

H. M. du Plessis

S4 waterbulletin

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APRIL / MAY 1989

HYDROLOGY

New rainfall maps now available from the WRC

WATER SUPPLY

Researchers develop portable toxicity detector for water

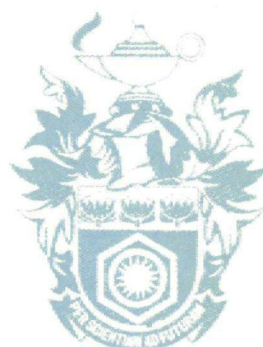
SLUDGE

Final report on sludge bulking released

00020076



THE SOUTH AFRICAN
CHEMICAL INSTITUTE
Northern Transvaal Section,
ChromSA, SAAMS
FIRST NATIONAL
SYMPOSIUM ON
ANALYTICAL SCIENCE



ANALYTICA '90

**March 18 - 23,
1990**

Pretoria

THEME

**ANALYTICAL
TECHNOLOGY
IN A
DEVELOPING
SOUTH AFRICA**

AIM

The Symposium aims to bring together all people concerned with analytical science.

**SCIENTIFIC
PROGRAMME**

The programme will cover both theoretical and applied aspects of analytical science and will be organised around plenary, invited and contributed papers, which will include both oral and poster presentations.

EXHIBITIONS

The latest analytical equipment will be exhibited throughout the symposium. Any enquiries can be directed to:
Dr M Booth, Research and Development, AECI,
PO Modderfontein 1645,
South Africa.

Tel No: (011)6052316.
Telefax: 608-2540.

ACCOMMODATION

Delegates will be responsible for their own travel and accommodation arrangements.

A list of hotels will be supplied.

CALL FOR PAPERS

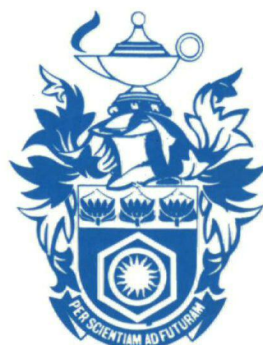
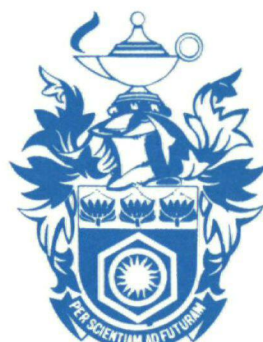
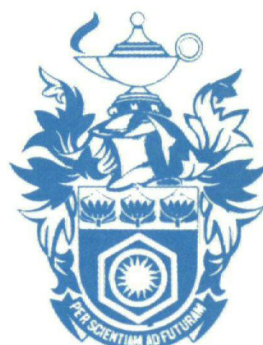
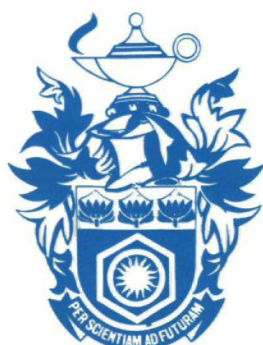
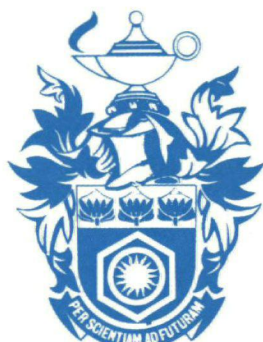
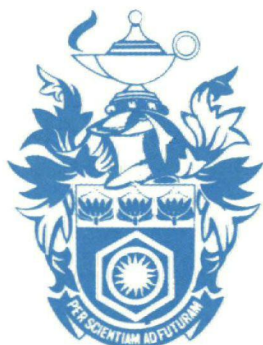
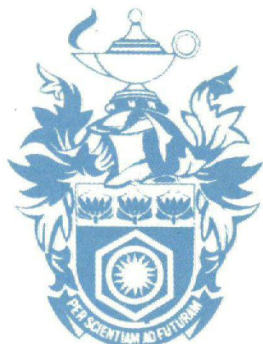
Participants are invited to submit papers to be included in the scientific programme. A booklet containing the abstracts of all papers will be made available to delegates at the Symposium.

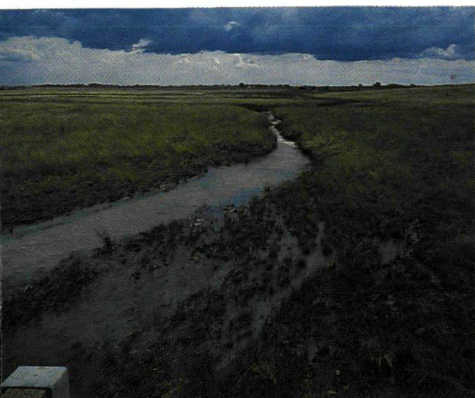
Those who wish to attend Analytica '90 are kindly requested to complete the provisional registration post card in this Bulletin and return it to the organisers.

**ADDRESS FOR
CORRESPONDENCE**

The Chairman
Analytica '90
Department of Chemistry
University of Pretoria
PRETORIA
0002,
South Africa

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Telefax: (012) 342 2453





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Buiteblad: Wolke (foto: WNK)

SA Waterbulletin is 'n tweemaandelikse tydskrif oor water en watervorsing wat uitgegee word deur die Suid Afrikaanse Watervorsingskommissie (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 die lede van die WNK nie, en mag herbruik word met erkenning van die bron.

Redaksie: WNK, Posbus 824, Pretoria 0001, Republiek van Suid-Afrika. Tel. (012) 28-5461.

Redakteur: Jan du Plessis.

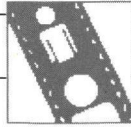
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Tipografie en uitleg: Nicola van Nikkelen Kuyper.

Drukwerk: Creda Press, Kaapstad.



Dr J P Kriel - Sy loopbaan én sy stok- perdjie is water!

Vir 52 jaar het hy onvermoeid in die waterveld gewerk en vroeër vanjaar die hoogste eer vir hierdie onbaatsugtige en toegewyde ywer van die Staatspresident ontvang: Die Orde vir Voortreflike Diens, Klas 1: Goud.

Die bestudering van water was vir dr J P Kriel 'n lewenstaak, sy eerste liefde.

"Die voorkoms en benutting van water is so 'n interessante en multi-dissiplinêre studie dat dit nie alleen my werksterrein was nie, maar ook my stokperdjie," sê die 74-jarige dr Kriel wat aan die einde van Julie as voorsitter van die Waternavorsingskommissie uittree.

"Dr Kriel is 'n briljante siviele ingenieur wie se naam reeds jare lank met die vernaamste siviele ontwerpwerk vir Staatswaterskemas verbind word," lui die aanvangswoorde van die sitaat wat tydens die oorhandigingsplegtigheid van die Staatspresidenttoekenning in Kaapstad gelees is.

Sy vindingryke inisiatiewe het 'n baie belangrike bydrae gelewer tot die optimale bewaring en benutting van Suid-Afrika se skaars waterbronne en die daarstelling van 'n Department van Waterwese wat gespesialiseerde diens van hoogstaande gehalte aan alle fasette van die volkshuishouding lewer.

Hy was onder meer mede-verantwoordelik vir die Oranjerivier-ontwikkelingsprojek asook vir die beplanning van die Tugela-Vaal-staatswaterskema. Sedert 1968 het hy as Sekretaris van Waterwese opgetree en ook in die destydse Wetenskaplike Adviesraad en die Beplanningsadviesraad van die Eerste Minister gedien.

Benewens sy ampspligte het dr Kriel ook 'n leidende rol gespeel in die daarstelling van die Waternavorsingskommissie en die bedrywighede van die Suid-Afrikaanse Instituut van Siviele Ingenieurs. Hy was verder instrumenteel in die viering van die Nasionale Waterjaar in 1970, waardeur gepoog is om die algemene publiek bewus te maak van die belangrikheid en skaarsheid van water.

Dr Kriel se tegniese kennis en aktiewe betrokkenheid by professionele organisasies, binnelands sowel as buitelands, byvoorbeeld as lid van die Internasionale Kommissie oor Groot Damme (wat bestaan uit sowat vyf-en-sewentig lidlande) het hoë aansien vir die ingenieursberoep in die Republiek van Suid-Afrika teweeggebring. Sodoende is ook goeie betrekkinge met ander lande en individue in die buitenland opgebou.

In 1976 is dr Kriel deur die Universiteit van Pretoria benoem tot ereprofessor in siviele ingenieurswese uit erkenning vir sy besondere bydrae tot hierdie vakgebied. In dieselfde jaar het die Universiteit van die Witwatersrand die graad D.Eng (h.c.) aan dr Kriel toegeken - die eerste keer dat 'n Suid-Afrikaanse universiteit 'n eredoktorsgraad aan 'n dienende departementshoof toegeken het. Gedurende 1989 is die Goue Medalje deur die Instituut vir Siviele Ingenieurs aan hom oorhandig - sedert die instelling van die medalje in 1953, slegs die agste persoon wat dit ontvang.

Jacques Pierre Kriel is op 18 April 1915 op Alice in die Oos-Kaap gebore as die vyfde van ses kinders van 'n predikant. Sy oupa se broer was die bekende dr Kriel wat die Abraham Kriel-kinderhuis op Langlaagte in Johannesburg begin het, terwyl dr Kriel se vader, na sy aftrede in 1937, die Jan Kriel Skool vir kinders met epilepsie op Kuilsrivier stig.

Dr Kriel voltooi sy matriek aan die Hoër Jongenskool te Stellenbosch (vandag die Paul Roos Gimnasium) en studeer daarna aan die Universiteit van Kaapstad waar hy in 1936 die graad B.Sc Ing. (siviel) ontvang. Gedurende sy universiteitsjare neem hy aan talle kultuuraktiwiteite en sport deel ("Ek het in vier jaar vir al die spanne rugby gespeel, behalwe die eerste span") en reis ook vir die eerste keer oorsee.

"Aan die einde van my tweede jaar op Universiteit moes ek gedurende die vakansie as deel van my ingenieurskursus vir ses weke meganiese praktiese werk doen. Ek het daarin geslaag om in die enjinkamer van 'n vragskip van die Clan Line te werk van Kaapstad na Liverpool en drie weke later van Londen terug na Kaapstad. In Londen kon ek besienswaardighede, 'n groot ingenieurswerk en toneelopvoerings besoek. Vriende in Suid-Afrika het gereël dat ek 'n familielid, 'n ingenieur in beheer van die konstruksie van 'n groot dam in Frankryk, kon besoek en op pad soontoe het ek 'n uitvoering van "Aida" in die Paryse Operahuis bygewoon. Die hele werktyd saam met die seemanne aan boord van die skip en die besoeke aan Londen, die ingenieursfamilie en die damme in die Alpe was 'n hoogtepunt.

In Januarie 1937 sluit dr Kriel as assistent-ingenieur by die destydse Departement

van Besproeiing in Kaapstad aan. Uiteindelik sou hy altesaam 41 jaar vir dié Departement werk en tot op die hoogste vlak vorder deur in Desember 1968 as Sekretaris van Waterwese aangestel te word. Aanvanklik is hy gemoeid met die ondersoek van kleinere besproeiingskemas vir boere.

Maart 1937 word hy verplaas na die topografiese opmetingsafdeling te Robertson.

September 1937 word hy terugverplaas na die Wes-Kaapse Seksie, Kaapstad, met 'n brief van die Hoof van die opmetingseenheid dat baie goeie vordering met opmetingswerk gemaak is.

Hy ondersoek weer eens kleinere besproeiingskemas vir besproeiingsrade en boere en waterskemas vir kleiner munisipaliteite. Doen opmetings, beplanning en ontwerp van kanaalstelsels, kleinere damme, verspreidingsnetwerke en vloedbeskermingswerke. Hou toesig oor die konstruksie van sulke werke en konstruksie van militêre kampe 1940 - 1942 en ondersoek watervoorsiening vir Robbeneiland.

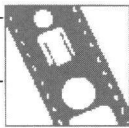
"In 1938," vertel dr Kriel, "het 'n sekere prof. Wicht in verband met navorsing oor bosopvanggebiede in Jonkershoek behoefte gehad aan 'n betroubare afloopformule vir saamgestelde meetkepe. Deur bemiddeling van prof. Nape van die Universiteit van Kaapstad en die Seksie-Ingenieur van die Departement van Besproeiing in Kaapstad is die taak aan my opgedra om die nodige formule te ontwikkel en te toets met hidrouliese proewe. Dit is suksesvol gedoen. Die werk het my bevrediging verskaf, maar die seël daarop is veel later, tydens 'n konferensie op Stellenbosch, in November 1987, daarop geplaas toe aan my meegedeel is dat die 'Kriel'-formule nog steeds in verband met navorsing oor bosbouopvanggebiede gebruik word."

Im 1941 is dr Kriel met Hilda Barbara Gerber in Kaapstad getroud en drie seuns is uit die huwelik gebore.

In Maart 1944 word hy na Vaalhartsbesproeiingskema verplaas en gesekondeer aan die Departement van Lande vir toesig oor 'n bouprogram vir 1 200 huise vir nedersetters op Vaalharts- en Rietrivierskemas. Hy ondersoek watervoorsiening en bestudeer die beplanning en aanleg van 'n kanaalstelsel.

Septemer 1945 bedank dr Kriel uit die Departement en aanvaar 'n pos as ingenieur van die Breërivier-Waterbewaringsraad te Robertson. Hy is gemoeid met die administrasie van Brandvleidam naby Worcester en in die kanaalstelsels tot onderkant Bonnievale met die konstruksie van betonvoerings in die hoofkale asook onderhoudswerk.

Twee jaar later, in Oktober 1947, sluit hy, teen 'n laer salaris, weer by die Departement van Besproeiing as senior ingenieur te Vaalharts aan.



"Ek het besef die Waterbewaringsraad stel hoofsaaklik net belang in die besproeiingsaspekte van die bestaande ontwikkeling en dat hulle nie 'n groot rol sou speel in die ontwikkeling van die waterbronne van die Breërivier in die algemeen nie."

Op Vaalharts is dr Kriel gemoeid met die administrasie van die besproeiingskema, hidrouliese toetse en onderhoudswerk.

Februarie 1948 word hy verplaas na die Ontwerpseksie by die Departement se hoofkantoor te Pretoria. Hy ondersoek waterbronne en die beplanning en ontwerp van watervoorsieningsprojekte insluitende damme, kanaalstelsels en streekwaterskemas. Hy doen veldondersoeke van damterreine, insluitende terreine vir damme op die Oranjerivier en help met die bevordering van boorwerk op die roete van die Oranje-Vistonnell. Hy besoek Maroneiland in 1949 vir ondersoek na moontlike hidro-elektriese- kragvoorsiening aan die weerstasie.

Junie 1950 word hy verplaas as onderhoof van konstruksie vir die OVS Goudvelde staatswaterskema.

Januarie 1951 word hy verplaas na Kaapstad as professionele assistent vir die Departementshoof tydens die Parlementsitting en in Julie 1951 word hy terugverplaas na Pretoria na die afdeling Beplanning. Dit het te make met die algemene beplanning van watervoorsieningsprojekte.

Februarie 1953 word dr Kriel aangestel as die plaaslike ingenieur vir die konstruksie van die Waterdowndam in die Klipplaatrivier, suid van Queenstown.

