SA waterbulletin

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WATER QUALITY
Gamtoos Estuary studied

WATER POLLUTION
Biocatalyst clears up rivers

WATERVOORSIENING
Navorsers ontleed Pretoria se waterverbruikersdata

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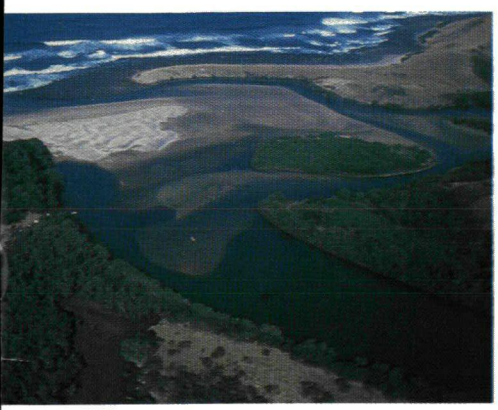

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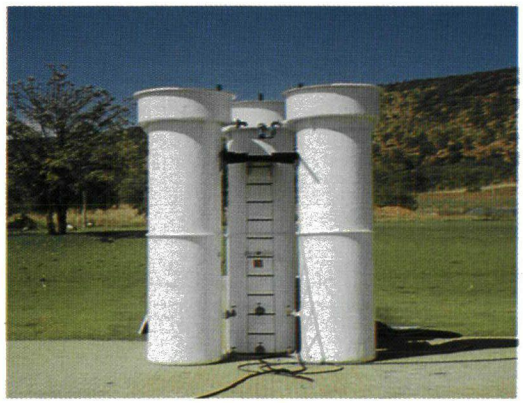

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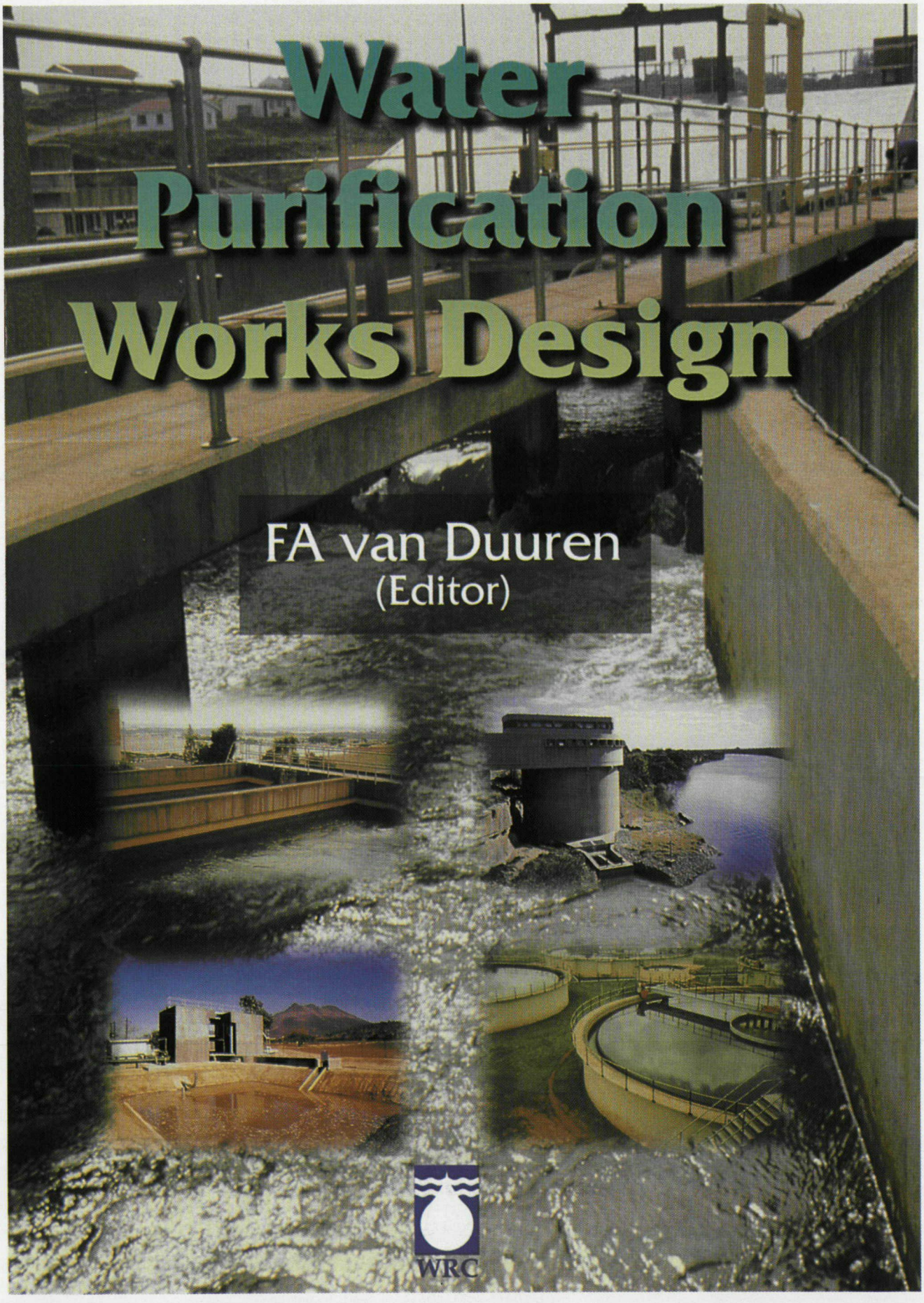
Cover: The Swartvlei estuary in the Wilderness area. (Photo: Helene Joubert)

SA Waterbulletin is a two monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source. Editorial offices: Water Research Commission, PO Box 824, Pretoria 0001, Republic of South Africa. Tel (012) 330-0340. Fax (012) 331-2565. Editor: Jan du Plessis (E-mail: Jan@wrc.ccwr.ac.za). Asst Editor: Helene Joubert (E-mail: Helene@wrc.ccwr.ac.za). Ed Secretary: Rina Human (E-mail: Rina@wrc.ccwr.ac.za). Layout: Chilli Design 082 578-7257. Colour Separations: 4 Images. Printing: Beria Printers.


Water
Purification
Works Design
FA van Duuren
(Editor)
WRC

WRC publishes water purification works design guide

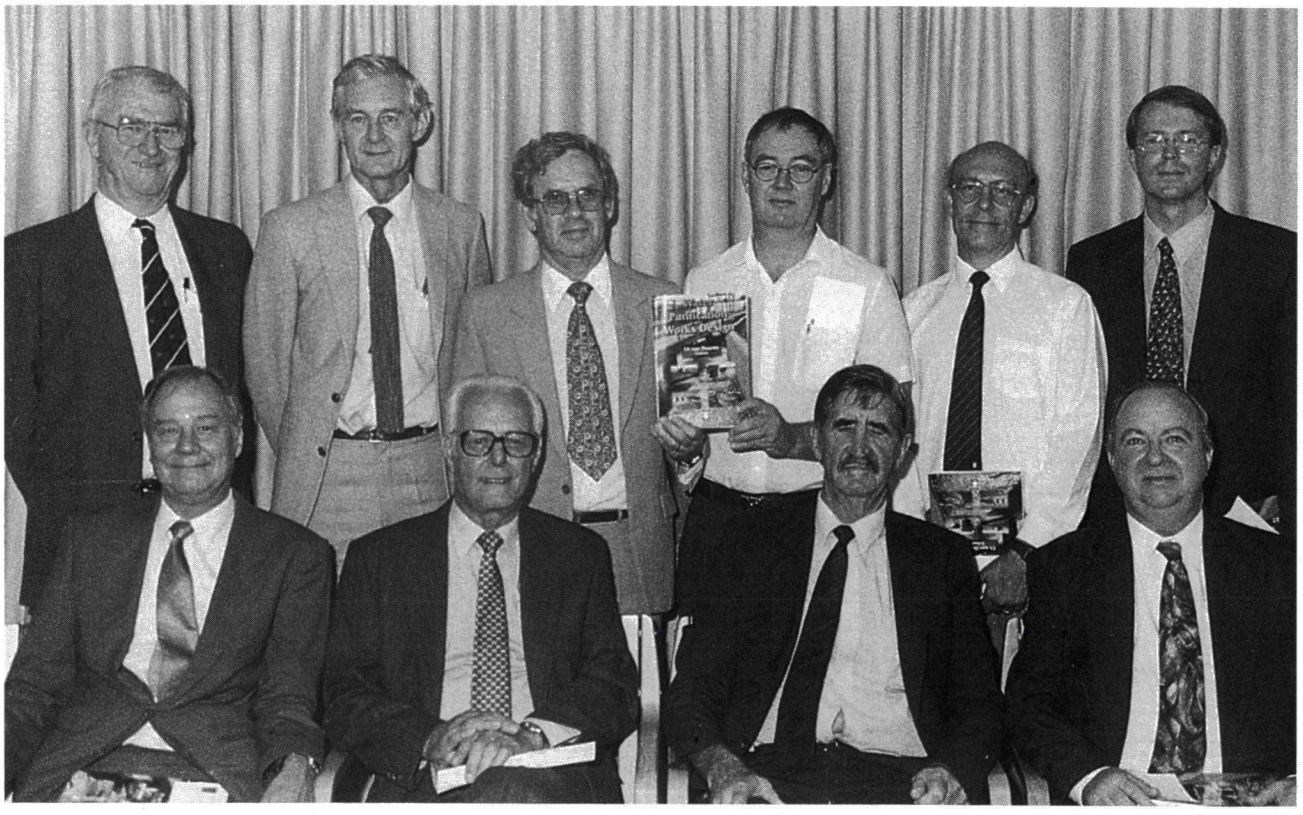
A new South African textbook for water purification and treatment works is obtainable from the Water Research Commission in Pretoria. It is aimed at engineers who design these plants, the personnel of existing water purification works, academics as well as students.

Research undertaken by the University of Cape Town a few years ago revealed a lack of understanding in South Africa about the workings of water purification processes as well as what could be done to enhance the operation of such plants.

As some R1,2 billion is spent on new water purification works annually and a further R15 billion each year on distribution systems to deliver the water to consumers, it is of the utmost importance that these systems are effectively designed and managed, says Dr Gerrit Offringa, Research Manager at the Water Research Commission.

The publication was compiled by a team of experts under the editorship of Dr FA van Duuren, formerly a professor of water utilisation engineering science at the University of Pretoria. The 21 chapters cover the full spectrum of water needs determination, process selection, process design, mechanical and electrical instrumentation and process control, costing and estimation as well as the operation, control and management of the completed plant.

The book contains 422 pages and is bound in soft cover. Copies are available from the Water Research Commission, P.O. Box 824, Pretoria, 0001. Price: R150 (in South Africa). Foreign orders: US$ 50 (via surface mail).



Some of the contributors to the new Water Purification Works Design publication. From left (front): Professor WA Pretorius (University of Pretoria), Dr FA van Duuren (consultant and Editor), Dr LJR van Vuuren (consultant), Mr D Nozaic (Umgeni Water). Back Row: Mr PJ Pybus (consultant), Mr A Bell (consultant), Mr FJ Retief (consultant), Professor J Haarhoff (Rand Afrikaans University), Dr G Offringa (WRC) and Dr GE Rencken (US Filter, JHB).

WRC funds research into Eastern Cape estuaries

A major water research programme has recently been launched in the Eastern Cape to ensure the improved protection of the province's precious estuaries. Among the aims of the programme, which will be financed by the Water Research Commission (WRC), is to protect and promote the sustainable use of estuaries, particularly in the development of tourism.

Mr Piet Odendaal, Executive Director of the WRC, said the Eastern Cape is a province with relatively few resources, but tourism has the potential to stimulate economic development in this region.

Most of the development potential is to be found along the Eastern Cape coastal region which boasts some 45 per cent of all the estuaries in South Africa.

"However, there are indications that these unique habitats of a wide variety of fresh-water and marine organisms are already under pressure as a result of changing patterns of land use in the catchments and poor management."

Among the threats to the estuaries and their associated ecosystems are the facts that too much water is drawn from the rivers, the vegetation on the banks is being destroyed, erosion leads to sediment deposition and there is large-scale pollution in some areas.

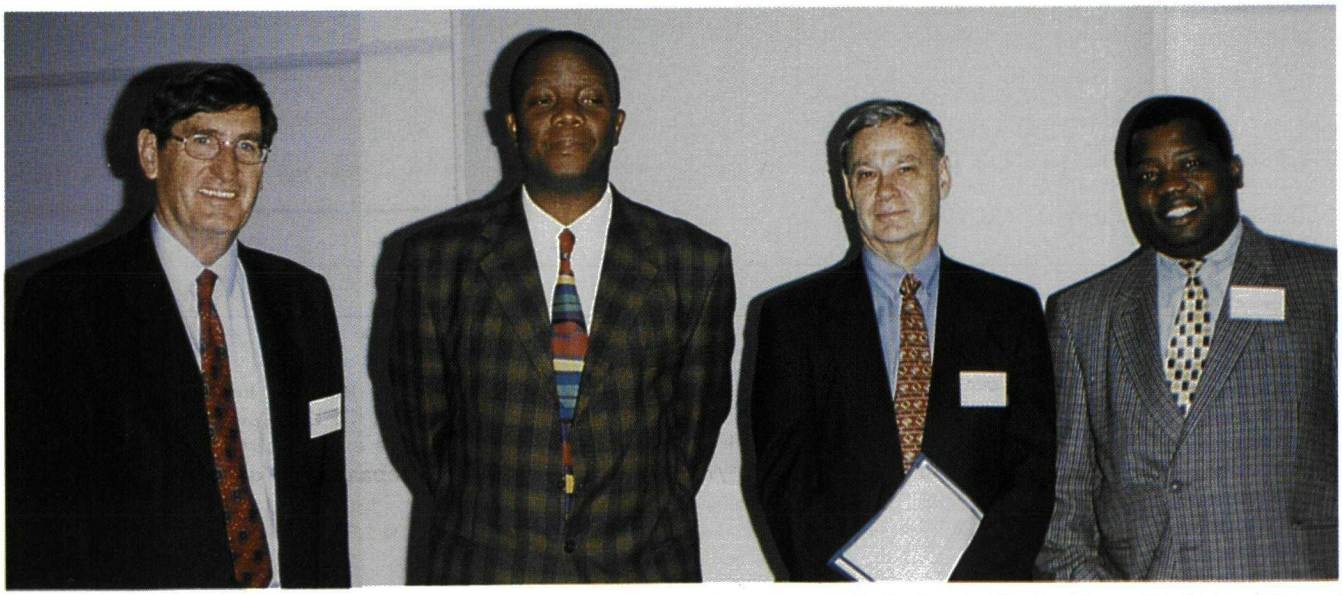
ECONOMIC ASSET

"The Eastern Cape is in danger of losing one of its most important economic assets if estuaries are not managed scientifically," he said. According to Mr Odendaal successful management of estuaries will require sound research and strong support from stakeholders.

