly by the government departments of Water Affairs and Forestry, Environment Affairs, the Foundation for Research

Development (now National Research Foundation), the National Parks Board (now South African National Parks), the Water Research Commission and various research institutions and provincial nature conservation authorities.

Research was conducted in discrete projects, each of which was supported by way of a steering committee. Project managers had to report separately to the steering committee and funding agency. The Kruger National Park Rivers Research Programme was the 'nerve centre' and the interface between research and implementation. This report does not, therefore, consider the detail of individual projects. The reader is directed to project reports for such information. This report is the end-of-contract report for the Programme and is presented in three parts. Part 1 is an overview which provides context and an assessment of achievements, strengths and weaknesses. Part 2 comprises reports by the sub-programme managers. Part 3 comprises statements by the partners and a statement by the Kruger Park management of their perceptions of the programme. 

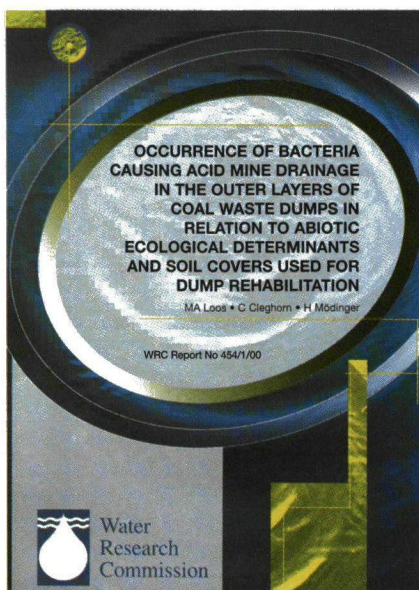
Report 454/1/00 - Occurrence of bacteria causing acid mine drainage in the outer layers of coal waste dumps in relation to abiotic ecological determinants and soil covers used for dump rehabilitation.

Report to the Water Research Commission by the Department of Microbiology at the University of Stellenbosch.

Authors: MA Loos, C Cleghorn and H Mödinger

Overseas price: US\$ 20 (via surface mail)

Many of the older coal waste dumps in South Africa are producers of acid mine drainage. Drainage from these dumps is typically high in acidity (as sulphuric acid), iron and sulphates. Sulphuric acid and ferrous iron, resulting from the chemical and biological oxidation of pyrite, enter the drainage and runoff



areas surrounding coal mine waste dumps. This pollution causes great concern and is difficult to treat. In northern KwaZulu-Natal, for instance, serious pollution of rivers has been reported as a result of acid mine drainage from coal mining operations in that area.

Thiobacillus ferrooxidans and other iron-oxidizing bacteria growing in the aerobic outer layers of coal waste

dumps play a major role in the formation of acid mine drainage. Therefore, the creation of anaerobic conditions can be expected to inhibit iron oxidation by these organisms, thereby reducing the production of acid drainage.

Recent developments in coal dump construction and rehabilitation techniques have the aim of counteracting both acid drainage and spontaneous combustion of the coal waste by reducing access of air to the dumps and the flow of water through and from the dumps.

The report deals with comparative quantitative and qualitative studies on iron-oxidizing and associated bacterial populations (primarily *T. ferrooxidans*) which could catalyse acid drainage production in the outer layers of coal waste dumps. The dumps studied included waste dumps constructed differently or dumps where different rehabilitation methods were used, for example, non-compacted and compacted dumps, dumps without and with clay and/or soil caps, vegetated and non-vegetated dumps. The researchers also tried to identify dump construction or rehabilitation techniques which most successfully limit populations of acid-drainage producing bacteria. 