"Die bou van hierdie dam is beskou as 'n toets vir die doeltreffendheid van die Departement se werkverrigting aangesien daar nadat tenders vir die bou van die dam gevra is, besluit is dat die Departement self dit goedkoper as die laagste tenderbedrag kon bou.

"Dit het beteken dat produktiwiteit van die konstruksiewerk op 'n hoë vlak moes wees en dat 'n kosteberekeningstelsel wat werklike kostes getrou sou weergee vir vergelykende doeleindes ontwikkel en toegepas moes word. Die konstruksie van die dam is egter voltooi teen 'n aansienlike besparing in vergelyking met die koste van die laagste tender wat ontvang is."

Julie 1957 word dr Kriel terugverplaas na Pretoria, na die Afdeling Beplanning en Navorsing. Hy is verantwoordelik vir 'n nuwe seksie vir besoedelings- beheer en doen ondersoeke insake besproeiingsgebiede van die Oranjerivier-projek, hidro-elektriese ontwikkeling en algemene beplanning. Hy is ook betrokke by ondersoeke na klagtes oor onteieningsaanbiedings vir watersake.

Dr Kriel praat met groot lof oor die bystand en verdraagsaamheid van sy vrou en sy gesin met al die verplasinge.

"Toe my oudste seun, bv. in st 7 kom, was dit sy sewende skool. Elke keer as ons getrek het, het ons baie van ons goed op die nuwe plek eers in die motorhuis gepak en later het ons die gesegde gehad dat as die motorhuis uiteindelik skoongemaak is, dan weet ons dit is nou weer tyd om te trek!"

Tog het dr Kriel geglo 'n mens moet in die Departement gaan waar die werk is. "As jy wil hê die werk moet na jou toe kom, kan jy nie die beste werk verwag nie, veral op die terrein van water," sê hy.

In Maart 1959 word dr Kriel aangestel as Eerste Hidroloog in die afdeling Hidrologie. Hy is gemoeid met montering van waterbronne en hidrologiese navorsing, asook Grondwaterondersoeke.

In 1963 word hy bevorder tot Assistent-Hoofingenieur (Beplanning en Navorsing). Hy is verantwoordelik vir die ontwerp van groot waterskemas insluitende die

nie," sê hy. Ek het vroeg in my lewe uitgevind dat samewerking met andere baie vrugbaarder is en baie beter resultate lewer as om ander mense uit jou terrein te probeer weghou. Veral in die waterveld wat so multi-dissiplinêr is, is samewerking tussen die entoesiastiese deskundiges op baie terreine absoluut noodsaaklik. Kommunikasie is ook belangrik. "Ek het gedurende die Waterjaar in 1970 gevind die algemene publiek stel nie baie belang in wetenskaplike syfers en gegewens nie. 'n Mens moet dus uitvind hoe jy wetenskaplike begrippe aan die publiek kan oordra, want as jy nie die publiek met jou saamneem nie, kan jy nie vir hulle verduidelik wat die regte besluite is nie."

"Voorts het ek geglo dat iemand in 'n staatsdepartement wie se taak dit is om inligting aan die minister oor te dra, dit sonder enige persoonlike vooroordele moet doen. Die minister sal besluit wat politieke aanvaarbaar is, maar die amptenaar moet altyd sorg dat die minister oor die werklike feite beskik."

Dr Kriel beskou waternavorsing en die oordeelkundige gebruik van water as twee van die belangrikste strategieë om Suid-Afrika se toekomstige moontlike watertekorte te bowe te kom.

"Om werklike antwoorde te kry oor wat ons in die toekoms moet doen, het ons nog baie navorsing, deeglike ontleding en verdere studies oor die praktiese uitvoerbaarheid van verskillende moontlikhede nodig."

Een aspek van waternavorsing wat dr Kriel meen wat versnel moet word, is reënvalstimulering.

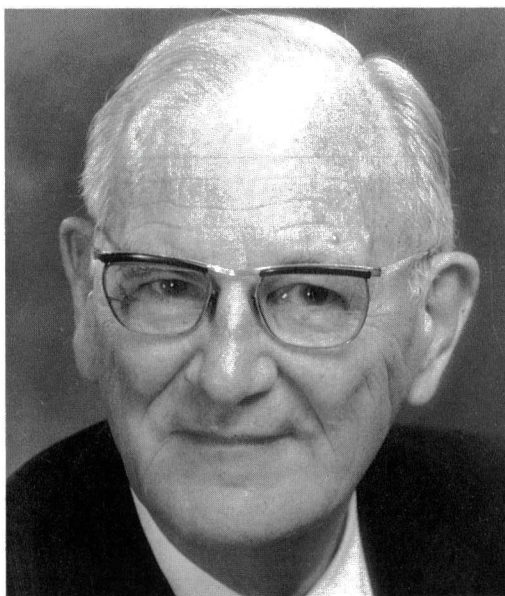
Hierdie is langtermynnavorsing en finale antwoorde moet nie binne tien of twintig jaar verwag word nie. Dr Kriel sê volgens berekenings wat hy gedoen het, waai 90 persent van die vog wat oor Suid-Afrika beweeg weg en slegs 0,9 persent van hierdie vogwater bereik uiteindelik ons riviere.

As wetenskaplikes dus daarin kan slaag om net een persent van hierdie vog uit die lug te onttrek, sal dit die land se waterbronne verdubbel!

"Reënvalstimulering hou vir Suid-Afrika enorme voordele in en die bedrag wat ons aan hierdie navorsing bestee, is totaal ontoereikend, veral as dit vergelyk word met die R1 300 miljoen wat die afgelope twintig jaar deur Suid-Afrika in die soektog na aardolie spandeer is."

Wat beplan dr Kriel op die vooraand van sy "tweede aftrede"?

"Daar is nog heelwat wat ek moet doen, maar voortaan sal ek darem seker meer tyd kry om ook aan my stokperdjie te spandeer," glimlag hy.



Oranjerivierprojek asook die beplanning van die Tugela-Vaal Projek en begin met ondersoeke na en onderhandelings oor Lesotho-Hooglande-Projek.

In 1967 word hy bevorder tot Hoofingenieur (Beplanning en Ontwerp). Hy doen algemene ondersoeke in verband met waterskemas en adviseer Spaanse ingenieurs oor tenderreëlins vir die Tago-Segura Projek in Spanje in die lig van sy ervaring met die Oranjerivier-Projek.

Dr Kriel word in 1968 aangestel as Sekretaris van Waterwese - 'n pos wat hy beklee het tot sy aftrede in April 1980.

Vanaf 1980 is hy 'n konsultant gemoeid met spesiale waterstudies, hoofsaaklik vir die Departement van Waterwese. Hy is ook vir die afgelope drie jaar voorsitter van die Waternavorsingskommissie.

Wat was die sleutel tot sukses in sy loopbaan? "Ek is nie 'n 'Empire-bouer



SA rainfall statistics mapped

A set of rainfall maps together with a final report entitled *Mapping mean annual and other rainfall statistics over Southern Africa* has been released by the Water Research Commission.

The report details the methodology employed in producing the information contained on the maps and was compiled by M C Dent, S D Lynch and R E Schulze of the Department of Agriculture Engineering at the University of Natal, Pietermaritzburg. The maps and the report resulted from a project funded by the Water Research Commission called "Revision of the temporal and spatial distribution of precipitation statistics in Southern Africa".

The rainfall or isohyetal maps have been produced as overlays to the 1:250 000 map series which is plotted to the Gauss Conformal Projection.

The isohyets are interpolated from estimates of mean annual precipitation (MAP) at 1' by 1' of a degree intervals. The estimate of MAP at each

grid point was determined using an adjusted regression surface in which MAP was regressed against factors such as altitude, latitude, longitude, continentality and aspect.

The location of the rainfall stations are plotted to the nearest 1' of a degree and therefore may appear to be slightly incorrectly situated when overlayed on a map. At most they will be displaced by approximately 800 m from their correct location.

The estimates of MAP at each 1' by 1' grid point are available for each of the 70 maps in the series.

Contact the Computing Centre for Water Research, P O Box 375, Pietermaritzburg 3200; Tel (0331) 6-3320, for details concerning these data which are available on computer compatible media.

The maps and the report are available from the Water Research Commission. To order please complete the ordercard in this Bulletin.

COST AND ENROLMENT

The seminar fee will be about R550 per person (excluding the cost of accommodation) with a possible extra levy for delegates not registered at the hotel. Full details of the fees and enrolment procedures will be given in the next announcement. Interested persons are strongly advised to fill in and return the reply slip as soon as possible so as to be among the first to receive the next announcement and enrolment form and thus ensure a place at one of the seminars.

CORRESPONDENCE AND ENQUIRIES

All correspondence and enquiries about the seminar should be addressed to:

CSIR Conference Co-ordinators C.126
P O Box 395
0001 Pretoria

Telephone: (012) 841-3979
(Maureen Ruane)
Telefax: (012) 86-2856

SEMINAR CONTENTS

SEMINAR ON NUTRIENT REMOVAL FROM WASTEWATER STREAMS

Nutrients in the environment	Theory of bio P removal
Nitrification	Design for N and P removal
Denitrification	Monitoring and control
Design for nitrification/denitrification	Wetland systems
Case studies in nitrification/denitrification	Case studies in N and P removal
Background to bio P removal	Chemical P removal

SEMINAR ON THE DESIGN AND OPERATION OF BIOLOGICAL TREATMENT PLANTS

Systems approach	Bulking in the activated sludge system
Activated sludge systems	Final clarifiers
Trickling filters	Industrial wastes
Inlet works, pumps and hydraulics	Mechanical equipment
Sludge production and sludge treatment	Sequential batch reactors
Modelling the activated sludge system	Retrofitting and upgrading

SEMINAR ON INDUSTRIAL AND HAZARDOUS WASTE TREATMENT

Existing problem areas	Saline wastes
Pre-treatment	Activated sludge treatment
Hazardous waste	Pond systems
Hazardous sludges	Adsorption
Physical chemical treatment	In-situ biological treatment
Anaerobic treatment	Case studies

POST TO:

Conference Co-ordinator C.126
CSIR
P O Box 395
0001 Pretoria

Three Concurrent Seminars on

**Nutrient removal from wastewater streams
Design and operation of biological treatment plants
Industrial and hazardous waste treatment**

The three seminars held earlier this year at Mount Grace Country House were so successful that a further three will be held in the same series next year. The seminars are intended for engineers and scientific personnel in charge of the design, monitoring and control of waste treatment plants with emphasis on nutrient removal and industrial and hazardous waste treatment plants. They will also be of great interest to persons with regulatory compliance responsibilities.

It is the intention of the organizers to run these seminars biennially from now onwards.

DATE AND VENUE

As the seminars will again run concurrently from Monday 2 April to Wednesday 4 April 1990 (Good Friday: 6 April – school holidays: 6 to 23 April) **it will not be possible to register for more than one.** The venue will once again be a country hotel within easy reach of Pretoria and Johannesburg. Full details of the venue and accommodation costs will be given in the next announcement.

BACKGROUND

Nutrient removal and the treatment of industrial and hazardous waste are very topical at the moment. South African expertise in nutrient removal and treatment plant design and American expertise in hazardous waste water treatment will be disseminated to delegates by the engineers and scientists who have actually been implicated in this exciting area of development and with the subsequent applications. The organizers have taken heed of the delegates' suggestions to make future seminars even more productive and much time will be set aside for discussion and individual problem solving. It will also be possible to consult the lecturers.

EXHIBITIONS/DISPLAYS/SPONSORSHIP

Organizations and companies are invited to contact the Conference Co-ordinator C.126 if they wish to display/exhibit at the venue, and/or sponsor a component of the seminars.

✂

REPLY SLIP

Wastewater seminars: 2nd-4th April 1990

Please complete and return this slip before 30 July 1989 to: The Conference Co-ordinators C.126, CSIR, P O Box 395, Pretoria 0001

By returning this slip you are indicating your interest in one of the seminars without any obligation.
You will receive the final announcement in due course.

SURNAME _____ INITIALS _____ TITLE _____

ORGANIZATION _____

POSTAL ADDRESS _____

POSTAL CODE _____

Please tick your interest in:

NUTRIENT REMOVAL FROM WASTEWATER STREAMS
 DESIGN AND OPERATION OF BIOLOGICAL TREATMENT PLANTS
 INDUSTRIAL AND HAZARDOUS WASTE TREATMENT
 EXHIBITING AT CONFERENCE VENUE



Water Research Commission

Questionnaire on Stasoft

(Interactive computer program from the University of Cape Town for water softening and stabilisation)

What was/were the objective/s in using the program? Design ☐ Control ☐ Other ☐ Please state

For what purposes have you used the program?

Softening and restabilization	<input type="checkbox"/>	} More than once per month	<input type="checkbox"/>	} Once per month	<input type="checkbox"/>	} Less than once per year	<input type="checkbox"/>	} Not yet
Treatment of underground waters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
Stabilization of "normal" waters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	
Stabilization of soft acid waters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>	

How often does your organisation use the program?

More than once a week ☐ Once/week ☐ Once/month ☐ Less than once/month ☐

Have you found the program helpful in resolving treatment problems?

Very ☐ Quite ☐ A little ☐ No ☐ If "No", please state reasons

Is the program user-friendly?

Very ☐ Quite ☐ Insufficiently ☐ If "Insufficiently", please comment

Is the User Manual clear?

Very ☐ Quite ☐ Insufficiently ☐ If "Insufficiently", please comment

Would you like the "input" to, or "output" from the program to be modified?

Yes ☐ No ☐ If "Yes", in what way?

Have you encountered any "bugs" in the program?

Yes ☐ No ☐ If "Yes", please comment

Have you encountered problems in stabilization/softening of your type of water which the program does not address?

Yes ☐ No ☐ If "Yes", please comment

Any other matters regarding the program you would like to bring to our attention?

Thank you very much for your valued contribution.

Please return questionnaire to: **The Executive Director**
Water Research Commission
P.O. Box 824
Pretoria
0001
For attention Mr G Offringa



Waternavorsingskommissie

Vraelys oor Stasoft

(Interaktiewe rekenaarprogram van die Universiteit van Kaapstad vir waterversagting en -stabilisasie)

Wat was u oogmerk(e) in die gebruik van die program? Ontwerp ☐ Beheer ☐ Ander ☐ Noem asseblief

Vir watter ander doelwit(te) het u die program aangewend?

Versagting en herstabilisasie	<input type="checkbox"/>	} Meer as eenkeer per maand	<input type="checkbox"/>	} Eenkeer per maand	<input type="checkbox"/>	} Minder as een- keer per jaar	<input type="checkbox"/>	} Nog nie
Behandeling van ondergrondse waters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>			
Stabilisasie van "normale" waters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>			
Stabilisasie van sagtesuurwaters	<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>			

Hoe gereeld gebruik u organisasie die program?

Meer as eenmaal per week ☐ Eenmaal/week ☐ Eenmaal/maand ☐ Minder as eenmaal/maand ☐

Hoe nuttig het u die program gevind in die oplos van u waterbehandelingsprobleme?

Baie ☐ Redelik ☐ Effens ☐ Glad nie ☐ Indien "Glad nie", gee asseblief u rede(s)

Is die program gebruikersvriendelik?