Over the years the WRC has developed models which facilitate management of estuaries, but these rely on the input of accurate and extensive data - data which mainly does not exist in the Eastern Cape. "And therefore new approaches will have to be developed which can be adopted as data become available."

The WRC has contracted the Institute of Natural Resources at the University of Natal, under the leadership of Professor Charles Breen, to plan and co-ordinate the research programme. The idea is that the research will be undertaken by organisations in the Eastern Cape, including Rhodes University, the University of Fort Hare, the University of Transkei and the University of Port Elizabeth. The project will enhance capacity at these institutions so that they can better serve the needs of those who have the responsibility of managing estuaries.

Initially, management plans will be developed for two estuaries that require the most urgent attention and which provide the best opportunity for learning how to develop practical management plans which can be implemented locally. These will be used as models to develop management programs for the other estuaries in the region.



At the launch of the new water research programme in the Eastern Cape (from left): Professor Charles Breen (Institute of Natural Resources), Mr Sonwabile Mancotywa, the Minister of Sport, Art and Culture, Eastern Cape Provincial Government, with Mr Piet Odendaal (WRC) and Mr Patrick Sokhela (Chief Executive Officer of the Institute of Natural Resources).

Navorsers ontleed waterverbruikersdata

Ontleding van die maandelikse waterverbruikersdata van Pretoria Stadsraad se watervoorsieningsgebied vir die tydperk 1982 tot 1994 toon dat die gemiddelde maandelikse aanvraag na water per erf sterk korreleer met die inkomste van die verbruiker en dat die bestaande riglyne vir watervoorsiening in Pretoria te konserwatief is.

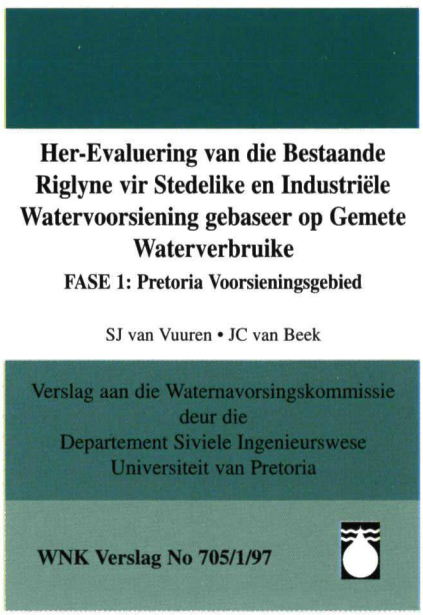
Navorsers aan die Universiteit van Pretoria sê in 'n verslag aan die Waternavorsingskommissie dat inligting oor verbruikersgedrag ontwerpers van infrastruktuurdienste in staat stel om uitspraak te lewer oor die verwagte toekomstige aanvraag wat die verbruiker op infrastruktuurdienste kan plaas, hetsy dit kragverbruik, privaatvervoer of wateraanvraag is.

Die navorsers, SJ van Vuuren en JC van Beek van die Departement Siviele Ingenieurswese, sê dit bly egter altyd moeilik om verbruikers se behoeftes presies te bepaal - veral in die geval van nuwe ontwikkelings waarvoor daar slegs binne breë aannames voorspel kan word wat die grondgebruike en diensvlakke sal wees.

Die gevolg hiervan is dat duidelike voorskrifte vir die bepaling van diensvlakke (oa watervoorsiening) slegs as 'n riglyn beskou kan word. Die slaafse toepassing van hierdie riglyne kan daartoe lei dat 'n stadsraad se infrastruktuur of onvoldoende is of 'n oormaat kapasiteit mag hê.

Die eerste riglyne wat in Suid-Afrika saamgestel is met die doel om inligting oor die voorsiening van ingenieursdienste vir residensiële ontwikkeling daar te stel, is deur die destydse Departement van Gemeenskapsontwikkeling geïnisieer. Dit staan bekend as die sogenaamde "Blou Boek".

'n Paar jaar na die verskyning van die "Blou Boek" het die Departement van Nasionale Behuising en die Nasionale Behuisingsadviesraad die WNNR se afdeling Boutegnologie opdrag gegee om die "Blou Boek" te hersien en die leemtes wat daarin geïdentifiseer is, aan te vul. Die hersiene riglyn moes infrastruktuurvoorsiening oor 'n wye spektrum aanspreek. Dit is in 1994 onder die titel "Guidelines for the provision of engineering services and amenities in residential township development "gepubliseer - die sogenaamde "Rooi Boek".



ONDERSOEK

Ten einde die bestaande riglyne vir die verskaffing van 'n stad se watervoorsieningsinfrastruktuur (soos vervat in die "Blou" en "Rooi" boeke) te vergelyk met die werklike gemete waterverbruik in woon- en nywerheidsgebiede het die Waternavorsingskommissie die Departement van Siviele Ingenieurswese van die Universiteit van Pretoria aangestel om, in noue samewerking met die Stadsingenieur van Pretoria, Pretoria se beskikbare waterverbruikersdata te ontleed.

Die Stadsraad van Pretoria het sedert 1983 waterverbruikersdata per perseel versamel. In die middel negentigerjare het die omvang daarvan so groot geword dat die Stadsraad in 1994 moes besluit of hulle die data gaan vernietig, al dan nie. Die Stadsingenieursdepartement wat sedert 1987 al begin afwyk het van die bestaande riglyne vir watervoorsiening, was van mening dat die verbruikersdata eerder benut moes word om 'n vergelyking te tref tussen die historiese verbruiksrekords en die toepassing van die riglyne vir 'n waterinfrastruktuur. Derhalwe is besluit om die waterverbruikersdata van die Pretoria voorsieningsgebied te ontleed as Fase 1 van die Waternavorsingskommissieprojek.

Ander doelwitte van die ondersoek was die volgende:

- Om die invloed van waterbeperkings op die aanvraagpatroon van verskillende verbruikersgroepe te bepaal en om hieruit die pryselastisiteit van water te ontleed.
- Om die invloed van enkele klimaatsfaktore binne die Pretoria voorsieningsgebied op die waterverbruik te ontleed, en
- Om seisoenale effekte op die wateraanvraag te evalueer.

Al die belangrikste bevindinge van die ondersoek is saamgevat in 'n finale verslag met die titel **'n Her-evaluering van die bestaande riglyne vir stedelike en industriële watervoorsiening gebaseer op gemete waterverbruike - Fase 1: Pretoria voorsieningsgebied** (WNK-verslag 705/1/97). Afskrifte van die verslag is gratis verkrygbaar vanaf die Waternavorsingskommissie, Posbus 824, Pretoria 0001. E-pos adres vir bestellings: tineke@ wrc.ccwr.ac.za.

Gamtoos Estuary studied

Freshwater flow in most South African rivers has been reduced as a result of dams being built in the catchment regions, and through abstraction of water for agricultural, industrial and domestic purposes. Estuaries are also severely affected by this reduction of freshwater inflow in three different but interrelated ways:

❒ Limited floods mean that, particularly in flood-dominant estuaries, marine sediments can enter the mouth and cause partial or total closure. This would limit, or even stop, natural ocean-estuary exchanges.

❒ Agricultural runoff, including pesticides and fertilizers, may accumulate in the estuaries as a result of limited flushing, and the reduction of both freshwater flow and ocean-estuary exchange.

❒ Estuarine biota are dependent on the freshwater inflow, and are particularly sensitive to the freshwater-saltwater interface.

This is said by researchers of the University of Port Elizabeth, MW Pearce and EH Schumann, in a report to the Water Research Commission, on the effect of land use on the water quality of the Gamtoos estuary. The report **The Effect of Land Use on Gamtoos Estuary Water Quality** (WRC Report 503/1/97) is available, free of charge, from the Water Research Commission, PO Box 824, Pretoria 0001. E-mail: Tineke@wrc.ccwr.ac.za (Foreign orders: US $25 per copy, via surface mail.)

This project aimed to investigate the input of potential pollutants in agricultural runoff into an estuary, and to determine whether the natural flushing processes in the estuary were sufficient to prevent any build-up of such pollutants. Groundwater processes are also important in these processes, therefore monitoring of rest water levels (RWL's) and water analyses formed an important part of the project.

AIMS

The aims of the project were to:

❒ Investigate the groundwater dynamics and subsurface drainage patterns, in relation to geological structures and the effects of rain, irrigation water and tidal variations in the adjacent estuary, as well as the effects of vegetation cover, wind and solar radiation (temperature).

❒ Estimate the input of fertilisers, herbicides and pesticides on the agricultural lands, and assess the resultant input of chemical products into the estuary.

❒ Investigate estuarine processes such as tidal action, water stratification and the influence of freshwater input, particularly in terms of mixing and removal of chemical products, and possible effects on water quality and biota.

The Gamtoos estuary was chosen for the following reasons:

❒ It has an established intensive agriculture area (with newly founded irrigation areas a period of stabilisation should be allowed before such processes are investigated)

❒ The tidal reach is substantial for South African estuarine systems (about 20 km upstream of the mouth), and this part of the estuary is an important recreational and angling facility

❒ Ease of access.

METHODOLOGY

The Gamtoos estuary has an extensive flood plain of which only a small section was selected within which several groups of boreholes were established for assessment of the groundwater component. Borehole monitoring involved measuring rest water levels (RWLs) and taking water samples on a regular basis.

An agricultural drainage system provided easily sampled discharge into the estuary. Salinity, temperature and dissolved oxygen (DO) were sampled along the whole tidal region of the estuary using a small boat, while continuously recording instrumentation allowed time series of water levels and some current structures to be obtained.

Water analyses included the determination of electrical conductivity, cations: calcium (Ca^{++}), magnesium (Mg^{++}), sodium (Na^{+}), potassium (K^{+}) and anions: chloride (Cl^{-}), and sulphate (SO_4) as well as nitrate (as N), nitrite (as N) and total phosphorus (as P). Since pesticide analysis is very expensive, only six samples were analysed using a broad screening method - the cholinesterase inhibition test.

Study period

The experimental programme started in August 1992, and continued through to February 1994, though some monitoring extended to the end of 1994. The intensive measurement periods involving estuarine and borehole sampling were designed to cover a spring-neap tidal cycle. These periods, November/December 1992, March/April 1993, and June as well as November 1993, were chosen to cover all the seasons, because of the known differences in estuarine structures over spring and neap tides. During the study period the Gamtoos mouth was severely constricted by flood-tidal deltas, and tidal heights within the estuary were only about thirty per cent of those in the adjacent ocean.

A very dry period, during which the farmers were on reduced irrigation quotas, preceded the main study period in 1993. During 1993, however, the rainfall was above average with a record maximum within 24 hours on 12 June. The 1994 rainfall was closer to the long-term mean.

Evaporation losses are high in the Gamtoos valley, causing moisture deficits with consequent decreases in the groundwater recharge during summer months.

RESULTS

Rest Water Levels

Rest water levels (RWLs)at all the borehole sites were well above the water levels in the estuary, and no detectable variations could be found in response to tidal fluctuations in the estuary. In the experimental area the borehole RWLs generally responded within a few days to both rainfall and irrigation. The hydraulic gradient between most of the boreholes was very slight, and the constantly changing surface inputs coupled with variable recharge rates meant that the groundwater exhibited highly dynamic and variable subsurface flow. The water table throughout the study area was at its lowest at the end of 1992. With the increased rainfall in 1993 the level of the water table rose, reaching a maximum immediately after the heavy June rainfall. During the last six months of 1993 the water table was generally higher than before June, but by early 1994 a declining trend was evident.

Agricultural discharge

Information on the application of fertilizers, herbicides and pesticides in this area was not readily available. However, inputs into the estuary from surface runoff, effluent from the surface agricultural system, discharge from the subsurface drainage system as well as groundwater inputs were analysed. The discharge from the drainage pipe, in particular, gave an indication of chemical inputs into the estuary. Analyses of the discharge frequently showed high concentrations of nitrate-N, sulphate and potassium. The nitrite-N content often exceeded the recommended limit of 0.06 mg/l, and all samples had total phosphorus levels above that recommended for the protection of aquatic life. The pesticide screening test yielded positive results on all of the samples analysed.

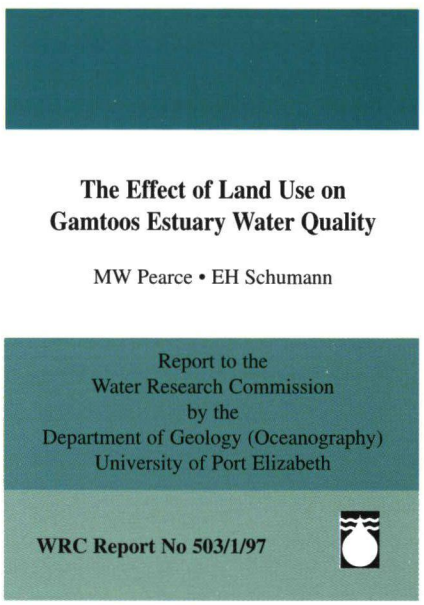
Nutrient levels

Groundwater samples obtained from the boreholes varied in quality, though patterns emerged with certain areas having higher nutrient concentrations; however the groundwater discharge of the estuary can be expected to vary spatially and temporally. Similarities found between the drainage discharge and water quality from a seepage into the estuary, enabled the researchers to obtain rough estimates of the amount of nutrients entering the estuary on an annual basis.

The nutrient content of the water in the Gamtoos estuary was generally low, but from time to time certain nutrient levels, phosphorus in particular, exceeded the limits recommended for the protection of marine life. Such elevated values were found in the upper estuary more frequently than in the lower reaches.

