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Eutrofikasie bestudeer:

Navorsing oor damme wyse besluit — De Wit

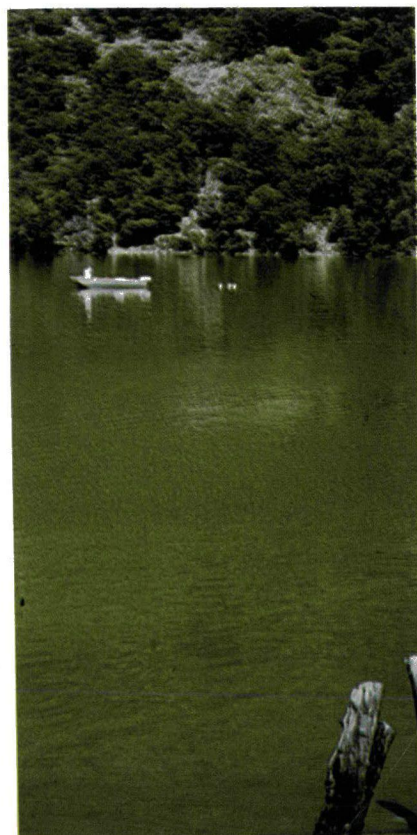
“Hierdie is ’n puik voorbeeld van vrugbare samewerking tussen administrateurs van waternavorsing en navorsers van verskeie organisasies,” het mnr JP de Wit, vise-president van die WNNR, onlangs gesê toe hy twee finale verslae oor waternavorsing amptelik aan die voorsitter van die Waternavorsingskommissie, dr MR Henzen, oorhandig het.

Die verslae is die finale produk van ’n kontrak oor eutrofikasie wat in 1973 tussen die WNNR en die Kommissie aangegaan is, en meer as ’n halfmiljoen rand se navorsing word daardeur verteenwoordig (kyk ook TO-rubriek op bl 2 van hierdie uitgawe).

Mnr De Wit het gesê dat dit vandag duidelik is dat dit ’n wyse besluit was om navorsing oor eutrofikasie te inisier op ’n stadium toe daar min oor die toestande in ons damme en die oorsake en uitwerking van eutrofikasie bekend was. Daar is byvoorbeeld indertyd baie aandag daaraan bestee om aan te toon dat voedingstowwe in die uitvloei van riool-suiweringswerke algroei stimuleer — ’n feit wat nou so algemeen aanvaar word dat dit nie nadruk verg nie.

Hy het bygevoeg dat verskeie instansies en organisasies buite die WNNR se Nasionale Instituut vir Waternavorsing (NIWN) en sy Natalse streeklaboratorium bygedra het tot die omvattende eerste werk wat onder die titel *The limnology of some selected South African impoundments* gepubliseer is. Dié verslag bevat inligting oor die voedingstofladings, algroei en die

(Na bl 7)



Algopbloei in Hartbeespoortdam — die verskynsel is grondig bestudeer en verslae daarvoor gepubliseer.

(Foto: WNNR)

TEGNOLOGIE- OORDRAG

In hierdie rubriek sal gereelde aankondigings verskyn van publikasies, simposia of ander gebeurlikhede met 'n praktiese inslag wat kan help om die gaping tussen navorsing en toepassing te oorbrug.



TECHNOLOGY TRANSFER

In this column regular announcements will be published of publications, symposia and other events of practical import which could contribute towards closing the gap between research and application.

Swartvlei:

Planning for the future

A report entitled *The ecology of Swartvlei: research for planning and future management* by C Howard-Williams and BR Allanson was published during the course of 1980. The report is based on research carried out by the Institute for Freshwater Studies, Rhodes University, on behalf of the Water Research Commission.

Swartvlei is one of the five major water bodies in the Wilderness Lakes region, and provided an ideal site for a quantitative study of the role played by aquatic plants in maintaining trophic conditions in shallow waters. At the same time the Wilderness Lakes region is one of South Africa's prime recreational areas and there is increasing pressure to maintain the area in an unspoiled state. The research findings, therefore, not only focus on the effect that aquatic plants have on water quality generally, but also provide guidelines for the management of Swartvlei specifically. These guidelines, as consolidated in the report, have been accepted by the Lake Management Committee for the Knysna/Wilderness/Plettenberg Bay area of the Department of Water Affairs, Forestry and Environmental Conservation.