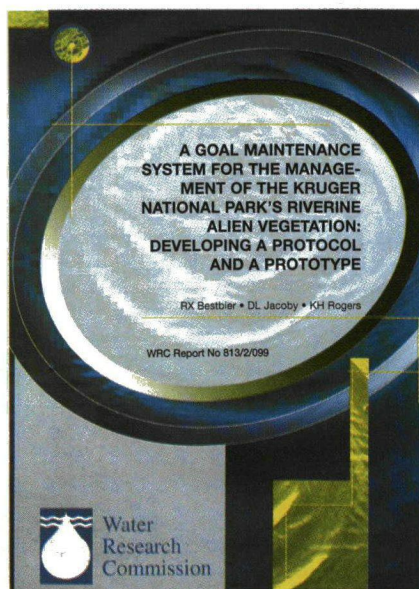
Report 813/2/00 - A goal maintenance system for the management of the Kruger National Park's riverine alien vegetation: developing a protocol and a prototype.

Report to the Water Research Commission by the Centre for Water in the Environment at the University of the Witwatersrand.

Authors: RX Bestbier, DL Jacoby and KH Rogers

Overseas price: US\$ 15 (via surface mail)

The report is the second of a two-part series. According to the report invasive



alien plants are considered to be the single most important threat to the biodiversity of the Kruger National Park.

Alien species, particularly plants, are increasing in abundance and frequency in the Kruger Park with 214 species recorded to date. Some of these invasive plant species, such as *Lantana camara* and *Opuntia stricta* have already invaded thousands of hectares of land, forming impenetrable thickets in places. Alien aquatic weeds (*Azolla*, *Eichornia*, *Pistia* and *Salvinia*) have also formed dense mats on various water bodies throughout the Kruger National Park.

The protocol developed in this study provides a disciplined, systematic approach to enable the development of a goal maintenance system which encourages commitment from all stakeholders. Although the development of the alien vegetation goal maintenance system is still in progress, the available details are presented in the report. 

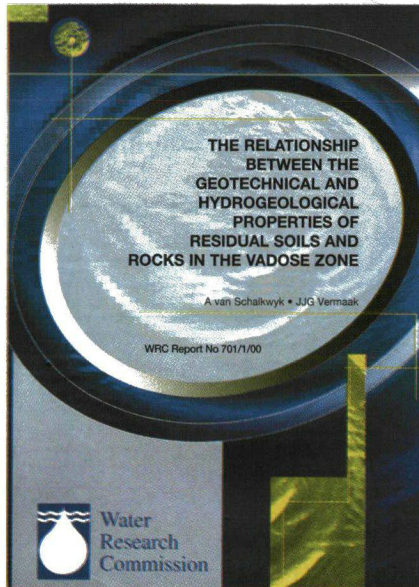
Report 701/1/00 - The relationship between the geotechnical and hydrogeological properties of residual soils and rocks in the vadose zone.

Report to the Water Research Commission by the Department of Earth Sciences at the University of Pretoria.

Authors: A van Schalkwyk and JJG Vermaak

Overseas price: US\$ 30 (via surface mail)

In general terms, this report aims to bridge the knowledge gap between practising geohydrologists involved in groundwater recharge and contamination investigations and engineering geologists and geotechnical engineers involved with similar investigations from an engineering point of view. It also aims to utilise the wealth of existing geotechnical data to estimate important hydrogeological properties of materials in the vadose zone. These estimated properties can be used, in conjunction with relevant climatic and geohydrological information, to estimate groundwater recharge and contamination.



The vadose zone is the portion of the geological profile above the groundwater surface. Voids within the profile are usually, but not always, partially filled by liquid and partially by gas. The term "unsaturated zone", "capillary zone" and "zone of aeration" are frequently used in literature referring to this portion of the soil profile. The vadose zone is subjected to weathering, erosion, pedogenic and other processes, often resulting in a complex geological setting.

The initial approach to the study has been to obtain direct relationships between geotechnical and hydrogeo-

logical properties as described by established one-dimensional flow equations through the soil matrix of the vadose zone. However, it soon became apparent that preferential flow may have a major impact on fluid flow and solute transport through the vadose zone. It also became clear that the spatial distribution and variability of soil properties may have a significant impact on recharge within a regional area.