Estuarine dynamics

Substantial differences were found in the estuarine salinity structures during spring and neap tides. The lower reaches were mostly well mixed during spring high tides by the input of sea water through the tidal inlet, with the concurrent flushing out occurring at the following low tides. The input of sea water at neap tides was limited, and well-stratified conditions were found.



The dominant influences on water density were the salinity differences between freshwater and saltwater. The average freshwater input at the head of the Gamtoos estuary was estimated at less than 1 m^3/s. Pulses of freshwater emanating from rainfall events caused substantial increases in this flow, but was difficult to measure. Inflows in excess of 1 m^3/s effectively flushed out much of the upper reaches of the estuary, but in the lower 14 km the cross-section broadens and deepens and the freshwater tended to exit in the surface layers.

CONCLUSION

The conclusion of the researchers is that presently the Gamtoos estuary is still in a healthy condition. Although there are times when the water quality exceeded specified limits, the systems is resilient and water quality is restored within a few days. However, there are indications that problems could be experienced in future, as there is the potential that polluted water of an unacceptable quality persist, with adverse implications for the management of the system.

There is a substantial input of pollutants (fertilizers and pesticides) from the land into the estuary as irrigation return flow and discharge will not easily be avoided. It is therefore essential that the flushing capability of the estuary be maintained, by both the input of freshwater at the head of the estuary and the tidal exchanges at the estuary mouth. It should be noted that many biota are dependent on the freshwater input, and that the Gamtoos is an important recreational and angling region where diverse species should be maintained.

Presently there is no means of monitoring the freshwater inflow, as there is no suitable gauging weir. Most of the problem conditions occur in the upper reaches where tidal flushing is limited, which implies that freshwater inflow is necessary tomove pollutants further downstream to where tidal action can abstract them into the ocean. To facilitate the process, future drainage systems should discharge into the estuary as far downstream as possible.

Finally, the ocean-estuary exchanges through the tidal inlet must not be allowed to decrease. There are indications that the flood-tidal deltas are closing the estuary mouth, and that eutrophication problems could arise if nutrients cannot be exported from the system. In the past the mouth has been scoured open by regular floods, but in 1993 not even the heavy rains in June were sufficient to cause any substantial opening of the mouth. It may be necessary to open the mouth mechanically, however due cognisance need to be taken of the biological requirements and implications of such an action.

The general results presented in this report should be applicable to other estuaries where intensive agriculture is practised on the flood plain with a concomitant input of fertilizers and pesticides. However, it is important to take note of differences, and each system should be considered individually.

Developing tolerant membranes for industrial and municipal use

A research project for developing "tolerant membranes" was initiated at the University of Stellenbosch to assist the South African industrial and municipal sector in managing their water and effluent needs. Researchers from the Institute for Polymer Science at the University say that significant advances in membrane technology will be made by the development of "tolerant membranes" (Tolerant meaning resistant to fouling and chemical degradation by chlorine, ozone, etc).

The "tolerant membranes" programme, funded by the Water Research Commission at the Institute, is directed at the development of novel and robust membranes and procedures for use by industry and municipalities. Use of such membranes will increase the range of membrane applications as they would be more tolerant to harsh feedwater conditions.

FAR-SIGHTED RESEARCH

In the early 1970s, a far-sighted research and development programme initiated by the then Minister of Water Affairs and administered and directed first by the CSIR and then the Water Research Commission (WRC), has resulted in the emergence of South Africa as one of the ten leading countries in the world in the field of water treatment technology, particularly in the field of membrane technology.

Preparation of Tolerant Membranes

MJ Hurndall • RD Sanderson • CE Morkel
PW van Zyl • M Burger

Report to the Water Research Commission
by the
Institute for Polymer Science
University of Stellenbosch

WRC Report No 619/1/97

Aspects of the programme have included the addressing of problems in the treatment of industrial effluents and municipal (domestic) waters, the recycling of water from effluents and wastes and the purification of water for the supply of potable water.

The success of the research and development programme has largely been due to the multi-disciplinary and collaborative nature of the work done at the Institute for Polymer Science, which has provided a sound and growing data base now available for the solution of many water quality problems.

One of the important developments which emerged from the programme was the founding, initially with WRC support, of the commercial membrane manufacturing company MEMBRATEK, now known as ENVIG, and the membrane technology which has evolved that has been applied, inter alia, on large scale to the recycling of water at SASOL and MONDI.

Despite the successes of the membrane technology R & D programme to date, there remains a continuing and growing need for further advances in the field.

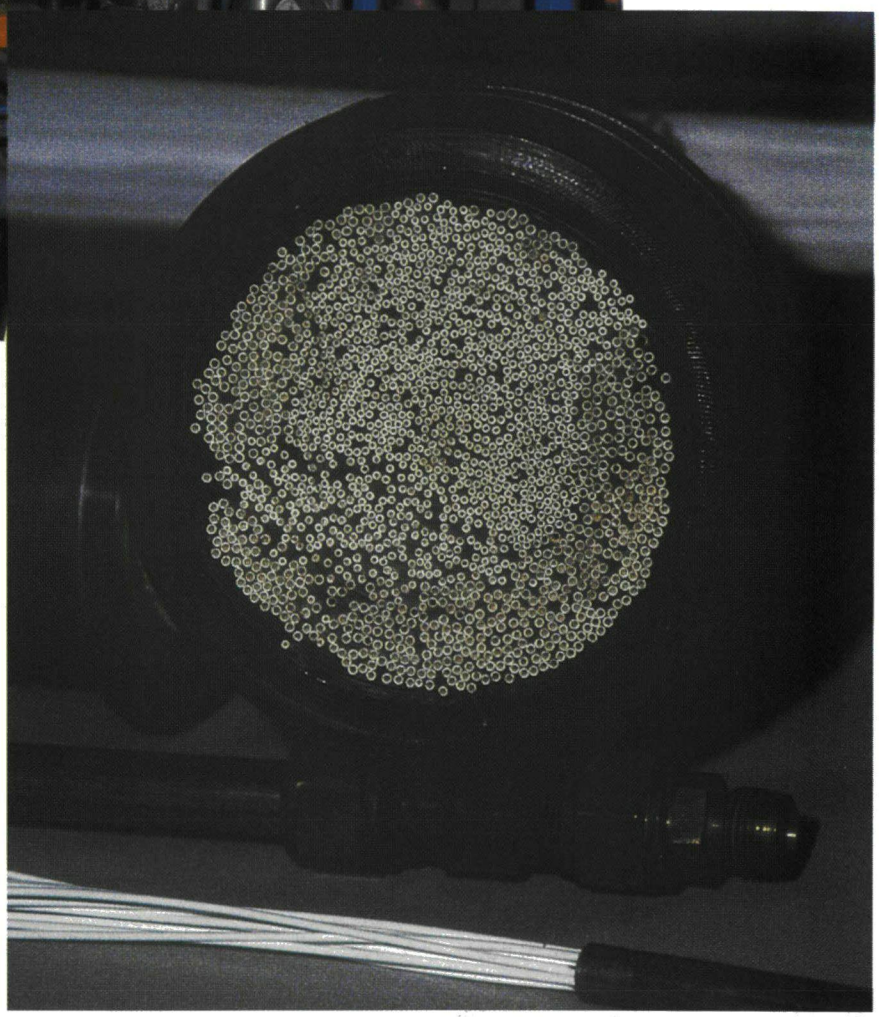
Industries need better and novel membranes for improved reduction of the salt content of effluents (in zero-discharge applications), the reduction of the intake of valuable resource water by improving and increasing the recycling of water reclaimed from effluents, and the sterilisation of water.

Municipalities require efficient water treatment means so as to be able to supply disinfected water, of good quality and in adequate quantities, for domestic use. Membrane systems, which purify, soften and decolourise water, can be used to meet these ends.

There is also a need to train and provide skilled membrane scientists to plan and operate the necessary systems.

Left: Experimental membrane units on trial at the Paradyskloof municipal water works

Below: Polymer membrane units produced by the Institute for Polymer Science, at the University of Stellenbosch.



OBJECTIVES

According to a final report describing the "tolerant membrane" research and summarising the results, the initial objectives of the project included:

❒ To collaborate with industry and other research bodies such as ENVIG, the University of Stellenbosch and VISTA University in the development of a local composite tubular membrane module, the synthesis of polyamides from furans and the modification of polysulphone.

❒ Regeneration of substandard and degraded cellulose acetate membranes.

❒ Study of polyvinyl(alcohol)-based membranes for nanofiltration, their modification, characterisation and evaluation as novel membrane materials.

❒ Preparation of fluorinated microfilter membranes for ozone distribution in gas/water membrane contactors.

❒ Preparation of hydrophilic polymer surfaces, gluable by epoxy and wettable by water.

❒ Attention was also given to the preparation of hollow-fibre carbon membranes and the oxygenation of water by means of nonporous gas-separation membranes.

Copies of the report entitled **Preparation of tolerant membranes** (WRC Report 619/1/97) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US$ 20, via surface mail).

ACRU comes to town

Results are available of a project aimed at expanding the existing agrohydrological model ACRU to incorporate the simulation of urban flow patterns and water quality loads from different urban land uses.

According to the researchers, PMU Schmitz and G du T de Villiers from the Department of Geography and Environmental Studies at the University of Durban-Westville, the ACRU-model was originally developed as an agrohydrological model by the Agricultural Catchments Research Unit of the Department of Agricultural Engineering at the Pietermaritzburg campus of the University of Natal.

"ACRU is designed to model sediment yield, crop yield, irrigation water demands, supply, etc. It is a physical conceptual model which uses daily input values such as rainfall and temperature and revolves around daily multi-layered soil water budgeting. ACRU can either be used in a lumped or distributed form."

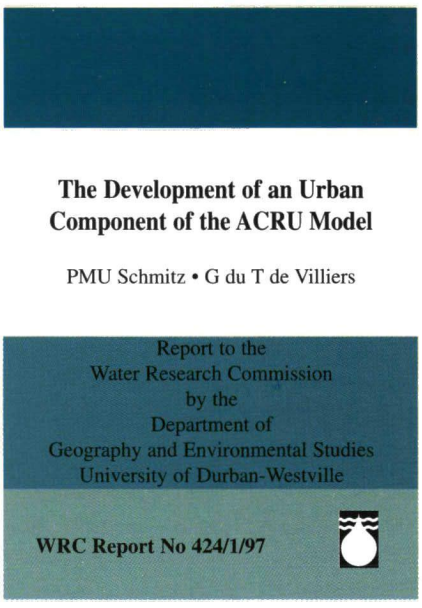
The researchers say ACRU was developed to function primarily on catchments with an urban land use comprising less than twenty per cent. They therefore integrated existing urban models as submodels for ACRU to enable ACRU to operate on a fully urbanised catchment in terms of runoff, hydrograph development and water quality simulations from non-point sources. The models integrated were the WASHMO-model for hydrograph simulation and the washoff and accumulation equations used in the SWMM, BMPSOFT and HSPF water quality models.

METHODOLOGY

The researchers say the project can be divided into two main parts.

"The first part involves the incorporation and refinement of models into the existing ACRU modelling structure, whilst the second part involves the collection of rainfall data and flow data measured at a weir in the Palmiet River near the University of Durban-Westville."

Water samples were collected on a weekly basis at ten different points along the Palmiet River and its tributaries for a period of two years. Rainfall data were collected for the same period at the University of Durban-Westville, using a syphon and standard rain gauge. At the weir in the Palmiet River, which is one of ten sample points, water samples were collected each week as well as on days of high flow events. All the collected samples were sent to the wastewater treatment works of the Municipality of Pinetown for water quality analysis. The water samples from high flow events were collected with the aid of an ISCO sampler, which took a 200 ml sample with every 5 cm rise or fall in the river flow level.



Three high flow events were sent to Umgeni Water for analysis of water quality changes over a hydrograph. All recorded data were sent to the University of Natal's Department of Agricultural Engineering for digitizing purposes and the digitized data were downloaded onto the computer at the Computing Centre for Water Research in Pietermaritzburg.

Data collected on the Pinetown catchment were used to test the model on a fully reticulatedcatchment. Verification runs were done to test and calibrate the model against the collected data in order to give realistic outputs from the different simulation runs.

RESULTS

The following results were obtained:

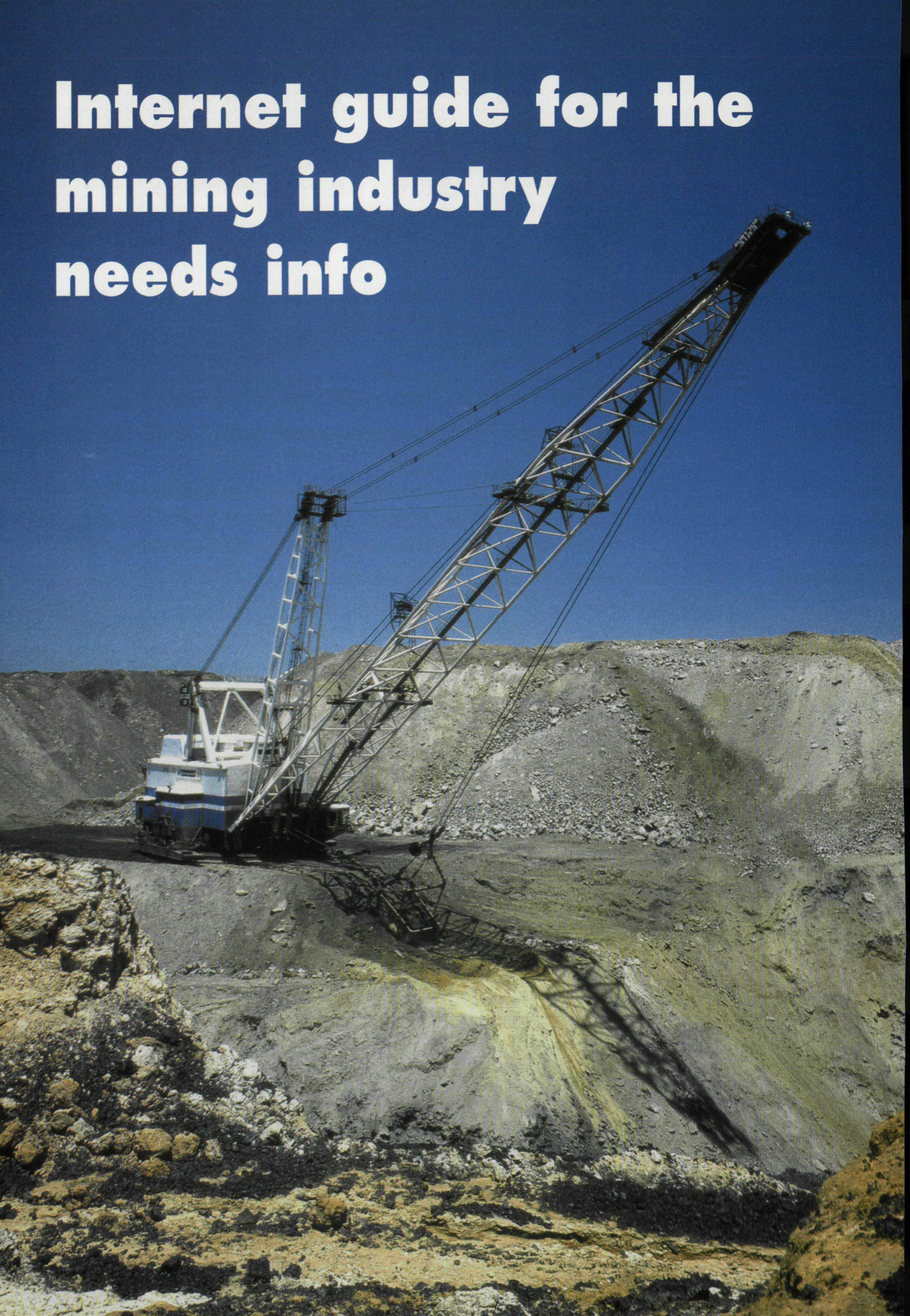
- It was established that by incorporating the WASHMO-model into the ACRU-model, it became possible to generate realistic hydrographs from urban catchments. The WASHMO-model was altered to accommodate runoff from pervious as well as connected (adjunct) and unconnected (disjunct) impervious areas. The ACRU-model was also changed to be used in conjunction with the WASHMO-section as a single event storm model. This enables ACRU to be used for design storm purposes similar to the SCS-models.