Copies of the report are available from the Chairman, Water Research Commission, PO Box 824, Pretoria 0001.



Swartvlei, one of the Wilderness Lakes. Proper management of these lakes is essential for maintaining the area in an unspoiled state.

(Photograph: Cape Department of Nature Conservation)

Waterverliese:

RIGLYNE VIR BEHEER

Waterverliese uit pypnetwerke kan 'n aansienlike persentasie van die totale watervoorsiening beloop: In 'n opname van vyf Suid-Afrikaanse munisipaliteite, het geblyk dat die gemiddelde jaarlikse verlies by een munisipaliteit vir vier agtereenvolgende jare meer as 20% was. Voordele verbonde aan die vermindering van sodanige verliese is klaarblyklik.

Navorsing oor die onderwerp is namens die Waternavorsingskommissie deur die Universiteit van Pretoria se Afdeling Waterbenuttingsingenieurswese en Omgewingswetenskappe uitgevoer. Op grond van die werk is riglyne vir die beheer van waterverliese uit pypnetwerke opgestel met die titel *A guide to the control of water losses in pipe networks*. Die outeurs

is FA van Duuren, W Koschade en HC Chapman.

Van die aspekte wat deur die verslag gedek word, is die volgende:

- Watermeters: akkuraatheid, waarskynlike leeftyd en aanwending in die bepaling van waterverliese
- Pypmateriale en konstruksiemetodes
- Metodes van lekkasie-opsporing en die instelling en voordele van 'n opsporingsprogram
- Die ekonomiese implikasies van pypnetwerkverliese

Eksemplare van die verslag is verkrygbaar by: Die Voorsitter, Waternavorsingskommissie, Posbus 824, Pretoria, 0001.

Hydrology:

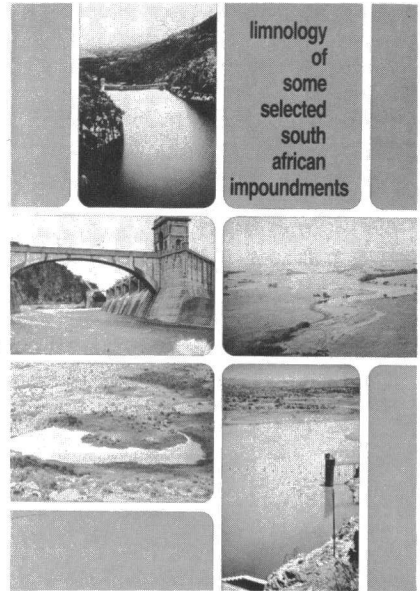
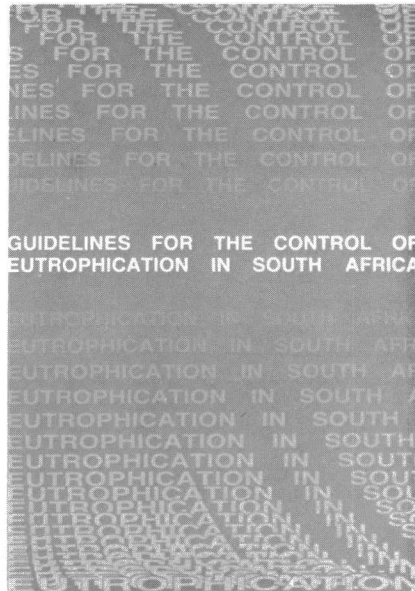
REPORT ON DATA

It is characteristic of hydrological research that large amounts of data must be collected, stored and retrieved for analysis. Consequently, the initial phase of a hydrological research programme is taken up with the development of a computerized data management system that is necessarily complex. The data management system includes the extraction of information from instrument charts by means of digitization as well as the subsequent quality control, coding, storage, retrieval and routine analysis.

Experience and expertise in hydrological data control has been built up at several South African universities that are undertaking hydrological research projects financed by the Water Research Commission. Much of this experience has been incorporated in a report entitled *Digitizing and routine analyses of hydrological data* by Dr RE Schulze of the Department of Agricultural Engineering at the University of Natal (Pietermaritzburg).

