

# S4 waterbulletin

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## **AFVALWATER**

metode vir die bekamping van biologiese skulm ontwikkel

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## **IRRIGATION**

Model aircraft aids Irrigation scheduling

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## **AFVALBEHANDELING**

Erdwurms Ingespan vir afvalverwerking

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# **S T A S O F T**

A user friendly IBM compatible computer program for the softening and stabilisation of municipal water supplies

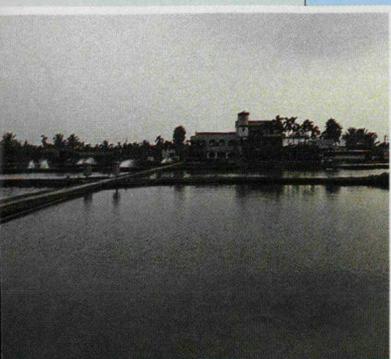
STASOFT has been written to assist chemists, engineers and plant operators in the municipal water supply field with a method for quick and accurate determination of the chemical state of a water and the amount of conditioning chemicals to be added to it to obtain a desired final state.

The program is available free of charge to South African users and can be ordered from the Water Research Commission, P O Box 824, Pretoria 0001.

STASOFT was developed by the University of Cape Town with the financial support of the Water Research Commission with whom copyright is vested.

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SA Waterbulletin is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organization 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: WRC, P O Box 824, Pretoria 0001, Republic of South Africa. Tel. (012) 28-5461.

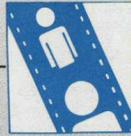
Editor Jan du Plessis, Asst Editor Ilse Lombard, Ed. Secretary Rina Human, Typesetting Heer Printing Co, Colour separations Litho Technik, Typography and design Nicola van Nikkelen Kuyper, Printing Creda Press, Cape Town.

SA Waterbulletin is n tweemaandelikse tydskrif oor water en waternavorsing wat uitgegee word deur die Suid-Afrikaanse Waternavorsingskommissie (WNK), 'n statutêre organisasie wat in 1971 by Wet gestig is.

Intekening is gratis. Stof in dié publikasie weerspieël nie noodwendig die oorwoë menings van lede van die WNK nie, en mag hergebruik word met erkenning van die bron.

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## Symposium on forced aeration stabilisation and disinfection

**A** one-day symposium on forced aeration stabilisation and disinfection of sewage sludge was held recently at the Indaba Hotel, north of Johannesburg.

Delegates from various municipalities and consulting engineers attended the symposium organised by the Water Research Commission (WRC) and the National Institute for Water Research (NIWR), in conjunction with the Johannesburg City Engineers' Department.

After Papers were presented on various aspects of forced aeration, delegates visited the Johannesburg Northern Sewage Works where this composting process was demonstrated.

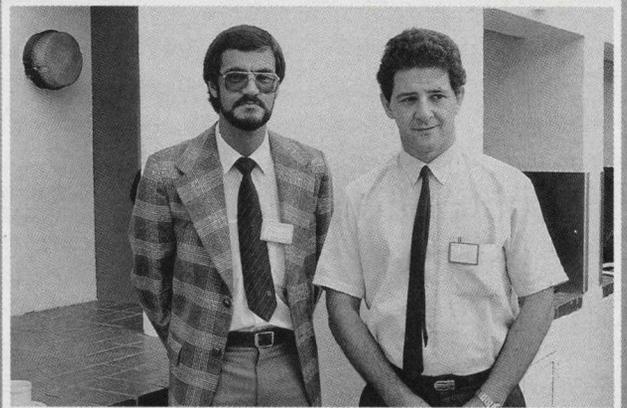
The WRC financed the research at the NIWR in Bellville where the process of forced aeration composting was further developed to suit South African conditions. The municipality of Stellenbosch has already constructed and is successfully operating a full-scale forced aeration facility at their sewage works.

WRC



From left: Mr J A Duvenhage and Mr P D Willemse (Krugersdorp municipality).

WRC



From left: Mr J F Kleynhans (Potchefstroom municipality) and Mr M Pishiri (Stewart, Sviridov & Oliver).

WRC

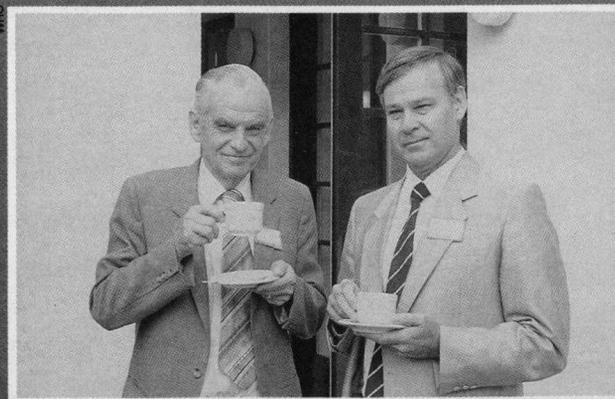


From left: Mr B C Trim (Johannesburg municipality) and Mr J E McGlashan (WRC).

WRC

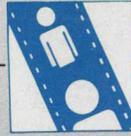


From left: Mr S L Deacon (Johannesburg municipality) and Mr H Nicholls (Johannesburg municipality).



From left: Mr D W Osborn (Johannesburg municipality) and Mr P E Odendaal (WRC).

From left: Mr H P Vermeulen and Mr H J Duvenhage (Vanderbijlpark municipality).



## Meeting on Artificial Wetlands

**T**he capacity of Artificial Wetlands as purification systems and nutrient sinks, is well documented and extensively practised both in Europe and in the United States. The potential to systematically enhance waste-water treatment efficiency through the creation of controlled Artificial Wetlands, has been gaining increasing attention in South-Africa. The establishment of a national Co-ordinating Committee on Artificial Wetlands (CCARWET) by the CSIR and the construction of trial units at such places as Mphophomeni, for the Umgeni Waterboard, are proof of a general interest in the concept. These systems offer low cost, low technology, robust, localised, yet efficient waste-water treatment with a minimum of supervision and maintenance.

Acting as a subsurface biological filter, reed beds are planted in an enclosure which contains a medium such as gravel or ash suitable for anchoring the plants. As the sewage or effluent passes through the bed, the reeds rapidly transfer oxygen to the media via their hollow stems and rhizomes and this stimulates the growth of bacteria to break down the sewage in a similar manner to conventional biological treatment.

The performance efficiency of these beds can be determined by comparing inflow and outflow nutrient loads and other parameters.

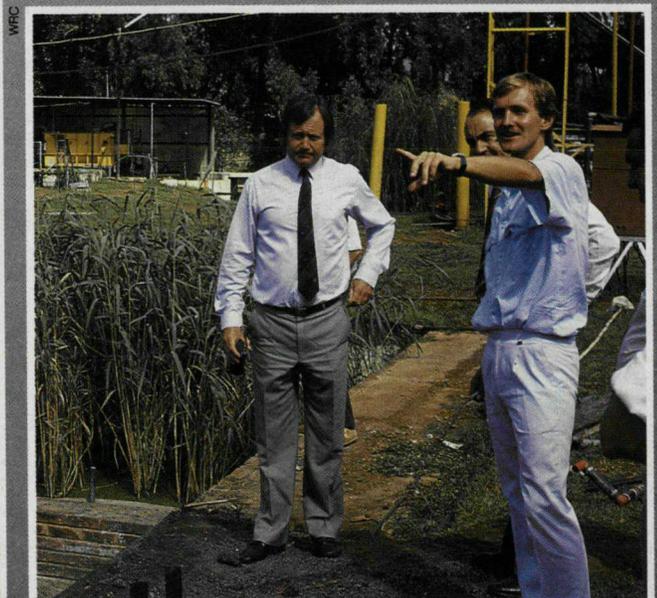
In terms of an agreement with the Division of Water Technology at the CSIR, the consulting engineering firm Stewart Sviridov and Oliver and the Water Research Commission, Engineering Design Guidelines for Artificial Wetlands for waste-water treatment, will be prepared over a period of one year.

A pilot plant has been erected at Daspoort Sewage Works in Pretoria consisting of twelve beds containing various substrate/macrophyte combinations. The substrates used for the experiment are ash and gravel. The tanks receive a range of influents, namely: Stabilisation pond effluent, filtered stabilisation pond effluent and septic sewage.

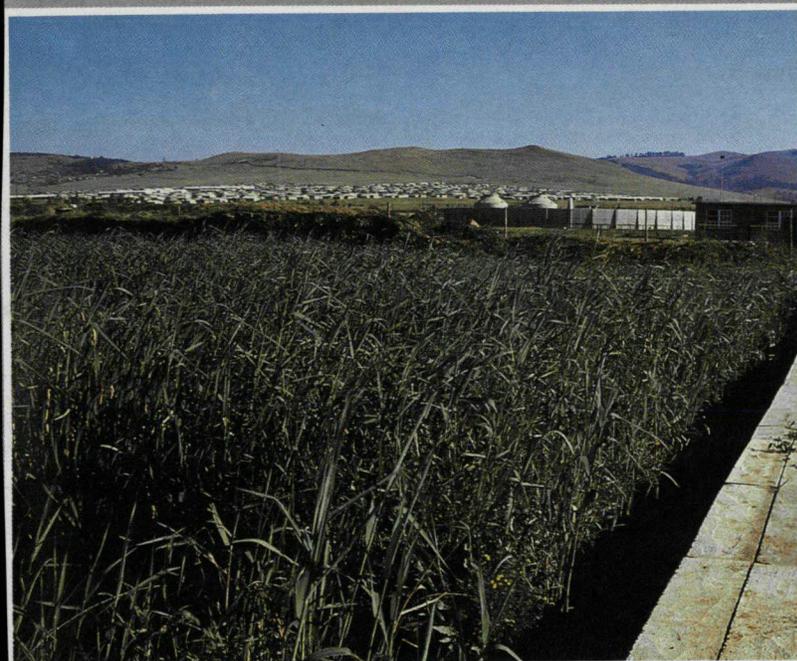
The experiment at Daspoort is aimed at evaluating the use of artificial wetlands as an alternative waste-water treatment technology under South African conditions, to identify appropriate applications for the system and to then prepare a set of guidelines for the optimum design of such systems.



Delegates at the CCARWET meeting inspecting a reed bed experiment.



Dr Andrew Wood explains the NIWR's research on wetland systems at Daspoort Sewage Works in Pretoria.



The Umgeni Water Board's artificial wetland system at Mphophomeni, near Pietermaritzburg.

# MODEL AIRCRAFT TO AID IRRIGATION FARMERS

The hand launched aerial photographic unit (the "witch") fitted with an infra-red thermometer, data recorder and colour video camera taking off.



UNIVERSITY OF THE NORTH

**A** unique project to develop and evaluate economic means of data acquisition, using remote sensing, is being undertaken by the University of the North.

The five year project is sponsored by the Water Research Commission and will be supervised by Prof Paul Fouché of the Department of Soil Science.

Specially equipped radio controlled aircraft, carrying scientific instruments for various applications, will monitor crop water stress and other parameters related to the estimation of crop water requirements and the attainment of optimum irrigation efficiency.

The use of such aircraft for aerial photography of crops on a large scale (1:500 to 1:1 000) can provide an inexpensive instantaneous view of an entire field under irrigation. Studies of crop leaves have shown that plant condition such as moisture stress affect leaf reflectance properties especially in the near infra-red region. Areas of moisture stress on crops can therefore be determined by infra-red photography or alternatively by measuring the surface temperature of the crop canopy. Some work has been done by Berliner et al. (1984) in the Republic of South Africa on using an infra-red thermometer as a crop moisture stress detector. Increases in leaf temperature have been correlated with decline in soil water content, leaf diffusive resistance and leaf water potential. Torman, also made use of infra-red thermometer measurements of the canopy temperature of nectarines to estimate plant water stress. By measuring the differences in canopy temperature and air temperature along with vapour pressure deficit measurements, Throssell et al. (1987) developed a model to schedule irrigations on Kentucky blue grass.

Most of these measurements were made at low levels,  $\pm 1$  meter above the canopy surface. Because measurements were made by hand held instruments, only small restricted surface areas could be covered at a time. By using the proposed remote control aircraft, a much larger surface area can be covered and scanned at different heights. The construction of this aircraft is such that it can also carry instruments for measuring air temperature and vapour pressure deficit. Instruments will be connected to a multi channel electronic recorder for storing all data measured. Data from this recorder is retrieved and further evaluated on a computer. The data is needed for the development of a mathematical model which can be used to optimise irrigation scheduling of crops. This

research work by remote control aerial surveillance, is the first to be done in the Republic of South Africa and will also benefit an existing project with the University under the guidance of Prof M S Burgers on the subject of practical scheduling of irrigation in the Northern Transvaal.

A remote control aerial surveillance unit consisting of a radio controlled model aircraft capable of a payload of up to 5 kg will be used to carry the following equipment:

- A 35 mm camera for colour or black and white pictures.
- An infra-red thermometer for measuring canopy temperature of crops under surveillance.
- Multichannel data-logger for storing all measurements.
- A colour video camera to monitor the irrigated area for any deficiencies such as sparse plant density, nutrient deficiencies, poor water distribution etc. This camera is also linked by TV signal to a ground station so that the aircraft can be guided to record exactly the areas and information required.

The use of ordinary aerial colour photography by using large aircraft is too expensive for the average farmer today. A spin-off from this project is that by developing a cheap simple aerial photography unit, the farmer could photographically monitor and keep record of the performance of his crops and irrigation systems.



UNIVERSITY OF THE NORTH

Avocado orchards at Westfalia Estate near Tzaneen. Aerial photography of crops on a large scale 1:500 to 1:1 000 can provide an inexpensive instantaneous view of an entire field under irrigation.



UNIVERSITY OF THE NORTH

At the official signing of the irrigation research contract. From left: Prof P Fouché, Head of the Department Soil Science; Mr P E Odendaal, Executive Director of the Water Research Commission and Prof P C Mokgokong, Rector of the University of the North.