The contents of this report take into account that it may be used by a broad spectrum of professionals involved in groundwater studies. Few of these professionals may have any knowledge of unsaturated and preferential flow processes occurring in the vadose zone. In addition, many private sector practitioners do not have access to comprehensive libraries. For this reason, the report contains an extensive literature survey covering aspects ranging from basic textbook information to frontline research findings.

The report has been structured into three sections. The first section (Chapters 2 to 11) comprises an extensive literature survey. The second section (Chapters 12 to 14) describes the methodology and results of experiments conducted during the research. The third section (Chapters 15 to 17) describes how the identified relationships can be applied in a regional hydrogeological investigation. 

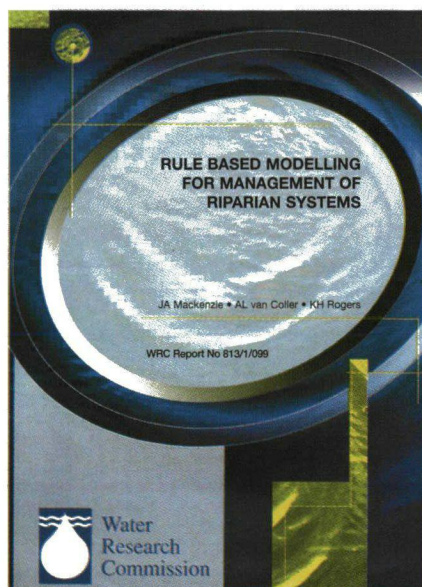
Report 813/1/99 - Rule based modelling for management of riparian systems.

Report to the Water Research Commission by the Centre for Water in the Environment at the University of the Witwatersrand.

Authors: JA Mackenzie, AL van Collier and KH Rogers

Overseas price: US\$ 30 (via surface mail)

The overall aim of this project was to improve the national potential to manage the response of riparian systems to changes in flow regime and geomor-



phology. The researchers, inter alia, evaluated the riparian vegetation abiotic/biotic links model of the Sabie River that was developed as one of the products of the Kruger Park rivers research programme to ascertain additional knowledge and data needs for improved decision support. The researchers also improved the knowledge base by assessing the response of vegetation and geomorphology of the Sabie River to recent severe droughts (1992 and 1995) and floods in 1996. They further developed a monitoring programme to evaluate the achievement of riparian management goals for the Sabie River and produced a protocol for the development, testing and use of rule based models as decision support tools for river management. 

SA WATERKALENDER

The Water Research Commission is placing this calendar in order to assist with the co-ordinating of water events in South Africa.

You are invited to send information about conferences, symposia or workshops to the SA Waterbulletin.

Address:
The Editor,
SA Waterbulletin,
P.O. Box 824,
0001 Pretoria
Tel (012) 330-0340
Fax (012) 331-2565

Legend:

- An SA Water Event arranged for these dates.
- 2nd SA Water Event scheduled for these dates.
- × 3rd SA Water Event scheduled for these dates.

See conferences and symposia pages for events.

2001

JANUARY	FEBRUARY	MARCH	APRIL
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Die Waternavorsingskommissie plaas hierdie kalender om te help met die koördinerings van watergebeurtenisse in Suid-Afrika.

Alle belanghebbendes word uitgenooi om inligting aan SA Waterbulletin te stuur.

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Gids:

- Een SA Watergeleentheid vir hierdie dae.
- 'n Tweede SA Watergeleentheid vir dié datums.
- × 'n Derde SA Watergeleentheid vir dié datums.

Sien Konferensies- en Simposiumbladsy vir aangeduide geleenthede.

2002

JANUARY	FEBRUARY	MARCH	APRIL
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SOUTHERN
AFRICA

2001

ENVIRONMENTAL
MANAGEMENT

SEPTEMBER 18 - 20

A short course on environmental management will be held at the Post-Graduate Centre of the University of Pretoria.