Baie ☐ Redelik ☐ Onvoldoende ☐ Indien "Onvoldoende", gee asseblief u rede(s)

Is die Handleiding duidelik?

Baie ☐ Redelik ☐ Onvoldoende ☐ Indien "Onvoldoende", gee asseblief u rede(s)

Sou u graag die intik van data of die uitdruk van resultate gemodifiseer wou sien?

Ja ☐ Nee ☐ Indien "Ja", op watter wyse?

Het u enige foute in die program teëgekom?

Ja ☐ Nee ☐ Indien "Ja", u kommentaar asseblief

Het u enige probleme teëgekom in die stabilisasie/versagting van u tipe water wat die program nie aanspreek nie?

Ja ☐ Nee ☐ Indien "Ja", u kommentaar asseblief

Enige ander aspekte rakende die program wat u graag onder ons aandag sou wou bring.

Baie dankie vir u gewaardeerde bydrae.

Stuur asseblief u vraelys terug aan: **Die Uitvoerende Direkteur
Waternavorsingskommissie
Posbus 824
Pretoria
0001
Vir aandag: Mnr G Offringa**

One of the most widely used variables in agrohydrology, engineering design and water resources planning is that of rainfall and in particular mean annual precipitation (MAP). In the past two decades the basic source of information on mean annual rainfall in Southern Africa has been the 1:250 000 average annual rainfall map series compiled and drawn by the Hydrological Research Division, Department of Water Affairs in 1965 from data obtained from the South African Weather Bureau. Since then the rainfall data base has lengthened by more than 20 years and as a consequence of enhanced computer power, the techniques of analysis have become more sophisticated. The engineering and hydrological fraternities requested the Water Research Commission to initiate research into the revision of the abovementioned maps.

The task of mapping the temporal and spatial statistics of rainfall in Southern Africa is one which requires extensive data sets. The creation, collation, checking and management of these data formed a large part of this project. Daily or monthly rainfall records from 9 409 stations form the precipitation data set. Since physiography plays an important role in influencing the spatial distribution of long term average rainfall in many areas, a comprehensive set of raw and generated physiographic data for Southern Africa was also created. These data were collected and assembled onto a grid at a resolution of one minute of a degree. In view of the magnitude of this data set it was necessary to computerise most of the functions of checking, manipulation and management.

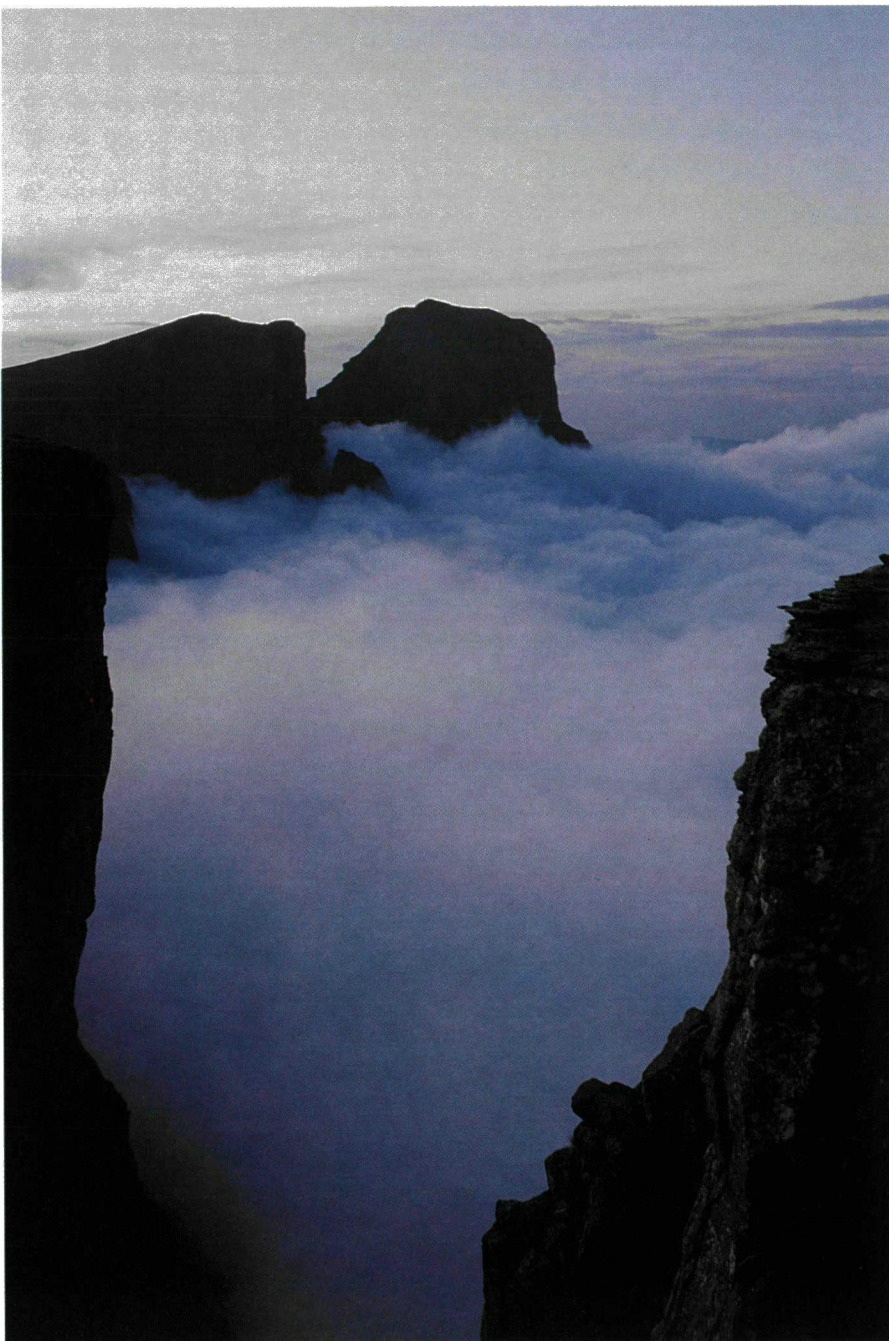
The rainfall data record at many of the stations was lengthened by synthesising in order to obtain a better estimate of the mean monthly and mean annual rainfalls. A combination of the multiple regression surface of MAP and the interpolated residual surface was used to provide the final MAP image before a contouring program prepared the 70 isohyetal maps of MAP at

a scale of 1:250 000. Maps of mean monthly as well as monthly and annual percentiles and co-efficients of variability (CV) were furthermore produced. The latter maps were produced at a scale of 1:1 000 000 and/or as digital images to a spatial resolution of 1 minute of a degree.

A PHYSIOGRAPHIC DATA SET

Polynomial spline, multi-quadric surfaces, Thiessen polygons and the subjective interpolation of isohyets rely on a fundamental assumption of the juxtaposition of

similar amounts of rainfall. Their use is therefore generally confined to flatter areas where rainfall gradients are not marked. It was thought initially that the flatter areas of the Karoo, Orange Free State and the Transvaal would be mapped more suitably by such interpolation techniques. In the southern and south western Cape and the eastern seaboard of South Africa, where the raingauge network is sparse in relation to the complex nature of the terrain, it is more suitable to undertake rainfall mapping with techniques which are able to accommodate these physiographic complexities.



In the absence of a formal report on the techniques employed to produce the 1:250 000 maps of MAP produced in the 1960s and on inspection of these isohyets, it was presumed that a major decision had been taken with regard to the influence of altitude on MAP. This new study has made no such decision, but has rather gathered and generated physiographic information for use in multiple regression equations which relate MAP to physiographic variables.

BASIC RAINFALL AND PHYSIOGRAPHIC DATA

The nature of this project dictates that it should utilize the most comprehensive precipitation data set available in Southern Africa. Numerous organisations and individuals contributed most generously to this rainfall data set. Substantial contributions were received from the South African Weather Bureau, the Department of Agriculture and Water Supply, the South African Sugar Association, provincial parks boards, organised agriculture, municipalities, mines and private individuals. The rainfall data base comprises 9 409 stations of which 996 have more than 50 years of good data. Most of these stations have daily records which were processed to yield monthly and annual means as well as other statistics. Extensive checks were carried out to ensure that these data were as error free as possible.

In view of the aforementioned evidence in respect of the influence of physiography on mean long term rainfall it was clear that a physiographic data base would be required. A major effort in gathering and generating physiographic data was therefore embarked upon, involving the establishment, on maps of scale 1:50 000 of the exact location and altitude of all the rainfall stations, and the preparation of an altitude data set on a grid of resolution 1 minute by 1 minute of a degree, for the whole of Southern Africa.

The grid system formed the framework for the entire physiographic and regional information system, in that at each point in the grid the variables necessary for trend surface analyses, were assigned a value. The choice of grid resolution (or grid size) is of great significance. If the grid was too coarse the resultant trend surface would lack resolution. If on the other hand the grid resolution was too fine, an unmanageable amount of data would have to be processed. The choice of a 1 minute grid was a suitable optimum in this regard.

A grid data base for approximately 70 per cent of Southern Africa was made available by the erstwhile Hydrological Research Unit (HRU), of the University of the Witwatersrand. These data had been extracted off maps of scale 1:250 000 with contour intervals of 500 feet. Altitude data from 1:50 000 scale maps with contour intervals of 20 metres were obtained from the Soil and Irrigation Research Institute of the Department of Agriculture and Water Supply and from the Department of Land Surveying and Mapping at the University of Natal for parts of the western Cape and Natal, respectively. All these data were subjected to extensive manual and computerised checks. The grid data for the eastern Transvaal, Karoo and northern Cape as well as parts of Natal and the south western Cape were completed by the staff of this project.

GENERATED RAINFALL AND PHYSIOGRAPHIC DATA

The basic data base of rainfall, latitude, longitude and altitude was insufficient for the task of mapping rainfall statistics. A large amount of generated or synthetic rainfall and physiographic data was necessary.

It was decided to synthesise monthly rainfall in order to increase the rainfall data record length. Model 5 of Zucchini and Hiemstra, was selected to perform this synthesis. Other techniques which were considered were linear and multiple regression, models proposed by Zucchini and Hiemstra, Gandin's method and Universal Kriging. The generated monthly rainfall values were flagged appropriately.

The altitude data formed the foundation of a set of techniques which produced other physiographic variables at each grid point: These variables were distance to a mountain range, continentality, exposure, surface roughness and aspect with respect to rainbearing weather systems. These variables were then used as predictors in the regression analysis of MAP on physiographic variables.

CHECKING THE RAINFALL AND PHYSIOGRAPHIC DATA

It became necessary to develop computerized checking procedures to screen the rainfall and physiographic data for gross errors. An example of such checks was

the daily rainfall data, which was aggregated in order to produce the monthly data set, these data screened to select the daily data for each month in which more than 200 mm was recorded on one day. Each of the 3 200 occurrences of such high rainfall was checked against records from neighbouring stations, the time of the year and daily rainfall extreme value statistics for feasibility, before the decision to reject or accept these data was taken.

The altitude data were classified and printed out in matrix form. The classified image was then coloured in order to facilitate the visual checking of the features according to the 1:250 000 topographic map series. Prior to this more detailed check an unclassified image was produced in order to check that all the points were present and that no points had been duplicated.

In addition to the above checks, the altitude assigned to each rainfall station was checked against the altitude on the grid data set at that point. This provided a useful check for gross errors in data capture at 9 409 "random" points on the grid altitude data set and provided for a coarse check on each of the rainfall station altitudes.

REGRESSION OF MAP ON PHYSIOGRAPHIC VARIABLES

The large volumes of data, numbers of variables and possible regression models made it imperative to develop techniques to automate the management of the procedures leading up to and including the regression procedure for relating MAP to physiographic variables. An intricate system involving numerous major procedural steps and incorporating 27 programs in FORTRAN or SAS languages was developed to perform the abovementioned functions. Throughout the system there were points at which human intervention and checking was necessary.

Southern Africa was divided into 34 regions for the purposes of the regression exercise. All these regions overlapped by a half degree with neighbouring regions to ensure continuity of the isohyet surfaces at regional boundaries.

The process of achieving the best regression expression for the rainfall surface was iterative in the sense that maps of residuals from regression at the station points and isohyet maps were actually produced and then studied before accepting, rejecting or modifying the regres-

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**Mrs Tineke van der Schyff
c/o Water Research Commission
PO Box 824
PRETORIA
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Insert to *SA Waterbulletin* April/May 1989.

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Complete and return to the Water Research Commission, PO Box 824, Pretoria 0001.

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G A Ekama, D Jenkins, M C Wentzel and G v R Marais (WRC Report No. 165/1/89).

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Please send me **Isohyetal Maps** as indicated overleaf.

Remittance of R enclosed.

Please send me a copy of the final report: **Mapping mean annual and other rainfall statistics over Southern Africa** by M C Dent, S D Lynch and R E Schulze. (WRC Report No 109/1/89).

Yes ☐ No ☐

Name: Telephone

Address:

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Insert to SA *Waterbulletin* April/May 1989.

MAPS: Please circle the correct reference number/s.

2228	Alldays	2628	East Rand	2916	Springbok	3122	Victoria West
2230	Messina	2630	Mbabane	2918	Pofadder	3124	Middelburg
2326	Ellisras	2632	Mkuze	2920	Kenhardt	3126	Queenstown
2328	Pietersburg	2720	Noenieput	2922	Prieska	3128	Umtata
2330	Tzaneen	2722	Kuruman	2924	Koffiefontein	3218	Clanwilliam
2426	Thabazimbi	2724	Christiana	2926	Bloemfontein	3220	Sutherland
2428	Nylstroom	2726	Kroonstad	2928	Drakensberg	3222	Beaufort West
2430	Pilgrim's Rest	2728	Frankfort	2930	Durban	3224	Graaff-Reinet
2520	Nossob	2730	Vryheid	3017	Garies	3226	King William's Town
2522	Bray	2816	Alexander Bay	3018	Loeriesfontein	3228	Kei Mouth
2524	Mafikeng	2818	Warmbad	3020	Sakrivier	3318	Cape Town
2526	Rustenburg	2820	Upington	3022	Britstown	3319	Worcester
2528	Pretoria	2822	Postmasburg	3024	Colesberg	3320	Ladismith
2530	Barberton	2824	Kimberley	3026	Aliwal North	3322	Oudtshoorn
2620	Twee Rivieren	2826	Winburg	3028	Kokstad	3324	Port Elizabeth
2622	Morokweng	2828	Harrismith	3030	Port Shepstone	3326	Grahamstown
2624	Vryburg	2830A	Richard's Bay	3118	Calvinia	3420	Riversdale
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Rainfall Maps (Isohyetal Maps)

Price: R10,00 per map (inclusive). All orders must be prepaid. Cheques payable to the Water Research Commission, please.

The maps carry individual reference numbers. To order simply circle the appropriate number/s on this card, complete the name and address section and mail together with your payment to the address shown overleaf.

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**The Chairman (Prof J F van Staden)
Analytica '90
Department of Chemistry
University of Pretoria
PRETORIA
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Insert to *SA Waterbulletin* April/May 1989

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March 18-23 1990

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Enquiries: Prof J F van Staden (012) 420-2515 (Voorsitter/Chairman)

Dr P L Kempster (012) 808-0374 (Sekretariaat/Secretariat)

BESTELVORM

Voorsien ons asseblief van ☐ kopieë van die publikasie:

THE HARTBEESPOORT DAM ECOSYSTEM PROGRAMME: 1980 – 1988
deur T Zohary, A C Jarvis, F M Chutter, P J Ashton en R D Robarts

Naam:

Adres:

.....