NIGB



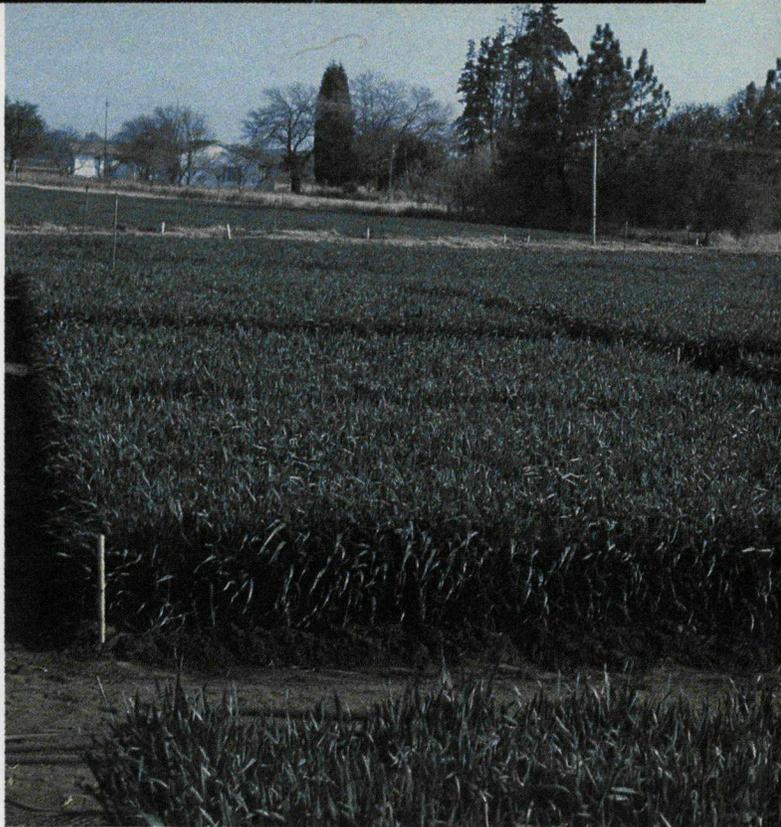
Besproeiing is met 'n perseelbesproeier op proefpersele toegedien.

# Navorsers ondersoek nuwe benadering vir skedulering

**D**ie Navorsingsinstituut vir Grond en Besproeiing (NIGB) het 'n praktiese manier ondersoek om die gewas se waterstatus in aanmerking te neem wanneer besproeiing geskeduleer word.

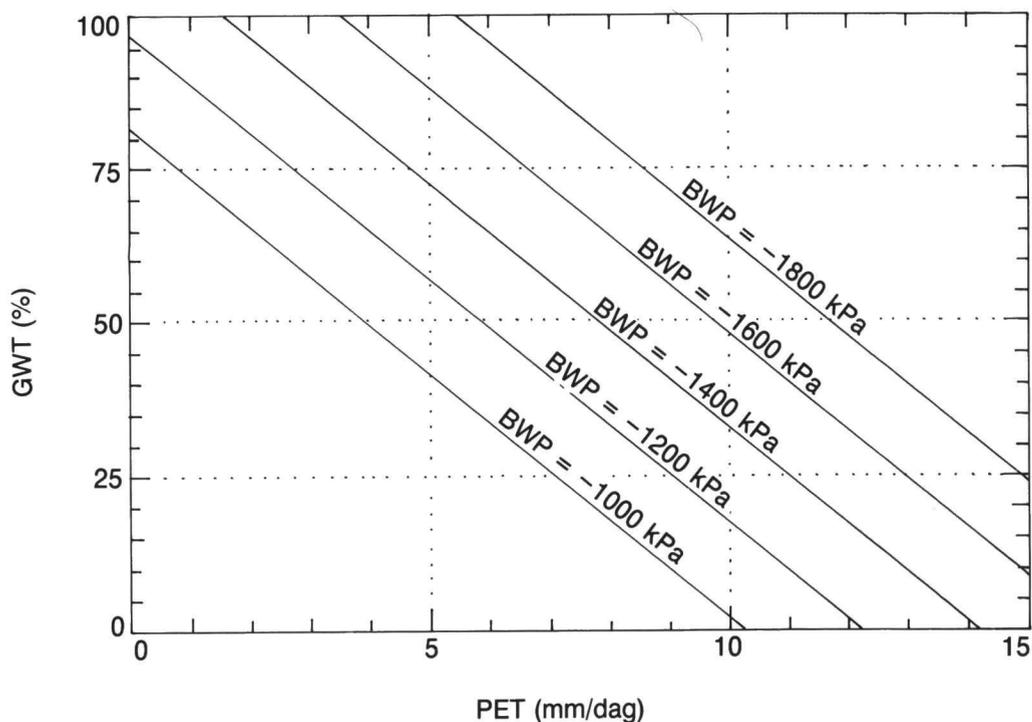
Besproeiingskedulering word meestal gedoen deur die grondwaterstatus van 'n gewas te monitor en dan daarvolgens te besluit wanneer en hoeveel om te besproei. Mnr André Nel, landbounavorser by die NIGB, sê egter dat dit eerder die waterstatus van die gewas moet wees wat die tydstop van 'n besproeiing behoort te bepaal aangesien dit uiteindelik die gewas is wat die opbrengs moet lewer. Die probleem bestaan egter in die praktyk dat dit moeilik is om die gewaswaterstatus te bepaal.

Gedurende 1986 is 'n proef uitgevoer waarna daar onder andere ook gekyk is na maontlik verbande tussen die gewaswaterstatus en ander makliker meetbare parameters.



Die koringkultivar Zaragosa, is op proefpersele van 5 x 10 meter by die Rooodeplaat proefplaas geplant.

NIGB



Figuur 1 Die verwantskap tussen die daaglikse potensiële evapotranspirasie (PET), grondwatertekort (GWT) en blaarwaterpotensiaal (BWP) van koring te Rooodeplaat.

Die doel is om die gewas se waterstatus te beraam en dan daarvolgens te besluit wanneer om te besproei.

Koring is as proefgewas gebruik. Behandelings het daaruit bestaan dat besproeiing toegedien is as sekere gekose vlakke van waterstroming ontwikkel het. Die "interne" behandeling is tweekeer per week besproei, waar die grondvog bykans heeltyd by veld kapasiteit gehou is.

Die blaarwaterpotensiaal, wat die waterstatus van die koring weergee, is gereeld gemeet; so ook die grondwatertekort en potensiële evapotranspirasie en panverdamping wat weer die verdampingsaanvraag van die atmosfeer weergee.

Die eerste belangrike bevinding was dat die blaarwaterpotensiaal van die "nat" perseel wat gereeld besproei is 'n liniêre verband met die potensiële evapotranspirasie toon. Tweedens is geredeneer dat persele wat 'n laer blaarwaterpotensiaal het as die nat perseel dit moet ondervind weens 'n laer grondvoginhoud. Vervolgens is die verband tussen die verskil in blaarwaterpotensiaal (tussen die nat en gestremde perseel) en die grondwaterinhoud ondersoek en daar is ook 'n liniêre verband gevind.

Die implikasie van die resultate is dat, ten minste vir die proefterrein, die blaarwaterpotensiaal van 'n spesifieke koringperseel waarvan die grondwatertekort en die potensiële evapotranspirasie of panverdamping vir 'n spesifieke dag bekend is, bereken kan word. 'n Grafiese voorstelling in die verband word in Figuur 1 getoon.

## TOEPASSING OP SKEDULERING

Deur die grondwatertekort en daaglikse evapotranspirasie gereeld te meet en die blaarwaterpotensiaal op Figuur 1 af te lees, kan besproeiing toegedien word sodra die koring 'n spesifieke gekose blaarwaterpotensiaal bereik.

Om dié skeduleringsbenadering prakties uit te voer kan van verskillende instrumente gebruik gemaak word. Die Klas A-verdampingspan kan as alternatief tot PET berekening, gebruik word om die potensiële evapotranspirasie met behulp van gewasfaktore te beraam en die grondwatertekort kan deur middel van daaglikse boekhouding gevolg word.

Die voordeel van dié skeduleringsbenadering, is dat dit vir die grootste gedeelte van die seisoen geldig is. Dit laat ook die keuse aan die gebruiker oor watter instrument of instrumente gebruik gaan word om die PET en GWT mee te bepaal.

Verdere ondersoek na die tegniek is egter nog nodig, naamlik dat vasgestel word hoe ander grondsoorte en gewasse sal reageer op hierdie skeduleringsmetode. Ook is dit noodsaaklik om beter inligting in te samel oor die BWP-waardes waarby die komponente van opbrengs, soos dit ontwikkel met verloop van die seisoen, nadelig geraak sal word.

# Biologiese skuim met flottasie bekamp

up





Biologieseskuim-voorkoms by Randfontein Estate Goudmyn-aanleg met *M. parvicella* die dominante skuimbakterie.

**B**aie geaktiveerdeslykaanlêe wêreldwyd ondervind periodiek 'n opbouing van biologiese skuim op die oppervlakte van belugtingsbakke en besinktenks. Dié skuim is baie moeilik om te hanteer en kan soms ernstige bedryfsprobleme by rioolwatersuiweringswerke meebring.

Navorsers aan die Universiteit van Pretoria, het nou 'n metode ontwikkel waarmee biologiese skuim suksesvol met selektiewe flottasie bekamp en beheer kan word.

Dié navorsingswerk, wat finansiële deur die Waternavorsingskommissie gesteun is, is in 'n finale verslag saamgevat wat pas by die WNK vrygestel is. Die verslag is getiteld Biologieseskuimbeheer met selektiewe flottasie in die geaktiveerdeslykproses en is gratis op aanvraag by die WNK beskikbaar.

Die navorsers, dr C P J Läubscher en prof W A Pretorius, van die departement chemiese ingenieurswese, Universiteit van Pretoria, sê in dié verslag dat hulle met die studie bevind het dat die opbouing van biologiese skuim in geaktiveerdeslykaanlêe te wyte is aan die dominante voorkoms van die organismes, *Nocardia* spp. of *Microthrix parvicella*, in die skuim. Die bykans selektiewe teenwoordigheid van hierdie bakterieë in biologiese skuim word veroorsaak deur benattingsmiddels wat onder sekere toestande aan die selwande adsorbeer en meebring dat wanneer lugborrels deur die slykmengsel versprei word, hierdie bakterieë mettertyd aan die lugborrels vassit en sodoende flotter.

Aangesien skuimbakterieë neig om te dryf, hoop dit op in kompartemente wat oor oppervlakteskotte beskik. Dit word gevolglik nie onderwerp aan die proses van slykverspilling vir slykouderdombeheer nie, met die gevolg dat dit in hierdie "mikrobiële selekteerders" vermeerder. Slykbakterieë in 'n vasgekeerde skuimlaag beskik dus oor 'n veel langer slykouderdom as die besinkbare slyk, en sulke stelsels het dus in effek twee slykouderdomme.

Die besonderse fisiologiese eienskappe van hierdie skuimvormende organismes, naamlik dat dit verhongeringsbestand is en 'n hoë substraataffiniteit openbaar, bring mee dat dit in 'n laeslykladingstoestand bo die meeste ander organismes bevoordeel word. Indien dit in 'n skuimvormende staat onder anaërobiese toestande verkeer, word hierdie organismes verder bevoordeel bo ander aërobiese organismes deurdat dit feitlik eksklusief aan lugborrels kleef en sodoende oor 'n kontinue lugtoevoer beskik.

Verskeie metodes is reeds toegepas om biologiese skuim te bekamp, maar nie een was besonder doeltreffend nie. Hierdie studie het dit ten doel gestel om metodes te ontwikkel waarvolgens skuimbakterieë,

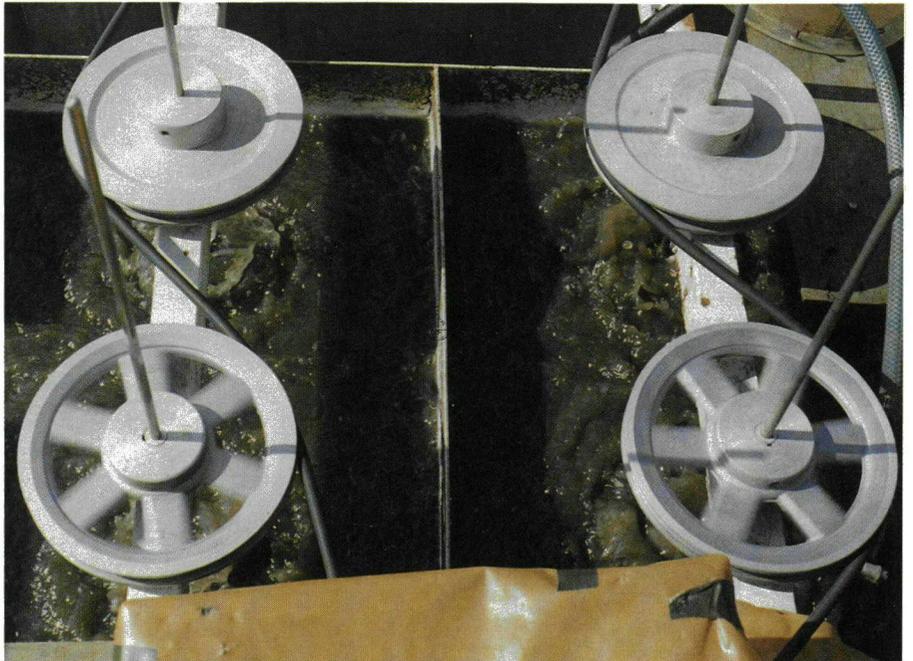
deur gebruik te maak van die besondere flottasiermoë waaroor dit beskik, eers in 'n stelsel te kwantifiseer en tweedens selektief uit 'n stelsel te flotteer. Die hipotese was dat indien die skuimbakterieë teen 'n vinniger tempo negatief geselekteer word as wat dit deur positiewe seleksie vermeerder, dit uit die stelsel verwyder kan word, om sodoende die voorkoms van biologiese skuim te beëindig.

'n Wiskundige model is ontwikkel waarvolgens die tempo van skuimverwydering uit 'n stelsel bereken kan word tydens die aanwending van verskillende flottasieselgroottes en kombinasies bedryfsparameters. Die lugvloeiempo per volume flottasiesel, die diepte van die sel en gemiddelde borrelgrootte, is saamgevat in 'n sogenaamde bedryfsfaktor,  $F_b$ . 'n  $F_b$ -waarde van tussen 22 en 24 en 'n werklike retensieperiode van tussen 10 en 20 minute bied 'n kostedoeltreffende skuimverwyderingstelsel. 'n Lugvloeiempo van  $10 \text{ m}^3/\text{m}^3 \text{ reaktor}\cdot\text{h}^{-1}$ , wat binne die bestek van normale aanwending val, 'n seldiepte van 3 m, 'n gemiddelde borrelgrootte van 2 mm wat 'n optimale balans tussen maksimale flottasietempo van skuimbakterieë en minimum flottasie van ander slykorganismes, bied byvoorbeeld 'n  $F_b$ -waarde van 23.