Enquiries: Ms Tanya de Bruin. Tel: (012) 362-5118/9. Fax: (012) 362-5285. E-mail: tanya.ce@up.ac.za

MINE WATER

SEPTEMBER 25 - 28

A conference on environmentally responsible mining in Southern Africa will be held at the Misty Hills Country Hotel, Muldersdrift, near Johannesburg.

Enquiries: Me Ammie Wissing, Conference Planners, PO Box 36782, Menlo Park, Pretoria 0102. Tel: (012) 348-4493. Fax: (012) 348-1563. E-mail address: wissing@iafrica.com

AGRONOMISTS

OCTOBER 25

The next annual general meeting of the South African sugar industry agronomists' association will take place at Kwashukela, Mount Edgecombe. The theme of the meeting will be "Water use efficiency - constraints and potential". The focus will be on sugar-cane.

Enquiries: A Singels, Agronomy Department, SASA Experiment Station. Tel: (031) 539 3205. E-mail: singelsa@sugar.org.za Web address: <http://www.sugar.org.za/sasexabout/agronomy/agronassoc.htm>

TOXICOLOGY

NOVEMBER 21

The 5th one day seminar and workshop on "The practical applications of Whole Effluent Toxicity (WET) testing" will be held at a venue in Pretoria.

Enquiries: Dr. Pieter van Eeden at 016-889-3795, or e-mail: pieter.vaneeden@freemail.absa.co.za

WATER MANAGEMENT

NOVEMBER 25 - 29

The International Management Training Network (ITN) conference with the theme "Learning opportunities for water management in Africa" will be held in

Midrand, Johannesburg.

Enquiries: Diane Kotze, NCW-STI-ITN Conference, c/o Event Dynamics (Pty) Ltd, PO Box 98009, Sloane Park, 2152. Tel: (011) 706-5010. Fax: (011) 453-7195. E-mail address: diane@eventdynamics.co.za

2002

RIVER SYSTEMS

MARCH 3 - 8 2002

The 4th international ecohydraulics symposium with the theme "Environmental flows for river systems" will be held in Cape Town.

Enquiries: Conference Secretariat, Southern Waters Ecological Research and Consulting (Pty) Ltd. PO Box 13280. Mowbray 7705. Fax: (021) 6503887. E-mail: conference2002@southernwaters.co.za. Web address: <http://www.southernwaters.co.za>

HYDROLOGY

MARCH 18 - 22

UNESCO's 4th international conference on Flow Regimes from International Experimental and Network Data (FRIEND) with the theme "Bridging the gap between research and practice" will be held in Cape Town.

Enquiries: Juanita McLean, Institute for Water Research, Rhodes University, PO Box 94, Grahamstown 6140. Tel: (046) 622-4014. Fax: (046) 622-9427. E-mail: Juanita@iwr.ru.ac.za

DESERTIFICATION

APRIL 8 - 10

An international symposium on alternative ways to combat desertification - Connecting community action with science and common sense - will be held in Cape Town.

Enquiries: Mary Seely, Desert Research Foundation of Namibia, PO Box 20232, Windhoek, Namibia. Tel: +264 61 229855. Fax: +264 61 230172. E-mail: mseely@drfn.org.na

WISA

MAY 19 - 23

The Water Institute of Southern Africa (WISA) will hold its next biennial meeting at the ICC conference centre in Durban. **Call for papers.**

Enquiries: Roelien-M Bakker, WISA. Tel: (011) 805-6368. Fax: (011) 315-1258. E-mail address: conference@wisa.co.za

OVERSEAS

2001

WATER RESOURCES

SEPTEMBER 24 - 26

The first international conference on water resources management will be held in Halkidiki, Greece.

Enquiries: Web: <http://www.wessex.ac.uk/conferences/2001/wrm01/>

WASTE MANAGEMENT

OCTOBER 1 - 5

The 8th international waste management and landfill symposium will be held in S. Margherita di Pula, Cagliari, Italy.