..... Poskode:

Telefoon: Telefax:

Handtekening: Datum:

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**Die Programbestuurder:
Watergehalte Inligtingstelsels
Divisie vir Watertegnologie
WNNR
Posbus 395
PRETORIA
0001**

Bylae tot SA *Waterbulletin* April/Mei 1989

sion expression. Outliers, anomalies and hyper- or insensitivity of the surfaces were thus detected and corrected.

MAPPING MAP

The techniques of mapping MAP fall into two broad categories, viz trend surface analysis based on multiple regression and direct interpolation. The merits of trend surface analysis and direct interpolation were investigated. A combination of the regression surface and the surface generated by interpolating between the residuals was considered to be the most pragmatic solution. The surfaces of MAP only have real merit if their quality is known. Therefore, residual analyses and estimation of confidence levels of regression estimates were performed on the MAP-data.

MEAN MONTHLY AND OTHER RAINFALL STATISTICS

The surface of MAP provided the foundation for the mapping of mean monthly rainfall and the variability of monthly and annual rainfall. The amount of work involved in producing separate regression expressions for each of the monthly surfaces and for each of the abovementioned statistics was prohibitive. An alternative technique which established the ratio between the mean monthly rainfall and MAP at station points was therefore employed. These ratios were interpolated onto a regular grid and then multiplied by the MAP image. The resultant image was one of mean monthly rainfall which fitted the observed data exactly at station points and followed the general shape of the MAP surface in areas between stations. Similar techniques were employed to produce images of monthly and annual variability of rainfall.

HOMOGENEOUS RAINFALL REGIONS

The primary reason for delimiting rainfall regions was to provide a logical, physically based division of the rainfall stations so that the regression analyses could proceed using areas which were both manageable and meaningful.

The delimitation of 712 homogeneous rainfall regions proceeded in the following manner. A classified image of altitude of the entire Southern Africa was printed at a resolution of 1 minute of a degree. Super-

imposed on this image were the locations of all stations with 10 or more years of record. The MAP at each station was noted at the station point. Thereafter followed the careful, patient and very time consuming process of delimiting homogeneous rainfall regions based, inter alia, on MAP, altitude and aspect whilst keeping the regions reasonably small and consulting 1:250 000 topographic maps in order to provide a more detailed interpretation of the classified altitude map.

The re-evaluation of the distribution of homogeneous rainfall regions fulfilled one of the major objectives of the project. However, these regions were not used in the regression modelling and final mapping due to the severe problems of merging MAP at boundaries of these small regions. This detailed regionalisation is, however, useful for other applications, inter alia, for delimiting regions of equal agricultural potential and planning requirements, from the climatological point of view.

ISOHYETAL MAPS VS DIGITAL IMAGES OF RAINFALL

Isohyetal maps of MAP provide an efficient and effective means of communicating important and frequently applied information to a wide range of users. In addition, maps are inexpensive, portable and durable. However, printed isohyetal maps do have several disadvantages, e.g.:

- ☐ the scale of the map is fixed,
- ☐ the isohyetal interval is fixed,
- ☐ it is time consuming to estimate catchment mean areal rainfall from these maps,
- ☐ the capture of isohyetal information from maps and into computer compatible form is tedious,
- ☐ the information content on the isohyetal map is fixed insofar as one cannot manipulate these data without first capturing them on computer.

Digital images of all the isohyetal maps were created in the process of producing the maps. These images have been retained on computer tape and are available on request. The digital images have a number of advantages, viz.:

- ☐ the images may be printed to maps at any desired scale,
- ☐ the grid point estimates ensure that no information content is lost due to isohyetal intervals,

- ☐ estimates of catchment or areal mean rainfall can be calculated rapidly,
- ☐ the grid point information can be subjected to any number of manipulations with relative ease,
- ☐ the data are readily transportable (all the abovementioned images for Southern Africa can be contained on one magnetic tape).

M C DENT
S D LYNCH
R E SCHULZE

MAPPING MEAN ANNUAL AND
OTHER RAINFALL STATISTICS
OVER SOUTHERN AFRICA

Report to the
WATER RESEARCH COMMISSION
by the
DEPARTMENT OF AGRICULTURAL
ENGINEERING
UNIVERSITY OF NATAL

WRC Report No 105/1/89
ACRU Report No 27

OTHER USES

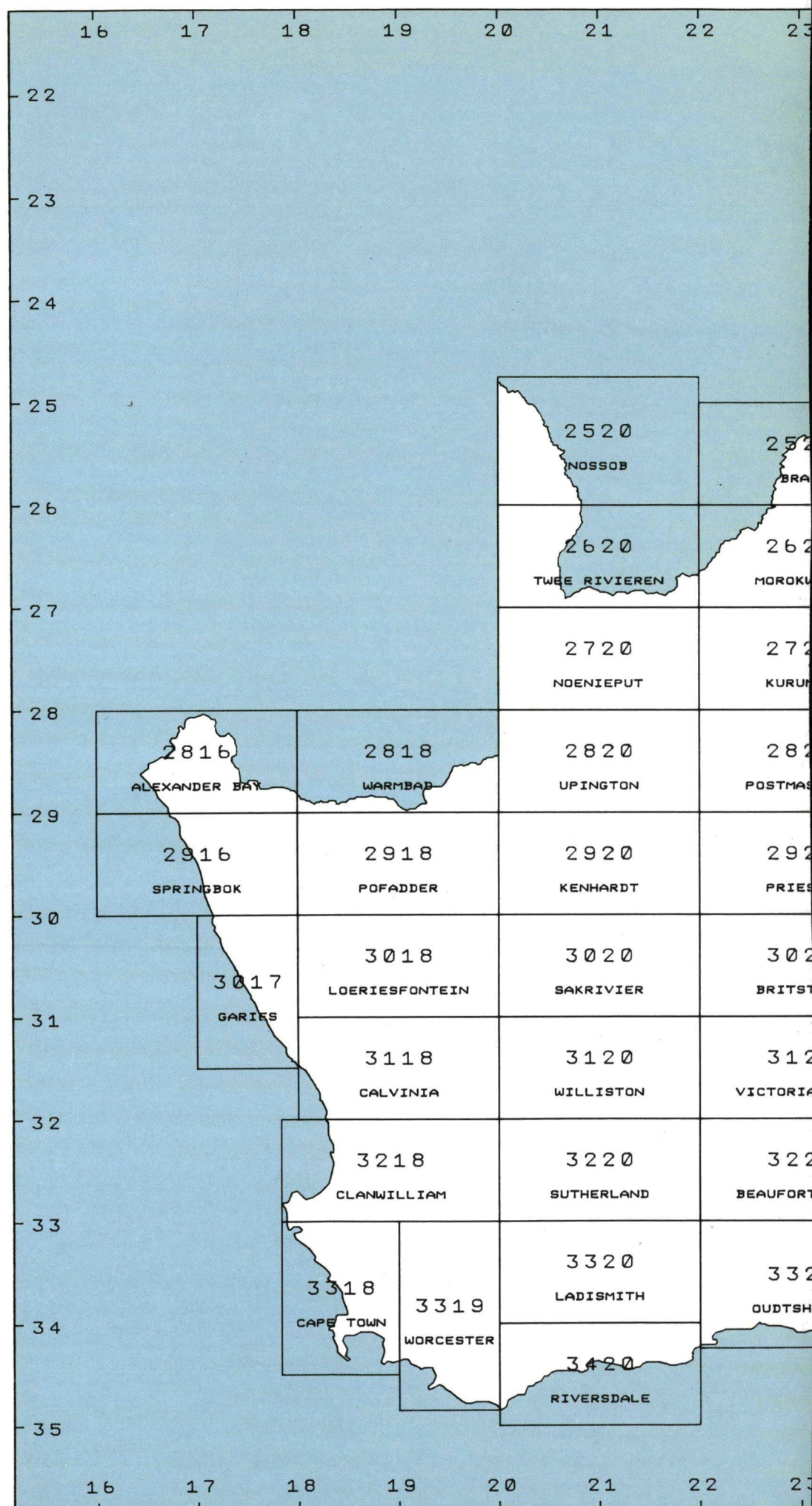
The combination of these images of precipitation statistics, the programs for interpolation and contouring, the monthly data file and the grid of altitude points provides a powerful and valuable new information base to the water research and development community of Southern Africa.


NETWORK EFFICIENCY

It is not one of the objectives of this study to make recommendations on network efficiency. However, a careful visual analysis of the isohyetal maps, on which are printed the rainfall stations used in the analysis, will reveal areas where the isohyetal surface is complex yet the gauge density is sparse. Scrutiny of the confidence level maps will reveal generally that the estimates in such areas have wide confidence limits. These then are the areas in which the networks could be improved. However, this is "easier said than done", since it was probably inaccessibility and economic factors which caused a dearth of station in such areas in the first instances. Of particular note in this regard are many of the mountain catchment areas and the National States, ironically, the very areas where these data are needed most. The platform provided by this project could be used to assist in future research to study network efficiencies and to make recommendations on the placement or removal of stations in any future rationalisation programme on the national rain gauge network.

THE MEAN ANNUAL PRECIPI- TATION ISOHYETAL MAPS

The maps are printed on a transparent medium which may be overlaid on the 1:250 000 map series outlined here. Please use these numbers to order your maps. Circle the appropriate numbers on the order card included in this Bulletin.





The use of Macrophytes in water pollution control

At the IAWPRC Biennial Conference in Brighton, United Kingdom, July 1988, a Specialist group was formed to cover the increasing attention, research and application of the use of Macrophytes in Water Pollution Control, including the Reedbed or Artificial Wetland technologies.

The main objectives of the group are:

- ☐ To serve as a communication link between individual scientists working with the scientific and technical aspects of using Macrophytes for water pollution control and resource recovery.
- ☐ To contribute to the co-ordination of research activities in this field and to promote exchange of results and needs in order to prevent the duplication of effort and expense.

The concept of a Specialist Group to coordinate research into the Use of Macrophytes in Water Pollution Control had its beginnings at a seminar held in Brazil in August 1986. From the interest shown there in the topic, a proposal had been submitted to IAWPRC to form a new group on Use of Macrophytes in Water Pollution Control.

The chairman of the group is Dr Hans Brix of the University of Aarhus, Botanical Institute, Denmark. The secretary of the group is Mr PF Cooper of the Water Research Centre, Stevenage, England, and the regional coordinator for Australia, Dr Tom Davies; for Asia Dr H Orth; for North America Dr D Hammer and for Africa Dr A Wood. Regional coordinators for South Africa and the Middle East remain to be decided.

The programme of activities consists of:

- ☐ exchange of scientific and technical information through news letters or reprints
- ☐ organisation of workshops and conferences for technology transfer
- ☐ co-ordination of design guidelines
- ☐ establishment of guidelines for reporting performance of macrophyte based wastewater treatment plants
- ☐ development of a comparative performance data-base for macrophyte systems and dissemination of useable information to potential users
- ☐ compilation of a directory of research programmes

- ❑ sponsorship of communication on particular topics
- ❑ development of a commonly accepted conceptual model on the functionality of macrophyte based systems

It has been suggested that a conference should be arranged in mid 1990, probably as a cooperative initiative of the IAWPRC, the EC Expert Contact Group on Emergent Hydrophyte Treatment Systems and the European Water Pollution Control Association. It is hoped that the useful research and development of the technology being undertaken in South Africa will be presented at this conference.

As an introduction to the increasing International interest in Wetland Wastewater Treatment technology, the following brief resumé has been compiled on the current international research activities in the 'Use of Macrophytes in Water Pollution Control'.

AUSTRALIA



Several research scale facilities are being investigated both by professional research organisations, such as the CSIRO and the Chisholm Institute of Technology, and interested Water Authorities. The research is principally directed at evaluating the use of artificial wetlands for wastewater treatment, and the role of emergent aquatic plants, in subsurface flow systems as well as shallow-lagoon aquatic plant systems.

The research has also led to the implementation of small scale units to treat sewage effluent of a small village in Papua New Guinea, using Phragmites reed planted in a gravel substratum.

AUSTRIA



Austria was one of the earlier countries to adopt the wetland treatment technology. There are presently a number of full scale operating systems, principally treating domestic sewage, as well as a number of research facilities. The Mannersdorf units have been under investigation for 8 years by the University of Soil Science, Vienna, based upon the Root-Zone, soil substrata design. Recent research is also investigating the effects of macrophyte vegetation to improve the water quality in eutropic lakes. Despite the cold winter conditions, the beds are reported to continue to perform satisfactorily, even when subjected to heavy snow.

BELGIUM



The University of Gent is investigating the potential of constructed wetlands for the advanced treatment of industrial and domestic wastewater either by means of flow - through or percolation fields where a verticle flow regime is operated. Soil hydraulic problems have been experienced in some Belgium systems and recommendations now suggest soil profile and

infiltration studies prior to implementastion and avoidance of compaction during construction and operation.

BRAZIL



The floating Water Hyacinth systems are being investigated in Brazil for domestic wastewater treatment and the upgrading of polluted river systems.

CANADA



The Saskatchewan Research Council has been evaluating the efficiency of the wetland systems exposed to long and severe winter which may limit the yearround operation of certain of the designs and macrophyte species. The study pertains to the long-term behavior of some aquatic plants in a nutrient rich environment, their ability to remove phosphorus and nitrogen from municipal effluents, and the possibility of using the harvested plants as animal feed.

CZECHOSLOVAKIA



Research underway in Czechoslovakia on the use of aquatic macrophytes for waste management is part of a broadly conceived project on the adaptability of aquatic and wetland plants to the highly variable environmental conditions in wetlands and shallow waters, both lotic and lentic. A national working group "Use of Green Plants for Improvement of Water Quality" has been established to coordinate research direction and application. Floating macrophytes, including algae, water hyacinth and duckweeds are being investigated as well as reedbeds for the treatment of sewage from recreation sites, small villages, an observatory and gardening sites.

DENMARK



More than 1000 reed bed systems are operating in Denmark, most of them for small villages, with many more in the process of construction by companies specializing in reed bed construction as a complete package.

The Botanical Institute of Aarhus University is investigating the treatment of wastewater in constructed wetlands at a number of pilot and full scale systems in Denmark. Research is also evaluating the gas exchange and internal gas transport mechanisms and pathways in aquatic plants, and the ecology of swamp plants and vegetation in the lake littoral zone.

At the Engineering Academy of Denmark the suitability of various crop and field plants as nutrient salt removers in fishfarms is

being investigated at the pilot scale, as well as the use of Iris as a macrophyte in the root-zone technique for upgrading the quality of fish farm recirculation waters.

WEST GERMANY



Data has been collected from 188 reed bed plants constructed in Germany, although it is reported that the total number is much higher. Of the 188 systems 155 were in operation in 1988, 131 treating domestic sewage and 24 treating other wastewaters, including recreation sites, tip leachate, brewery effluent, creamery waste, dyeing factory and oil-bearing effluents.