Die model inkorporeer die gelyktydige toename in skuimbakterie-produksie as gevolg van groei. Aangesien die groeitempo van *M. parvicella* reeds bekend is, is slegs dié van *Nocardia* by die Rynfield-(Benoni) aanleg bepaal. Dit is naamlik vasgestel as 0,01 selle per uur.

Hierdie metode van biologieseskuimbeheer met selektiewe flottasie, is uiteindelik suksesvol getoets op loodsskaal en daarna op volskaal by die Daspoort-(Pretoria) rioolwatersuiweringsaanleg.

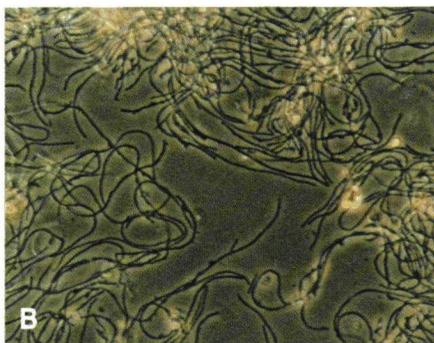
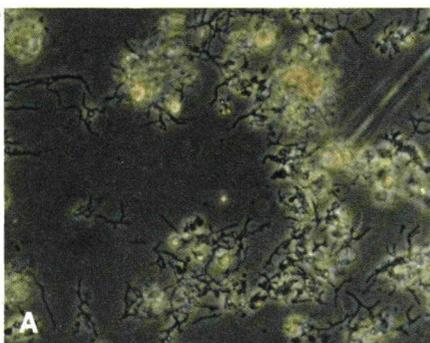
Eksemplare van die verslag Biologieseskuimbeheer met selektiewe flottasie in die geaktiveerdeslykproses is gratis beskikbaar vanaf die Waternavorsingskommissie, Posbus 824, Pretoria (Aandag mev Tineke van der Schyff). Tel.: (012) 28-5461.



Reaktor B by afloop van ondersoek met geen skuim sigbaar nie.

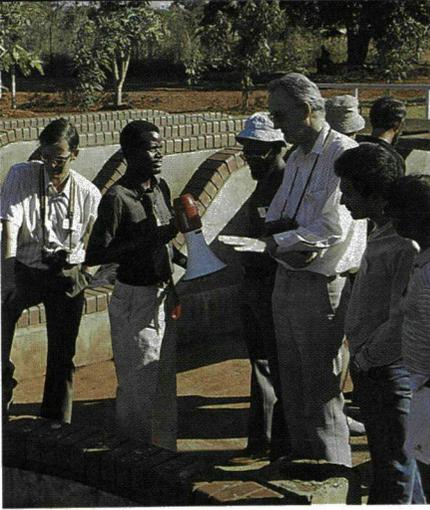


Reaktor A na afloop van ondersoek met volop skuim sigbaar.

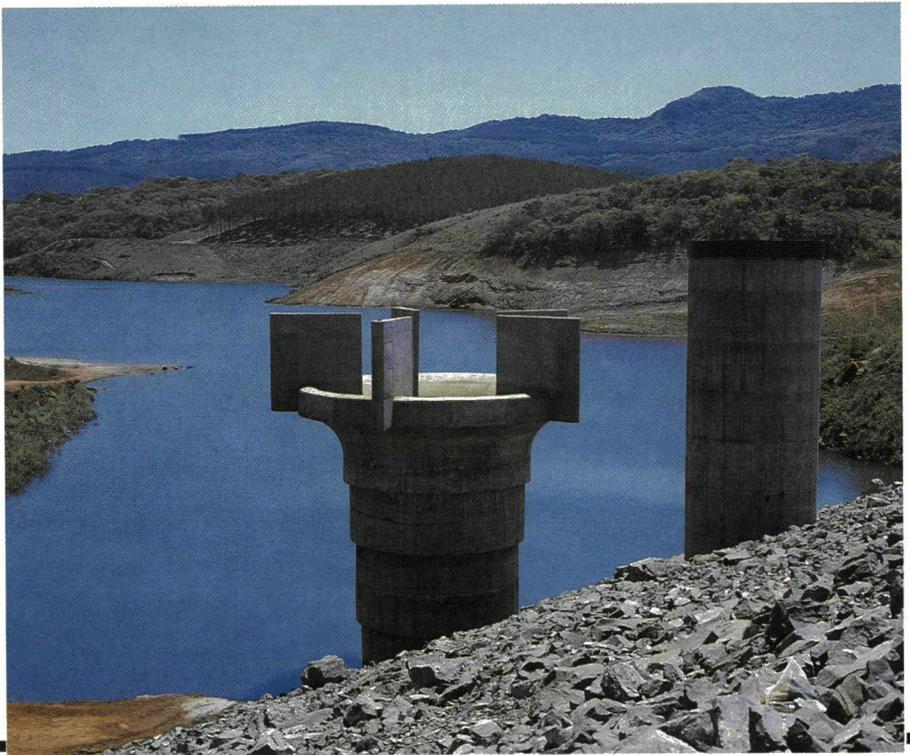


Verrykte skuimmonsters met

- a) *Nocardia* en
- b) *M. parvicella*



# WATER FOR KWAZULU



The Elangeni Hotel, Durban, will open its doors on 28 June 1988 to welcome delegates to a Seminar on Water Supply and Sanitation, with special reference to KwaZulu. The Seminar will be opened by the Chief Minister of KwaZulu, Chief Mangosotho Buthelezi. It will also be attended by the President of the International Water Supply Association (IWSA), Mr Jan Dirickx, and the Secretary-General, Mr Leonard Bays. This will be the second visit to southern Africa for Mr Bays, who was in Mmabatho for the Bophuthatswana Seminar in June 1986.

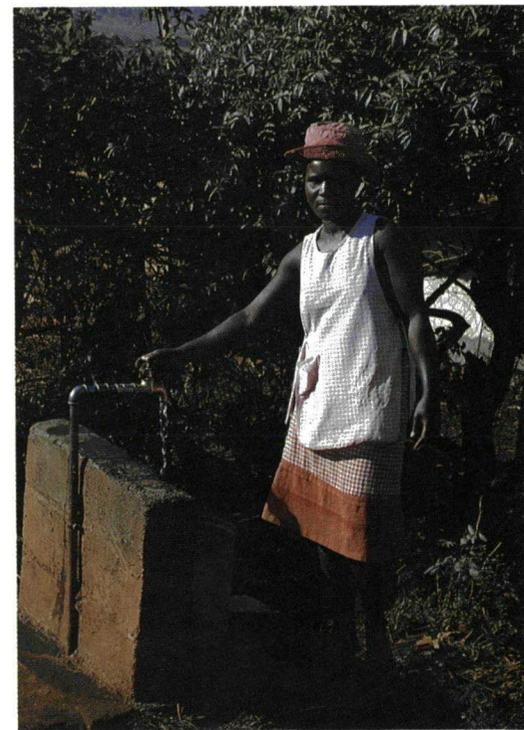
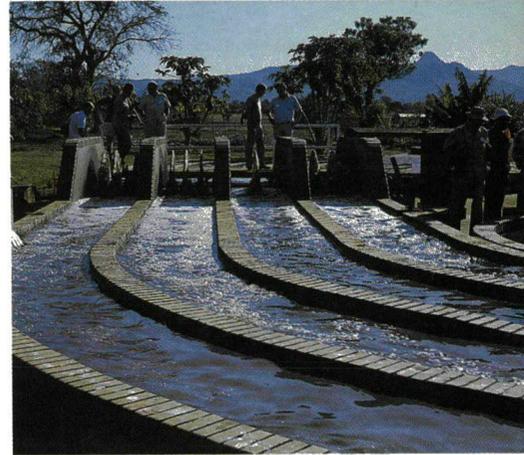
The first across-the-border conference dealing with regional water supply and sanitation was held at Mbabane, Swaziland, in June 1975. This provided the first opportunity to look at water supply and sanitation in one of South Africa's neighbouring states and was well supported by Chief Ministers and senior officials of several self-governing states. Some of these have since become Presidents, such as the Presidents of Ciskei and Venda. Many who attended this conference will remember the keen interest shown by the late Dr Cedric Phatudi, Chief Minister of Lebowa. The Swaziland Conference was held under the joint auspices of the IWSA and the International Association on Water Pollution Research and Control, two organizations with which South Africa has been closely involved for many years.

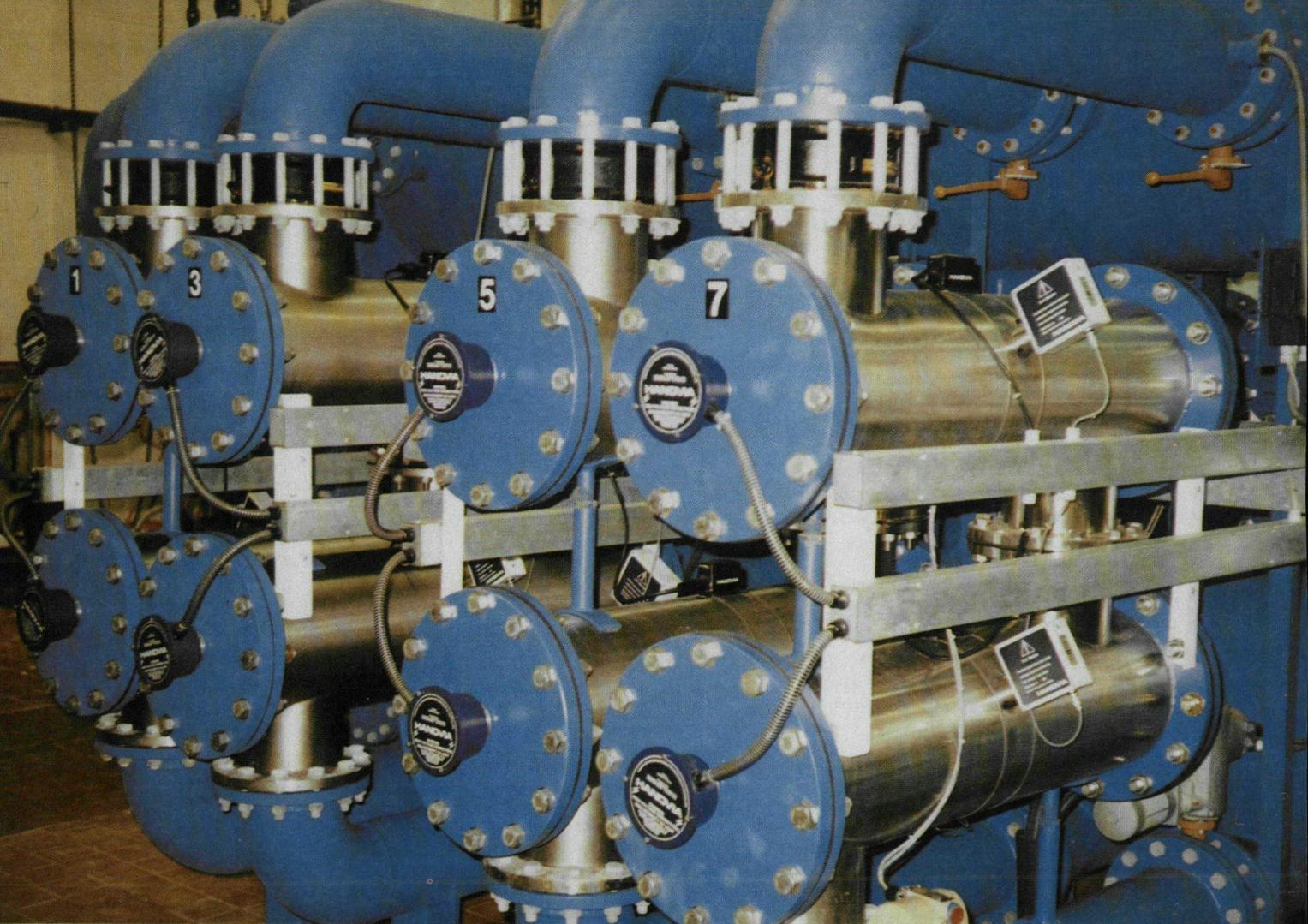
The beginning of the nineteen eighties saw the launch of the International Drinking Water Supply and Sanitation Decade and the IWSA was approached to co-ordinate efforts worldwide to help realize the objectives. These are summarized as the provision of a safe and sufficient water supply for all, combined with suitable sanitation by the year 1990. It was at this stage that the South African National Committee appointed a special Subcommittee under chairmanship of Dr Lucas van Vuuren to examine ways in which South Africa could assist in promoting the aims and objectives of the Decade. The Subcommittee was made up of representatives from the CSIR, various government departments and statutory bodies, Venda, Ciskei, Bophuthatswana, South West Africa/Namibia and the Chamber of Mines.

It has recently been joined by Transkei, QwaQwa and the Development Bank of Southern Africa. The Subcommittee identified various needs, in particular the different requirements of urban and rural situations. Baseline data were collected at the start of the Decade, showing the amounts of money spent on water supply and sanitation schemes throughout the country. Despite an economic recession, there has been a steady increase in funds used for these schemes.

One area in which a valuable contribution could be made was that of technology transfer, in which appropriate technology would be made available to those in the less developed parts of southern Africa. Three technology transfer seminars have been held so far in Venda (1983), Ciskei (1985) and in Bophuthatswana (1986) and the fourth will take place at the end of June. Each of these seminars has followed a similar pattern with the first day devoted to technical presentations, followed by a day of technical visits and a final day of presentations. The technical visits have always proved popular and have given delegates a chance to see the situation on the ground at first hand and to discuss problems at a personal level. The social activities have always been a valuable feature of the programme and have helped promote a better understanding of problem areas. In the KwaZulu Seminar a similar programme will be used with the important difference that the final day will be taken up with workshop sessions.