Enquiries: EuroWaste srl, via Altinate, 96 - 35121 Padova. Tel: +39 049 663860. Fax: +39 049 663960. E-mail: eurowaste@tin.it Web: www.unipd.it/sardiniasymposium

GROUNDWATER

OCTOBER 4 - 5

An international conference on "Applying policies and decision-making tools to land-use planning" will be held in Birmingham, UK.

Enquiries: Lamorna Zambellas or Mary Goldsworthy. Tel: +44 (0) 121 711 5885. Fax: +44 (0) 121 711 5925 or e-mail: ngwclc@environment-agency.gov.uk

WEFTEC 2001

OCTOBER 13 - 17

The 74th annual conference and exhibition of the American Water Environment Federation will be held in Atlanta, USA.

Enquiries: E-mail address: confinfo@wef.org Fax: +1 703 684 2475. Web: <http://www.wef.org/docs/conference.html>

WORLD WATER

OCTOBER 15 - 19

The 2nd world water congress hosted by the International Water Association (IWA) will be held in Berlin, Germany.

Enquiries: Cornelia Wolff von der Sahl. Tel: +49(0)30/3038-2085. Fax: +49(0)30/3038-2079. E-mail: wolffvondersahl@mess-berlin.de Web-page: <http://www.iwa-berlin.de>

IWEX 2001

OCTOBER 30 - NOVEMBER 1

The international water and effluent treatment exhibition will be held at the Nec, Birmingham,

England.

Enquiries: Paul Tweedale. Tel: +44 (0) 1895 454540. Fax: +44 (0) 1895 454640. E-mail: p.tweedale@turret-rai.co.uk Web: www.iwex.co.uk

LAKE MANAGEMENT

NOVEMBER 11 - 16

The 9th international conference on the conservation and management of lakes (Biwako 2001) will be held in Otsu City in the Shiga Prefecture, Japan.

Enquiries: Conference Secretariat, c/o Shiga Prefectural Government, 4-1-1 Kyomachi, Otsu, Shiga 520-8577, Japan. Tel: +81-77-528-3466. Fax: +81-77-528-4849. E-mail address: lake2001@pref.shiga.jp. Website: <http://www.pref.shiga.jp/lake2001/>

PUMPS

NOVEMBER 13 - 16

A conference and exhibition on pumps and systems will be held in conjunction with Watertec Malaysia in Kuala Lumpur.

Enquiries: HQ Link, 150 South Bridge Road, #13-01 Fook Hai Building, Singapore 058727. Tel: +65 534 3588. Fax: +65 534 2330. E-mail: hqlink@singnet.com.sg Web: www.hqlink.com

ENVIRONMENT 2001

CANAGUA VIII - an international fair on water, energy and the environment will be held on the Canary Islands, Spain.

Enquiries: CANAGUA - Apartado de Correos, PO Box 50, 35080 Las Palmas de Gran Canaria, Islas Canarias, Spain. Tel: +34 828010 203. Fax: +34 928 411 710. E-mail address: canagua@infecar.es Web: www.infecar.es/canaguaEu

AGRO 2001

NOVEMBER 16 - 18

The 5th international symposium on waste management problems in agro-industries will be held under the auspices of the International Water Association (IWA), in Shiga, Japan.

Enquiries: Agro 2001, Kyoto University, 1-2 Yumihama, Otsu, Shiga 520-0811 Japan. Fax: +81-77-524-9869. E-mail: agro2001@biwa.eqc.kyoto-u.ac.jp

WATER & LAND

NOVEMBER 28 - 29

An international conference on sustainable development strategies - water and land planning will take place in Liège, Belgium. Enquiries: Water Academy, Ms Tchanilé. Tel: 00 33 141201856.

E-mail: academie@oieau.fr

FRESHWATER

DECEMBER 3 - 7

A conference on freshwater will be held in Bonn, Germany.

Enquiries: Secretariat of the international conference on freshwater, Tulpenfeld 7, 53113, Bonn, Germany. Tel: +49 (0) 228-28046-55. Fax: +49 (0) 228 28046 60. E-mail address: info@water-2001.de

2002

UAWS

FEBRUARY 18 - 21

The 11th congress of the Union of African Water Suppliers (UAWS) will be held in Libreville, Gabon, with the theme, "Water and the environment, strategic factors in poverty alleviation".