The Bavarian State Bureau for Water Management is evaluating the performance of wetland systems through a coordinating committee for "Sewage Treatment in Helophyte bed Systems" of the German Group on "Emergent Helophyte Treatment Systems". A National Database for logging design and performance data of German reed bed plants has been established.

The Institute for Biotechnology is also investigating the elimination of nitrate in contaminated ground and tap waters with the aid of artificial wetlands, gas exchange properties of artificial wetlands and the fate of nutrients and other pollutants (ie pesticides) in artificial wetlands.

FINLAND



A large amount of research is being performed in Finland on the leachate discharges of sanitary land fills, infiltration and hydraulic conductivity and management of tree plantations in landfill management and vegetation coverage.

FRANCE



The CEMAGREF scientific and technological organisation is evaluating both research and full scale emergent macrophyte systems based on the gravel bed substrata approach of Seidel. The research is directed at providing guidelines and design criteria of an available type of Emergent Hydrophytes plants for rural communities. This will include optimisation of design and dimensioning of primary, secondary and tertiary stages, long term performance for sewage treatment and evaluation of the role of the macrophytes.

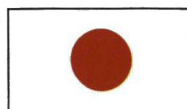
INDIA



The National Environmental Engineering Research Institute of India is researching macrophyte systems in order to develop low

cost wastewater treatment systems to provide tertiary treatment to the wastewater and development of design criteria for field trials.

JAPAN



The Research Institute for Bioresource of Okayama University is undertaking research to develop guidelines for the practical use of Water Hyacinth as a purification system of the resource-saving and energy-saving type. The relationship between growth rate and nutrient concentration and effective harvesting regimes are being investigated in laboratory and field cultivation systems.

The Technical Takenaka Research laboratory is researching the treatment of natural waters such as lakes, rivers and channels by cultivating Water Hyacinth as a valuable resource, whilst the Ministry of Transport is evaluating the application of emerged aquatic macrophytes to water quality improvement along the eutropic coast to remove excess nutrients in coastal areas.

The National Institute for Environmental studies is investigating the water purification of lakes, ponds and rivers by applying the physical and ecological purification capacity of Reed fields.

LUXEMBURG



Several full scale wetland systems are in operation and under construction in Luxembourg under the coordination of the EEC - Expert Contact Group.

NETHERLANDS



Research since the early 1970s has resulted in the establishment of many wetland systems to treat sewage from urban and rural and recreational sites, particularly where there is a marked seasonal variation in load and treatment requirements. Treatment efficiency of various system designs and operation is being evaluated, in association with mechanisms of purification, groundwater protection, seasonality, economics and design optimisation.

SWEDEN



Landfill leachate treatment and reuse in pinetree (Salix) plantations is under investigation to develop alternative on-site leachate management system which could imply environmental as well as economic advantages. Similarly, a six year field study on sewage sludge fertilisation of Salix stands will be completed during 1989. The Graduate School of Theme Research is

studying the economic and societal feasibility of a wetland filter compared to conventional wastewater treatment methods, as well as the physiological potential for wetland systems for wastewater treatment.

THAILAND



The Asian Institute of Technology is evaluating a combined overland flow macrophyte pond system to compare the suitability of various macrophytes for wastewater treatment, investigating the main processes contributing to the overall treatment efficiency, and the development of design criteria and operational guidelines.

UNITED KINGDOM



The Strathclyde University is examining the effectiveness of reed beds to polish effluent from sediment lagoons receiving surface and groundwater from open-cast coal mines. The focus being on an iron removal and pH buffering.

Portsmouth Polytechnic are studying primary modifications of the Nutrient Film Technique for agricultural reuse of fully treated sewage effluent in growing a range of crops. Gravel bed hydroponic systems planted with *Phragmites*, *Carex* and *Spartina* receive primary settled domestic sewage effluent prior to crop production beds.

The Water Research Centre are coordinating research on reed bed systems at the sites being operated by regional water authorities for the treatment of primary, secondary and tertiary effluents. The majority of the full scale reedbeds are based upon the Root-Zone process although research is evaluating gravel systems and modifications of the soil systems to enhance permeability and treatment efficiency.

UNITED STATES OF AMERICA



The Reedy Creek Energy Services are conducting experiments at the Walt Disney World Resort Complex into the optimisation of design and management parameters of aquatic macrophyte-based treatment systems. Parameters include system type (eg ponds, gravel or sand beds) plant species, substrate type, wastewater loading rate and mechanical aeration. An anaerobic digester is utilised for methane production studies using plant biomass and municipal wastes.

The Tennessee Valley Authority have established a number of full scale demonstration constructed wetlands to:

- ☐ evaluate the relative advantages/disadvantages of constructed wetlands
- ☐ to determine the ability to comply with discharge consent requirements

- ☐ to evaluate basic design and operational factors and develop criteria

- ☐ to evaluate cost-effectiveness and

- ☐ to promote the technology and transfer to users and regulators.

Demonstration systems are investigating primary and secondary domestic wastewater treatment in subsurface and surface-flow systems, marsh-pond-meadows, and modified natural wetlands. Agricultural waste treatment, Acid Mine Drainage and Industrial Wastewaters are also being extensively evaluated both at the pilot and full scale.

SOUTH AFRICA



Research is now being undertaken at a number of locations in South Africa to evaluate the potential of natural and constructed wetlands for wastewater treatment and acid mine drainage control.

The Division of Water Technology of the CSIR in Pretoria has established a research programme to investigate the fundamental and applied aspects of the concept. The research includes studies into the role of the substrata in terms of their contribution to the oxidative degradation of pollutants and improved soil permeability; and the role of the operational factors in terms of effluent types, loading rates and retention times and whether the system is operated in a horizontal or vertical mode.

Umgeni Water have been operating a vertical flow reed bed receiving biofilter effluent at Mpophomeni in KwaZulu and are undertaking research to improve permeability problems with the system whilst maintaining treatment efficiency. Similarly, trial systems have been established at Grootvlei and Lethabo power stations, Secunda and in Gazankulu with variable degrees of success.

A system being studied by the Witwatersrand University and Johannesburg Municipality is designed to model the mechanisms, and efficiency of natural wetland systems in achieving nutrient and pathogen removal.

Although several systems are presently at the design and construction stage for primary and secondary domestic effluent treatment, the concept is still relatively unknown and unproved outside the scientific community despite the obvious attractions it holds.

For the technology to be generally accepted, full scale demonstration projects, similar to those highly acclaimed in the USA, are required to investigate treatment effectiveness on various wastewaters with different types of design.

Information concerning the group's activities, and information on systems in the research, design or implementation stage which would be of interest to the group and interested parties as a whole, can be directed to Dr A Wood, regional Co-ordinator for Africa, at Steffen, Robertson and Kirsten Inc, PO Box 8856, Johannesburg 2000. Telephone number: (011) 492-1316.

A Water Research Commission report (No 165/1/89) outlining the research undertaken by the Department of Civil Engineering, University of Cape Town, into the evaluation of bulking control in long sludge age systems, (in particular nitrogen and nutrient removal ones) is now available from the WRC.

Activated sludge bulking control methods evaluated

The objectives of the research were to:

- identify the filamentous organisms causing bulking in nutrient removal systems in South Africa,
- evaluate non-specific bulking control with chlorination on biological N and P removal, and
- evaluate specific bulking control procedures for long sludge age systems, in particular the role of aerobic, anoxic or anaerobic selectors for bulking control in nitrogen (N) and nutrient (N and P) removal systems.

In the survey, which covered 33 out of about 45 nutrient (N and P) removal plants in South Africa, the six most frequently dominant filamentous organisms were found to be 0092, dominant in 82 per cent of plants, 0675 in 45 per cent, 0041 in 39 per cent, *Microthrix parvicella* in 33 per cent, 0914 in 33 per cent and 1851 in 21 per cent. In a different order these 6 filaments are also the six most frequently dominant ones in all (96) activated sludge plants most of which are nitrogen (N) or nutrient (N and P) removal plants. Four of the 6 filaments sort into the low F/M1 (low Food/Micro-organism ratio or equivalently long sludge age) group of filaments.

Chlorination bulking control was investigated on a Modified UCT (University of Cape Town) system with a bulking sludge caused by 0092, *M.parvicella* and 0914. Following the procedure set out in the Manual on Causes and Control of Filamentous Bulking and Foaming by Jenkins, Richard and Daigger, it was concluded that chlorination is a viable method without significant reduction in biological N and P removal.

With regard to specific bulking control of low F/M filaments, the promoted method is system configuration modification so as to incorporate alternating feed-starve conditions such as intermittent (batch) feeding, multi-reactor or plug flow systems or

completely mixed systems incorporating selector reactors. The mechanism whereby these systems apparently effect control of the low F/M filaments is hypothesized to be by the preferential removal of the readily biodegradable COD (RBCOD) at a high concentration and rate by the floc-formers at the time of feeding in intermittently fed systems, at the influent end of plug flow or multi-reactor systems or in the selectors.

The above mechanism and systems for controlling low F/M filaments were investigated and the following conclusions emerge from this work:

- The alternating feed-starve conditions imposed by
 - (i) intermittent feeding to completely mixed reactor systems,
 - (ii) selector reactors (aerobic) incorporated in continuously fed completely mixed systems

under aerobic or anoxic conditions stimulate in the mixed liquor a high readily biodegradable (or dissolved, 0.45 µm filtered) COD (RBCOD) uptake rate. The RBCOD uptake rate is 2 to 3 times higher than in systems which do not have alternating feed-starve conditions, such as continuously fed completely mixed systems. If the conditions are aerobic the high RBCOD uptake rate gives rise to an associated high initial oxygen uptake rate under batch conditions; if the conditions are anoxic, it gives rise to an associated high (initial) nitrate uptake rate under batch conditions. For convenience, a sludge in which a high RBCOD uptake rate has been stimulated, is said to have acquired a "selector effect". The selector effect can be stimulated or lost in a period of less than a sludge age in long sludge age systems by introducing or eliminating alternating feed-starve conditions. The acquisition of a selector effect by a sludge under alternating feed-starve conditions is in agreement with the literature.

- Low F/M bulking sludges (Diluted Sludge Volume Index, DSVI > 250 ml/g and containing usually in varying proportions, 0092, *M.parvicella*, 0914, 0675, 1851 and 0041 filaments) from long sludge age full-scale nitrogen removal plants, when used to start up laboratory scale long sludge age activated sludge systems under fully aerobic conditions invariably ceased bulking (DSVI < 80 ml/g) within a month irrespective of whether or not the system stimulated a selector effect. Evidently, in long sludge age fully aerobic systems, the selector effect was irrelevant because the low F/M filament growth was suppressed both when the selector effect was present or absent.
- In long sludge age (low F/M) systems in which there was no selector effect, when bulking was observed, it was not due to proliferation of low F/M filaments but due to the low dissolved oxygen (DO) filament *Sphaerotilus natans* and/or septic sewage filament *Thiothrix*. Curiously, *S.natans* has not yet been observed to cause bulking in South African full scale long sludge age plants and *Thiothrix* only rarely.
- It was established that *S.natans* proliferation in laboratory units can be caused by seeding from *S.natans* attached growth on the feed line walls. This artefact seems to have been present in many laboratory scale studies throughout the world because numerous investigators have reported the proliferation of *S.natans* in their laboratory units under a wide range of operating conditions.
- The selector effect (i.e. aerobic selectors and intermittent feeding conditions) controlled the proliferation of *S.natans* and *Thiothrix*. This observation is in conformity with results reported in the literature. The success of the selector



D M D GABB D JENKINS
D A STILL M C WENTZEL
G A EKAMA G v R MARAIS

**DEVELOPMENT AND FULL SCALE
EVALUATION OF PREVENTATIVE
AND REMEDIAL METHODS FOR
CONTROL OF ACTIVATED SLUDGE
BULKING**

Report to the
WATER RESEARCH COMMISSION
by the
DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF CAPE TOWN

Copies of this report entitled
"Development and full-scale
evaluation of preventative and
remedial methods for control of
activated sludge bulking" can now
be ordered from the Water
Research Commission, P O Box
824, Pretoria, 0001. Please
complete the postcard in this
Bulletin.

effect in controlling bulking by *S.natans*
and *Thiothrix* in laboratory scale sys-
tems possibly contributed to the notion
that the selector effect also controls low
F/M filament proliferation.

- The research programme was contin-
ued by investigating the earlier obser-
vation that purely aerobic conditions
ameliorated bulking by low F/M fila-
ments irrespective of the presence of a
selector effect. Three single reactor
systems were set up all at the same
sludge age (20 days), received the same
sewage, and started up with a low F/M
bulking sludge from a laboratory scale
nutrient removal (Modified UCT) sys-
tem; two were purely aerobic, one
intermittently fed, the other contin-
uously fed and one was anoxic (1/2
hour) - anaerobic (5 1/2 h) - aerobic
(16 h) and intermittently fed. The
DSVI in the two purely aerobic systems
declined and bulking by the low F/M
filaments was ameliorated while over
the same period, the DSVI remained
high and the low F/M filaments contin-
ued to proliferate in the parent Modified
UCT system and in the anaerobic-aer-
obic intermittently fed system. This indi-
cated that (i) continuous aeration inhib-
its the growth of most of the low F/M
filaments, (in particular *M.parvicella*,
0092 and 0914) irrespective of whether
the conditions are alternating feedstarve
(intermittently fed) or completely mixed
(continuously fed), and (ii) in systems
with alternating unaerated:aerated con-

ditions the low F/M filaments continue
to proliferate.

- To grow low F/M filaments in laboratory
systems other than nutrient removal
ones, long sludge age single reactor
continuously fed completely mixed sys-
tems with intermittent aeration (1 min-
ute air on, in a 10 minute cycle with
peak DO 2,0 mg/l) were set up. It was
found that in these systems most (but
not necessarily all together) of the low
F/M filaments proliferated (DSVI > 300
ml/g), in particular *M.parvicella* and 0092,
but also 0914, 0041, 0675 and 1851.
Switching from intermittent aeration to
continuous aeration caused a sharp
decline in bulking (DSVI < 80 ml/g in
under one sludge age) with a concomi-
tant reduction in low F/M filaments;
switching back to intermittent aeration
caused regrowth of the low F/M fila-
ments and associated bulking (DSVI >
300 ml/g).
- Installing an aerobic selector (which
stimulated a selector effect) on a single
reactor intermittent aeration system did
not control most of the low F/M fila-
ments; the DSVI remained above 280
ml/g for over 5 sludge ages.
- Aerobic selectors and anaerobic reac-
tors stimulate removal of RBCOD by
floc-formers. Because these do not
control low F/M filament proliferation, it
would appear that the influent readily
biodegradable COD does not play an
important role in low F/M bulking.

RESEARCHERS DEVELOP NEW PORTABLE TOXICITY DETECTOR FOR WATER

A research project funded by the Water Research Commission has led to the successful development of a portable toxicity detector for water.

The detector was designed to satisfy the need for a low-cost, portable instrument for the measurement and processing of extremely low light levels emitted by certain bioluminescent compounds. The instrument is to be employed to detect hazardous materials in surface and drinking water supplies in the laboratory and/or field rapidly, simply and cost effectively.

Bioluminescent reactions, which are adversely affected by hazardous toxic compounds, have proved viable for the detection of such compounds in water. However, the instrumentation utilized thus far to detect the low light outputs of such biochemical reactions, depending as it does on the use of photomultipliers, is energy demanding, fragile and expensive. Such instrumentation is not suitable for use in the field.