An encouraging sign is the increasing interest shown by the IWSA in these seminars. After the Secretary-General's visit to Mmabatho in 1986, he will be all the more welcome, along with the President of the IWSA, at the KwaZulu Seminar in June this year. More details can be obtained by returning the enclosed reply card in this Bulletin. It promises to be a memorable and worthwhile experience, so try not to miss it.





## British plant disinfects water with UV

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In 1987 the installation of an ultraviolet disinfection system at the Hambleden Pumping Station in Britain established the largest plant of this type ever to be used to treat water for domestic use. Dr Frik Schutte, Senior Adviser to the Water Research Commission, recently visited the plant and explains how the system works.

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**U**ltraviolet (UV) radiation has many advantages over chlorination for the disinfection of water of which the most important is the fact that virtually no by-products are formed.

Until recently technical restrictions prevented the large scale application of UV, but with the development of a high yielding UV source, the precise monitoring of UV intensity and automatic control systems, the problems were overcome and paved the way for the full scale application of ultraviolet radiation in water treatment plants.

The Hambleden Pumping Station in Buckinghamshire near London, UK, treats up to 55 Ml/d of raw water and provision has been made for extension to 73 Ml/d. The water is abstracted by nine submersible pumps in six chalk boreholes on a site 1 kilometre away on the North bank of the River Thames at Medmenham.

Prior to delivery into the 9 000 m<sup>3</sup> reservoir on site, the raw water is subjected to ultraviolet disinfection and marginal chlorination.

Part	Section	Contents	Frequency of use		
			Often	Seldom	Never
<b>Volumes</b>					
1 - Text	Chapter 1	Introduction			
	Chapter 2	Methodology			
	Chapter 3	Background information			
	Chapter 4	Worked examples - Manual			
	Chapter 5	Worked examples - Computer			
2 - Appendices	Appendix A1	Rainfall data			
	Appendix A2	Streamflow data			
	Appendix A3	Evaporation data			
	Appendix B1	Irrigation areas			
	Appendix B2	Afforestation areas			
	Appendix B3	Reservoir data			
	Appendix B4	Land-use map			
	Appendix C1	Tertiary catchment division			
	Appendix C2	Model parameters			
	Appendix D1	Tertiary catchment map			
	Appendix D2	Tertiary catchment MAR			
	Appendix D3	Synthesized streamflows			
	Appendix E1	Catchment cross-references			
	Appendix E2	Quaternary catchment data			
	Appendix E3	Quaternary catchment maps			
	Appendix F1	Low-flow analyses - gauges			
	Appendix F2	Low-flow analyses - zones			
	Appendix F3	Hydrological zone maps			
	Appendix F4	Storage-draft-frequency			
	Appendix F5	Evaporation loss diagram			
	Appendix F6	Sediment yield map			
	Appendix F7	Trap efficiency diagram			
	Appendix G1	Computer programs			
	Appendix G2	Program HDYPO8			
	Appendix G3	Program HDYPO9			
	Appendix G4	Program RESSIM			
	<b>Guide</b>	Chapter 1	Introduction		
Chapter 2		Legal aspects			
Chapter 3		Warnings and possible pitfalls			
Chapter 4		Problem solving by hand calculation techniques			
Chapter 5		Problem solving by computer techniques			
<b>Addendum</b>	Section 1	Introduction			
	Section 2	Frequency distribution of riverflow			
	Section 3	Additional evaporation data			
	Section 4	A quick appraisal of surface water resources			

Please return the completed (or partially completed) questionnaire to:

Mr Brian Middleton  
c/o Steffen, Robertson and Kirsten Inc  
P O Box 8856  
JOHANNESBURG  
2000

- 6 Do you have any disagreement with the methodology used in the Volumes?  
Yes/No (If yes, give details and suggest alternative techniques)  
.....  
.....  
.....
- 7 Do you have any suggestions for improving the format of the Volumes?  
Yes/No (If yes, give details)  
.....  
.....  
.....
- 8 What do you consider to be the most useful information in the Volumes?  
.....
- 9 What do you consider to be the least useful information in the Volumes?  
.....
- 10 Do you still refer to HRU Report No 2/69? Yes/No (if yes, give details)  
.....
- 11 Please list the more important water studies undertaken by you or your  
organization in which the report series was referred to  
.....  
.....  
.....  
.....
- 12 General comments  
.....  
.....  
.....  
.....

The attached table lists the various sections of the report series. Please tick the relevant column under frequency of use and add any comments you wish to make on matters such as ease of application, accuracy of information, relevance of information or any other aspect you wish to bring to our attention if we recast the Survey.

**QUESTIONNAIRE ON "SURFACE WATER RESOURCES OF SOUTH AFRICA"**  
 (Reports Nos 8/81 to 13/81 of the Hydrological Research Unit, Wits)

Name(s) .....

Organization .....

Address .....

.....

1 How often do you refer to the report series? Often [ ] Seldom [ ]  
 Never [ ]

2 Rank the six Volumes and the Guide and Addendum in order of usage frequency  
 (1 = least used, 8 = most used)

Volume	Rank
I - Limpopo	
II - Vaal	
III - Orange	
IV - W.Cape	
V - E.Cape	
VI - Escarpment	
Guide	
Addendum	

3 Did you purchase any of the magnetic tapes containing data and programs?  
 Yes/No (If yes, give details)

.....  
 .....

4 Have you come across any serious errors/omissions in the reports? Yes/No  
 (If yes, give details)

.....  
 .....

5 Have you, or are you aware of, any information that could be incorporated  
 into a similar survey? Yes/No (If yes, give details)

.....  
 .....

**WATER RESEARCH COMMISSION**  
**SURFACE WATER RESOURCES OF SOUTH AFRICA**  
**PROPOSAL TO UPDATE THE REPORT SERIES**

The Water Research Commission is considering a proposal to update "Surface Water Resources of South Africa", which was compiled by the Hydrological Research Unit and published as a series of six reports in 1981.

The Commission has appointed Prof D C Midgley to develop the format for the proposed updating and he has gathered part of his former HRU team to assist him, namely Dr Bill Pitman and Brian Middleton.

Some corrections and additions were effected in an Addendum to the Survey published by the Water Research Commission in 1983. At the same time, a Guide to the use of the survey was issued. A major reason for wishing to update the Water Resources Survey is the need to include the period of severe drought that was experienced over much of the country during the 1980's. Equally important is the need to improve the accuracy of the information presented in the original report series and to incorporate technical advancements made since the 1981 Survey. Furthermore, the experience of individuals and organizations in using the information in the Survey needs to be collated so that improvements can be made to the format and content of an updated version.

This questionnaire on the merits (or otherwise) of the original Survey has accordingly been drawn up. Please spend a little time to fill in the questionnaire. By doing so, you can make a valuable contribution to improving our knowledge of South Africa's water resources.



**D C MIDGLEY**

Project Leader

Please return the completed (or partially completed) questionnaire to:

**Mr Brian Middleton**  
**c/o Steffen, Robertson and Kirsten Inc**  
**P O Box 8856**  
**JOHANNESBURG**  
**2000**

The UV plant is hydraulically sized to meet a potential flow of 73 000 m<sup>3</sup>/d and is fitted into a space of 47 m<sup>2</sup>. Sixteen medium pressure UV lamps, arc length 610 mm, are housed in sixteen stainless steel chambers and two chambers make up one treatment stream capable of treating 80 l/s. Total UV power requirement is 40 kW.

The contract price for the plant was £200 000 or approximately R14 000 per megalitre installed. As no chemicals are used, the only running costs are the electrical power consumption and the replacement of lamps (expected to last 3 000 to 4 000 hours). The power consumption amounts to 0,017 kWh/m<sup>3</sup> and at R0,06/kWh, it comes to 0,1c/m<sup>3</sup>.

The radiation capacity of the medium pressure UV lamps, is 50 times greater than that of the old low pressure arc lamps at 254 nm. However, the lamps are effective over the whole biosidic frequency spectrum of approximately 240 to 280 nm.

## THE PRINCIPLE

It has been known for nearly 100 years that the ultraviolet rays in strong sunlight will kill many forms of micro-organism. The vulnerability of all forms of bacteria and viruses and most moulds to ultraviolet rays below a wavelength of 300 nm appears to centre around the tendency of nucleic acids to absorb energy within the UV section of the electro-magnetic spectrum. The nucleic acids become the site of an initial photo-chemical reaction leading to the inactivation and eventual destruction of cells.

## ULTRAVIOLET PROCESS CONTROL

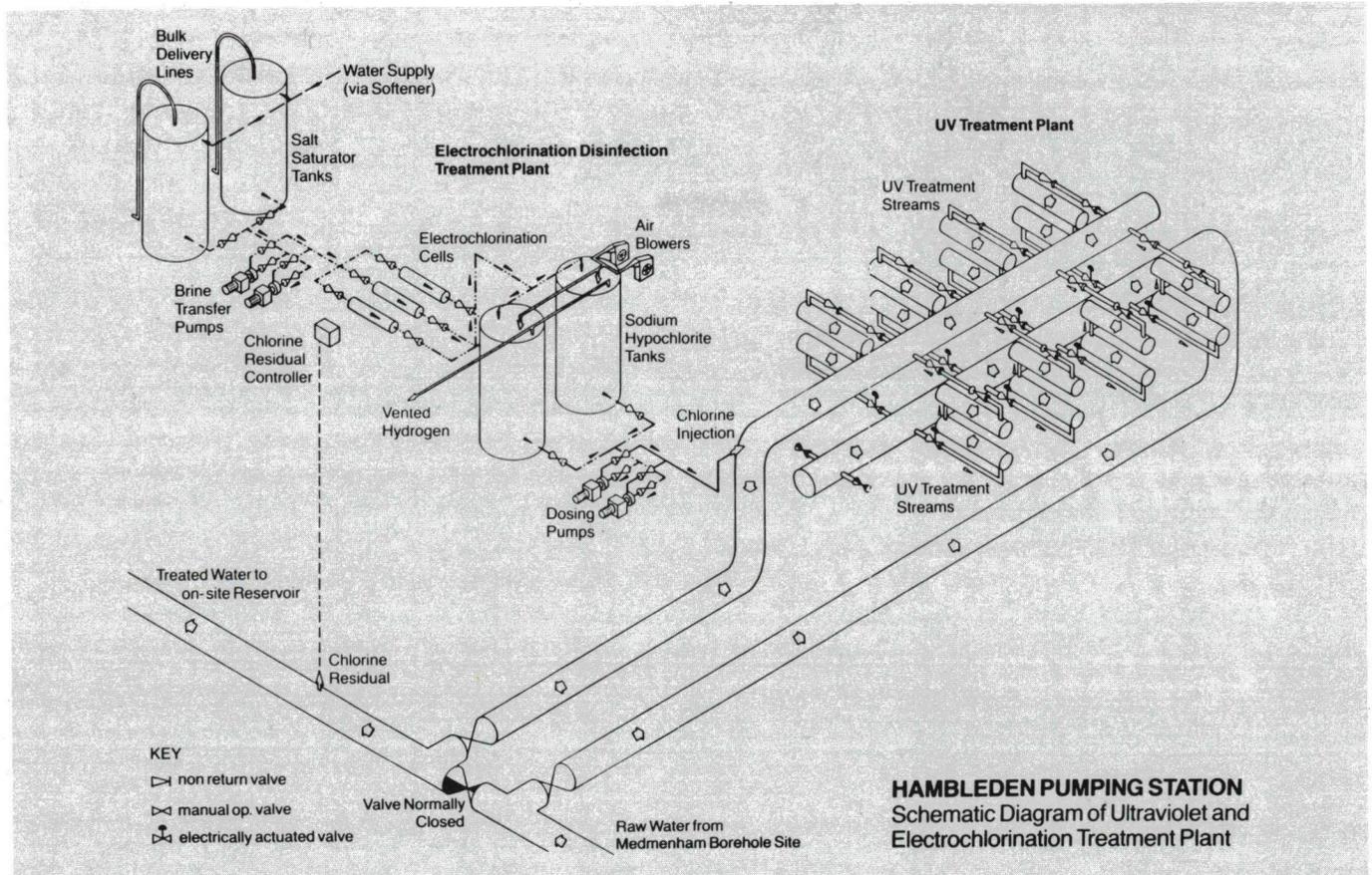
The rise and fall of the on-site reservoir controls via four level signals the number of submersible pumps required. Each level signal is fed into the UV process controller which initiates the appropriate number of treatment streams to: turn on the UV lamp, allow for lamp warm up, check lamp intensity and open the stream incoming valve before the submersible pumps start. On receipt of the tank high level signal, the processor checks that the pump has stopped and the treatment stream valve is closed before extinguishing the UV lamp. High and low pressure monitoring and control is provided for.