- It was established that the ACRU-model in its existing form can simulate runoff on a daily basis from fully urbanized catchments.

- After the inclusion of accumulation and washoff equations ACRU is capable of simulating non-point pollution from urban areas with a higher degree of accuracy from fully reticulated urban areas than from natural streams. This is mainly due to the fluctuations in chemical loads in the baseflow component of the streamflow.

Copies of the final report on this research project entitled **The development of an urban component of the ACRU model** (WRC report 424/1/97) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US$ 25).

Internet guide for the mining industry needs info



Guide to water modelling systems...

Help!

On behalf of the mining industry, and in collaboration with the Water Research Commission, Pulles Howard & De Lange (PHD) is seeking help in developing an Internet service centre for water modelling systems for the mining industry. Input is sought from the mining and water industries, consultants and universities, who will benefit from the service.

The service, drawing on local and international resources, will provide information enabling appropriate predictive mathematical models to be selected. Industry representatives believe that the project could prove of inestimable value to the mining industry.

Predictive models are becoming widely used within the industry. They cover a range of subjects from mine planning to decommissioning. Water-related issues have an important role in this environment, not only for identifying what may happen in the future but also what changes can be expected after management implements a specific strategy.

A research project team has identified the following modelling areas:

- Hydrology
- Water quality
- Geochemistry
- Groundwater
- Water and salt balances
- Radiation

The project team is investigating three global types of models:

- Freely available, widely used models which can be downloaded from the Internet;
- Models which must be bought from a supplier; and
- Models which need not be bought, or which cannot be bought, but which can be run by the supplier for the benefit of industry members.

The team is already accessing the first category of models. The second and third categories are generally developed in-house and in order to make the Internet Service Centre (ISC) as complete as possible the project team is seeking information about those models.

INFORMATION REQUIRED

This notice serves as a request to those able to supply the research project with relevant information for each model, including the following details:

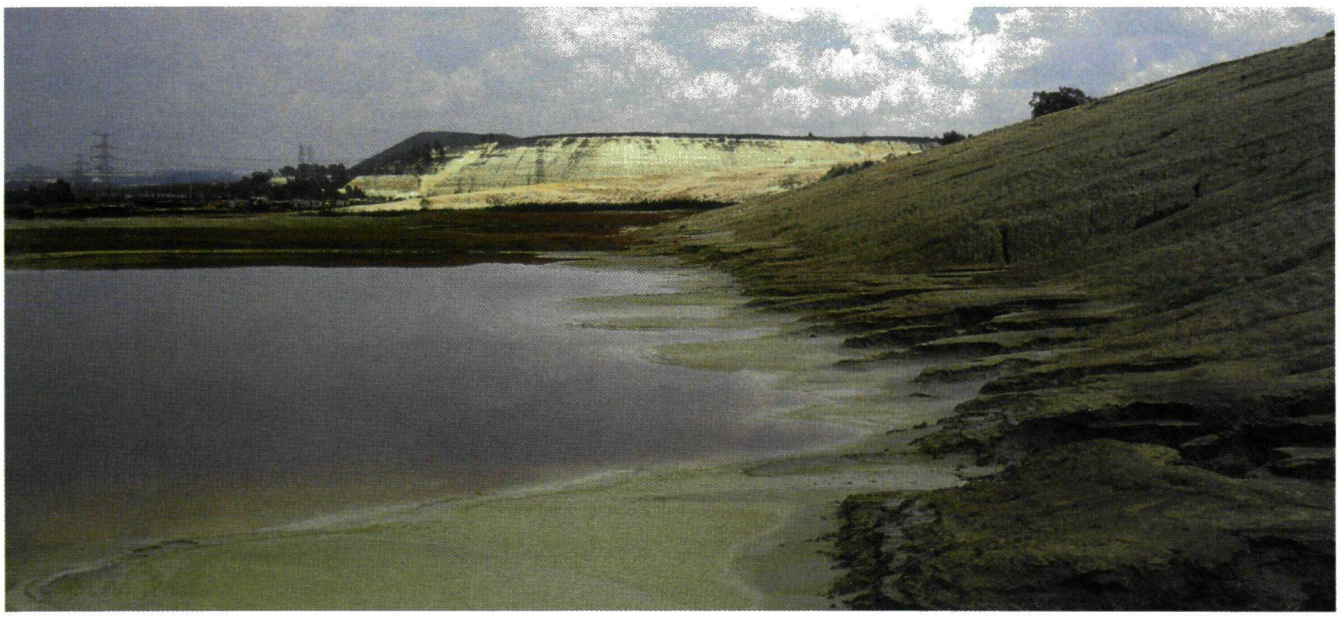
- Availability
- Range of application
- Strengths and weaknesses
- Cost
- Data requirements
- Computer requirements
- Case studies

Companies and individuals responsible for supplying information are asked to include:

- Name and address;
- Area of expertise;
- Company details;
- Company Internet Web address.

If a model is accepted for inclusion on the ISC, links will be established between users and modellers for the benefit of all.

If you are able to contribute to this research project - please contact:
Mike Howard, at: Pulles Howard and De Lange Inc.,
P O Box 861,
2006 Auckland Park.
E-mail: phd@ phd. co.za,
Phone:(011) 726 7027.
Fax: (011) 726 6913.



New biocatalyst technology rehabilitates dirty rivers and estuaries

The rapid urbanisation in South Africa into largely informal settlements together with high population growth and a shortage of capital for infrastructure development is resulting in the pollution of water courses, often beyond their capacity to assimilate the waste product loading.

According to a Water Research Commission report on the bioenhancement of a polluted river, the resultant health hazards such as eutrophication problems and oxygen depletion of river systems is particularly evident in the KwaZulu-Natal coastal region.

"Continued efforts to reduce the volumes of untreated sewage entering the river systems draining informal and semi-formal areas have met with limited success. The control of diffuse source pollution make in-stream waste treatment, such as bioenhancement (where a biological catalyst is used), one remaining potential option which may ensure the receiving water body is maintained for the recognised water use sectors."

Before treatment: Food cannery waste pollution in a lagoon.

The same lagoon after three months of biocatalyst treatment.

The three researchers, MMB Talbot (Talbot & Talbot cc), SW Ascough (Alpha Biotech cc) and A Rankin (Department of Water Affairs & Forestry: KwaZulu-Natal Region), who compiled the report say that the use of biological methods, e.g. the addition of enzymes or cultures of bacteria, is well known in waste water treatment.

"These techniques are usually referred to as biosupplementation or bioaugmentation. However, bioenhancement is a technique where the performance of indigenous micro-organisms is enhanced by the Alpha biocatalyst."

The Alpha biocatalyst consists of a complex mixture of a very low concentration of by-products from the fermentation of a proprietary, natural substrate. Some of these by-products have dramatic effects on naturally occurring aerobic bacteria. The most significant effects are:

❒ Conference of an ability to function in oxygen deficient environments by using an apparent alternative mechanism to source oxygen.

❒ Increased rate of metabolism.

❒ Increased growth rate by up to a thousand per cent in certain circumstances; and

❒ The conference of an ability to function in rigorous environments such as high salt concentrations, low or high pH and high temperatures.

These effects created by the Alpha biocatalyst technology have enabled the development of a number of application areas around the world, including:

❒ Oil well treatment for microbial enhanced oil recovery and paraffin control.

❒ In-situ bioremediation of hydrocarbon contaminated soil and groundwater.

❒ Bio-remediation of hazardous waste material by land farming.

❒ Enhancement of waste water treatment plants: industrial, municipal and agricultural.

❒ Remediation of lakes, lagoons and sludge pits.

❒ Control of odour caused by anaerobic activity.

During a review of applications of the Alpha biocatalyst technology, both in South Africa and overseas, the idea of treating a polluted river in South Africa was formulated. The researchers say that during discussions with representatives of the KwaZulu-Natal region of the Department of Water Affairs and Forestry, it became apparent that there was a potential need for a low cost, low technology process for the rehabilitation of rivers and estuaries.

"Current efforts are directed at the identification and elimination of point

Before treatment: Piggery manure in a lagoon.

Six months later after biocatalyst treatment.

sources of pollution but do not address the issues of diffuse source pollution nor accumulated organics in the system."

There are at least three river systems in the KwaZulu-Natal region which already exceeded 10 000 colony forming units of E-coli per 100 ml water on a virtually continuous basis. Together with eutrophication and anaerobic sludge build up this indicates extensive pollution. The rivers are the Baynespruit, the Mlazi and the Sipingo. The Sipingo river was considered the most suitable for investigation because of the following reasons:

❒ There is a relatively large amount of historical water quality data available.

❒ The river is utilised for recreation (contact and fishing) in the semi-tidal lagoon area and is presently considered a health hazard.

❒ The river is considered to have the most severely impacted estuary system in KwaZulu-Natal according to regional and town planning reports.

❒ The type of pollution is mainly organic and lends itself to a biological enhancement study.

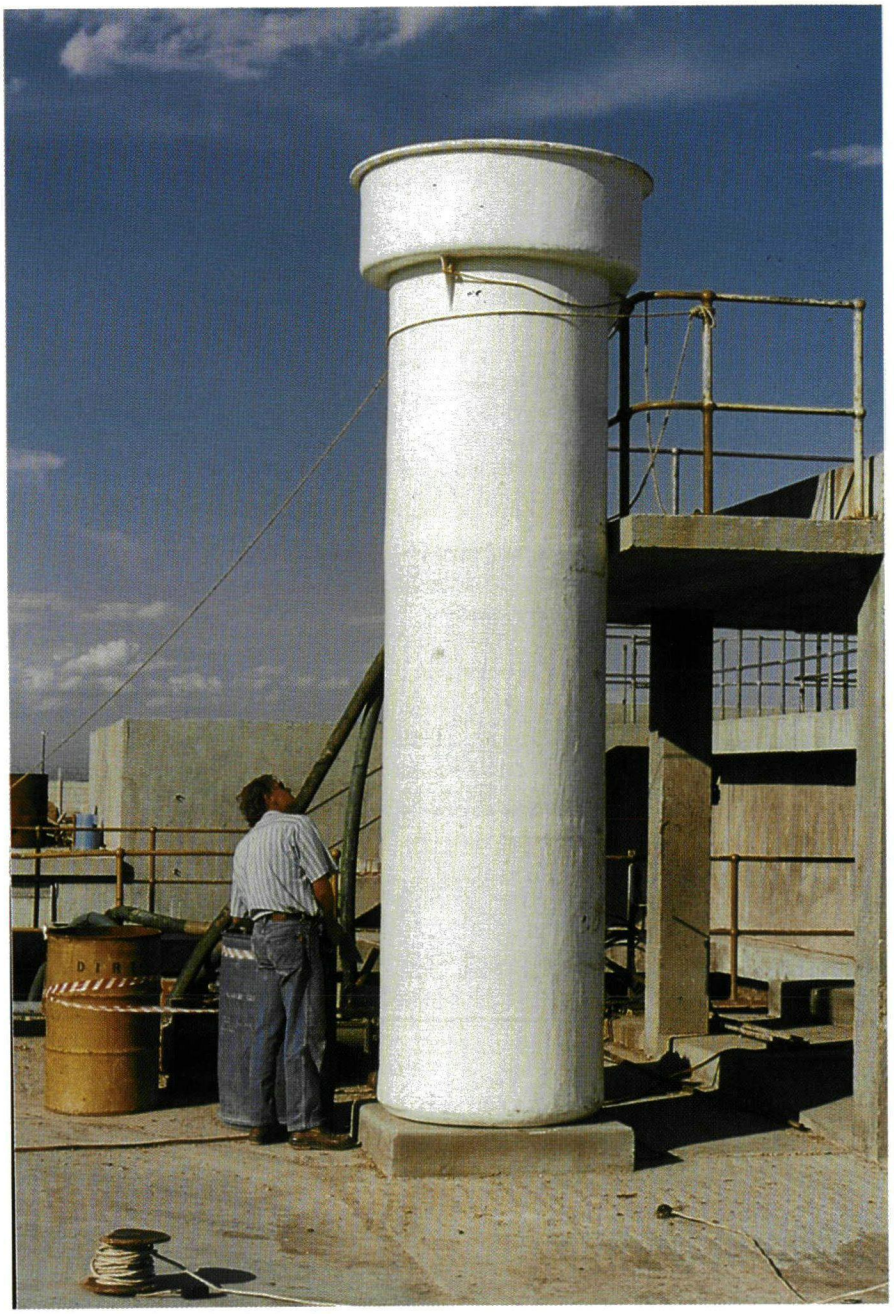
❒ The Mlazi waste water plant is the only continuous point source discharge into the river system and, therefore, the biocatalyst could be introduced at that point.