This report includes information such as, in the case of rainfall, mean and extreme amounts and intensities over periods ranging from less than 5 minutes to days, time distribution of rainfall during storms and rainfall kinetic energy, or, in the case of runoff, volumes of flow over varying time periods, peak rates of discharge, the separation of baseflow from stormflow and other hydrograph characteristics.

The publication sets out procedures for chart reduction by describing the procedures to be followed and then providing the flow charts and listings of the computer programs. The information on the charts is stored in such a way that data can be retrieved at any convenient time resolution ranging from one minute to one year. Reference to this report will save considerable time for hydrologists who wish to undertake new research programmes.



Eutrofikasie bestudeer

'n Verslag getiteld *Guidelines for the Control of eutrophication in South Africa*, deur RD Walmsley en M Butty, het pas verskyn. Die verslag is gegrond op navorsing wat die Nasionale Instituut vir Waternavorsing onder kontrak met die Waternavorsingskommissie uitgevoer het.

In die verslag word die oorsake, manifestasies en effekte van eutrofikasie ter inleiding bespreek, gevolg deur 'n uiteensetting van die verskillende parameters wat gebruik word om eutrofikasie te meet en die maatstawwe om trofiese toestande te bepaal.

Op grond van die navorsingsresultate is 'n eutrofikasiemodel ontwikkel wat die verhouding tussen die hoeveelheid alggroei in 'n dam en die fosfaatbelading en deursigtigheid van die water beskryf. Die model kan gebruik word om die oorlastoestande in 'n dam in verhouding te plaas tot die gebruik van die dam en die voedingsbelading.

'n Oorsig word ook gegee van strategieë wat aangewend kan word om eutrofikasie te beheer.

In die navorsing wat gedoen is om die eutrofikasiemodel te ontwikkel, is 'n deeglike limnologiese studie van 21 Suid-Afrikaanse damme gemaak. Die inligting wat so ingewin is, is saamgevat in 'n publikasie *Limnology of some selected South African impoundments*, wat 'n waardevolle rekord daarstel om toekomstige ontwikkelings in die damme teen te meet. Die verhouding tussen die hidrologiese, chemiese, fisiese en biologiese eienskappe van elke dam, sy toevloeiende water en die ontwikkeling binne die opvanggebied word kortliks bespreek. Dit blyk uit die globale opname dat Suid-Afrikaanse damme dikwels troebel is en dat die meeste limnologiese eienskappe aansienlik varieer as gevolg van groot jaarlikse verskille in watertoevloei. Wanneer fosfaat die beperkende voedingstof is hou die trofiese stand verband met die ortofosfaatbelading. Verder is gevind dat troebelheid 'n belangrike rol speel om die invloed van voedingstofbelading op die trofiese stand van 'n dam te bepaal.

Eksemplare van beide verslae kan aangevra word by: Die Voorsitter, Waternavorsingskommissie, Posbus 824, Pretoria, 0001 of Die Direkteur, Nasionale Instituut vir Waternavorsing, Posbus 395, Pretoria, 0001.



Copies of the report are available from the Chairman, Water Research Commission, PO Box 824, Pretoria 0001.

FLOOD PRODUCING RAINFALL

Design engineers and planners require information on flood producing rainfalls throughout Southern Africa and much work has been done in the past to provide information on the recurrence intervals of high intensity storms of different magnitudes. These high intensity storms are usually of relatively short duration and are often associated with localized thunderstorms.

Recent literature on short duration design rainfall in Southern Africa is available but there has been a paucity of information on situations where major floods have developed from long soaking rains that have fallen over a wide area on catchments that have recently received rain and are already wet.

It was this paucity of much needed information on medium to long duration rainfall which prompted Dr RE Schulze of the Department of Agricultural Engineering at the University of Natal (Pietermaritzburg) to initiate a survey of potential flood producing rainfall in Natal based on available daily rainfall records. With further financial support from the Water Research Commission, Dr Schulze extended this survey to the entire Republic of South Africa, including the now independent states, and produced a report entitled *Potential flood producing rainfall of medium and long duration in Southern Africa*.

Important

The report contains the results of an analysis of approximately 400 stations and presents the probabilities of occurrence of two and three consecutive days each with at least 25 mm rainfall and also the magnitudes of extreme one-, two- and seven-day rainfalls for return periods of 2, 10, 25 and 50 years. Further included in the survey is an examination of the probability of occurrence of extreme rainfalls in different seasons; how frequently longer duration extreme rainfall amounts exceed those of the one-day value by at least 50 per cent and to what degree two- and seven-day extreme rains occur in association with the one-day extreme event.