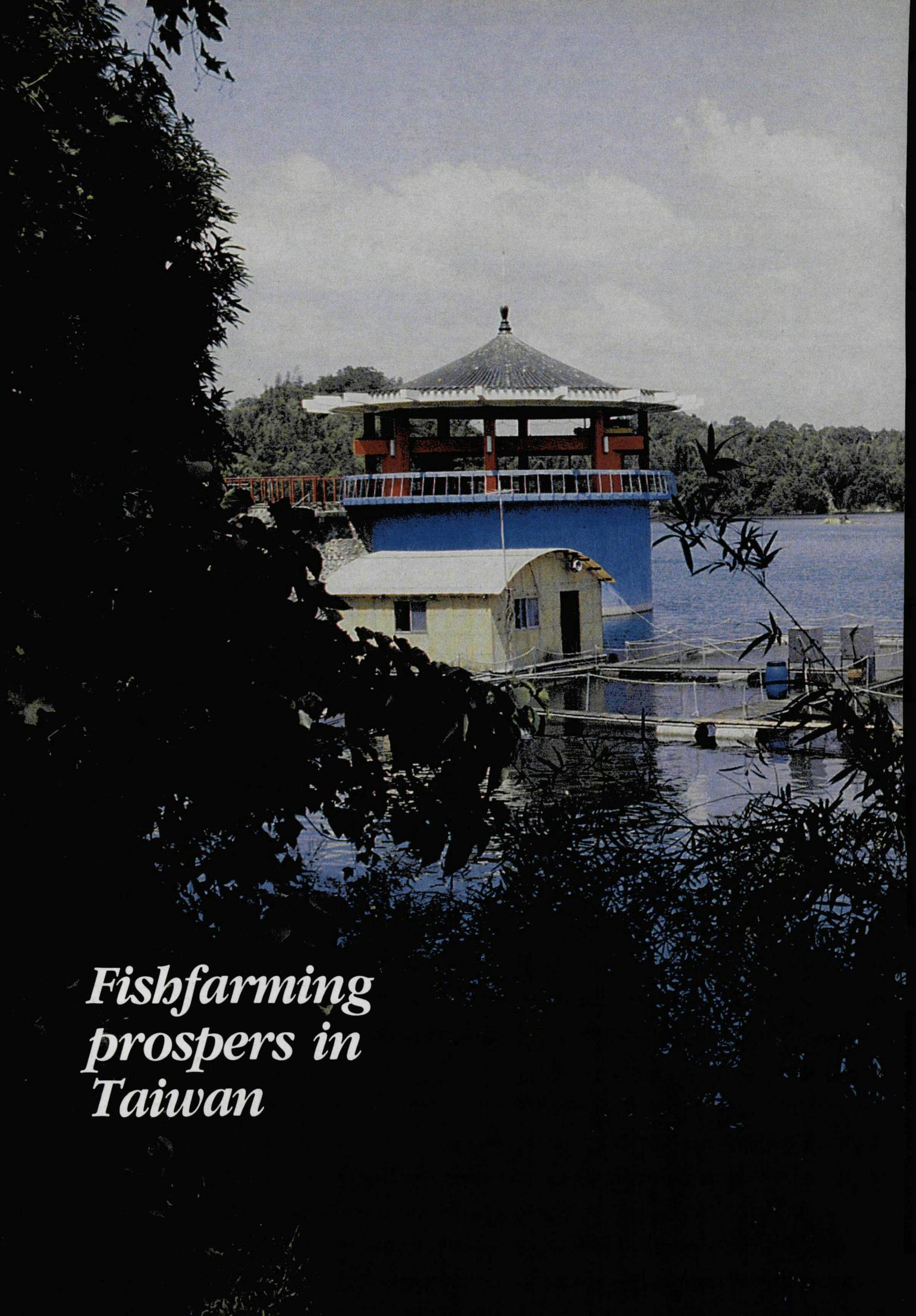
Optimisation of the process is provided for via a dose control function which uses the processor to monitor water flow, lamp intensity and increase or decrease the number of treatment streams according to dose requirements.

The plant is fully automated with no personnel on site. It is telemetrically monitored and visited periodically.

According to the regional engineer almost no problems were encountered with the start up of the plant, but because it has only been operating for a few months, he would only venture to comment on its reliability, etc after a longer period of operation.

With ever increasing demands by legislation with respect to the use of hazardous chemicals, such as chlorine and sulphur dioxide gas, the use of ultraviolet disinfection is considered to be a viable and acceptable alternative in Britain.





*Fishfarming  
prosperes in  
Taiwan*





WRC

Taiwanese scientists visited the Rand Afrikaans University's Zoology Department which specializes in aquaculture research. From left: Dr Houg-Yung Chen, Dr J T Ferreira, Dr D H R Hellwig, Prof N J Scheepers, Dr I-Chiu Liao, Prof H J Schoonbee, Dr Yew-Hu Chien, Dr J H van Vuren, Prof R van den Berg, Miss Lee, Prof K Prinsloo, Prof Allen H Chung, Prof H J Swanepoel and Prof J Saaman.



A typical hatchery in Taiwan where the larvae are kept in silk nets.

Prominent researchers in the field of aquaculture recently visited South Africa from Taiwan. The purpose of their visit was to establish an active exchange of new aquaculture technology which would benefit both countries.

Dr I-Chiu Liao, Director of the Tungkang Marine Laboratory and Director-General of the Taiwan Fisheries Research Institute, gave a brief outline of the status and constraints of the aquaculture industry in Taiwan, during a visit to the Rand Afrikaans University (RAU).

Taiwan has a long history of aquaculture practices, and already had an annual aquaculture production of about 20 000 metric tons during the 1930s because of good water and soil quality, suitable climatic conditions, rather high availability of natural fish and prawn fry, and diligent aquafarmers. "Furthermore, owing to the good cooperation among government, researchers and aquafarmers, aquaculture techniques and industries in recent decades have made tremendous progress," said Dr Liao.

Due to the inherent geographical limitations in Taiwan, a large scale expansion of the aquaculture area is unlikely in the future. However, in recent years because of the low profit of growing rice, the number of ricefields being converted into aquaculture ponds has been increasing continually. Furthermore, thousands of hectares of sandy, arid land, tidal flats and lowlands along the westcoast which originally had been of little economic value, have also been converted into prawn culture ponds. The total area under aquaculture today has increased to 1.4 times what it was ten years ago, and reached a total of 65 360 ha in 1986.

Aquaculture in Taiwan can be classified into two main categories according to the salinity of pond water and environmental characteristics of ponds: freshwater aquaculture and salt water aquaculture. In addition, there are also other types of aquaculture such as those in paddys and in floating net-cages. Aquaculture in floating net-cages in large bays has been proved practical and successful, and has been gaining popularity, whereas paddy culture has been declining in recent years as a result of indiscriminate use of pesticides, and its practice is unlikely in the future.

A total of 52 species of aquatic organisms are currently under aquaculture in Taiwan; most of which are finfish. Dr Liao believes Taiwan to be one of the leading countries in the world in aquaculture technology, judging from the fact that the majority of the aquaculturists in Taiwan can skillfully and successfully perform the techniques of artificial propagation for many important species of aquatic organisms under aquaculture.

Some of the important species used in Taiwanese aquaculture are:

## EELS

Eel farming in Taiwan started around 1950. Since 1966, as a result of increasing demand for eel on the Japanese market, the total acreage of eel culture has expanded rapidly and continually from an acreage of 60 ha in 1966 to more than 2 900 ha in 1985. Eel production reached its peak in 1985

with a total production of 36 900 metric tons and the value of eel exported exceeded US \$300 million.

The species of eel cultured in Taiwan is *Anguilla japonica*. It takes an average of one year for a glass eel (6 000 individuals/kg) to attain a marketable size of 200-250 g. If they are reared from glass eels to marketable size in a one hectare pond, a production of 10-16 metric tons can be obtained. However, if the eels are reared from juveniles to marketable size in the pond, the production may reach more than 30 metric tons per hectare pond.

The attempts to artificially propagate eels have not been successful to date, and the eel farmers must depend completely on wild elvers for stocking. Estimated from a total pond acreage of 2 900 ha, the annual demand for elvers in Taiwan is approximately 25 million pieces. However, at most about 50 million pieces of elvers in total were caught from Taiwanese waters in recent years. It has become necessary to import large quantities of elvers yearly from Japan and Korea to meet the demand, and the development of the eel farming industry in Taiwan has been greatly hampered.

Due partly to the disease and parasites carried by imported elvers and partly to the high stocking density applied in eel culture, serious disease and parasite infestations have occurred. Thus, the study on the artificial propagation and on effectively controlling diseases and parasite infestation needs much attention.

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## TILAPIA

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Among the species of fish cultured in Taiwan, tilapia has the highest production rate reaching an annual production of 100 000 metric tons in 1986. Tilapias are exotic species. In 1946, thirteen *S. mossambicus* were introduced from Singapore, and established a successful foundation for tilapia culture in Taiwan. About 10 species of tilapia, including one newly introduced species, *Tilapia randalli* from South Africa, are presently cultured in Taiwan.

The culture method is exclusively intensive monoculture. Fish are fed with pellet feeds, and paddle wheels are used to supply sufficient dissolved oxygen. An abundance of water is needed for this practice. By applying this method, fingerlings with a body weight of 0.01 g can be grown to a marketable size of 600 g within 6 months. However, thinning should be used frequently to segregate fish of different sizes, to culture separately in order to get an even and fast growth.

During the last stage of culture, 40 000 fish with a mean mass of 20 g are stocked into a one-hectare pond, and they grow to an average size of 600 g after four months. With a survival rate of 90 percent and two crops per year, an annual production of 40 metric tons per hectare can be obtained.

At present, because of the lowered market price as a result of overproduction, the interest of aquafarmers in tilapia culture has been slightly depressed. However, since the requirement of the CP value in tilapia feed is below 23 percent, and the cost of feed is relatively low, the future of tilapia culture is still promising. The delicious taste of tilapia cultured in sea water in particular is as good as sea bream, and it is possible to export the red tilapia as a substitute to the Japanese market where sea bream is in high demand.

Furthermore, hybrids of *S. niloticus* and *S. aureus* can reach a size of 3-5 kg after two years of cultivation. This big fish can be used to supply high class frozen fish fillets.

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## PRAWN

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Grass prawn production exceeded 60 000 metric tons in 1986. Before 1968, prawn culture was based entirely on an extensive culture style. Small numbers of prawn fry were polycultured in milkfish ponds. Without feed, they depended solely on the benthic algae and other benthic organisms growing in the pond as food. Their survival rate was very low, with an annual production of slightly over 100 kg/ha or less. They were considered merely a by-product of milkfish culture.

After the success of the artificial propagation of the grass prawn in 1968, the prawn culture industry in Taiwan showed a significant change. Since then, the number of private prawn hatcheries have increased rapidly, and by 1986 there were about 2 000 private prawn hatcheries engaging in the mass production of prawn fry. The establishment of artificial propagation and the successful development of pellet feeds are the two main factors contributing to the success of the prawn culture industry in Taiwan.

The grass prawn is one of the most important species of prawns under culture in Taiwan as it can grow rapidly from a size of 1 g to 30-40 g within three months. With the improvement of culture techniques, the possibility of achieving 3 to 4 crops per year through proper manipulation, and further increase in stocking density, it is not impossible that an annual production of 40 or more metric tons per hectare may be reached in future.

To develop the prawn culture industry, the techniques of broodstock raising, and proper measures of disease prevention and treatment need to be established.

Owing to the rapid expansion of the culture area of grass prawn, serious land depression caused by overdrawing underground water for culturing has become prominent. Proper use of underground water for culturing needs special attention. By recirculating pondwater or using seawater for culturing, overdrawing of underground water may be prevented.

Although aquaculture developments in Taiwan have been hampered by the limitation of available land, an annual aquaculture production of more than 266 000 metric tons has been achieved in 1986, accounting for 24 per cent of the total fishery production in terms of quantity and 42 per cent in terms of monetary value because of the higher price of aquaculture products compared to fishery products harvested from the sea. So far, there are only a few countries in the world with their aquaculture production accounting for more than 20 per cent of the total fisheries production.

Recently, growing attention is being paid to aquaculture as a means to further increase the production of aquatic food, particularly animal protein. Dr Liao foresees a promising future for further aquaculture development in Taiwan once some of the problems such as prevention of water pollution, prevention and control of disease, improvement of management and marketing etc, have been solved.

For the past four years the Water Research Commission has contracted a firm of consulting engineers to investigate the nature of water use by the South African industry.

This project, known familiarly as NATSURV (a national industrial water and waste-water survey), is aimed, primarily at the establishment of a national average specific water intake (SWI) for all significant water consuming industries and, where applicable, to compute an average specific pollution load for each industry generating effluent.

Survey teams, each headed by a chemical engineer, visit the various factories to collect data, and analyse effluent samples for an extensive range of parameters. The field and laboratory data are collated, checked and coded before being entered onto a computer database.

The data collected by the surveyors is extensive and includes:

- a mass balance for each step of the manufacturing process, showing the type and quantity of raw material used, the water consumption and the quantity of effluent generated,
- the type, quality and quantity of all other wastes, and
- the monthly production and water consumption figures.

So far test surveys have revealed a wide variation in the specific water intake per unit product within particular industries. For instance, in the tanning industry it was found that some tanneries consumed four times as much water as competitors performing the same operation. SWI's for poultry abattoirs were found to differ by a factor of 6, whilst the least water-efficient soft drink manufacturer showed a SWI ten times that of more water conscious competitors.

In this article Mr Paul Skivington, the Natsurv project engineer at the firm Steffen, Robertson and Kirsten, gives an update on the project as well as a summary of what has been achieved so far.

# NATSURV SURVEY MOVES AHEAD

**I**n January 1984, the original motivation for phase I of the NATSURV project was approved. The initial contract duration was for one year and it was during this period that the project was established and its procedures initiated and tested.

At the end of 1984 the contract was extended for a further two years. During phase II, NATSURV was fully operational. However, changes were made to the mode of operation and the project was streamlined. The most significant change was the formalisation of the project into an industry and an area survey rather than a broad based geographical approach. Priorities were established for both industry and area surveying in order that the most important information be gathered first. As the priority goals are achieved, the results are presented so that they may provide feed-back on the success and usefulness of NATSURV.

Phase III of NATSURV began in 1987 with a further three year extension to the contract. Phase III finishes on 31 December 1989.

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## INDUSTRY SURVEYING

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The present approach to industry surveying is to tackle it industry-by-industry on a priority basis with each of the engineers responsible for a few industries. The experience gained by the engineer in the

surveying of a certain industry will be incorporated along with the survey results into an informative executive Guide to Water and Waste-Water Management in that particular industry.

The priority industries are as shown below:

TABLE 1 NATSURV Priority industries

Priority industry	Status of industry guide
Brewing (malt)	Published
Metal Finishing	Published
Soft Drinks & Carbonated Waters	About to be published
Dairy	Editorial Stage
Edible Oils	Draft Stage
Red Meat	Draft Stage
Brewing (sorghum)	Draft Stage
Laundries	Draft still to be produced
White Meat	Draft still to be produced
Sugar	Draft still to be produced
Wine Making	Draft still to be produced
Iron & Steel Basic Industries	Draft still to be produced

In addition the leather and tanning and pulp and paper industries are being considered for addition to the list of priority industries.

## AREA SURVEYING

The current approach to the area survey is to cover a complete catchment area in order to estimate the total industrial water demand and the pollution load for the area. Further breakdown of these figures into water usage categories and into industrial categories will yield valuable information for planning as well as for catchment area management purposes. As with the industry survey, the quaternary drainage regions in the catchment area are priority ranked and then covered in this order so that interim results may be presented.

A decision was taken at technical sub-committee no 10 to limit the NATSURV area survey to the Vaal Barrage Catchment area. Priorities have also been established as shown in Table 2.