❒ Suitable facilities and security for the biocatalyst production units are available at the treatment works.

The aims of the investigation, funded by the Water Research Commission, therefore were as follows:

❒ To evaluate the effects of the Alpha biocatalyst on the in-stream treatment of a segment of the Sipingo river and estuary which is polluted with organic waste of domestic and industrial origin, and

❒ To evaluate the effects of the Alpha biocatalyst on the capability of the river segment to assimilate waste and maintain fitness for the recognised water user sectors.



A biocatalyst production unit on-site used for bioremediation.

THE SIPINGO RIVER

The Sipingo river is situated in KwaZulu-Natal immediately south of the Durban airport. Prior to 1952 both the Sipingo river and the Mlazi river entered the Indian Ocean via the Sipingo estuary. The estuary was normally open to the sea and tidal interchange occurred freely. Following the diversion of the Mlazi river for the construction of the airport, the flow of water was insufficient to maintain the estuary open and a sandbar developed. Only in times of heavy storm water run off would this sandbar be breached. To partially remedy this situation a steel pipeline was installed through the sandbar to allow some contact with the sea. This pipeline failed and was replaced in 1961 by two concrete pipes each of about one metre in diameter. These

pipes are still operational with limited intertidal exchange.

In 1969 the Prospecton industrial area was developed and in order to prevent flooding, part of the flow of the Sipingo river was diverted to the Mbokodweni river some two kilometres to the south. Sluice gates were installed at the diversion to allow a certain amount of water to enter the canalised section of the Sipingo river and thus into the estuary. Over time these sluice gates became silted up and a study in 1991 concluded that no fresh water from the Sipingo river was flowing through the sluices. A caisson wall was subsequently installed to prevent siltation of the sluice gates and ensure a continuous flow of fresh water into the canalised section.

The situation that now exists is that the Sipingo river flows to the canalised section until the flow rate exceeds the capacity of the sluices when the excess flow diverts to the Mbokodweni river. Upstream of the diversion works the river flows through the residential and informal settlements of the Umlazi Township and receives the discharge from the Umlazi waste water treatment plant.

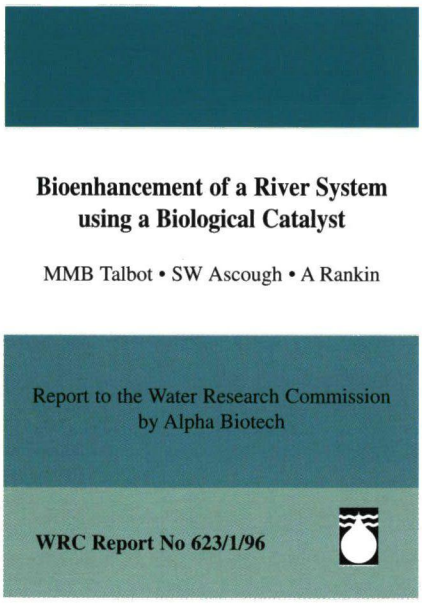
The reduced flow combined with the sewage infiltration, the discharge from the Umlazi waste water treatment works, industrial pollution (mainly runoff from the Prospecton area) and rubbish infiltration have degraded the riverine and estuary ecosystems to the extent that all recreational activities have largely ceased. The estuary contains a variety of mangrove species and was considered to be the best endowed lagoon system between Durban and Illovo Beach. It has considerable potential as a recreational area and a nature reserve if the system can be rehabilitated.

METHODOLOGY

The Alpha biocatalyst is produced on-site for a continuous flow system in specifically designed fermentation vessels called Catalyst Generating Units.

During start up the proprietary substrate is pre-processed in the laboratory for two weeks prior to charging into the fermentation vessels which are filled with water. The substrate sinks to the bottom of the vessels and is left for a further period of seven days to establish the fermentation process. A continuous flow of water is introduced part way down the vessel to carry out the fermentation products.

After the establishment of the production process, the water flow is maintained at a constant rate and the units are fed with additional substrate once per day. No specialised knowledge or skills are needed for routine operation. For this application in the Sipingo river the continuous flow of biocatalyst was introduced into the final leg of the maturation pond of the Mlazi waste water treatment plant and thus into the river.



To monitor the effects of the biocatalyst, samples of water were taken at random time intervals on a weekly basis. Seven sample points were chosen to be representative of the river and lagoon system and the samples were analysed for the following water quality indicators: chemical oxygen demand, oxygen absorbed, free and saline ammonia, nitrate, soluble phosphate, pH, conductivity, chloride, soap, oils and grease, suspended solids. E-coli, total coliforms and various metals, such as aluminium, calcium, magnesium, sodium, potassium, iron, manganese, zinc and copper. Dissolved oxygen measurements were made on site at the time of sampling using a portable dissolved oxygen meter.

RESULTS

❒ The dissolved oxygen concentration downstream of the biocatalyst addition point trended upwards relative to the upstream concentration. The change took place over an extended period, for example, four months at one sample point and seven months at another sample point. This indicates a substantial improvement in the quality of this stretch of the Sipingo river.

❒ The rate of disappearance of colony forming units of E-coli seems to be quite high, given that the residence time from the first sample point to the lagoon is in the region of only two days. However, the residence time from the sample point where the highest concentrations of E-coli were found, is much lower.

❒ Main sources of faecal contamination is from upstream of the sewage works and a large inflow occurs somewhere in the canalised section of the industrial area.

❒ Both ammonia and nitrate concentrations trended downwards further downstream from the point sources of the river and the discharge of the sewage works

❒ The lack of control against which to compare the measured performance is a limitation in an investigation with so many uncontrolled variables.

Copies of the report entitled **Bio-enhancement of a river system using a biological catalyst** (WRC report 623/1/96) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US$ 15, via surface mail).

Invisible leaks within a distribution system are probably the most significant component of unaccounted-for water.

Procedures for controlling unaccounted-for water

Few local authorities have comprehensive structures in place to deal with the control and reduction of unaccounted-for-water (UAW). Most local authorities use reactive rather than pre-emptive procedures for leakage control and the replacement of consumer meters, etc. without addressing any of the other UAW components at all. This is one of the findings in a study carried out for the Water Research Commission (WRC) by W de Vallier and DW Broadhurst of De Leuw Cather (North) Pty Ltd, into the reduction of water loss in water distribution systems.

In the final report presented to the WRC, the more pertinent results of the research are summarised as follows:

❒ Unaccounted-for water is defined in various ways by different local authorities leading to inconsistencies in the data recorded by the local authorities.

❒ Traditionally, the treasury department of a local authority is responsible for the reading of consumer meters. This results in further anomalies when consumption data is compared with total supply records.

❒ Invisible leaks within a distribution system are probably the most significant component of unaccounted-for water.

❒ Inaccuracies in and incorrect sizing of water meters, especially bulk and large consumer meters, can be a significant component of unaccounted-for water. Errors in the reading of meters and account processing exacerbate the situation.

❒ The rapid urbanisation experienced in South Africa since the late 1980s has significantly increased the number of unmetered consumers. The establishment of informal settlements and the regular occurrence of illegal land invasions has resulted in a significant increase in theft and the unauthorised use of water.

❒ The lack of detailed records on a national basis has made it impossible to estimate with any degree of certainty

what South Africa's national figure for unaccounted-for water is.

STRUCTURE

The researchers say that to achieve the aims of the study they divided the research into the following areas of work:

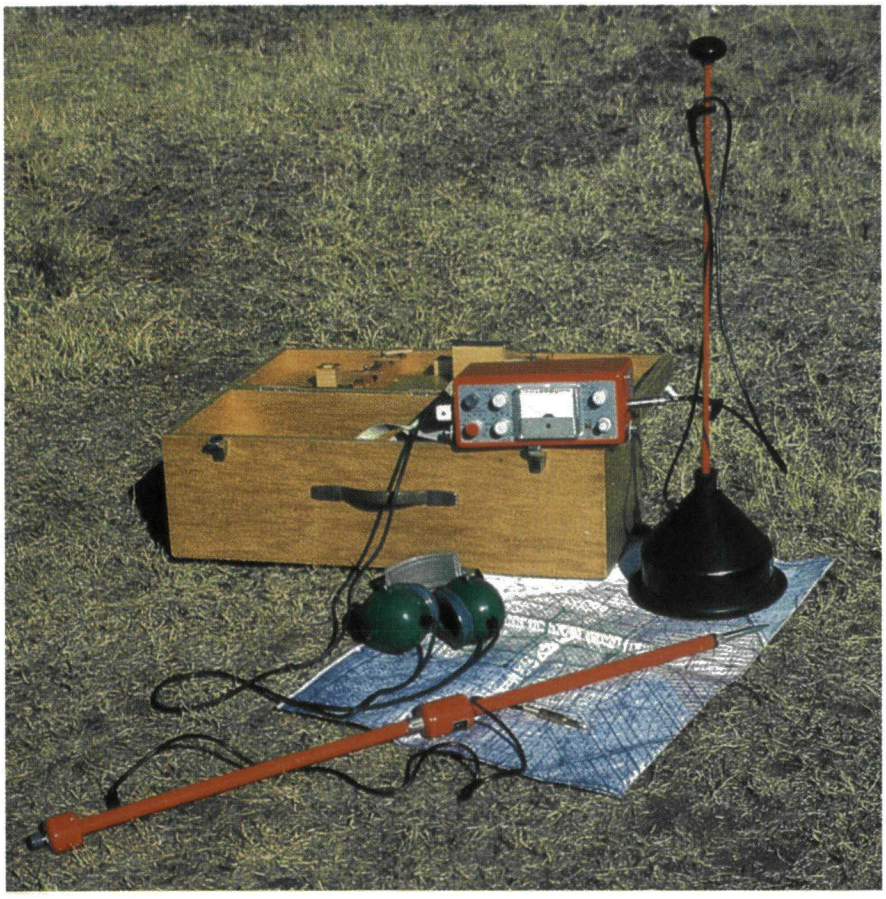
- A literature search - on a national and international basis was conducted of technical libraries, learned societies, water authorities and associations and other interested parties.

"By far the most comprehensive research done in the management of water leakage is that of the Water Research Centre in the United Kingdom. The research produced a series of reports entitled 'Managing Leakage'."

- Survey of local authorities - a questionnaire was sent to a large number of local authorities in an effort to determine the status quo of unaccounted-for water measurement and control in South Africa. The results and analysis of the information gathered through these questionnaires are discussed in the report.

- In-situ meter testing - four local authorities, namely, Johannesburg, Kempton Park, Durban and Pinelands in the Cape, were selected to provide sites for the in-situ meter testing of domestic and large consumer water meters.

- Compilation of an unaccounted-for water manual - the information and results gathered from the research project was used to compile a Manual for use by local authorities. The Manual deals with all aspects of unaccounted-for water, giving guidance and recommendations on the formulation and implementation of systems for the effective control of unaccounted-for water. The Manual was published under the title "Unaccounted-for Water: Guidelines for the formulation of a policy and implementation of practical methods for the control thereof" (WRC report 489/2/97).



Leak detection equipment.

The Development of Procedures for the Control of Unaccounted-for Water in Water Distribution Systems and for the Reduction of Water Loss

W de Vallier • DW Broadhurst

Report to the
Water Research Commission
by De Leuw Cather (North) (Pty) Ltd

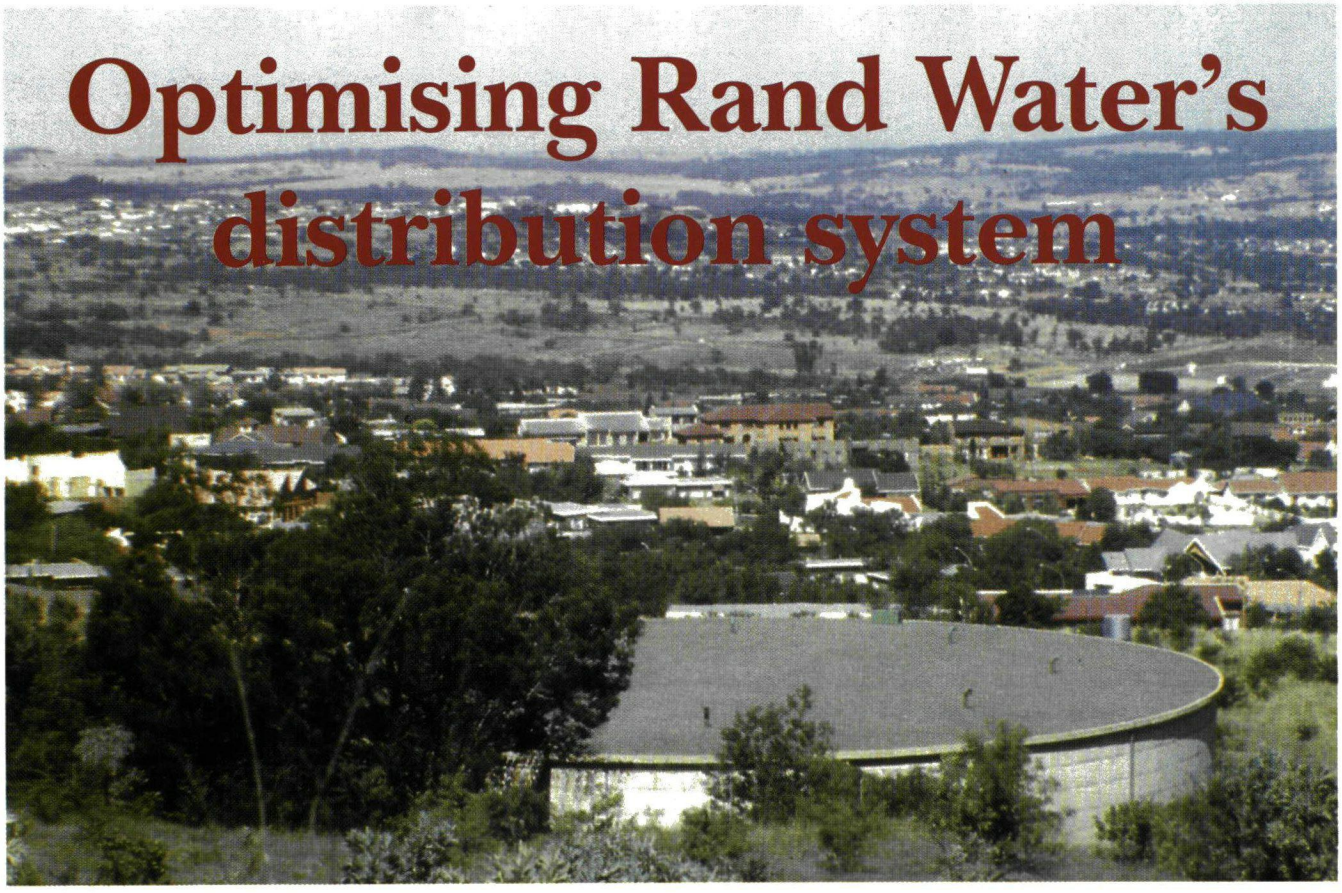
WRC Report No 489/1/97

The researchers stress the fact that the urgent implementation of comprehensive management procedures on a national basis is essential to safeguard the availability of water in the interest of future generations of South Africans. Furthermore, international experience has shown that each new water source costs four times as much as its predecessor to develop.