Experimental development work carried out by WSG Morgan and PC Kühn at CSIR's Division of Water Technology and the Industrial Electronics division of Production Technology resulted in a prototype, single channel detector (LUCID 1) which was capable of providing reliable detection of these biochemical light emissions.

Subsequently an optimized, dual channel instrument incorporating a microcomputer which could be programmed to provide automatic indication of toxic hazard in water samples, was fabricated (LUCID 2).

The instrument comprises a detector cell having two identical lighttight chambers and two channels for measuring the extremely low light levels emitted by the biological or biochemical samples contained in two small vials inserted therein. Temperature control is affected by circulating water from a temperature controlled bath through the detector cell.

Unique analogue electronic circuitry provided sufficient sensitivity, resolution and signal-to-noise ratio to achieve a meaningful correlation between the LUCID 2 instrument and a standard laboratory luminometer.

A dedicated microcomputer unit measures the processed light signals from both channels and displays the light output from both channels on a 16 character Liquid Crystal display panel.

The instrument is interfaced with a dot matrix printer which depicts peak height and peak area for the light output from each sample. The presence of hazardous substances is evaluated using a software expansion capability which compares the light output of a test and control sample.

The instrument is self-contained, battery operated with built-in battery charger and of a size and weight suitable for field use.

Laboratory simulation experiments inves-

W S G MORGAN
P C KÜHN

DEVELOPMENT OF A PORTABLE TOXICITY DETECTOR FOR WATER

Report to the
WATER RESEARCH COMMISS
by the
DIVISION OF WATER TECHN

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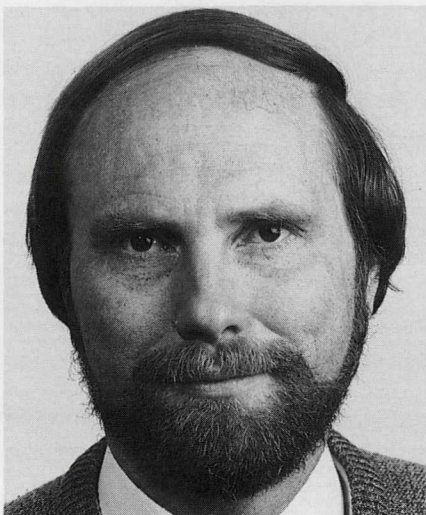
*Dr WSG Morgan and
Mr PC Kühn, the researchers
and authors of the report.*

Investigating the effects of six toxicants upon the bioluminescent output of the bacterium *Photobacterium phosphoreum* have indicated that the instrument is capable of detecting, within 15 minutes, levels of toxicity equivalent to those of the standard 96-h fish bioassay.

LUCID 2, therefore, detects toxic effects successfully and its level of sensitivity compares well with standard bioassays presently being employed.

For further information on the electronic hardware and software, please contact Dr WSG Morgan, Division of Water Technology, CSIR, PO Box 395, Pretoria 0001.

A final report entitled Development of a portable toxicity detector for water is available from the Water Research Commission, on request. To order, please complete the post-card in this Bulletin.

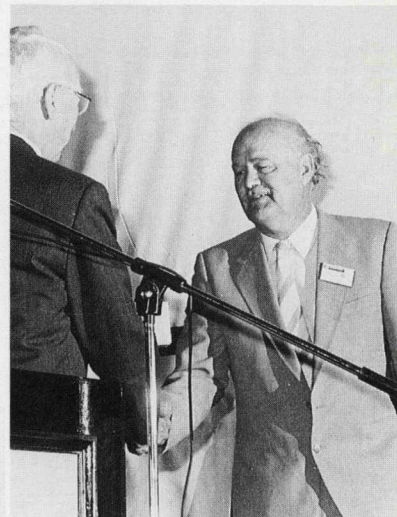


IWSA NEWS · IWSA NEWS



THE HATFIELD AWARD is given for outstanding water treatment plant operation and has been won by Mr Deon Engels of the Vereeniging Town Council. Here Mr Engels (right) accepts the award from Mr Arthur Saarinen, Vice- President of WPCF.

AWARDS PRESENTED AT WISA CONFERENCE



THE BURKE AWARD was established to promote safety programs and the collecting and report of injury data at municipal and industrial wastewater facilities. The award was presented to the Germiston and Benoni Municipalities and accepted by Mr JP Marais, Chief Chemist of Benoni (top) and Mr AN Dell, City Engineer of Germiston (bottom).



THE UMGENI WATER AWARD is a cash award to the value of R500 to the author(s) of a paper which according to the WISA Council, makes a noteworthy contribution to water science or engineering. The award was won by Mr JA Slim (second from right) and Mr RW Wakefield (right) from Port Elizabeth Municipality for their paper entitled "The utilisation of sewage sludge in the manufacture of clay bricks".



THE WILSON AWARD acknowledges the combined competence and initiative of the owner and works manager of a wastewater treatment works. This year the award has been won by the King William's Town sewage works. Mr CJ Swart (right) superintendent and Mr I Crawford the Borough Engineer, (centre) accept the award from Dr James Barnard, Chairman of WISA.



IWSA NEWS · IWSA NEWS ·

Presidents of the International Water Supply Association (IWSA) seem to find their way to Southern Africa these days more easily than in the past and very welcome they are too. For many years the only time we saw the President of the IWSA was at the biennial congress, wherever it happened to be held.

In June 1988 Jan Dirickx, during his term of office, accepted an invitation to deliver the keynote address at the Seminar on Water Supply and Sanitation, KwaZulu. The new President, elected at the last biennial congress in Rio de Janeiro, is Bill Richardson from Chicago, Illinois. Bill was among the distinguished overseas speakers taking part in the first biennial conference of the Water Institute of Southern Africa, held in Cape Town at the end of March this year. Drawing on his wide experience, he presented a paper on The Ingredients Necessary for Successful Operation and Maintenance. It was not possible for him to address a meeting of the SA National Committee of the IWSA, but several members were able to meet him personally in Cape Town. However, during his short time in this country he was able to visit the Rand Water Board, Umgeni Water and the Chairman of the National Committee, Bob Laburn.

WATER SUPPLY AND SANITATION: TRANSKEI

The National Committee, through its Water Decade Subcommittee under the chairmanship of Lucas van Vuuren, is planning the fifth and final seminar in the Decade. Past seminars in the series have been held in Venda, Ciskei, Bophuthatswana and Durban (KwaZulu). The emphasis in the next one will be on the situation in the Transkei and the venue chosen is the University of the Transkei at Umtata. The

dates will be from 26 to 28 June 1990. The first meeting of the Organising Committee has already been held in Umtata and more details will be available soon, but in the meantime, keep the dates clear.



Mr Bill Richardson, President of the International Water Supply Association.

MEETING OF SCIENTIFIC AND TECHNICAL COUNCIL, BERLIN

As well as being Chairman of the National Committee, Bob Laburn is also South Africa's representative on the policy making body of the IWSA, known as the Scientific and Technical Council. He recently returned from a meeting of the STC in Berlin at which the programme for the 1991 Biennial Congress in Copenhagen was discussed. The number of subjects to be handled in the form of general reports will be increased to nine as follows:

- ☐ Setting up a legal system for water supply.
- ☐ Influencing the machinery of Government.

- ☐ Changing water demand influences economic bases.
- ☐ Evaluation of resources protection policies.
- ☐ Requirements for the quality of drinking water.
 - ☐ The development of membrane technology.
 - ☐ Unaccounted-for water and the economics of leak detection.
 - ☐ Corrosion problems in water distribution systems: the practical/general diagnostic approach.
 - ☐ Expert and information systems in water supply.

The technical programme at IWSA biennial congresses is made up of general reports and special subjects. In Copenhagen there will be 14 special subjects, each one covered by three separate authors:

Resources

- ☐ Air pollution and its consequences on soil and water.
- ☐ Micropollutants (through the aquifer and in long term storage).

Quality and Treatment

- ☐ Nitrate removal.
- ☐ Tastes and odour - new methods of identification and control.
- ☐ Fast methods of bacterial and viral research.
- ☐ Toxicological basis of norms for the quality of drinking water.
- ☐ Water quality and the relationship with the consumer.
- ☐ Interaction of pipes and water.
- ☐ Presence and effects of aluminium in drinking water.

Management

- ☐ Public or private?
 - Management of water supply
 - Comparison of efficiency.



Overseas guests of honour enjoying the mayoral reception during the WISA Conference in Cape Town. From left: Mr WH Richardson, President of IWSA, Mrs Richardson, Cape Town Mayor, Alderman Peter Muller, Dr JL Barnard, Chairman of WISA, Mrs Saarinen, Mr AW Saarinen, Vice - President of the Water Pollution Control Federation (USA), Mrs Truesdale, Prof D Strauch, University of Hohenheim, Germany, Mr GA Truesdale, President of the Institute of Water and Environmental Management (UK) and representative of the European Water Pollution Control Association and Mrs Strauch.

Distribution and Instrumentation, Control and Automation

- ☐ Rehabilitation of pipelines, internal linings.
- ☐ Possibilities of influencing water demand.
- ☐ Remote reading of water meters.

General

- ☐ Agriculture and water supply (non-point source pollution).

If you would like more details about the programme for Copenhagen, contact the Secretary, Phil Coombs, at (012) 841-2231.

FOUNDATION FOR THE TRANSFER OF KNOWLEDGE

A new IWSA development is the establishment of the Foundation for the Transfer of Knowledge, which takes the place of COCODEV, the Committee for Cooperation in Development. The reader could be forgiven for thinking that a completely new academic institution is about to be set up. The reality is much more basic. Quoting from the Foundation's brochure, "Increasingly, worldwide funds have become available for capital investment in develop-

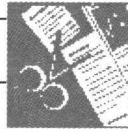
ing countries to counter deficiencies in water supply, improve treatment and increase distribution. All too often, however, capital works cannot in themselves provide answers to water problems. Unless the works and systems are managed, operated and maintained to consistently high standards by local staff after works are commissioned, the benefits are quickly lost and large capital sums are wasted. Investment in infrastructure is only successful when there is a parallel investment in people to manage it well.

"The IWSA Foundation for the Transfer of Knowledge has been established to provide for this management and operational training need. It offers training in the widest possible range of management and technical skills to achieve a functional, not theoretical benefit in improved standards and more efficient service in water supply."

The Trustees of the Foundation include Jan Dirickx (Chairman), Brian Thorpe CBE, Dr Maarten Schalekamp and Leonard Bays. The indications are that we shall be hearing much more about the Foundation in the near future.

PHIL COOMBS
SECRETARY

TELEPHONE NUMBER: (012) 841-2231.



KEMPSTER RECEIVES DOCTORATE

Dr Phillip Kempster, a specialist scientist heading the Trace metal laboratory at the Hydrological Research Institute (HRI) at Roodeplaatdam, was recently awarded his doctorate by the University of Pretoria.

Born in Pretoria he matriculated at the Pretoria Boys' High School in 1964. He obtained a B.Sc degree in 1967 majoring in physics and mathematics. He then studied medicine, but preferring research, he became involved in water research shortly after obtaining the MBChB degree.

Trace metal analysis is today his specialist field. He piloted the trace metal laboratory at the HRI. In both his M.Sc. and D.Sc. studies he explored the Inductively Coupled Plasma Emission Spectrometer (ICP spectrometer) and its use in detecting trace metals. Among others he redesigned the spraychamber of the ICP spectrometer to improve its efficiency. The ICP spectrometer is extremely useful in analysing polluted water and solid waste material. Dr Kempster is also much involved with the formulation of water quality criteria.

This shy, unassuming researcher also has a specialist hobby - in his spare time he grows orchids. He also enjoys gardening, cycling and reading.

NUWE ASSISTENT-REDAKTRISE

Mej Helene Joubert is as assistent-redaktrise van die SA Waterbulletin aangestel. Sy volg mev Ilse Lombard op wat einde 1988 na Tzaneen in Noordoos-Transvaal verhuis het.



Mej Joubert beskik oor 'n B Sc (Hons) graad asook 'n diploma in skakelwerk en was voorheen verbonde aan die Universiteit van Pretoria. Sy is lid van die Openbare Skakelinstituut van Suidelike Afrika (OSISA) en die Suider Afrikaanse Vereniging vir Bedryfsredakteurs (SAVBR). Haar belangstellings sluit onder meer lees, plante, fotografie en Frans in.

SAWIC SERVICES NOW CHARGED FOR

The South African Water Information Centre (SAWIC) has announced that charges will be introduced for their services as from 1 April 1989.

As a result of increasing costs in providing services to clients of SAWIC, the Water Research Commission, which is financing SAWIC, has decided to review the present system in which services are provided free of charge and to recover some of SAWIC operating costs from users. SAWIC has tried to keep these fees as low as possible and will still be providing information at a subsidised rate.

There will be different rates for different groups of users, and certain groups of users, on the Water Research Commission's recommendation have been exempted.

Charges are as follows:

Industry, business and private users

- ☐ Retrospective information searches R75,00 per topic search
- ☐ SDI monthly profiles R100,00 per annum
- ☐ Selected Journals on Water (SJOW) R100,00 per annum

Government Departments, Provincial and Municipal Authorities, State and Semi-state Organizations, Regional Services Councils, etc. and CSIR. (Department of Water Affairs and Water Research Commission are excluded).

- ☐ Retrospective information searches R25,00 per topic search
- ☐ SDI monthly profiles R50,00 per annum
- ☐ Selected Journals on Water (SJOW) R100,00 per annum

Department of Water Affairs, Water Research Commission, Universities and Technikons - staff and students. These users will not be charged for any SAWIC services.

NAVORSINGSBESTUURDER AANGESTEL

Dr Henry Saayman is onlangs by die WNK aangestel as navorsingsbestuurder belas met ontsouting, membraanontwikkeling en chemiese aspekte van nywerheids-uitvloeiels.

Dr Saayman is op Queenstown in die Oos-Kaap gebore. Hy matrikuleer in 1954 aan Monument Hoërskool te Krugersdorp. Daarna was hy aan Rhodes Universiteit verbonde, eers as student en later junior dosent. Sy B Sc hoofvakke was Chemie en Fisika.

Na voltooiing van sy M Sc graad in Chemie

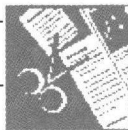
sluit hy aan by die Leernywerheidsnavorsingsinstituut (LNNI) te Grahamstad, waar hy later hoofnavorsingsbeampte word.

In 1967 ontvang hy die graad PhD van Rhodes Universiteit.



Dr Saayman word in 1978 aangestel by die WNNR as hoof van die Organiese Materiale-afdeling by die Bounavorsingsinstituut. Dr Saayman is in die verlede reeds dikwels genooi om as spreker deel te neem aan seminare en simposia, asook om as verteenwoordiger of konsultant op te tree.

In sy vrye tyd restoureer hy klassieke ou motors en beoefen fotografie. Hy speel graag 'n potjie tennis en is lid van 'n boogskutklub.



RIVER DAY

The first River Day was recently held in the western Cape. The purpose of River Day was to create an awareness of the quality of our rivers, stimulating public interest in the conservation of rivers and the water environment. Schoolchildren were introduced to the theme and message "Rivers Give Life, Pollution Destroys" beforehand. On River Day one thousand children throughout the Cape peninsula spent the day cleaning their local rivers.