TABLE 2 Priorities for Area Survey

Quaternary drainage region	Municipality
C221	Johannesburg
C221	Germiston
C221	Roodepoort
C221	Alberton
C221	Boksburg
C221/C212	Brakpan
C212	Benoni
C212	Springs
C212	Nigel
C212	Heidelberg
C223	Vanderbijl Park
C223	Vereeniging
C223	Sasolburg

Progress has been rapid in the area survey under the phase III mode of operation and quaternary drainage region C221 has been completed. To complete quaternary drainage region C212 only Nigel and Heidelberg municipalities remain to be surveyed. This should be accomplished by the middle of the year. A feature of the rapid progress made with the area survey has been the good co-operation received both from industry and the various local authorities for which NATSURV is very grateful.

The guides produced by NATSURV resulting from both the industry and area survey are available through the Water Research Commission and should be of particular interest to the Department of Water Affairs, municipalities and of course industry itself.

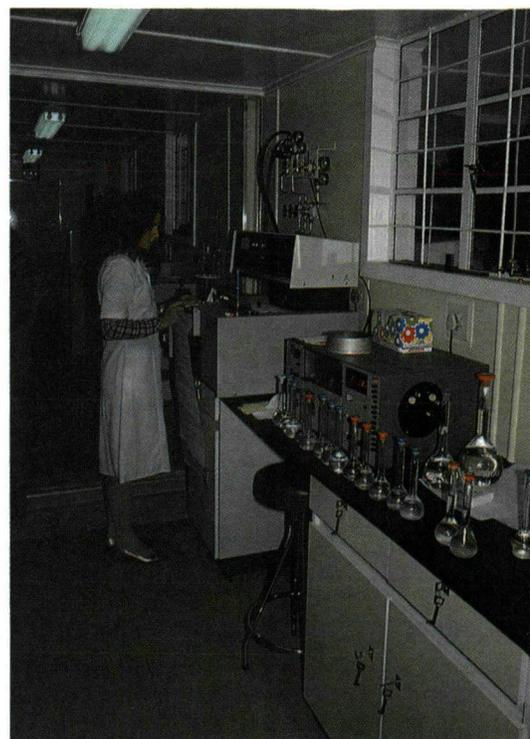
## NATSURV OPERATIONAL STRATEGY

The way in which NATSURV currently operates is best summarised by the two tables shown below:

TABLE 3 NATSURV survey types

Survey type	Time taken (day)	Information gathered
A	5	*SWI, **SPL and mass balance
B	4	SWI, SPL and mass balance
C	1	SWI, and SPL
D	-	no survey

\* Specific water intake  
 \*\* Specific pollution load



Routine analysis being carried out at the NATSURV laboratory.

TABLE 4 NATSURV mode of operation

Industrial water intake (m <sup>3</sup> /d)	Division	Survey type	
		Priority industries	Priority areas
>150	1	A	C
150-50	2	B	C
<50	3	C	C
<50	3	D	D

This shows clearly how creating priorities for industries has reduced the number of 5 day A type surveys to an optimum level and at the same time has enabled the area survey to collect the most relevant information in the quickest time possible.

An analysis of area survey results such as those presented in Table 5 quickly reveals those industrial categories which make the greatest contributions to water demand, effluent discharge or pollution load. From the table it is interesting to note that the chemicals and chemical products industry is clearly the major contributor to water demand and effluent discharge in this area. Apart from phosphate however, the effluent discharged by the chemicals and chemical products industry is not particularly significant. By the way of contrast the grain industry has only a moderate water demand and effluent discharge in the area but is responsible for 5 per cent of

TABLE 5 Some preliminary results from the area survey

Industrial Category	Percentage breakdown according to industry type						
	Water usage (%)	Effluent discharge (%)	COD load (%)	TDS load (%)	Ca load (%)	SS load (%)	PO <sub>4</sub> (P) load (%)
Plating, dipping & painting	4	6	1	12	1	55	30
Baking	1	1	n	n	n	n	n
Rubber & plastic products	1	1,5	n	n	n	n	n
Concrete, asbestos, cement & plaster products	0,5	n	n	n	n	n	n
Chemical & chemical products	54	64	4	3	6	5	26
Meat	3	5	11	12	n	n	n
Vehicle depots & marshalling yards	3	4	2	2	n	n	1
Dairy	2	4	18	25	24	8	3
Iron & steel basic industries	2	0,5	1	n	n	n	n
Soft drinks and carbonated waters	9	3	2	1	5	1	n
Paper products	14	9	8	10	47	3	3
Grain	7	2	53	35	17	28	64

\*n = negligible

Total industrial water consumption = 2 750 M/a

Total industrial effluent discharge = 1 510 M/a

Industrial pollution load : COD = 3 370 t/a

TDS = 2 343 t/a

Ca = 33 t/a

Na = 274 t/a

PO<sub>4</sub>-P = 3,2 t/a

the COD load, 35 per cent of the TDS load, 17 per cent of the calcium load, 28 per cent of the sodium load and 64 per cent of the phosphate load. Clearly this industry type is one worthy of attention if the quality of effluent discharged in this area is to be improved. Similarly the dairy industry ac-



Factory effluent flowrate measurement.

SRK



Factory and water meter calibration.

SRK

counts for only 4 per cent of the effluent discharged in the area but 18 per cent of the COD load and 25 per cent of the TDS load. It is clear from this sort of information that particularly problematic types of pollutants from an area, TDS for example, can be easily "homed-in" on and the industries primarily responsible for their discharge can be identified. The same is true for water demand and effluent discharge.

In instances where a problem industry in an area is identified, the results of the industry survey, given in the Guide to Water and Wastewater Management, can be used to assist in solving the problems for that industry, illustrating how the NAT-SURV industry and area surveys are intimately linked in helping to solve the water and effluent related problems in South Africa.

# GUIDELINES FOR ASSESSING



## FLOOD DAMAGE

**A** report that can help municipalities in flood stricken areas as well as insurance companies and farmers to assess flood damage as a result of the recent floods, is available from the Water Research Commission.

Following the wide-spread major floods in the Republic during 1974, the Department of Water Affairs requested the Water Research Commission to initiate research on the impact of these floods and the assessment of flood damage. This research was later extended to include the assessment of damage due to a major flood in the Vaal River in 1975.

The initial task of the research team was to construct a theoretical basis upon which a methodology for flood damage assessment could be developed. Only after this was completed, and the methodology spelled out, could the actual assessment of flood damage be carried out.

The research was conducted by scientists at the Universities of the Orange Free State and Stellenbosch, and resulted in a series of reports. One of these was specifically prepared

as a users' manual, entitled Guidelines for assessing flood damage in South Africa.

The purpose of this publication is to give a resumé of the completed research with the accent on guidelines for flood damage assessment in a retrospective context. However, the researchers warn readers not to regard the material presented as a final recipe, because practical problems will always be encountered and these should be solved by the logic underlying specific situations.

The report covers topics like: An approach for flood damage assessment including the role of welfare economics, cost benefit analysis, evaluation of different FDA procedures; procedures for measuring flood damage to livestock, buildings and contents, equipment etc; the practical application of procedures for assessing flood damage.

Copies of the report are available free of charge from: The WRC, P O Box 824, Pretoria 0001. Tel.: (012) 28-5461.

# Erdwurms verrig wondere met afval



Huishoudelike afval by die Bellville komposwerke.

**E**rdwurms kan gebruik word om organiese afval tot 'n nuttige en stabiele produk te verwerk wat bekend staan as vermikompos. Navorsing by die Universiteit van Potchefstroom (PU vir CHO) en by die Nasionale Instituut vir Waternavorsing (NIWN) in Bellville, het getoon dat erdwurms 'n belangrike rol kan speel by die behandeling van organiese afval.

Die erdwurms word in afvalprodukte soos rioolslyk, beesmis en ook huishoudelike afval geplaas in spesiaal ontwerpte reaktors waar die wurms die fisiese struktuur van die afval verander. Die groter dele word in die wurm se ingewande tot 'n massa kolloïdes verwerk en dit word dan as gietsels uitgeskei. Die oppervlakarea van die afval word vergroot met die byvoeging van die erdwurms en versnel die drogingsproses. Die verhoogde mikrobiologiese aktiwiteit in die afval beheer verder oorlasprobleme soos vlieë en onaangename reuke en versnel die stabilisasie van die afval.

Alhoewel die proses van vermikompostering in groot dele van die wêreld 'n erkende afvalverwerkingsmetode is, word dit in Suid-Afrika nog nie algemeen toegepas nie.

Die Departement Dierkunde aan die Universiteit van Potchefstroom is reeds 20 jaar lank besig met basiese navorsing oor erdwurms. Meer as 300 verskillende soor-



Nadat die blikke en bottels uit die huishoudelike afval verwyder is, word dit deur 'n hamermeul fyngestamp. In hierdie vorm word die afval in putte geplaas saam met die erdwurms.



Die afval voor en na die vermikomposteringsproses. Die aansienlike massareduksie wat plaasvind tydens die komposteringsproses, is duidelik sigbaar.



Die oesmasjien wat ontwerp is om die erdwurms en die onverteerde afval van die vermikompos te skei.

te erdwurms is in dié tydperk geïdentifiseer waarvan 'n klein hoeveelheid op rou afvalmateriaal soos beesmis, die pensinhoud van diere by 'n abattoir, geaktiveerde rioolslyk en organiese huishoudelike- en tuinafval kan leef.

Onder leiding van prof A J Reinecke, hoof van die Departement Dierkunde, word navorsing gedoen oor die basiese en toegepaste biologie van die verskillende erdwurmspesies. Dit sluit in die lewensloop, voortplanting, temperatuurvereistes en vogvereistes waaraan voldoen moet word sodat die wurms optimaal kan leef en kan reproduseer.

Die studie toon sover dat die erdwurm *Eisenia fetida* die geskikste afvalverwerker is omdat hy vinnig voortplant en ook die afval die vinnigste verwerk. Ander spesies word tans nog ondersoek waaronder een uit Wes-Afrika en een uit Asië.

Optimale groeitoestande vir *E. fetida* is die volgende:

#### TEMPERATUUR

Die beste temperatuur vir *E. fetida* is 25 °C. Onder 4 °C word kokonproduksie en jong erdwurmontwikkeling gestaak.

By baie lae temperature kan die erdwurms of hiberneer of na 'n warmer omgewing migreer. Warm temperature van meer as 27 °C laat alle aktiwiteite van die erdwurms afneem en later sterf hulle.

#### pH

Geskikte afval vir *E. fetida* moet 'n pH van tussen 7,0 en 8,0 hê. Langdurige blootstelling aan pH's laer as 4,5 of hoër as 9,0 is fataal vir die erdwurms.

#### VOG

Die afval moet 'n voginhoud van tussen 60 en 90 persent hê. Te hoë voggehaltes kan suurstofoordrag vanaf die atmosfeer na die erdwurm belemmer. Lae voggehalte kan daarenteen dehidrering van die wurms veroorsaak.

#### BELUGTING

Omdat vermikompostering 'n aerobiese proses is, moet die oppervlaktearea van die afval so groot as moontlik wees en moet waterversadiging van die afval verhoed word.

Met inagneming van hierdie navorsing wat by die Universiteit van Potchefstroom gedoen is, het die NIWN in Bellville die vermikomposteerbaarheid van munisipale

soliede afval (huishoudelike afval en geaktiveerde rioolslyk) geëvalueer.

Vars rioolslyk (90 persent vog) vanaf Borcherd's Quarry rioolwerke in Bellville en vars ongekompoteerde versnipperde huishoudelike afval (48 persent vog) vanaf Bellville komposwerke is vir die eksperiment gebruik.

Die resultate was baie bevredigend en het getoon dat die proses 'n aansienlike massareduksie van tot 54 persent teweegbring. Tydens die proses was daar geen oorlasprobleme nie en die afval is vinniger gekompoteer as met die konvensionele metode waar die afval in hope gelaat word om te kompoteer.

## VOLSKAAL

Mnr André Kitshoff, navorser by die NIWN, sê dat daar beoog word om vanjaar hierdie loodsskaalaanleg uit te brei tot 'n prototipe volskaalse aanleg. "Huishoudelike afval sal gebruik word en rioolslyk kan moontlik later bygevoeg word".

By die loodsaanleg by Bellville is die vermikompos uitgesif deur 'n masjien wat vir dié doel ontwerp is. 'n Arbeider skep die vermikompos in die sif wat met behulp van 'n motortjie in die rondte draai. Die kompos val deur die sif en die erdwurms en onverwerkte afval soos plastiek beweeg na die punt van die sif waar dit in 'n bak versamel.

Mnr Kitshoff voorsien dat so 'n stelsel by 'n volskaalse aanleg baie werksgleentehede kan verskaf maar waar arbeid skaars is, sal die proses gemeganiseer moet word. Die hantering van die vermikompos hou geen gevaar in vir die arbeiders nie.

Prof Reinecke meen dat vermikompostering ideaal geskik is vir boere wat byvoorbeeld naby 'n woongebied met beste boer en oorlasprobleme soos vlieë en onaangename reuke ondervind. Deur erdwurms in die beesmis aan te hou, word besoedeling van die omgewing bekamp en 'n nuttige kompos van die afval geproduseer.