"From an economic point of view it is therefore essential that all existing water sources are utilised to their utmost efficiency, thereby reducing or delaying the need to develop new sources."

Copies of this report entitled **The development of procedures for the control of unaccounted-for water in water distribution systems and for the reduction of water loss** (WRC report 489/1/97) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (E-mail address: tineke@ wrc.ccwr.ac.za). (Overseas price: US$ 20, via surface mail).

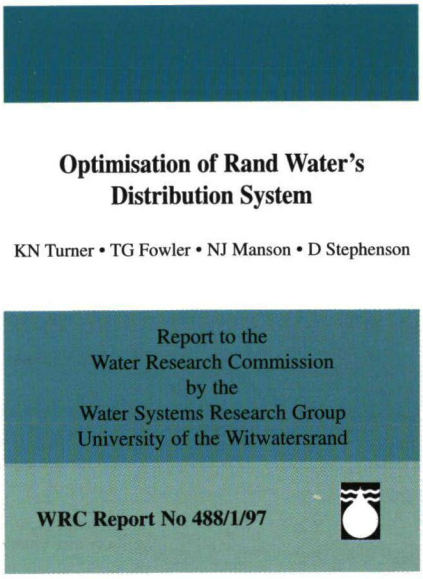
Optimising Rand Water's distribution system



People in densely populated low income areas use less water per capita than those in high income areas and high income areas often have low population densities. This has the effect of levelling out the consumption per unit area to about 10m³/ha/day in most normal residential areas. The value varies between five and 20m³/ha/day where there are deviations due to factors like type of supply (e.g. standpipes) or population density (e.g cluster housing, apartments or overcrowding).

These are some of the conclusions drawn in a study funded by the Water Research Commission into the optimisation of Rand Water's distribution system. The study was carried out by KN Turner, TG Fowler, NJ Manson and D Stephenson, from the Water Systems Research Group at the University of the Witwatersrand.

The researchers say that in a city or town, water consumption patterns vary significantly from suburb to suburb, even in relatively cohesive areas such as Gauteng. The effect of drawing different peaks at different times of the day can be used to advantage in planning water reticulation systems. By carefully juxtapositioning areas with different water consumption habits, the cost of supply pipes and balancing storage facilities can be minimised.



The data gathered in this study, that is daily consumption hydrographs, will also be useful for accurately estimating the required volumes for water balancing storage. Although it is likely that consumption patterns will change with changing living standards, the fact that data are available from different income level suburbs means that projections of future consumption patterns can be made. The data are also useful for estimating per capita water consumption figures as a function of standard of living or income level.

The researchers say the daily water flow patterns were gauged for fourteen varied areas in Gauteng. These suburbs range from high income groups in Sandton to squatter or informal housing dedustrial and commercial areas. Areas were isolated with the assistance of the town engineers and water consumption monitored on data loggers. Conventional turbine type water meters were used owing to their economy and accessibility. Data loggers connected to the water meters were down loaded every three to four weeks onto a laptop computer and the data was processed in the offices of the Water Systems Research Group.

Copies of the report summarising the results and titled **Optimisation of Rand Water's distribution system** (WRC Report 488/1/97) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US$ 30, via surface mail).

RE-DESIGNED WRC WEB SITE LAUNCHED

The Water Research Commission recently launched its newly designed Internet Web site, as the initial Web design launched during April 1997 was no longer capable of handling the dynamic information transfer required by the WRC. The new page is designed to be functional rather than fancy, for use on both older and new generation computers.

Information on the WRC is divided into three sections on the screen:

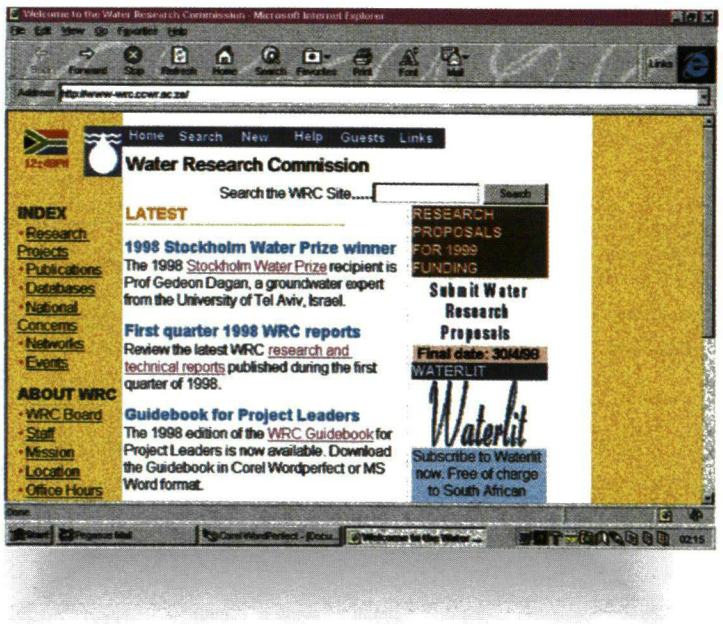
- Left column - information showing little or no change, e.g. National concerns, Mission statement, Location, etc.
- Dynamic Middle column - the latest news which will remain in this position for only a limited period.
- Right column - information which is still topical, but has been replaced by the more recent information given in the middle column.

As well as a facility to search the WRC Web site.

The information on the WRC's Web site is constantly updated. The 'Events' section, containing conference details, is one of the most dynamic parts of the site.

For comments or enquiries, please contact:
Francette Myburgh
E-mail: fmyburgh@wrc.ccwr.ac.za

http://www-wrc.ccwr.ac.za
(please note the hyphen!)

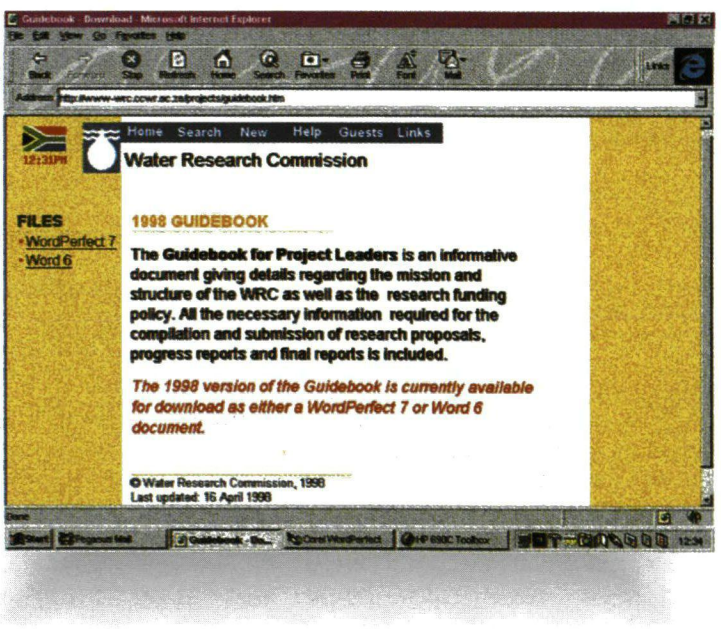


GUIDEBOOK FOR PROJECT LEADERS NOW ON THE WEB

The 1998 updated edition of the Guidebook for Project Leaders is now available on the WRC's Web site. This document provides detailed information to WRC research project leaders on the requirements for the compilation and submission of research proposals, progress reports and final reports to the WRC. The Guidebook is available for downloading as either a WordPerfect 7 or MS Word 6 document.

Please note ...
Project leaders are requested to take note of the revised requirements for the submission of Final Project Reports to the WRC. A new protocol, requesting hard copies as well as electronic copies in a prescribed format, of final project reports, has been developed and is included in the updated and revised version of the Guidebook.

Enquiries to:
Martha Pretorius
E-mail: mpretori@wrc.ccwr.ac.za



Programme Data Catalogue available on the Kruger National Park Rivers Research Programme

The main goal of the Kruger National Park Rivers Research Programme (KNPRRP) is to inform researchers, system managers and stakeholders about water quality and quantity requirements to sustain the natural environment of rivers which flow through the Kruger National Park.

However, after the research programme had been running for several years it became evident that researchers and managers were having difficulty in obtaining an overview of available data, particularly in relevant fields other than their own.

To address this problem it was decided to establish meta data files (data files describing data sets) for this purpose and properly catalogue and index these in as user-friendly but functional a way as possible. Since only one layout is available for any hard copy catalogue, it was decided to adopt (with slight modifications) one of the researchers, Kevin Rodger's project classification scheme for this purpose. Inside each category of this main classification, a standardised sub-classification by media type (document, digital, GIS, models, collections, maps, videos) has been adopted. Finally, within these two classification systems, records are presented alphabetically by the surname of the custodian.

A digital version of the Catalogue is currently available from which, through various automated steps, a fully updated Catalogue can be produced at any time. An additional flat file digital version is on-line at the Computing Centre for Water Research (CCWR) in Pietermaritzburg for use by anyone with IBM PC or DOS emulation. The Catalogue can also be used via the world wide web since it is on the home page of the KNPRRP. The address is: http://www.ccwr.ac.za/knprrp/index.html Any questions or further information about the Data Catalogue can be directed to Yvette Coetzee at Tel/Fax: 013-7355039. E-mail address: coetzeey @aqua.ccwr.ac.za.

Environmental management in Africa:

Call for papers

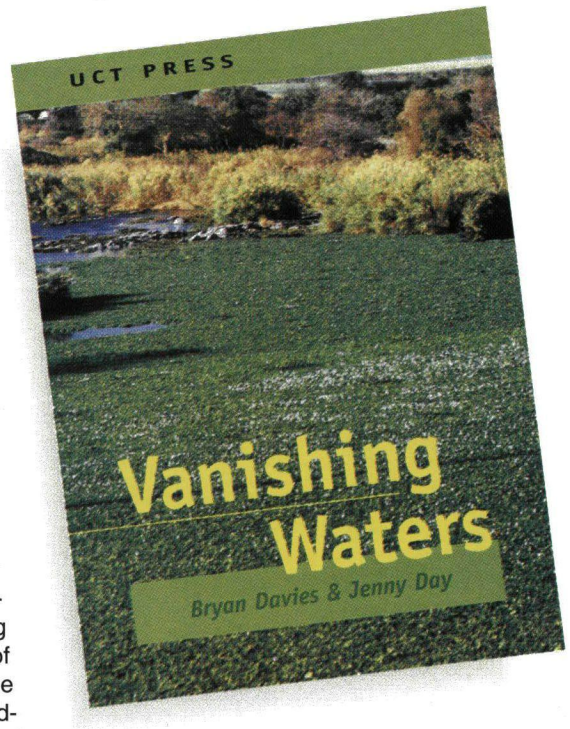
Papers are invited from research institutions, universities, government environment ministries, agencies and departments, non-governmental organisations and individuals concerned with environmental assessment and management principles and practices in Africa to be considered for publication in a yearbook that focuses exclusively on environmental issues in Africa. Subsequent volumes of the book are planned.

The main aim of this exercise is to give Africa the opportunity to report on its strides in caring for its environment as well as in institutionalising formal environmental assessment and management principles and practices irrespective of the huge economic difficulties the continent is facing.

Since this is one of the first major attempts to provide a forum for African ideas in the global debate on the environment. The book will be open to all aspects of environmental assessment and management in Africa including (but not limited to) EIA methods and procedures, public participation, EIA and project management, social impact assessment, health impact assessment, strategic environmental assessment, ecological impact assessment and development impact assessment, as well as environmental policy and institutional development.

For more information please contact: Alex Weaver, at: Cross Cutting Technologies, Division of Water, Environment and Forestry Technology, CSIR, PO Box 320, Stellenbosch 7599.
Tel: (021) 888-2696.
Fax: (021) 888-2443.
E-mail: aweaver@CSIR.co.za.

— Vanishing Waters — using and abusing South Africa's inland-water ecosystems



"All South Africa's water systems - rivers, vleis and estuaries - even the smallest and least impressive - are becoming less and less natural. Their very nature as water providers is being altered and destroyed by ill-considered human intervention and sheer ignorance and neglect." This is the view of Bryan Davies and Jenny Day, the authors of a new book - Vanishing Waters - published earlier this year by the University of Cape Town Press.

The authors say Vanishing Waters aims to provide an awareness "of our reliance on water and instil a respect for the aquatic environments, their diversity and their life forms".

Written for the layperson, as well as students and researchers, Vanishing Waters is comprehensive in its detail, but accessible in its approach. It offers the most up-to-date information on water conservation and usage, beautiful illustrations and line drawings for easy identification, and projects for teaching and classroom use. The language has been kept simple, technical terms being defined and explained both in the text and in an accompanying Glossary.