In various shopping centres displays of posters made the general public aware of rivers and the need to protect South Africa's rivers against pollution.

The Fairest Cape Association worked together with the Wildlife Society and the CPA Nature Conservation in organising events for the day.

It is hoped that River Day will become an official day recognised by the Department of Environment Affairs.

RESEARCHER WINS BURSARY

The prestigious Margaret Smith Bursary in African Ichthyology, which was first presented in 1986, has been awarded for the third time to Mr Glenn S Merron, of the J L B Smith Institute of Ichthyology, at Rhodes University, Grahamstown. Mr Merron's Ph.D. research involves an ecological study of the fish stocks of the Okavango Delta in Botswana.

He is especially interested in the long-term effects of various man-induced impacts on the fish stocks in this unique ecosystem. These include insecticide spraying, river regulation and various forms of commercial, recreational and subsistence fishing pressures. This ecological research is important in providing decision-makers in Botswana with up-to-date quantitative information on the fish stocks so that the impact of potential changes to the fish community can be predicted. "The over-all objective is to ensure the long-term sustainable utilization of the fish resources of the Okavango Delta", Mr Merron said.

Mr Merron received his B.Sc. degree, with distinction at New York University and went on to the University of Michigan, where he received a M.Sc degree, also with distinction, under a leading fisheries scientist, Professor Karl Lagler.

IN MEMORIAM

Dr K A Murray well-known water scientist and author of the book "Wastewater treatment and pollution control" recently died at the age of 78. Kenneth Angus Murray was born in Pretoria on March 29, 1911. He was concerned with wastewater treatment and pollution control problems for over fifty years. His academic qualifications included the following degrees conferred by the University of the Witwatersrand - B.Sc. (chemistry and physics majors), B.Sc. (Hons.) with First Class Honours in Physical Chemistry, M.Sc. in chemistry; and a Ph.D. degree conferred by UNISA.



He also held qualifications in education and bacteriology, viz. - T2 Teachers Certificate and a Higher Education Diploma (University of South Africa); and a Certificate in Bacteriology Applied to Chemistry (Battersea Polytechnic, London).

His experience in the wastewater treatment field started with the City Council of Johannesburg as Chemical Assistant to the late Dr Harold Wilson. He then carried out research on the colloids in sewage at University College, London, under the direction of the late Professor F G Donnan, C B E, F R S. This work was undertaken for the Water Pollution Research Board of the Department of Scientific and Industrial Research. This was

followed by his being appointed as Municipal Biochemist to Germiston, in which capacity he was responsible, inter alia, for controlling the operation of the Rondebult Sewage Purification Works and Farm on commissioning and thereafter for a period of seven years.

He has had experience as an editor of scientific publications and was author or co-author of papers in the fields of wastewater treatment and analytical chemistry.

He practised in the fields of education and research (as a university pedagogue); in wastewater treatment (as a municipal chemist and manager of a sewage treatment company); in the mining industry (as a manager of laboratories - Gold Fields of South Africa, Limited) and in water pollution control (as a water pollution control officer - Department of Water Affairs). During World War II he served in the Royal Navy on secondment from the South African Naval Forces.



PLASTICS VALVE RANGE

A supplementary new range of inexpensive PVC and Polypropylene valves has been introduced by Tubofit (Africa) (Pty) Ltd to complement its existing product range. The new product range which is readily available includes the following:-

A PVC Ball-Type Check Valve in sizes ranging from 20 mm to 110 mm.

Large Bore Diaphragm Valves which are available in PVC, PVDF and Polypropylene and in sizes from 75 mm to 250 mm. A 10 mm PVC Laboratory Valve which is ideally suited for use with flexible hose in small-bore piping systems and laboratory applications. Single and Double Union Polypropylene Ball Valves which are highly competitively priced for heat-fusion or threaded applications. These valves are easily identified by their black colour and have a very good inherent mechanical strength. The single union valve is ideal in crop-spraying equipment and is available in sizes ranging from 20 mm to 63 mm and the double union valve is available in sizes from 20 mm to 110 mm. The Compact PVC Ball Valve, in sizes from 20 mm to 63 mm, is particularly suited to the pool, jacuzzi and low-cost irrigation markets and can be used with the Tubofit Aqua-10 range.

Enquiries: Tubofit (Africa) (Pty) Ltd, P O Box 954, EDENVALE 1610. Tel.: (011) 609-1051.

NEW RANGE OF INJECTION-MOULDED PVC FITTINGS FOR WATER SUPPLY

Tubofit (Africa) (Pty) Ltd has recently launched a range of high-quality, low-cost, 10 bar PVC pressure fittings for water supply. Known as the Aqua-10 range, the fittings have been specifically developed for the South African irrigation market. Although the Aqua-10 fittings are injection-moulded of the highest quality PVC they are priced to compete with fabricated fittings as well as with moulded fittings of a reduced wall thickness previously available. The new range is 10 bar pressure rated at 20°C and is available in sizes ranging from 20 mm to 110 mm. Jointing is done by solvent welding the fittings to the pipe. An important characteristic of the fittings is their light grey colour which has the advantage of a higher ultra-violet resistance when used above ground and provides the discerning user with a clear distinction between the new Aqua-10 low pressure water fittings and the existing 16 bar fittings.

Enquiries: Tubofit (Africa) (Pty) Ltd, P O Box 954, EDENVALE 1610. Tel.: (011) 609-1051.

BURSARY AVAILABLE FOR GEOHYDROLOGY STUDENTS

A study bursary is being made available jointly by the Ground Water Division of the Geological Society of South Africa and the consultants Steffen, Robertson and Kirsten to students following a recognized course in geohydrology at Universities or Colleges. Applicants are invited from citizens of the Republic of South Africa, Transkei, Bophuthatswana, Venda and Ciskei, and of South West Africa/Namibia who are following a recognized course in geohydrology at a University, Technicon or Technical College from 1990. The study bursary is only available for 3rd year, Honours or post-graduate students in the case of a University, or post-diploma students in the case of a Technicon or Technical College. The award of the study bursary will be made at the discretion of the Executive Committee of the Ground Water Division. The maximum amount of the study bursary is R3 000 per annum and will be paid directly to the University, Tech-

nikon or Technical College at which the student is registered.

Applications should be made on the prescribed form obtainable from the Honorary Secretary and should be submitted by 30 September of the previous year. Applicants should indicate the nature and content of the course in geohydrology to be studied. In the case where a research treatise is involved, assistance will be provided by the consultants in the selection and development of a suitable research topic. On completion of the course of study the recipient of the study bursary will be expected to provide the Executive Committee with a short report giving details of benefits derived and the suitability of the course for future students. A copy of the research treatise will also be required.

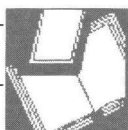
For further information contact the Honorary Secretary, Ground Water Division, P O Box 7015, PRETORIA 0001

JASWIC MEETS IN PRETORIA



Front left (standing) Mr P Cronje (Pretoria City Council), Mr K Rohner (Johannesburg City Council), Mr H C Chapman (Water Research Commission), Mr P Scribante (South African Bureau of Standards). (Seated, from left) Mr R Pinkerton (Durban Corporation), Mr T Proudlock (Chairman, Port Elizabeth Municipality), Mr R Donovan (Secretary, Cape Town City Council).

The joint acceptance scheme for water installation components (JASWIC) photographed at its recent meeting in Pretoria held at the SABS offices. Matters discussed included reviewing the requirements for acceptance of water supply fittings and the publication of the joint list for use by all participating local authorities. JASWIC was originally established for the convenience of local authorities, manufacturers and importers for the approval of fittings in plumbing installations. Previously a fitting would be accepted by one local authority but not by his neighbour, creating problems for the industry. Standardization has now been achieved through the broad implementation of a common list of accepted fittings published by JASWIC regularly.



WATER CONSUMPTION AND POSSIBLE WATER SAVINGS IN APARTMENT BUILDINGS

BY G J MALAN

A report to the Water Research Commission by the Division of Building Technology, CSIR.

Water restrictions and tariffing systems designed to reduce wastage of potable water in urban areas have proved only partially successful in the case of multi-dwelling complexes with bulk metering. An investigation into the effect of individual metering and billing on the consumption of water in apartment buildings in Pretoria and East London has revealed

G J MALAN

WATER CONSUMPTION AND POSSIBLE WATER SAVINGS IN APARTMENT BUILDINGS

Report to the
WATER RESEARCH COMMISSION
by the
DIVISION OF BUILDING TECHNOLOGY, CSIR

WRC REPORT NO 177/1/88

that savings of 20 to 30 per cent are attainable. Individual metering motivates tenants to attend to leaking fittings and is preferred by them to bulk metering. Individual metering would result in increased costs to the local authority, which may not be entirely offset by savings in the cost of water purchased from the bulk supplier. Retrofitting of individual meters in the great majority of existing multi-dwelling complexes is impractical; nevertheless, new buildings should be designed to allow for the installation of individual meters.

Copies of this report is available from the Water Research Commission, free of charge. To order, please complete the postcard in this Bulletin and send it to the WRC, P O Box 824, PRETORIA 0001.

A GUIDE TO THE COAST AND NATURE RESERVES OF TRANSKEI

BY

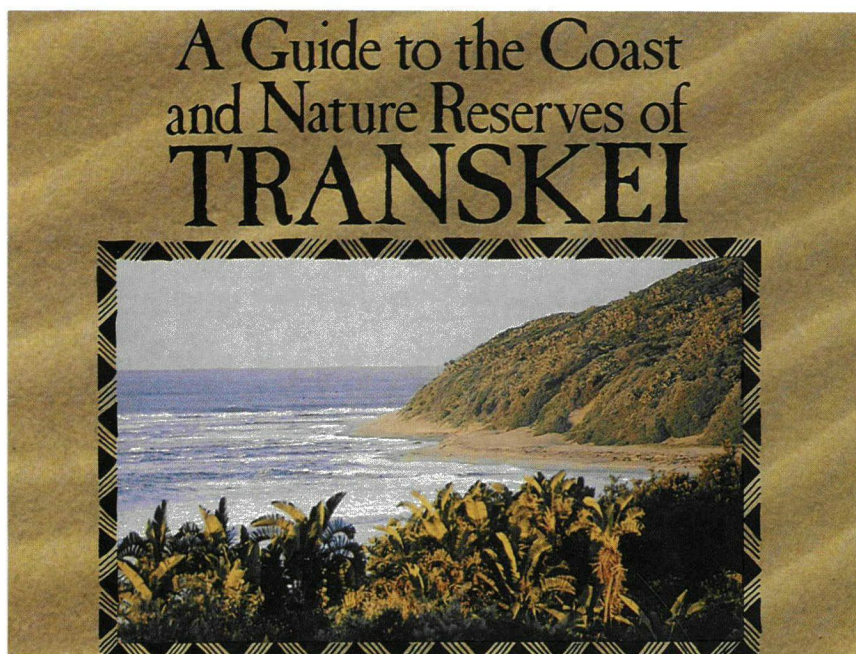
DUNCAN BUTCHART

This well-illustrated booklet concisely describes the coastal ecology and nature reserves of Transkei. Compiled and written by wildlife author and illustrator Duncan Butchart the booklet aims to introduce readers to the natural history of the Transkei coast and to encourage controlled tourism so as not to destroy the fragile coastal ecosystems.

The diverse habitats including rivers and estuaries, grasslands, forests, dunes and sandy beaches along the coast, as well as their characteristic flora and fauna, are described and illustrated.

Each of Transkei's ten nature reserves are discussed with special reference to habitats, bird and animal life in each reserve. Details of available accommodation are also given. Directions of how to reach the reserves and a location map is provided.

The rugged and beautiful Wild Coast Hiking Trail is briefly discussed. A detailed map indicates the route from the Wild Coast Sun to the Kei



Mouth. The more adventurous can tackle the entire route but specific sections can be hiked according to the hiker's preference. Camping sites along the route are indicated on the map and their facilities are listed. Butchart provides the novice hiker with some hints on what to expect and what essentials to take along.

At the back of A Guide to the Coast and Nature Reserves of Transkei a detailed bird, tree and mammal list as well as a list of useful contact addresses and telephone numbers is provided.

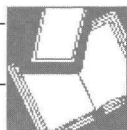
This booklet should be of value to every nature loving hiker or tourist travelling the Transkei. The booklet is visually appealing with 80 colour photographs, maps, diagrams, pencil drawings and watercolour illustrations.

1989 48 pages

ISBN 0 62013 4151

Price : R16,95 (including GST) (please add R1,50 postage).

Available from: The Wildlife Marketing Service, P O Box 44189, Linden, 2104. Telephone: (011) 782-4716/7



THE CULTURE OF SHARPTOOTH CATFISH, *CLARIAS GARIEPINUS*, IN SOUTHERN AFRICA

BY T HECHT, W UYS AND PJ BRITZ (EDITORS)

The report presents the proceedings of a two-day workshop held on the sharptooth catfish farm "Moirah" of Mr W Uys in the Eastern Transvaal in late January 1988. The overall aim of the workshop was to synthesize the available information on the culture of this important species in order to provide a skeletal guideline for prospective entrepreneurs. In the second instance the workshop also served to identify

of fish nutrition and then proceeds to summarize the dietary requirements of sharptooth catfish larvae and juveniles. The important issue of least cost diet formulation is also covered and practical diets for the intensive culture of catfish are recommended.

Chapter 6 provides practical guidelines for the intensive rearing of larvae and the intensive culture of fish in earthen ponds. Guidelines, in terms of stocking, feeding, water supply, size sorting and harvesting are also provided for nursery and production pond management.

Chapter 7 deals with the processing of

Chapter 11 summarizes the technique of cryopreservation of sharptooth catfish sperm. The value in terms of genetic selection and controlled breeding programmes is stressed.

Chapter 12 provides an introduction to the financial planning of a sharptooth catfish farm. This issue alone is as important to the ultimate success of a catfish farm as all the other issues combined.

Chapter 13 summarizes the legal implications in the development of a fish farm. Although there are no specific regulations governing catfish farming the information provided is of cardinal importance for the establishment of a commercial sharptooth catfish farm. The value of this chapter lies in the precise manner in which the channels, which a prospective entrepreneur has to follow in order to commence, have been identified.

Chapter 14 highlights several of the issues discussed during the workshop and suggestions are made for specific projects which should be given priority for future research.

1988: 133 pages

ISBN 0 7 988 4498 1

Available from the Foundation of Research Development, CSIR, PO Box 395, Pretoria 0001.



the research needs for the refinement of husbandry techniques.

Chapter 1 is an overview of the biology and ecology of the species. Particular emphasis is given to the intrinsic value of natural history studies and the benefits of such studies to the intensive culture of the species.

Chapter 2 summarizes the history of sharptooth catfish culture throughout Africa and elsewhere, although particular attention is given to the development of culture techniques on the subcontinent. This chapter also serves as a guide to the literature on clariid culture.

Chapter 3 deals with the important technical issues of site selection and planning as well as pond construction.

Chapter 4 provides a brief overview of artificial propagation of the species and fingerling production. The advantages and disadvantages of various techniques are discussed and recommendations are made how to best achieve success. A design for a catfish hatchery is also provided.