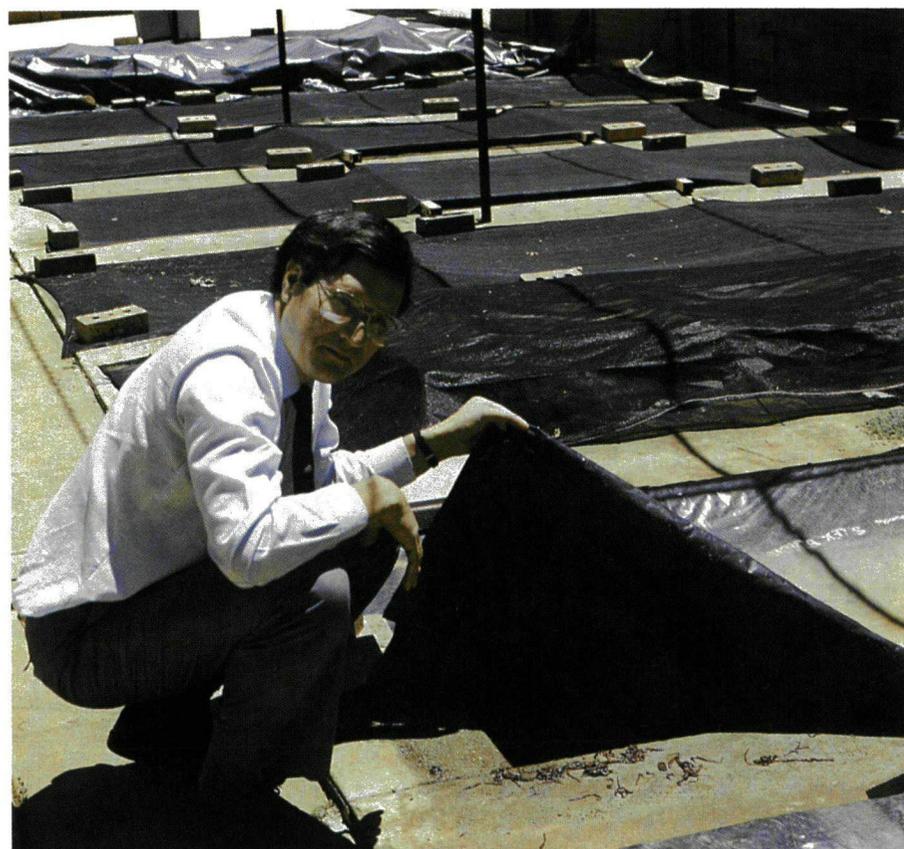
In 'n gewone huishouding gaan baie organiese afval verlore wat deur middel van vermikompostering in 'n nuttige produk omskep kon word. In Amerika het 'n vindingryke dame reeds 'n houer laat ontwerp wat saam met die erdwurms en 'n aanwysingsboekie verkoop word vir die vermikompostering van organiese huisvuilis.

Na die vermikomposteringsproses word twee produkte verkry, naamlik die vermikompos en 'n groot aantal erdwurms.

Die vermikompos is deur die NIWN gea-



Mnr André Kitshoff van die NIWN in Bellville by die putte waarin die huishoudelike afval deur die erdwurms gekompoteer word.



Prof A J Reinecke van die Potchefstroomse Universiteit by die teelputte waarin erdwurms beesmis tot kompos verwerk.

# POST CARD

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**Dr Frik Schutte**  
**c/o Water Research Commission**  
**P O Box 824**  
**Pretoria**  
**0001**

# Workshop on Desalination and Membrane Processes

A workshop will be held from 24 to 26 August 1988 to discuss new developments, problem areas and operating experience.

The main objectives will be information transfer and the identification of research needs.

Separate sessions will be devoted to microfiltration, ultrafiltration, reverse osmosis, electro dialysis and brine disposal.

The workshop will be held at a conference venue in the Eastern Transvaal. Arrangements will be finalised depending on response. The cost will be between R50 and R70 per day per person, which includes accommodation and all meals.

Attendance will be limited by available accommodation.

Early reply is therefore recommended.

Please complete this form and refer it to Dr C F Schutte, Water Research Commission, P O Box 824, Pretoria 0001.

**NAME:** .....

**ADDRESS:** .....

.....

**ORGANISATION:** .....

**I AM INTERESTED IN MAKING A CONTRIBUTION ON:** .....

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CSIR  
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0001 PRETORIA**

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## KWAZULU SEMINAR

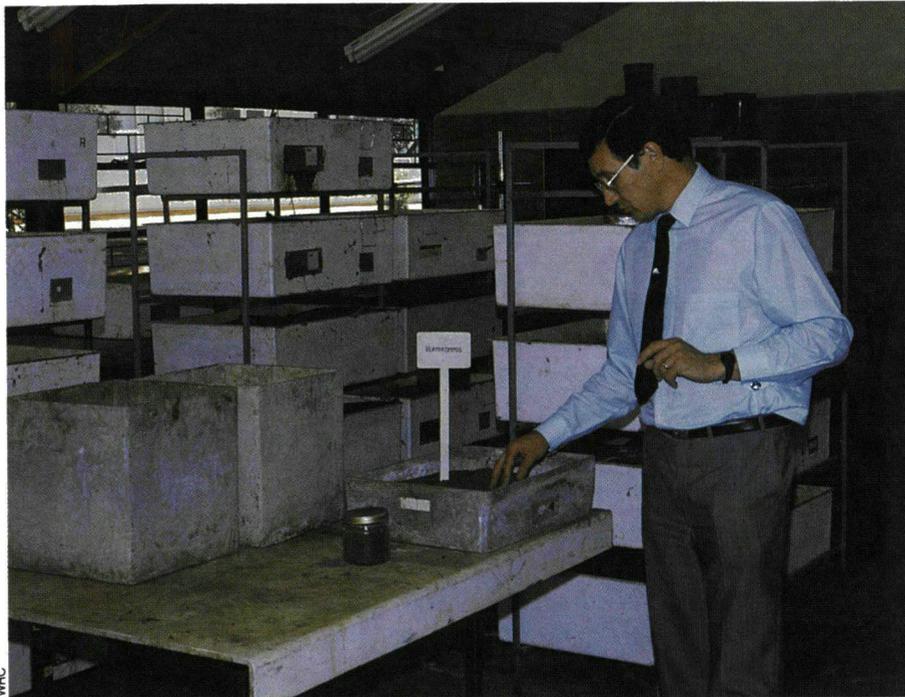
Please send me full details of the Seminar on Water Supply and Sanitation, KwaZulu, from 28 to 30 June 1988 at the Elangeni Hotel, Durban.

Name: .....

Address: .....

..... Postal Code: .....

Telephone:..... Telex: .....



WRC

Prof A J Reinecke by 'n bak vermikompos. In die agtergrond is 'n verskeidenheid bakke waarin erdwurms geteel word om onder meer die voedingsbehoefes van die wurms en die geskikte besettingsdigthede te ondersoek.



WRC

By die abattoir op Pyramid naby Pretoria, word erdwurms ingespan om die pensinhoud van die geslagte diere tot kompos te verwerk. Die moontlikheid word ondersoek om die wurms te oes en as proteïenaanvulling in karkasmeel te gebruik. Mnr Nico Scheepers, assistent-bedryfsbestuurder op Pyramid, verduidelik hoe die swart plastiek wat die putte bedek, die afval vogtig hou.

naliseer en is hoog in fosfate, kalium en stikstof. Die kompos is dus baie geskik as grondverbeteraar en is ook as ontkiemingsmedium vir byvoorbeeld komkommers, doeltreffend gevind.

## PROTEÏENBRON

Die surplus erdwurms kan geoes word en net so lewend of in 'n verwerkte vorm gebruik word as 'n proteïenbron in vee- en pluimveevoere.

By die Dierkunde Departement, aan die Universiteit van Potchefstroom is teelputte gebou waarin die wurms gevoer is. Die wurms is later geoes, gedroog en fyngemaal tot 'n meel wat as proteïenbron in hoenderrantsoene getoets is. Die chemiese samestelling van die wurmmeele toon dat 60 persent van die droë massa uit proteïene bestaan. Die wurmmeele bevat ook alle aminosure wat nodig is in die dieet van slaghoenders.

Biologiese evaluering is met behulp van braaikuikens uitgevoer oor 'n periode van 42 dae. 'n Hoë produksiedoeltreffendheid is met die wurmmeele verkry in vergelyking met die vismeelrantsoen. Daarbenewens was die voeromset bykans gelykwaardig vir wurm- en vismeel. Karkasontledings en studies op die eetkwaliteit van die hoendervleis lyk baie belowend.

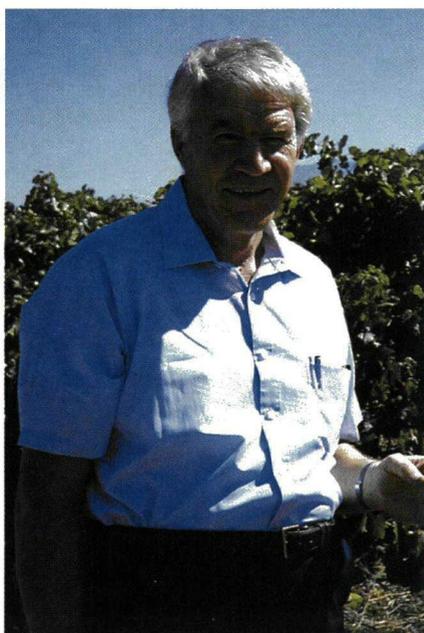
Naas die goeie kwaliteit van die wurmpoteïene is die sleutelvraag egter of erdwurmpoteïene ekonomies geproduseer kan word. Een braaikuiken benodig ongeveer 0,5 kg wurmmeele oor 'n groeiperiode van 42 dae. Met 'n gemiddelde biomassa van 0,4 g is ongeveer 5 000 wurms nodig om een braaikuiken te produseer. Dit stel hoë eise aan die erdwurmproduksie-aanleg wat die konsep met huidige produksiemetodes waarskynlik onrealisties maak. "Nuwe, verfynde produksiestelsels sal ontwikkel moet word om erdwurmproduksie vir proteïenvoorsiening haalbaar te maak", sê die Potchefstroomse navorsers.

Verskeie ander aspekte moet ook nog ondersoek word. Navorsers soos Hartenstein, Neuhauser en Collier, Ireland en Van Hook het bevind dat problematiese swaarmetale, naamlik kadmium, nikkell en lood, in erdwurmweefsel geberg kan word. Verder is dit ook bekend dat erdwurms soms optree as tussengasheer vir verskeie parasitiese en patogeen-organismes van vee. Voordat erdwurmmeele dus kommersieel in veerantsoene ingesluit kan word, sal die moontlike oordraging van swaarmetale en parasitiese en patogeen ook eers deeglik bestudeer moet word.



## PROF HANKS VISITS SA

One of America's leading researchers in the field of soil-plant-water relationships, Professor R J (John) Hanks from the Department of Soil Science and Biometeorology of the Utah State University in Logan, Utah, recently visited South Africa as a consultant for the Water Research Commission. Prof Hanks was asked to critically evaluate the progress of various WRC projects and to provide advice on modelling approaches in irrigation research.



## PROMOTED

Mr Brian C Trim was promoted to Assistant City Engineer (Sewerage: waste-water reclamation) at the City Engineers' Department in Johannesburg.

## MEIRING VERKIES

Mnr P G J Meiring van die raadgewende ingenieursfirma Meiring en Vennote is verkies as die eerste president van die nuutgestigte Waterinstituut van Suidelike Afrika (WISA). Die WISA is gestig na die ontbinding van die Suider-Afrikaanse tak van die Instituut vir die Bestryding van Waterbesoedeling (IBWB), waarvan mnr Dave Osborn, van die Johannesburgse Stadsraad, die laaste voorsitter was.

## SCIENTIST SHARES EXPERTISE

Dr Bärbel Niederwöhreiner from the Institut für Tiermedizin at the University of Hohenheim in Stuttgart, West-Germany presented a paper at the monthly meeting of the Water Institute of Southern Africa in Midrand. Dr Niederwöhreiner, who is on holiday in South Africa, is presently working in the field of disinfection of sewage sludge by microwave treatment. For her PhD she developed "a solid phase enzyme immuno test" for the identification of bacteria, using *Pseudomonas aeruginosa* and *Bacillus anthracis*.

## NEW UNDERGROUND SEWER PIPE LOCATOR

Peter Rothenberg has introduced a new system for surveying drains and locating problems underground in a very short time with no costly excavation and with complete accuracy.

The Tracka system consists of a battery-operated transmitter which is attached to the end of normal sewer rods and pushed down the pipe, and a small portable receiver which the operator uses to locate the exact position of the underground transmitter. Operation of the system is simplicity itself: a series of sweeps with the receiver rapidly establishes the position of the transmitter which may lie up to 6 m below the ground, and the amplifier is then turned down to pin-point the exact position of the transmitter to a spot 20 cm in diameter or less.

The transmitter is designed for the rough, dirty and wet conditions of a sewer, and emits signals which penetrate through a wide range of soils, clays, sands, concrete, and even reinforced concrete. The receiver is designed to respond only to the transmitter, and can be used not only to tell when the operator is directly above the transmitter, but also to indicate the depth at which it is lying. Both the transmitter and the receiver are powered by standard batteries with operating lives of several hundred hours without any external connecting wires.

The procedure for locating the transmitter takes less than ten minutes, compared with the hours and days required to dig trenches, and without the damage caused

by digging or the expense of restoring everything to its former condition. The Tracka system is being used very successfully by several South African municipalities and local industries to locate pipe blockages and breakages simply and inexpensively. Demonstration of the equipment can be arranged with the local agent, Peter Rothenberg.

For more information contact Peter Rothenberg (Pty) Ltd, P O Box 391552, Bramley, 2018. Telephone: (011) 786-2952, Telex: 4-30957 SA, Contact: Norman Woolf.

## SLUDGE MANAGEMENT WORKING GROUP FORMED

A working group on sludge management was recently formed under the auspices of the Western Cape Branch of the Water Institute of Southern Africa.

The group will concentrate on all aspects related to the treatment, disposal and utilization of sludge from water and waste-water plants. The group's main objective will be the promotion of contact between researchers, designers and practitioners with a view to creating a greater awareness of research requirements, research findings and the current operational problems and successes.

The group committee membership at present comprises representatives from research organisations, local authorities, consultants, the Department of Water Affairs and the Water Research Commission.

The committee plans to arrange open meetings with unrestricted attendance to discuss different aspects of sludge management.

Aspects to be included will centre around composting and disinfection of waste activated sludge, the use of dried anaerobically digested sludge as bulking media for composting, autothermal aerobic digestion, oxidative heat treatment of sludge, centrifuging, pasteurisation, vermicomposting, the use of sludge in the manufacture of bricks and the Rapid Sludge Dewatering Systems (RSDS).



## HYDROLOGICAL SCIENCES SYMPOSIUM

PROCEEDINGS: Volumes 1 and 2: Grahamstown Conference, September 1987

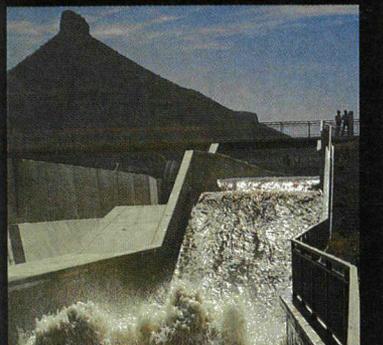
Edited by D A Hughes and A W Stone

All the oral and poster papers, except two, presented at the symposium are collected in the two volumes of these proceedings. The publication represents a broad spectrum of activity in the areas of hydrological research, planning and practice that is taking place in South Africa today.