STRUCTURE OF THE BOOK

The book is divided into eleven chapters. The problems facing freshwater ecosystems, related to the human demand for water, have been outlined in Chapter 1. Chapter 2 describes the distribution and types of inland waters in South Africa (rivers, reservoirs, wetlands, estuaries, pans and so on). Chapter 3 essentially concentrates on unaltered systems, examining the plants and animals of lakes and ponds, how they live and interact with their environments, and the effects that they have upon the water in which they live. In Chapter 4, the authors examine rivers, the most vital of inland waters of the region, describing natural, unaltered rivers, their plants and animals, and the natural processes that drive them. Chapter 5 deals in a similar way with wetlands, while Chapter 6 deals with coastal lakes, estuaries and flood planes. With this background, in Chapter 7 the authors switch the emphasis of the book from the natural to the not-so-natural, and begin to consider the effects of human intervention on inland waters, detailing the myriad types and effects of pollution. In Chapter 8 the authors continue with a consideration of the consequences of the quest for more water and the associated degradation of aquatic environments, as well as the problems facing aquatic ecosystems in urban environments. Chapter 8 also examines aspects of invasive species and human water-borne diseases, their causes and spread. The problems encountered with regulated rivers, the changes wrought by impoundment, and some of the consequences of river regulation by dams are detailed in Chapter 9, including the problems of reservoirs themselves, and the potential problems in moving water from one river to another. In Chapter 10 the need to conserve South Africa's inland waters is discussed in detail, with an in-depth examination of 'who uses what, how much and why'. The Chapter makes the case for the conservation and rational use of fresh waters, dips briefly into the complexities and inequities of the present South African water law, examines a number of rivers which have been degraded and indicates how readers can save water through their individual actions. Chapter 10 also offers a few solutions to some of the human-induced problems of South African aquatic ecosystems by examining how altered systems may be rehabilitated. Finally, Chapter 11 describes a variety of methods for studying the physical and chemical properties, and the organisms of freshwater systems.

The book also has an extensive index to terms, South African systems, and the organisms that can be encountered in South African inland waters.

TO ORDER

Copies of **Vanishing Waters** are obtainable from local bookstores as well as UCT Press. Tel: (021) 244519. Fax: (021) 232455. (E-mail: uctpress@hiddingh.uct.ac.za) The suggested retail price is R140 per copy plus R17.40 postage and packing. (Overseas orders: US$ 39.95, inclusive of postage and packing, via surface mail.)

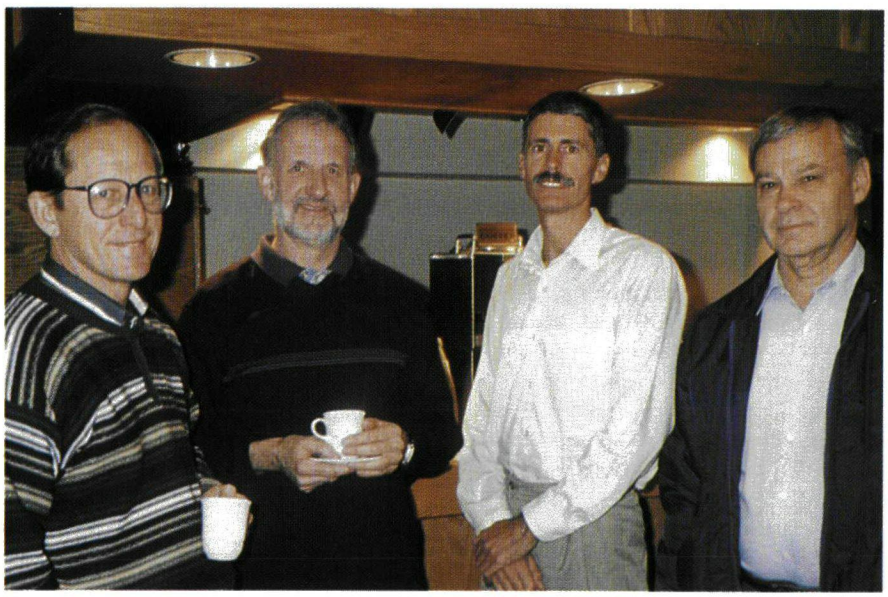
Drinking water research discussed at Emerging Technologies seminar

Drinking water experts from around the world have convened in Breckenridge, Colorado, USA, to discuss emerging technologies related to drinking water research. Research presented at the seminar ranged from highly technical topics, such as how to improve water quality through the use of filtration membranes, to how to satisfy customers.

Sponsored by the American Water Works Association Research Foundation (AWWARF), headquartered in Denver, the 1998 Emerging Technologies seminar provided a cooperative forum for learning about technological advances in water supply monitoring, distribution and treatment.

AWWARF founded the seminar in 1982 to foster worldwide information sharing. Previous seminars have led to a number of cooperative efforts between participating organisations, including joint research reports, international workshops and formal research partnerships. Emerging Technologies seminars are held biennially in locations throughout the world.

A 350-page report featuring papers presented at the seminar is available on the AWWARF web site (http://www.awwarf.com/etviii/etintro. htm). There is no charge to access or download the papers.



Taking a break form the discussions. From left: Keith Carns, Electric Power Research Institute, Community Environment Centre, USA; Ken Roberts, XCG Consultants Ltd., Canada; Chris Nokes, Environmental Science and Research Ltd., New Zealand and Piet Odendaal, WRC, South Africa.

Seminar participants had many questions for the presenters during the three days of technical sessions.

TOPICS

Research topics presented at the '98 seminar or described in the report include:

❒ Coagulation/Particle Removal (Australia, Canada, Czech Republic, France, New Zealand, Switzerland);

❒ Contaminant Removal (Algae and Algal Toxins: Australia, Germany, South Africa, United States; Cryptosporidium and Giardia: Canada, Czech Republic, Italy, New Zealand, Sweden; Nitrates: Austria, Italy);

❒ Oxidation, Disinfection and Disinfection By-products (Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, New Zealand, South Africa, Switzerland, the Netherlands, United Kingdom, United States);

❒ Monitoring and Analysis (Austria, Belgium, France, Germany, Italy, Japan, South Africa, Switzerland, the Netherlands, United Kingdom, United States);

❒ Customer Service (Germany, the Netherlands, United States);

❒ Distribution Systems (Corrosion/ Lead and Copper: Italy, South Africa, United States);

❒ Models and Water Quality (Germany, Hungary, Italy, Sweden, Switzerland, United States);

❒ Membrane Treatment (Belgium, Canada, France, Germany, Italy, New Zealand, South Africa, Switzerland, the Netherlands, United States);

❒ Residuals (Italy, United States);

❒ Water Resources Issues (Austria, Belgium, Hungary, Italy, Sweden, Switzerland, the Netherlands, United States).

Request for consultants

WELL (Water and Environmental Health at London and Loughborough) is seeking to expand its base of consultants in all water and sanitation-related fields, and would be pleased to hear from people with international experience who are interested in working for them.

Relevant areas of expertise include (but are not limited to) environmental monitoring and impact assessment, economics and finance, social development, institutional development, participatory assessment, public and environmental health, and water and sanitation technology and engineering.

If you have previous experience in these fields and are interested in working with WELL, please contact either Sue Sherry or Pete Kolsky at WELL, LSHTM, Keppel Street, London WC1E7HT, UK. Tel:0171-9272214. Fax: 0171-636-7843. E-mail: WELL@lshtm.ac.uk; or Ian Smout or Andy Cotton at WEDC, Loughborough University, Loughborough, Leics LE11 3TU, UK. Tel: 01509-222885. Fax: 01509-211079. E-mail: WEDC@lboro.ac.uk.

Further information about WELL is available on the website: http://www.lboro.ac.uk/well/

SA WATERKALENDER

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

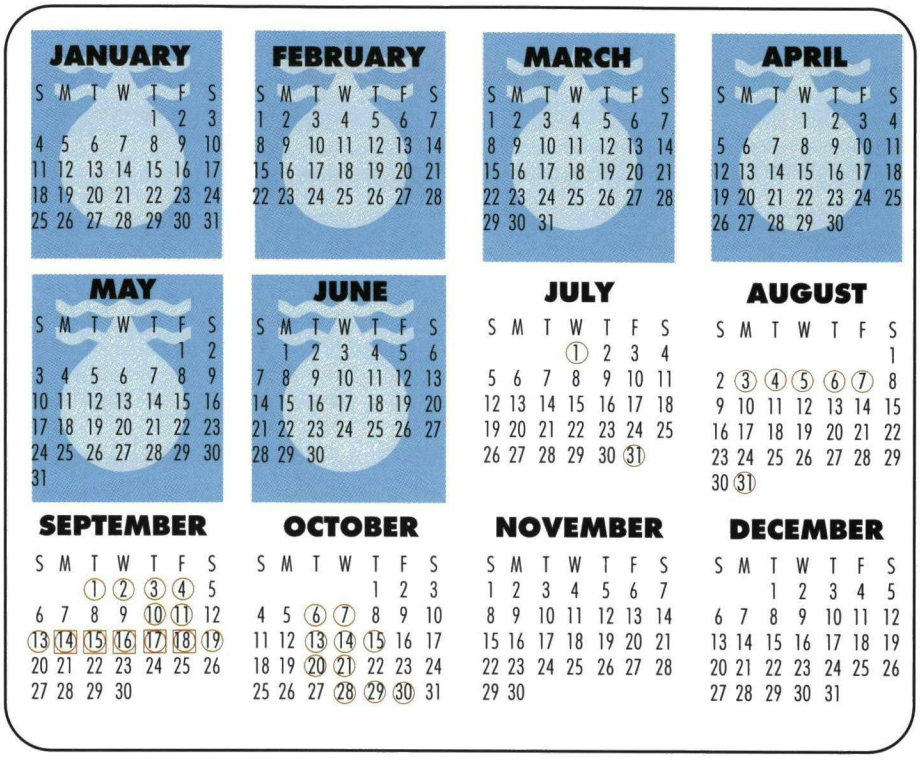
You are invited to send information about conferences, symposia or workshops to the SA Waterbulletin.

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.

1998



Die Waternavorsingskommissie plaas hierdie kalender om te help met die koördinering van watergebeurtenisse in Suid-Afrika.

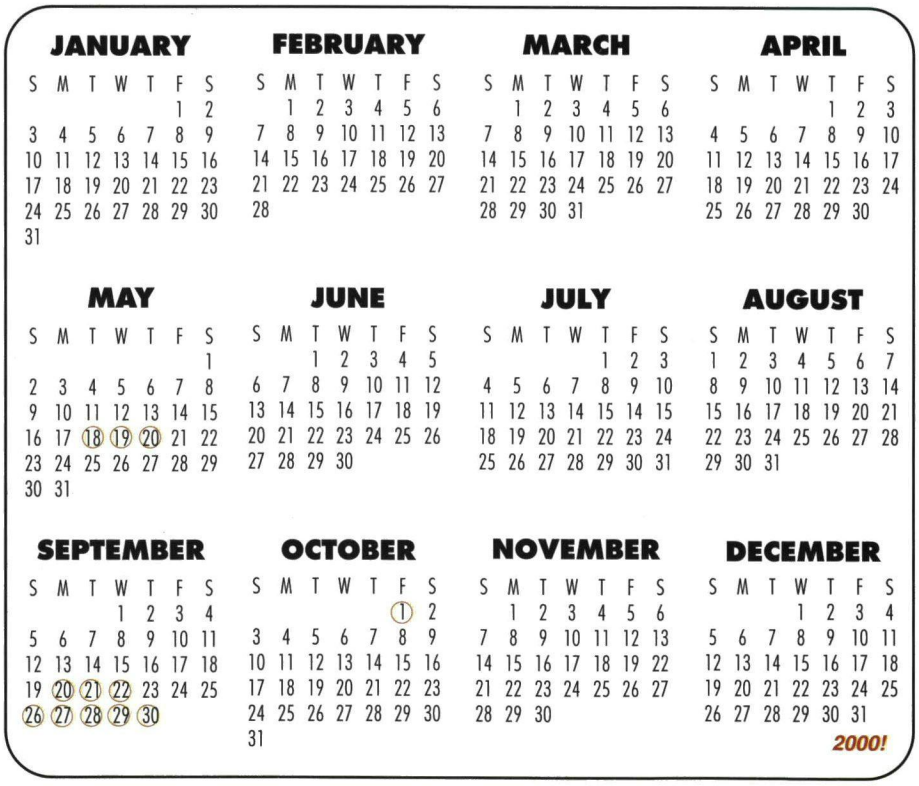
Alle belanghebbendes word uitgenooi om inligting aan SA Waterbulletin te stuur.

Adres:
Die Redakteur
Posbus 824
0001 Pretoria
Tel: (012) 330-0340
Fax: (012) 331-2565

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.

1999



SOUTHERN AFRICA

1998

MINE WATER
JULY 31
A one day symposium on "Mine closure water quality implications" will be held by the WISA Mine Water Division at Randfontein Estates Gold Mine Sports Club.
Enquiries: Ms C Kilian, Secretary, tel: (011) 726-7027. Fax: (011) 726-6913.

WATER CARE
AUGUST 3 - 7
A short course on the optimisation of a potable water purification plant will be held at the Technikon Pretoria. For details, see advertisement in this Bulletin.

ENVIRONMENT AUDIT
AUGUST 31 - SEPTEMBER 4
An ISO 14001 environmental management and auditor training course will be held at the Eskom Conference Centre in Midrand.
Enquiries: Crystal Clear. Tel: (011) 882 3368.

BIOFOULING
SEPTEMBER 10 - 11
An international workshop on biofouling and biocorrosion will be held at the University of Pretoria.
Enquiries: Conference Secretariat, Department of Microbiology and Plant Pathology, University of Pretoria, Pretoria 0001. Tel: (012) 420-3265. Fax: (012) 420-3266. E-mail: mikro2@ scientia.up.ac.za

AQUACULTURE
SEPTEMBER 13 - 19
An international conference on African fish and fisheries - diversity and utilisation will be held in Grahamstown in the Eastern Cape. The objectives of the conference are to address and discuss issues surrounding African fish biodiversity and sustainable utilisation of marine and inland fisheries resources and to consider recent advances in aquaculture in Africa.
Enquiries: JLB Smith Institute of Ichthyology, Private Bag 1015, Grahamstown 6140. Tel: +27 461 311002. Fax: 0461-22403. E-mail: fishcon@ru.ac.za Website: http://www.ru.ac.za/affiliates/jlb/fishcon

WATER CARE
SEPTEMBER 14 - 18
A short course on the operation of activated sludge plants will be held at the Technikon Pretoria. See advertisement in this Bulletin.

PROJECT MANAGEMENT
OCTOBER 5 - 9
A short course on the Logical Framework Approach for project management will be held for water sector professionals in Harare, Zimbabwe.
Enquiries: The Manager, Institute of Water and Sanitation Development, 7 Maasdorp Ave, Alexandra Park, Harare, Zimbabwe. Tel: 263-4-735017; 735026. Fax: 263-4-738120.