Enquiries: Administrative Secretary of UAWS, 01 Bp 1843 Abidjan 01, Côte d'Ivoire. E-mail: susher@sodeci.ci. Tel: (225) 2124-1443. Fax: (225) 2124-2629.

GROUNDWATER

FEBRUARY 20 - 22

An international groundwater conference on sustainable development and management of groundwater resources in semi-arid regions with special reference to hard rocks will be held in Dindigul, Tamilnadu, India.

Enquiries: Conference Secretariat IGC2002, NGRI, Uppal Road, Hyderabad 500007, India. Tel: +91 40 7170141. Fax: +91 40 7171564. E-mail address: postmast@csngri.ren.nic.in

GROUNDWATER

MARCH 25 - 29

An international groundwater symposium - bridging the gap between measurements and modelling in heterogeneous media will be held at Berkley, California, USA.

Enquiries: Dr Angelos Findikakis, Bechtel, Mail Stop 333/12/C34, PO Box 3965, San Francisco, California, USA. Tel: +1 415 768 8550. Fax: +1 415 768 4898. E-mail: anfindik@bechtel.com

SEWER PROCESSES

APRIL 15 - 17

The 3rd international conference on sewer processes and networks will be held in Paris, France.

Enquiries: GRAIE - 3rd SPN Conference, Secretariat, BP 2132, 69603 Villeurbanne cedex

- France. Tel: +33 4 72438368. Fax: +33 4 7239277. E-mail: graie@urgc-hu.insa-lyon.fr

BIOTECHNOLOGY

APRIL 15 - 17

The 2nd environmental biotechnology conference focusing on applications of biotechnology for treatment and utilisation of industrial wastes and by-products will be held in Palmerston, New Zealand.

Enquiries: Conference Secretary, Office of the Principal, Massey University, Private Bag 11-222, Palmerston North, New Zealand. Tel: +64 63505243. Fax: +64 63505862. E-mail: M.K.Edwards@massey.ac.nz

GROUNDWATER

MAY 12 - 17

An international groundwater conference with the theme - Balancing the groundwater budget - will be held by the International Association of Hydrogeologists (Australian Chapter) in Darwin, Australia.

Enquiries: Des Yin Foo IAH (NT), PO Box 95, Palmerston, NT 0831, Australia. Fax: (61) 8 8999 3666. E-mail: des.yinfoo@nt.gov.au

WATER QUALITY

MAY 21 - 22

A conference on automation in water quality monitoring will be held in Vienna, Austria.

Enquiries: E-mail: Mail@iwga-sig.boku.ac.at Web: www.iwga-sig.monet.boku.ac.at Tel: +43 (0) 1 36006 5800. Fax: +43 (0) 1 3689949.

ECWATECH-2002

JUNE 4 - 7

The 5th international congress and trade fair - Water, Ecology and Technology will be held in Moscow, Russia.

Enquiries: Sergey Malygin, SIBICO International Ltd, PO Box 173, Moscow, 107078 Russia. Tel/Fax: +7 (095) 975 1354, 975 5104. E-mail: ecwatech@sibico.com Web: www.sibico.com/ecwatech/index.htm

WATER UTILITIES

JUNE 12 - 14

A conference on the management of productivity at water utilities will be held at Praha in the Czech Republic.

Enquiries: Katerina Slaviakova, Aquion s.r.o., Delnika 38, CZ-170 00 Praha 7, Czech Republic. Tel: +420 283872265. Fax: +420 283872266. E-mail address: ManProWU@aquion.cz

AWWA

JUNE 16 - 20

The American Waterworks Association's annual conference and exhibition will be held in New Orleans, USA.