The symposium combined the Fourth Biennial Symposium of the Ground Water Division of the Geological Society of South Africa and the Third National Hydrological

### HYDROLOGICAL SCIENCES SYMPOSIUM PROCEEDINGS: VOLUME 1

Rhodes University  
September, 1987



Symposium into a single hydrology and geohydrology symposium with the overall theme of Southern African Water Resources. The proceedings therefore combine and integrate the expertise and understanding of surface and ground water aspects of hydrology and address many of the water resource problems of Southern Africa.

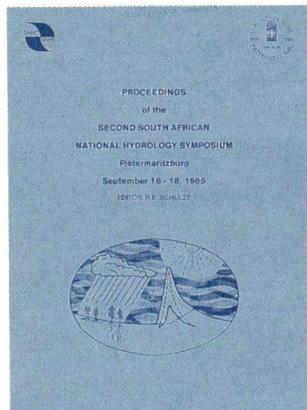
1987 1 155 pages  
Price R70,00 (All inclusive, cheques payable to Rhodes University)  
ISBN 0 86810 157 5

Available from Mrs Jenny King, Hydrological Research Unit, Department of Geography, Rhodes University, P O Box 94, Grahamstown 6140. Tel.: (0461) 2401.

## PROCEEDINGS OF THE SECOND SOUTH AFRICAN NATIONAL HYDROLOGY SYMPOSIUM

Editor R E Schulze

This publication provides a complete record of the symposium held in Pietermaritzburg from September 16 to 18, 1985.



It contains 43 of the original 59 oral and poster presentations at the symposium and reflects, to a large extent, the state-of-the-art of hydrology in South Africa in the mid-1980s. It provides information on water resources management, hydrometeorology, hydrological information systems, "Domoina" and fluvial processes, sediment studies, mineralisation and nutrient studies, models and land use effects, flood peak estimation and operational hydrology.

1986 564 pages  
Price R25,00 (inclusive)  
ISBN 0 86 980 507 X

Acru report 22

Available from the University of Natal, P O Box 375, Pietermaritzburg 3200. Tel: (0331) 63320.

## ACTIVATED SLUDGE MODEL NO1

by the IAWPRC task group on mathematical modelling for design and operation of biological wastewater treatment.

When one considers a system as complex as a single-stage activated sludge system capable of car-

bon oxidation, nitrification, and denitrification, it is apparent that a tremendous investment of time and money would be required to operate a pilot plant at all the possible conditions which might be considered during design. That means that our experience will always be limited. The availability of a mathematical model like the one presented here, however, in which rate equations are presented for the processes involved, allows the engineer to explore, through simulation, a very broad range of system configurations, inputs, and operational strategies.

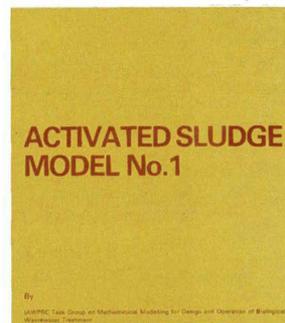
After a plant has been built, a model like this one can be used to evaluate the impact of new waste loads and to try new operational strategies.

Realizing the benefits to be derived from mathematical modelling, while recognizing the reluctance of many engineers to use it, the International Association on Water Pollution Research and



International Association on Water Pollution Research and Control

Scientific and Technical Reports No. 1



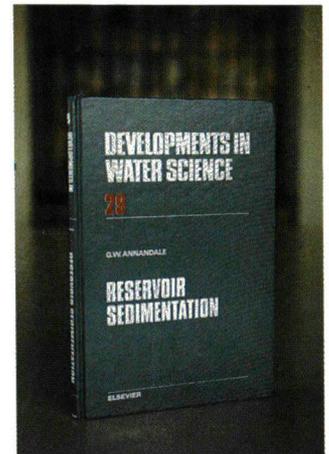
Control (IAWPRC) formed a task group in 1983 to promote the development of, and facilitate the application of, practical models for the design and operation of biological wastewater treatment systems. The goal was first to review existing models and second to reach a consensus concerning the simplest one having the capability of realistic predictions of the performance of single sludge systems carrying out carbon oxidation, nitrification, and denitrification. The model was to be presented in a way that made clear the processes incorporated into it and the procedures for its use. This report is the result of the group's efforts.

Available from IAWPRC, 1 Queen Anne's Gate, London SW1H 1BT.

## RESERVOIR SEDIMENTATION

by  
GW Annandale, Rand Afrikaans University, Johannesburg, South Africa

Research on reservoir sedimentation in recent years has been aimed mainly at water resources projects in developing countries. These countries, especially in Africa, often have to cope with



long droughts, flash floods and severe erosion problems. Large reservoir capacities are required to capture water provided by flash floods so as to ensure the supply of water in periods of drought. The problem arising, however, is that these floods, due to their tremendous stream power, carry enormous volumes of sediment which, due to the size of reservoirs, are virtually deposited in toto in the reservoir basin, leading to fast deterioration of a costly investment. Accurate forecasting of reservoir behaviour is therefore of the utmost importance.

The practical approach adopted in this book by illustrating theory with examples should appeal to the design engineer. However, new theory presented regarding processes involved in the deposition of sediment should also stimulate the more academically minded research engineer to some deeper thought.

1987 222 pages  
US \$57.75  
ISBN 0-444-42729-5.

Available from Elsevier Sciences Publishers, P O Box 211, 1000 AE Amsterdam, The Netherlands.



## DRINKING WATER

The third national conference on drinking water with the theme "small system alternatives" will be held at St John's, Newfoundland, Canada, from 12 to 14 June 1988.

Enquiries: Chairman, Third National Conference on Drinking Water, P O Box 205, St John's, Newfoundland, Canada A1C 5J2.

## REVERSE OSMOSIS

A symposium on the advances in reverse osmosis and ultrafiltration will be held in Toronto, Canada, from 5 to 11 June 1988. Enquiries: Dr S Sourirajan/Dr T Matsuura, Division of Chemistry, National Research Council of Canada, Ottawa, Ontario, Canada K1A0R9.

## POLLUTION

The 8th International Symposium on environmental pollution will be held from 9 to 10 June 1988 in Toronto, Canada.

Enquiries: Dr V M Bhatnager, Alena enterprises of Canada, Cornwall, Ontario, K6H5V7, Canada.

## LARGE DAMS

The 16th International Congress on large dams organised by ICOLD will be held from 13 to 17 June 1988 in San Francisco, USA. Topics include reservoirs and environment, embankment dams, new developments in concrete dams and design floods and operational flood control.

Enquiries: H L Blohm, Secretary, ICOLD, 88 Steering Committee, Bechtel Civil Inc, P O Box 3965, San Francisco, CA 94119, USA.

## LIMNOLOGY

The 25th anniversary congress of the limnological society of Southern Africa will be held in Pietermaritzburg from 27 June to 1 July 1988. Post congress excursions will include trips to Maputhaland (St Lucia, Lake Sibaya, Kosi Bay and Ndumu Game Reserve), the Drakensberg pump/storage scheme and the Mgeni system.

Enquiries: Mr J Akhurst, Department of Botany, University of Natal, P O Box 375, Pietermaritzburg, 3200.

## WATER SUPPLY AND SANITATION

A seminar on water supply and sanitation in KwaZulu will be held at the Elangeni Hotel in Durban from 28 to 30 June 1988. Enquiries: Symposium Secretariat S.433, CSIR, P O Box 395, Pretoria 0001, Telephone: (012) 841-2063.

## WATER QUALITY

The International Water Supply Association will arrange a workshop on water treatment and drinking water regulations in Vienna on June 30 to July 1 1988.

Enquiries: Prof D R Oehler (Chairman of the Standing Committee on Water Quality and Treatment) Bebelstrasse 60, D7 000 Stuttgart-1 Federal Republic of Germany.

## IAWPRC

The IAWPRC's 14th biennial conference and exhibition will be held during July 1988 in Brighton, England. South African companies are invited to participate in the exhibition.

Enquiries: IAWPRC, 1 Queen Anne's Gate, London SW1H9Bt, England. Telephone 01-2223848, Telex 918518 WAS-SOC, Attention IAWPRC.

## WATER QUALITY

A conference on water quality and management for recreation and tourism will be held in Brisbane, Australia, from 10 to 15 July 1988.

Enquiries: R. Sadler, working Group Secretary, P O Box 388, North Quay, Brisbane, Queensland, Australia, 4 000.

## NAVORSING

'n Konferensie getiteld Mense vir navorsing en ontwikkeling 1988, sal op 23 en 24 Augustus 1988 by die WNNR in Pretoria aangebied word.

Navrae: Die Konferensiekoördineerders, S.446 (aandag: mev Meyer), Posbus 395, Pretoria 0001. Tel: (012) 841-4412.

## ARTIFICIAL RECHARGE

The American society of Civil Engineers is

planning an International Symposium on Artificial Recharge of Ground Water from 23 to 27 August 1988 in Anaheim, California.

Enquiries: Ivan Johnson, 7474 Upham Court, Arvada, CO 80003.

## WASTE WATER TREATMENT

The 11th symposium on wastewater treatment will be held during November 1988 in Montréal, Québec.

Enquiries: Ms Stephanie Hunt, Environment Canada, Technology Development and Technical Services Branch, Conservation and Protection, Ottawa, Ontario K1A 0H3.

## POLMET 88

An International conference on pollution in the metropolitan and urban environment will be held in Hong Kong from 28 November to 2 December 1988. Papers are invited for the technical sessions which will include: Environmental management practice, Industry and environment, Air Quality management.

Enquiries: Polmet 88 Secretariat, c/o Hong Kong Institution of Engineers, 9/F Island Centre, No 1 Great George Street, Causeway Bay, Hong Kong.

## WATER POLLUTION

The thirtieth Convention of the SA Chemical Institute will be held on 15 to 20 January 1989 at the Johannesburg Sun. The Convention will accommodate a number of themes including "Environmental Protection" which will incorporate Water Pollution.

Enquiries: Prof J Boeyens, University of the Witwatersrand, Department of Chemistry. Tel: (011) 716-2076.

## WATER RESOURCES

An international symposium on water resource systems application will be held from 12 to 15 June 1990 in Winnipeg, Canada. Topics will include hydrology, hydropower, water supply, irrigation, water quality and reservoirs. Papers are invited.

Enquiries: Water resource systems application, the University of Manitoba, Civil engineering department, Winnipeg, Manitoba, Canada, R3T 2N2.



Talle geaktiveerdeslyk-  
aanlêe wêreldwyd on-  
dervind periodiek 'n  
opbouing van biolo-  
giese skuim op die op-  
pervlakte van belug-  
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baie moeilik om te han-  
teer en kan soms erns-  
tige bedryfsprobleme  
by rioolwatersuiwe-  
ringswerke meebring.

Navorsers aan die  
Universiteit van Pre-  
toria, het onlangs 'n  
nuwe metode ontwik-  
kel waarmee biologiese  
skuim suksesvol met  
selektiewe flottasie be-  
kamp en beheer kan  
word.

Dié navorsingswerk,  
wat finansiëel deur  
die Waternavorsings-  
kommissie (WNK) ge-  
steun is, is in 'n finale  
verslag saamgevat, ge-  
titeld Biologieseskuim-  
beheer met selek-  
tiewe flottasie in die ge-  
aktiveerdeslykproses.  
Die verslag is gratis op  
aanvraag by die WNK  
beskikbaar.

# '88

## FLOOD HYDRO

## DAMONTWERP

# Flood Hydro '88

University of Pretoria

18-21 July 1988

This is a completely revised course on flood hydrology. The emphasis will be on the practical applications of the methods described in the SANCOLD handbook on flood hydrology by W J R Alexander. Topics include statistical, deterministic and empirical methods as applied to single sites, regional analyses and dam safety evaluation. Background lectures will be given on hydrological statistics, storm rainfall, catchment processes, dam hydraulics and flood documentation.

Each afternoon will be devoted to hands-on microcomputer applications. No previous experience on micro-computers will be necessary. Case studies will be discussed.

The course is organised by the Department of Civil Engineering, University of Pretoria under the auspices of SAICE and SANCOLD. Lecturers will include Professors Alexander (course leader) and Rooseboom as well as Messrs Croucamp and Kovács from the Department of Water Affairs. The course fee of R500 will include a copy of the SANCOLD handbook, notes, lunches and teas. Payment must be made before the end of June. Only a limited number of persons can be accommodated in the microcomputer laboratory. **Closing date for registration 31 st May 1988.**

# Damontwerp '88

Universiteit van Pretoria

7-10 November 1988

Hierdie kursus word hoofsaaklik in Afrikaans aangebied en konsentreer op die nie-hidrologiese aspekte van damontwerp, met die klem op kleiner damme.

Sprekers van die Departement van Waterwese, raadgewende firmas en die Universiteit van Pretoria sal optree. Die kursus word gereël deur die Departement Siviele Ingenieurswese, Universiteit van Pretoria en word aangebied onder beskerming van SAISI en SANCOLD.

Aspekte wat aandag sal geniet is o.a. beplanning, veiligheid, wetgewing, fundamente, walontwerp (grond en betondamme), konstruksieaspekte wat ontwerp beïnvloed, bedryf en instandhouding, damhidroulika insluitende die ontleding van dambreekvloede en aanvaarbare risiko's. Lesings word gevolg deur werksessies.

Die kursusgelde van R480 sluit in aantekeninge, middagetes en tee en is betaalbaar voor 1 November 1988. Slegs 'n beperkte getal persone kan geakkommodeer word en voorkeur sal gegee word aan diegene wat vroeg registreer. **Sluitingsdatum vir registrasie is 30 September 1988.**

REGISTRATION FORM : Mailing address : Prof A Rooseboom  
REGISTRASIEVORM : Posadres : Dept of Civil Engineering/Siviele Ingenieurswese,  
Universiteit van Pretoria, Pretoria 0002

NAME/NAAM .....  
ADRESS/ADRES .....  
.....TEL: .....

Registers for Flood Hydro '88   
Registreer vir (Closing date 31st May)

Damontwerp '88   
(Sluitingsdatum 30 Sept)

Amount included/Bedrag ingesluit R  (Minimum Deposit/Deposito R50)