SHORT COURSE
OCTOBER 6 - 7
A short course on water quality modelling in water supply systems will be held at the Rand Afrikaans University in Johannesburg.
Enquiries: Zelna van Aswegen. Tel: (011) 489-2599. Fax: (011) 489-2466. E-mail: zelna@scotty.rau.ac.za.

WASTECON '98
OCTOBER 13 - 15
This international conference will be held at the World Trade Centre in Kempton Park and is intended to explore new perspectives in waste management, particularly those applicable to the southern African region. Topics will include management aspects such as auditing, reporting, monitoring, environmental management systems, legal institutional and policy developments, alternative and appropriate technologies and public participation.
Enquiries: Piet Theron or Sonja Havenga at the Institute for Waste Management. Tel: (011) 787-1151. Fax: (011) 787-1086.

AIR FLOTATION
OCTOBER 20 - 21
A short course on dissolved air flotation in water treatment will be held at the Rand Afrikaans University in Johannesburg.
Enquiries: Zelna van Aswegen. Tel: (011) 489-2599. Fax: (011)489-2466. E-mail: zelna@scotty.rau.ac.za.

SEASONAL CLIMATE
OCTOBER 28
A half-day symposium on numerical seasonal climate predictions will be held by Barrie Hunt, Program Leader: Climate Modelling, CSIRO, Division of Atmospheric Research, Australia, in the CEFIM Auditorium at the University of Pretoria.
Enquiries: Hannes Rautenbach. Tel: (012) 420-2469. E-mail: raut-cj@postino.up.ac.za.

ATMOSPHERIC SCIENCES
OCTOBER 29 - 30
The 14th annual conference of the South African Society for Atmospheric Sciences (SASAS) will be held in the Sanlam Auditorium of the University of Pretoria.
Enquiries: SASAS Conference Secretariat (Ammie Wissing), c/o Conference Planners, PO Box 36782, Menlo Park 0102. Tel: (012) 348-4493. Fax: (012) 348-1563. E-mail: wissing@ iafrica.com.

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WATER AFRICA
MAY 18 - 20
The Water Africa exhibition and conference will be held in Cairo, Egypt. The conference theme will be "Reconciling policy and practice: water and wastewater after 2000". **Call for papers.** Synopses of 200 - 300 words should reach the organisers by 31 October 1998. Full papers will be required by 31 January 1999.
Enquiries: Tracey Nolan, Water Africa, 37 Upper Duke St, Liverpool L19DY. Tel: +44 (0)151 709 9192. Fax: +44 (0)151 709 7801/3262. E-mail: africon@robart.demon.co.uk

AIEPS '99
JULY 4 - 8
The African international environmental protection symposium incorporating the fourth Southern African anaerobic digestion symposium will be held at the Imperial Hotel, Pietermaritzburg.
Enquiries: Dr Richard A Daneel, Soil and Pollution Research Services CC, Suite 101, Postnet X6, Cascades 3202. Tel: (0331) 962-696. Fax: (0331) 962-696. E-mail: soil&pol@sprs.co.za

DROUGHT MANAGEMENT
SEPTEMBER 20 - 22
An interdisciplinary international conference on integrated drought management - "Lessons for Sub-Saharan Africa" will be held at the CSIR Conference Centre in Pretoria. **Call for papers.**
Enquiries: Conference Planners, PO Box 82, Irene 0062. Tel: 667-3681. Fax: 667-3680. E-mail: confplan@iafrica.com

CORROSION
SEPTEMBER 26 - OCTOBER 1
The 14th international corrosion congress with the theme "Co-operation in Corrosion Control" will take place in Cape Town. A trade exhibition will also be held for the duration of the congress. **Call for papers.** Deadline 31 July 1998.
Enquiries: The Secretary, The Corrosion Institute of Southern Africa, PO Box 966, Kelvin 2054. Tel: (011)8025145. Fax: (011) 8043484. E-mail: norust@future-jhb.co.za

OVERSEAS

1998

WEDC
AUGUST 31 - SEPTEMBER 4
The 24th WEDC conference with the theme "Sanitation and water for all" will be held in Islamabad, Pakistan.
Enquiries: Water, Engineering and Development Centre, Loughborough University, Leicestershire LE11 3TU UK. Tel: +44 (0) 1509 222885. Fax: +44 (0) 1509 211075.

POLLUTION
AUGUST 31 - SEPTEMBER 4
The 3rd IAWQ specialist conference on diffuse pollution will be held in Edinburgh, Scotland.
Enquiries: Caryl Jackson, Scottish Environment Protection Agency, Erskine Court, the Castle Business Park, Stirling, FK9 4TR, Scotland. E-mail: cjackson@sepa.org.uk Tel: +44 1786 457700. Fax: +44 1786 448040.

WETLANDS
SEPTEMBER 98
A conference on wetland systems for water quality control will be held in Sao Paulo, Brazil.
Enquiries: Dr Samia Maria Tauk-Tornisielo, Centro de Estudos Ambientals/UNESP, Avedida 24-A, 1515 Bela Vista, CEP 13506-900, Rio Claro (SP), Brazil. Tel: +55 019 534 7298. Fax: +55 019 534 2358. E-mail: cea@life.ibrc.unesp.br

WATERSHED MANAGEMENT
SEPTEMBER 7 - 10
An international symposium on comprehensive watershed management (ISWM-'98) will be held in Beijing, China.
Enquiries: Mr Tan Ying, IRTCES, PO Box 366, Beijing 100044, China. Tel: +86-10-68413372. Fax: +86-10-68411174. E-mail: irtces@public2.bta.net.cn

HEALTH RISKS
SEPTEMBER 7 - 10
The 2nd international symposium on assessing and managing health risks from drinking water contamination will be held in Santiago, Chile.
Enquiries: Dr EG Reichard, USGS, 5735 Kearny Villa Road, Suite O, San Diego, CA 92123, USA. E-mail: egreich@s101 pcasnd.wr.usgs.gov Fax: +56-2-689-4171.

NATURAL DISASTERS
SEPTEMBER 7 - 11
An international conference to plan for the 21st century on Early warning systems for the reduction of natural disasters will take place in Potsdam, Germany.
Enquiries: Geo Forschungs Zentrum Potsdam (GFZ), Secretariat of LOC-EWC98, Telegrafenberg, D-14473 Potsdam, Germany. Tel: +49 331 2881523. Fax: +49 331 288 1504. E-mail: ewc98@ gfz-potsdam.de Web-site: http// www. gfz-potsdam.de/ewc98/

RIVER BASINS
SEPTEMBER 13 - 16
The 8th river basin conference - Management of large river basins will be held in Budapest, Hungary.
Enquiries: TRIVENT Conference Office, Szamoca u6/b, H-1125 Budapest, Hungary. E-mail: trivent@mail.elender.hu Fax: +36-1-156-6240.

WASTEWATER TREATMENT
SEPTEMBER 14 - 16
A conference on advanced wastewater treatment, recycling and reuse will be held in Milan, Italy.
Enquiries: ATW98, Scientific Secretariat, DIIAR - Sezione Ambientale, Piazza Leonardo da Vinci 32, 20133, Milano, Italy. Tel: +39 2 23996416. Fax: +39 2 23996499. E-mail: milano98@ amb1.amb.polimi.it

ENVIRONMENT-WATER
SEPTEMBER 16 - 18
The first inter-regional conference on environment-water - innovative issues in irrigation and drainage will take place in Lisbon, Portugal.
Enquiries: Portuguese National Committee of ICID, Instituto da Agua, Av. Almirante Gago Coutinho 30, 1000 Lisboa, Portugal. Fax: 351-1-8473023. E-mail: lenamar@inag.pt

ENVIRONMENT-WATER
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UDM '98
SEPTEMBER 21 - 24
A conference with the theme Developments in urban drainage will be held in London, UK. This conference is the fourth in a series of specialist conferences on aspects of urban drainage.
Enquiries: Dr D Butler, Imperial College of Science, Technology and Medicine, Dept of Civil Engineering, Imperial College Road, London SW7 2BU, UK. Tel: +44 171 594 6099. Fax: +44 171 225 2716. E-mail: d.butler@ ic.ac.uk

TISAR '98
SEPTEMBER 21 - 25
The third international symposium on artificial recharge of groundwater will be held in Amsterdam, the Netherlands.
Enquiries: Symposium Secretariat, Buerweg 51, 1861 CH Bergen, the Netherlands. Tel: +31 72 5899062. Fax: +31 72 589 9040. E-mail: R.R.Kruize@ inter. nl.net

GROUNDWATER
SEPTEMBER 21 - 25
An international conference and special workshops on groundwater quality: remediation and protection (GQ 98) will be held in Tübingen, Germany.
Enquiries: Conference Secretariat GQ'98, c/o Lehrstuhl für Angewandte Geologie, Sigwartstr 10, D-72076 Tübingen, Germany.Tel: +49 (0) 7071-297-4692 OR: 297-6468. Fax: +49 (0) 7071-5059. E-mail: mike.herbert @uni-tuebingen.de

IRRIGATION
SEPTEMBER 21 - 25
A workshop with the theme Young professionals' role in the development of irrigation and drainage will be held in Sofia, Bulgaria.
Enquiries: Bulgarian National Committee on Irrigation and Drainage, 136 Tzar Boris III Blvd., 1618 Sofia. PO Box 384, Bulgaria. Tel/fax: (+3592) 55-11-41.

WATER MANAGEMENT
SEPTEMBER 24 - 25
A conference on the application of models in water management will be held in Amsterdam, the Netherlands.
Enquiries: NVA/SIC Conference Secretariat, Buerweg 51, 1861 CH Bergen nh, the Netherlands. Tel: (+31)72-5899062. Fax: (+31)72-5899040. E-mail: R.R.Kruize@inter.nl.net.

WASTE MANAGEMENT
SEPTEMBER 23 - 25
A symposium on water management problems in agro-industries will be held in Istanbul, Turkey.
Enquiries: Prof Derin Orhon, Environmental Science Division, Istanbul Technical University, ITU Insaat Fakultesi, 80626 Ayazaga, Istanbul, Turkey. Tel: +90 212 285 3793. Fax: +90 212 286 2786.

IAH
SEPTEMBER 27 - OCTOBER 2
The 18th IAH congress - Gambling with groundwater - physical, chemical, biological aspects of aquifer-stream relations, will take place in Las Vegas, Nevada, USA.
Enquiries:John van Brahana, IAH Las Vegas, USGS, 118 Ozark Hall, University of Arkansas, Fayetteville AR 72701, USA. E-mail:jbrahana @jungle. uark.edu Tel: +501-575-2570. Fax: +501-575-3846.

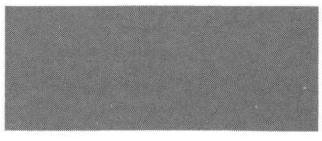
WETLAND SYSTEMS
SEPTEMBER 27 - OCTOBER 2
The 6th international conference on wetland sytems for water pollution control will be held in Sao Pedro, Brazil.
Enquiries: Dr Samia Maria Tauk-Tornisielo, Centro de Estudos Ambientais/UNESP-Av 24-A, 1515, Bela Vista. CEP 13506-900, Rio Claro SP Brazil. Tel/fax: +55 19 534 2358. E-mail: cea@life.ibrc.unesp.br

BIOFILMS
OCTOBER 8 - 10
A conference on the microbial ecology of biofilms: concepts, tools and applications will be held at Lake Bluff, Illinois, USA.
Enquiries: Dr Bruce E Rittmann, Northwestern University, Department of Civil Engineering, 2145 Sheridan Road, Evaston, IL 60208-3109, USA. Tel: +1 847 491 8790. Fax: +1 847 491 4011. E-mail: b-rittmann@nwu.edu

URBAN WATER
NOVEMBER 2 - 5
The 11th IWSA-ASPAC regional conference and exhibition on integrating the urban water cycle will be held in Sydney, Australia.
Enquiries: Convention Secretariat, PO Box 388, Artarmon, NSW 2064, Australia. E-mail: awwa@peg.apc.org Tel: +61-2-9413-1288. Fax: +61-2-9413-1047.

WETLANDS
NOVEMBER 8 - 14
The 2nd international conference on wetlands and development will be held in Dakar, Senegal.
Enquiries: Wetlands International, Marijkeweg 11, PO Box 7002, 6700 CA Wageningen, The Netherlands. Tel: +31 317 474711. Fax: +31 317 474712. E-mail: post@wetlands.agro.nl

MARINE POLLUTION
NOVEMBER 16 - 18
The third Middle East conference on marine pollution and effluent management will be held in Kuwait.
Enquiries: Dr Saleh M Al-Muzaini, Environmental Science Dept., Kuwait Institute for Scientific Research, PO Box 24885, Safat 13109, Kuwait. Tel: +965 4818712. Fax: +965 4845350.



SHORT COURSE

University of Pretoria

Water Utilisation Division

Design of activated sludge plants

Date: 3 - 7 August 1998

Venue: Water Utilisation Building
South Campus, University of Pretoria
(Map will be provided on request)

This is an advanced course aimed at the engineer or scientist responsible for the process size evaluation of existing and the process design of small, medium and large sized wastewater treatment plants based on the activated sludge principle. The main aim of the course is to provide the responsible person with the necessary theory and calculating skills to effectively evaluate existing treatment plant capacity and/or to do the process design of new activated sludge treatment plants.

Main focus of course

- ❒ Wastewater characterisation and its influence on process design.
- ❒ Theory and design of biological carbon, nitrogen and phosphorus removal processes.
- ❒ Theory and design of secondary settling tanks.
- ❒ Theory and design of disinfection and disinfection contact tanks.
- ❒ Design of sequencing and orbital activated sludge plants.

At the end of the course the successful candidate will be able to determine the capacity of an existing activated sludge plant and/or design a new nutrient removal activated sludge plant.

Lecturers

Prof WA Pretorius Tel No: (012) 420-3566
Prof CF Schutte Tel No: (012) 420-3571

Language

The course notes are in English. Lectures and discussions will be conducted in both English and Afrikaans in order to ensure that all obtain full benefit from the short course.

Course fees

R3 000,00 per person (excluding VAT)
Course fees include course notes, tea/coffee and lunch every day, but exclude accommodation.

Enquiries/Registration

Please contact Mrs Elmarie Otto at: Tel. No: (012) 420-3566
Fax No: (012) 362-5089