Chapter 5 reviews fundamental aspects

freshwater fish and in particular with sharptooth catfish. Throughout the chapter the provision of a top quality product to the market is stressed.

Chapter 8 deals with the complex subject of introducing a new product onto the market. Pertinent guidelines for the management of marketing are provided.

Chapter 9 reviews the bacterial and viral diseases which have been encountered in clariid fishes. No serious viral or bacterial diseases have been found on southern African sharptooth catfish farms. However, it is predicted that coupled with the upswing in the industry and higher stocking, densities it is inevitable that diseases will manifest themselves.

Chapter 10 lists the parasites that have been found on sharptooth catfish under natural conditions as well as in culture systems. These include protozoans, fungi, monogenetic trematodes, digenetic trematodes, cestodes, nematodes and crustaceans. The authors also refer to the important interplay between the environment and the fish and the reasons for parasite population explosions.

THE HARTBEESPOORT DAM ECOSYSTEM PROGRAMME

DEUR T ZOHARY, AC JARVIS, FM CHUTTER, PJ ASHTON EN RD ROBERTS

Die verslag is 'n oorsig van die navorsingswerk wat wetenskaplikes van die WNNR vanaf 1980 tot 1988 op die eutrofe water van die Hartbeespoortdam naby Pretoria gedoen het.

Die belangrikste resultate van die studie vir dambestuur in Suid-Afrika asook die belangrikste navorsingsbevindings, publikasies en nuwe metodologieë word kortliks in die publikasie vervat.

Volgens die verslag is die Hartbeespoortdamstudie die grootste dam-ekosisteenavorsingsprogram wat tot dusver in suidelike Afrika uitgevoer is. Die data is op groot skaal gebruik om eutrofikasiemodelle wat plaaslik en oorsee ontwikkel is, te toets.

Die publikasie is gratis vanaf die WNNR se Divisie vir Watertegnologie beskikbaar. Om te bestel voltooi asseblief die poskaart in hierdie Bulletin.

SOUTH
AFRICAN
NATIONAL
COMMITTEE

FOR THE
INTERNATIONAL
ASSOCIATION
OF
HYDROLOGICAL
SCIENCES

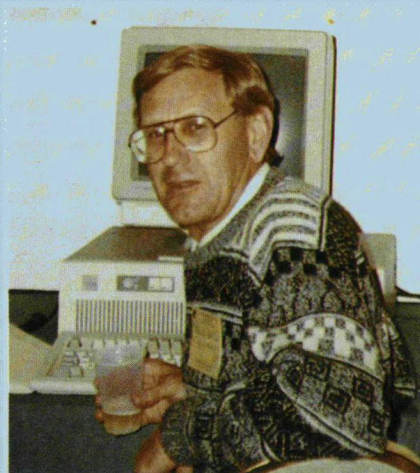
THIRD SCIENTIFIC ASSEMBLY OF THE IAHS IN BALTIMORE, USA

South Africa was well represented and apart from presenting evidence of our hydrological activities in South Africa we also managed to entertain the assembly with a melodious 'Sarie Marais' during the IAHS banquet in the Railroad Museum.

Roland Schulze presented a PC version of his ACRU-model.

David Stephenson presented two papers:

- Planning model for water resources development in developing countries.
- A modular model for simulating continuous or event runoff.



Prof Schulze at his presentation of the ACRU-model

Denis Hughes presented a poster "The application of an isolated event model to ungauged catchments using relationships between parameter values and catchment physiography."

Wolfgang Flügel presented two papers:

- Groundwater dynamics influenced by irrigation.
- Hydrology and salinity of the Breede River, western Cape Province, Republic of South Africa.

Hugo van Rensburg and Gert van Tonder presented a PC version of the "Simulation of a dolomitic aquifer by means of a finite element model for different abstraction and recharge options."

The Session Chairman : Erosion Control, read a paper prepared by Erberhard Braune and Ulrich Looser : "Cost impacts of sediments in South Africa".

Stephen von Biljon and myself attended the meetings as observers.

In his opening address to the assembly, the President, Vit Klemes again raised some thought provoking ideas and we are looking forward to his opening of our fourth Symposium in November in Pretoria.

Prof Peter S Eagleson, Chairman of the US National Research Council Commit-

JULY 1989



tee, introduced a forthcoming report on opportunities in the hydrological sciences. The report is planned to appear in Spring, 1990.

Bulletin, American Institute of Hydrology, Vol. 7, No.2, April 1989, p 1:

"A report will be issued which is expected to help guide science and educational policy decisions and should be of interest to the scientifically literate lay public. The document will stress the importance of the hydrological sciences and identify needed improvements in the research and educational infrastructure. The report should lead to improved management of water and the environment. The committee, which has met to develop the report structure and content, anticipates the report will contain seven chapters.

The first chapter, Hydrology and Life, must make an understandable and convincing case for the importance of the hydrologic science. Chapter two, Hydrologic Sciences, will contain the evolution of perception of hydrologic science. Chapter three, Critical and Emerging Areas, will contain a set of short unsigned 'essays' on frontier research areas. Chapter four, Scientific Issues of Data Collection, Handling, and Storage, will include brief discussions of why data are needed, characteristics of hydrologic data, current status of hydrologic data, and opportunities. Chapter five, Scientific Profiles, will include ranked synopses of the most important science issues or groups of issues. Chapter six, Education, will examine the current and historical backgrounds of those classifying themselves as hydrologists as a function of their type of employment. The last chapter, Resources and Strategies Needed, will suggest strategies and resources required to move toward the identified research and educational goals. An estimate will be made of the current state of federal support for hydrologic sciences."

I think it will help in getting a better focus on the role of hydrology as a science within the complex of water management and water engineering.

FOURTH NATIONAL HYDROLOGICAL SYMPOSIUM

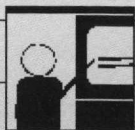
The final announcement is on its way. Unfortunately Dr Vit Klemes, President of the IAHS informed us that he will not be able to attend the symposium. This cancellation is a blow but we hope to find a suitable replacement to set the tone for the symposium. It looks like a very interesting programme with the right blend of hard and soft water management issues.

Don't miss it!



Hugo Maaren

*From your secretary
Hugo Maaren*



SOUTHERN AFRICA

ANAEROBIC DIGESTION

A symposium to discuss laboratory, pilot and full-scale experiences, current developments and research trends on processes will be held from 18 to 20 September 1989 in Bloemfontein, South Africa.

Enquiries: Mr Rhyno Kriek, Division for Non-Formal Education, P O Box 4345, Bloemfontein 9300, South Africa. Tel: (051) 4012425.

WASTE MANAGEMENT

The Transvaal Branch of the Institute of Waste Management (IWM) will be holding a branch seminar from 27 to 28 September 1989 at the World Trade Centre, Kempton Park. Subject areas will include: waste collection, waste disposal and hazardous waste.

Enquiries: IWM Seminar Committee, P O Box 1162, Bedfordview 2008, RSA.

Telephone: (011) 514949 (Danie Joubert)

SANCIAHS

The 4th South African national hydrological symposium will be held in Pretoria from 20 to 22 November 1989.

Enquiries: Mr Stefan Kienzle, Department of Water Affairs, Hydrological Research Institute, Private Bag X313, Pretoria 0001, RSA. Tel. (012) 821100x 207

SAMSIG

A symposium organised by the South African membrane separation interest group on all aspects of membrane separation will be held at the Karos Wilderness Hotel from 22 to 24 November 1989.

Enquiries: Dr OO Hart, Water Research Commission, PO Box 824, Pretoria 0001

ANALYTICA '90

The first national symposium on analytical science - Analytica 90 - will be held from 18 to 23 March 1990 in Pretoria. The theme will be: Analytical technology in a developing South Africa. Call for papers.

Enquiries: The Chairman, Analytica '90, Department of Chemistry, University of Pretoria, Pretoria 0002, RSA. Tel. (012) 4202515.

WASTEWATER

Three concurrent seminars on nutrient removal from wastewater streams, design and operation of biological treatment plants and industrial and hazardous waste treatment will be held from 2 to 4 April 30-SA Waterbulletin April/ May 1989

1990 at a country hotel near Pretoria and Johannesburg.

Enquiries: The Conference co-ordinators C 126, CSIR PO Box 395, Pretoria 0001.

OCEANS '90

The 7th national oceanographic conference will be held in Port Edward from 25 to 29 June 1990.

Enquiries: Mrs MA Joubert, Oceanographic Research Institute, PO Box 10712, Marine Parade 4056.

INTERNATIONAL

WASTEWATER TREATMENT

A symposium on the upgrading of wastewater treatment plants will be held in Munich, FRG, in August/September 1989.

Enquiries: Dr C-H Plumber, EWPCA, Markt 71, D-5205 Sankt Augustin 1, Federal Republic of Germany.

DRAINAGE

The 28th international post-graduate course on land drainage will be held from 20 August to 1 December 1989 in Wageningen, the Netherlands.

Enquiries: The Director of the International Agriculture Centre,

P O Box 88, 6700 A B Wageningen, the Netherlands.

ACID RAIN

A symposium on acid rain will be held from 5 to 7 September 1989 in Amsterdam, the Netherlands.

Enquiries: Prof R Perry, Public Health and Water Resources Engineering, Department of Civil Engineering, Imperial College, London SW7 2 BU, UK.

ORGANIC MICROPOLLUTANTS

A specialised conference, covering various aspects of micropollutants in water for human use, will be held from 19 to 21 September in Barcelona, Spain.

Enquiries: International Water Supply Association (IWSA), 1 Queen Anne's Gate, London SW1H 9BT, UK. Telephone number: 01-222 8111.

REMOTE SENSING

The 7th thematic conference on remote sensing for exploration geology will be held from 2 to 6 October 1989 in Calgary, Alberta, Canada. The conference will

include sessions on photogeology, engineering, environmental applications and hydrology. Enquiries: ERIM/Thematic Conferences, P O Box 8618, Ann Arbor, Michigan 48107-8618, USA.

WATER POLLUTION

The WPCF Asia/Pacific Rim conference on water pollution control will be held from 22 to 25 October 1989 in Hawaii, USA.

Enquiries: David Bills, 119 Merchant Street, Suite 607, Honolulu, Hawaii 96813, USA.

INDUSTRIAL WASTEWATERS

The first IAWPRC Eastern Africa Regional Conference - Industrial wastewaters '89 - will be held in Nairobi, Kenya, from 25 to 28 October 1989. Sessions on policy and legislation, sources and effects, control methods, rehabilitation and upgrading processes and plant O/M. Enquiries: Secretary, Scientific programme committee, Industrial Wastewater '89, Tampere University of Technology, P O Box 527, SF-33101, Finland.

WATER SUPPLY

An international conference and exhibition on water supply and treatment: World Water '89 Congress, will be held from 14 to 16 November 1989 in London, UK. Enquiries: Institution of Civil Engineers, 1 Great George Street, London SW 1 P 3 AA, UK.

TECHNOLOGY EXHIBITION

The third Asian Water Technology Exhibition '89 will be held in Kuala Lumpur, Malaysia from 27 to 30 November 1989.

Enquiries: International Conferences and Exhibitions Ltd, 29 Dering Street, London W1R9AA, UK.

WATER TREATMENT

The first joint IAWPRC/IWSA conference will be held in Jönköping, Sweden from 24 to 26 April 1990. The theme will be coagulation, flocculation, filtration, sedimentation and flotation in water and wastewater treatment. Enquiries: Joint Specialist Group, International Water Supply Association, 1 Queen Anne's Gate, London SW1H 9BT, UK.

GROUNDWATER MODELLING

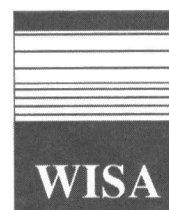
An international conference on calibration and reliability in groundwater modelling will be held in the Netherlands from 3 to 6 September 1990.

Enquiries: Modelcare 90, P O Box 30424, 2500 GK, The Hague, the Netherlands.

WORKSHOP ON WATER SUPPLY NETWORKS



The Water Institute of Southern Africa (WISA) in association with the Water Research Commission (WRC) has arranged a one day workshop to discuss matters of common concern relating to the management and analysis of water supply networks. The feasibility of establishing a WISA Technical Division on Water Distribution Management will also be discussed.



VENUE The Farm Inn
DATE Wednesday, 30th August 1989
TIME 09:00
FEE R50,00 per person includes teas
lunch

Cocktails will be served at the conclusion of the workshop

Topics of invited Speakers

Prof J Gessler	Guest Speaker Colorado State University
Mr D Behrmann	The Practical Application of the Use of Network Analysis Models. (de Leuw Cather)
Dr B F Loubser	Optimal Pipe Sizing for Extensions to Existing Networks. (Geustyn, Forsyth and Joubert)
Mr S Verrier	Analysis and Management of a water Reticulation System. (Johannesburg Water and Gas Department)
Dr C A Constantinides	Analysis, Design and Planning of Water Supply Systems – a comprehensive approach. (Hydraulic Computer Services)
Mr R M Wells	Application of a Real Time Network Simulation Programme to Durban's Trunk Main System.
Mr Z Szecei	Data capture for network applications in GIS (Geograph (Pty) Ltd)

Chairman for the meeting will be Mr Eric Hall. For further information please contact either Mr Hall (011) 403-3731 or Mr HC Chapman (012) 33-0340.

Reservations together with payment can be made before August 25, 1989, to: Miss Helene Joubert, Water Research Commission PO Box 824, Pretoria 0001.



OCEANS '90

7TH NATIONAL OCEANOGRAPHIC CONFERENCE
7DE NASIONALE OSEANOGRAFIESE KONFERENSIE

ANNOUNCEMENT AND CALL FOR DESCRIPTIVE TITLES

25 to 29 June 1990
San Lameer
Port Edward, Natal, RSA

COSTS:

Accommodation (all meals included): R600 per person for five nights and four days.

Registration:

R200, to cover invited guests, documentation and other conference costs.

Subsidies:

Efforts are being made to generate support to subsidise the attendance of students. The formula for awarding subsidies will be made known at a later date.

CALL FOR PAPERS:

At this stage a call is made only for descriptive titles which should clarify broadly the subject matter of the paper, poster or review which participants would wish to submit. The Organizing Committee would also appreciate suggestions regarding themes for workshops.



OCEANOGRAPHY PAST, PRESENT AND FUTURE

The conference will be an interactive working conference based primarily on workshops which are poster orientated. Oceans '90 is the 7th triennial national oceanographic conference. It is traditional that scientists report on the research they have undertaken over the past three years. Much of this research was sponsored and guided by SANCOR. The conference will also provide, therefore, an opportunity to evaluate SANCOR's achievements.

VENUE:

San Lameer, near Port Edward on the Natal South Coast. This is an attractive coastal resort.

FORM OF CONFERENCE:

The conference will be a mixture of plenary sessions and workshops. The latter will be held on each afternoon and, if necessary, extend into the early evening. Plenary sessions will include selected overviews/reviews and oral papers, and a report back of proceedings of workshops which took place the previous afternoon.

DEADLINES:

Submission of descriptive titles **30 July 1989**

Submission of extended
abstracts and photo reductions
of posters (Details to be provided) **1 April 1989**

Enquiries: The Secretariat, Ocean '90, ORI,
P O Box 10712, Marine Parade, 4056