Enquiries: David Rossiter, AWWA, USA. E-mail: rossiter@awwa.org Tel: +303 347 6209. Web: <http://www.awwa.org/tande/awwaconf.htm>

GROUNDWATER

JUNE 17 - 19

A conference on soil and groundwater pollution induced by the transport industry will be held in Oslo, Norway.

Enquiries: Transport and Pollution, Department of Geology, PO Box 1047, Blindern 0316 Oslo, Norway. Fax: +47 22 85 42 15. E-mail: transp-pollution@geologi.uio.no

ISWA 2002

JULY 8 - 12

The International Solid Waste Association (ISWA) world environment congress and exhibition will be held in Istanbul, Turkey. Theme: Appropriate environmental and solid waste management and technologies for developing countries.

Enquiries: MICWORLD, Bagdat Cad. No: 254/2-8 81060 Göztepe, Istanbul, Turkey. Tel: +90 216 467 5398. Fax: +90 216 302 5216. E-mail: iswa2002@iswa2002.org Web address: <http://www.iswa2002.org>

IRRIGATION

JULY 21 - 28

The 53rd IEC meeting and 18th international congress on irrigation and drainage will be held in Montreal, Canada.

Enquiries: Jean-Marcel Laferrière, Chairperson of the Organising Committee, CIDA, 200 Promenade du Portage, Hull, QC K1A 0G4 Canada. Tel: +1 819953 4327. Fax: +1 819 994 0251. E-mail address: jeanmarc-laferriere@ACDI-CIDA.GC.CA

CSCE/ASCE

JULY 21 - 24

The 2002 joint CSCE/ASCE international conference with the theme - An international perspective on environmental engineering will be held at Niagara Falls in Canada.

Enquiries: Professor Richard G Zytner. E-mail address: CSCEASCE2002@yahoo.ca Web-address: www.eos.uoguelph.ca/webfiles/CSCE_ASCE_2002

WATER RESOURCES

JULY 22 - 26

The 3rd international conference on water resources and environmental research (ICWRER) with the theme "Water quantity and quality aspects in modelling and management of ecosystems will be held in Dresden, Germany.

Enquiries: Conference Secretariat ICWRER 2002, Institute of Hydrology and Meteorology, Dresden University of Technology, Wuerzburger Str 46, 01187 Dresden, Germany. Tel: +49 351 463 3931. Fax: +49 351 463 7162. E-mail address: icwrer2002@mailbox.tu-dresden.de Web: www.tu-dresden.de/fghihm/hydrologie.html

SOIL SCIENCE

AUGUST 14 - 21

The 17th world congress on soil science - confronting new realities - will be held in Bangkok, Thailand.

Enquiries: Mrs Catherine Vachon. Tel: 1 403 317 2257. Fax: 1 403 382 3156. E-mail: vachonc@em.agr.ca Web: www.res2.agr.ca/lethbridge/hebe/i/confindex.htm

ACID SOILS

AUGUST 25 - 30

The 5th world acid sulphate soils conference will be held at the Quality Resort Twin Towns, Tweed Heads, NSW Australia.

Enquiries: Jacki Rose. Tel: 0011 61 75536 4000. Fax: 0011 61 7 5599 5167. E-mail address: hwtweedm@onthenet.com.au Web address: www.acrosee69.webcentral.com.au/aciddates.htm

ANAEROBIC DIGESTION

SEPTEMBER 11 - 13

The 3rd international symposium on anaerobic digestion of solid waste will take place in Garching, Germany.

Enquiries: Rüdiger Dalhoff, Am Coulombwall, D-85748 Garching. Tel: +40 89289 13710. Fax: +49 89289 13718. E-mail: Dalhoff@bv.tum.de

DRY AREAS

SEPTEMBER 15 - 19

An international conference on environmentally sustainable agriculture for dry areas for the 2nd millennium will take place in Shijiazhuang, Hebei, People's Republic of China.

Enquiries: Mrs Catherine Vachon. Tel: 1 403 317 2257. Fax: 1 403 382 3156. E-mail: vachonc@em.agr.ca Web: www.res2.agr.ca/lethbridge/hebei/confindex.htm

INTRODUCTORY COURSE in WATER MICROBIOLOGY

Division of Water,
Environment and Forestry Technology
CSIR • Pretoria

20 -23 November 2001

Register before 30 October 2001

The Water Resources Management Programme, CSIR, is presenting a course for people in the water industry who need to know more about the basic techniques used in the microbiological analysis of water. The course is recommended for industries, municipalities, government departments, water boards and water bottlers.

The course will be limited to a maximum of 10 participants to ensure personal attention. They will be trained in the basic concepts of health related water microbiology. The theoretical (theory 25% and lectures 15%) and the practical (60%) aspects to be covered will include:

- Detection and enumeration of indicators of pollution (heterotrophic plate count, total and

faecal streptococci, coliphage and the confirmation of *E. coli*.

- Demonstration of the detection of other pathogens in water (viruses, parasites and *Legionella*).
- Interpretation and reporting of results.
- Lectures on water purification and water disinfection, the importance of the chemical composition of water and their related health implications, the geology and hydrology of ground water.
- Quality control and laboratory safety.

A certificate of attendance will be issued on completion of the course.

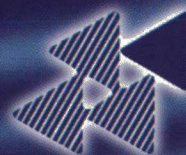
Should you be interested, please contact:

Pauline Coubrough

Tel: (012) 841 3952

Fax: (012) 841 2506

E-mail: pcoubrou@csir.co.za



**Water,
Environment
and Forestry
Technology**

CSIR

ENVIRONMENTAL FLOWS FOR RIVER SYSTEMS

International Working Conference on Assessment and Implementation
incorporating the

FOURTH INTERNATIONAL ECOHYDRAULICS SYMPOSIUM



3 – 8 MARCH 2002
CAPE TOWN, SOUTH AFRICA

This international working conference will focus on methods, procedures and policies for promoting sustainable use of water resources through proactive use of environmental flows. All parts of the river system will be addressed: the river channel and banks; associated wetlands, floodplains, lakes and estuaries; and linked groundwater and near-coast oceanic environments. A warm invitation is extended to river scientists, water engineers, water managers, policy makers, social scientists working on subsistence use of aquatic systems, and anyone interested in the sustainable use of river systems, to attend the conference and the related activities.

CONFERENCE OUTLINE

- Four plenary sessions
- Four days of parallel sessions
- One day of specialist workshops
- Pre-conference Training Courses
 - Flow assessment methods
 - Update on IFIM
 - Geohydrology
- Hydraulics & hydrology for ecologists
- Ecotoxicology
- Freshwater flows for estuaries
- Eutrophication
- Mid-week excursions
- Post-conference tours

KEYNOTE AND INVITED SPEAKERS

Minister Ronnie Kasrils, Minister of Water Affairs and Forestry, SA
Prof. Brian Moss, University of Liverpool, UK
Prof. Thayer Scudder, California Institute of Technology, USA
Prof. Klaus Jorde, University of Idaho, USA
Dr Catherine Sabaton, Electricité de France, France
Mr John Briscoe, World Bank, USA

Mr Bill Rowston, Water Affairs and Forestry, SA
Prof. Jack Stanford, Flathead Lake Biological Station, USA
Prof. Angela Arthington, Griffith University, Australia
Prof. Kevin Rogers, University of the Witwatersrand, SA
Prof. Geoff Petts, University of Birmingham, UK
Dr Cate Brown, Southern Waters, SA

The two prestigious journals – Regulated Rivers: Research and Management and Journal of Hydraulic Research – will each devote an issue to papers presented at the Conference.

DEADLINES

Abstracts 31 July 2001
Late registration 30 November 2001

CONFERENCE SECRETARIAT

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E-mail: conference2002@southernwaters.co.za
web site: <http://www.southernwaters.co.za>

ALL ENQUIRIES AND REGISTRATION:

Please refer to the Conference web site, or contact the Conference Secretariat.