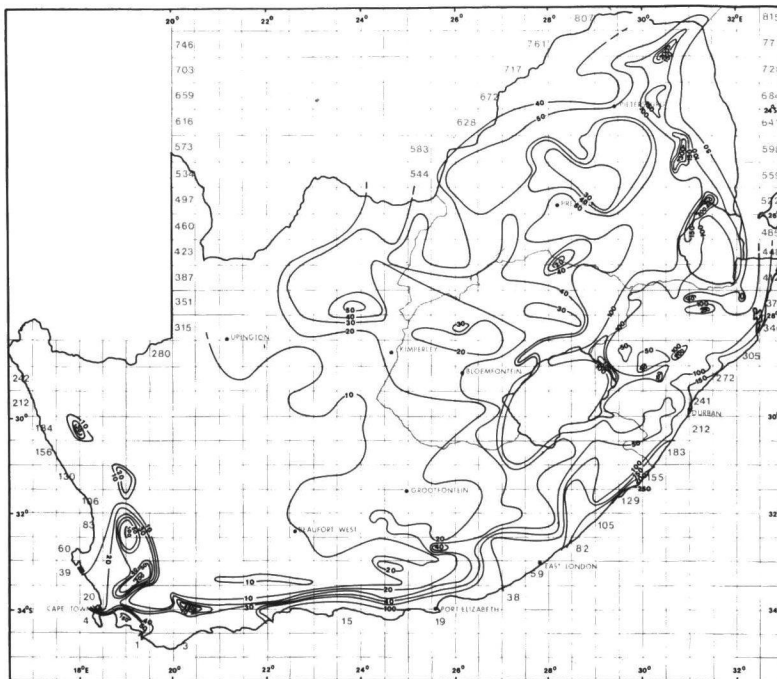


FIG. 1: Annual probabilities of occurrence (per cent) of two consecutive days each with ≥ 25 mm rainfall

The report can be regarded as a most important contribution to the available information on flood producing rainfalls and will provide the design engineers with at least a first approximation of medium and long duration flood producing rainfall in Southern Africa.

Copies of the report are available from: The Chairman, Water Research Commission, PO Box 824 Pretoria 0001.

This figure depicts annual probabilities of occurrence (%) of two consecutive days each with rainfall equaling or more than 25 mm.



Verhandelinge beskikbaar:

VOEDINGSTOFVERWYDERING

Die verhandelinge van 'n seminar wat in Mei 1979 in Pretoria gehou is oor die verwydering van voedingstowwe uit munisipale uitvloeiels kan aangevra word by die Voorsitter, Waternavorsingskommissie, Posbus 824, Pretoria, 0001.

Die seminar is gesamentlik gereël deur die Waternavorsingskommissie en die Instituut vir die Bestryding van Waterbesoedeling (tak Suidelike Afrika), in samewerking met die Suid-Afrikaanse Instituut vir Siviele Ingenieurs en die Instituut van Munisipale Ingenieurs van Suider-Afrika. Aspekte wat deur die

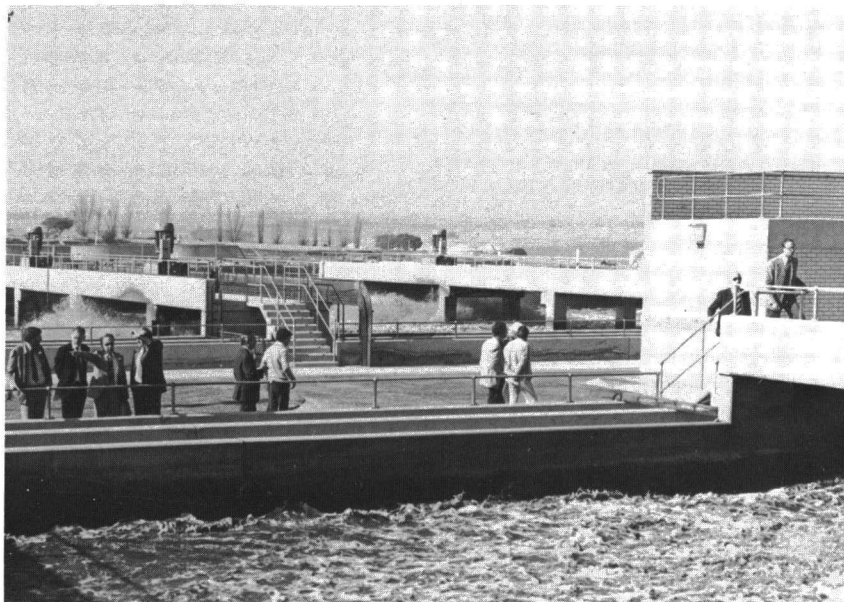
seminaar gedek is, is die volgende:

- Die noodsaaklikheid van voedingstofstandaarde in sensitiewe opvanggebiede in Suid-Afrika
- 'n Oorsig van tegnologie vir die verwydering van voedingstowwe
- Die huidige stand van navorsing oor fosfaatverwydering
- Ondervinding in ontwerp en bedryf van geaktiveerde-slykaanlêe in Johannesburg vir voedingstofverwydering
- Koste- en energie-oorewegings

'n Uitsig oor 'n deel van die geaktiveerdeslykaanleg vir die verwydering van voedingstowwe by Johannesburg se Noordelike Rioolwerke. Die verhandelinge van 'n seminaar oor die verwydering van voedingstowwe uit munisipale uitloeiels is nou beskikbaar.

- Nasionale navorsingsbehoefte oor die tegnologie van voedingstofverwydering

Die volledige besprekings tydens die seminaar is by die verhandelinge ingesluit.



A PLEA FOR AQUACULTURE

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Water enjoys a position of considerable Government attention in this country, not the least being its supply to that sector of the economy concerned with the production of foodstuffs. Ensuring its adequacy and continuity to this most vital sector of the economy, will require all the engineering and financial expertise that Government can muster in the years to come. Judging from the emphasis being placed upon the need to use and re-use water efficiently in the urban and industrial fields, it is unfortunate that the technology for implementing its wider spectrum of usage in the sphere of food production, namely aquaculture, remains limited to academic and research institutions. This lack of technology transfer to the farmers of this country, bodes ill for any serious consideration being given to the continuous cry for greater efficiency of water usage in the agricultural field.

South Africa, true to its definition of a semi-arid country, faces numerous pressures upon its limited water supplies. Ironically, however, it has turned to an enormous input of money and effort in the storage, translocation and anti-pollution

measures without sustaining any significant effort in the encouragement of a multi-dimensional role of water in food production. The absence of this effort will continue to seriously undermine any rational attempt at escaping the impasse existing between the suppliers of expensive waters and users vital to the provision of an adequate nutritional base for an urbanized society.

Setting aside for a moment our financial ability to import practically anything we desire, this country is rapidly approaching a total inability of meeting its annual animal protein requirements from its extensive grazing areas. A new technology has entered into the animal production field. The intensification of ani-

mal production practices whilst still limited to carcass improvement in feedlots, will of necessity lead to intensification of animal breeding. In turn, large volumes of expensive water will be required for the production of adequate quantities of high quality livestock feed, our traditional fodder crops. Contrasting this single aspect of the agricultural use of water with the very high level of effort being put into general water technology in the urban and industrial spheres, suggests an imbalance in our thinking in matters relating to efficient water usage.

Our national effort in exploiting the mineral wealth of this country is probably second to none in relation to other advanced mining nations of the world. This national effort, enormously assisted by Governmental sympathy for the exploitation of non-renewable natural resources, contrasts vividly with our inability to recognize and to exploit the enormous food producing capabilities of our limited yet renewable resource, water.

Akin to the fact that money must be used in order to create wealth, water must also be continuously used in order to produce food, to create wealth. By and large this country has every reason to be proud of the foresight characterized by our impoundment schemes. In

(To page 6)



This article merits inclusion under the Technology Transfer banner for, in fact, pointing out a lack of technology transfer in the field of aquaculture. Some of the arguments put forward may be considered contentious and SA Waterbulletin will welcome any reader responses for publication.



Aquaculture

(from page 5)

the same breath, however, catchment, impoundment and translocation do not create wealth. They are, however, vital cornerstones to the entrepreneur using these facilities for the creation of wealth. Should he of necessity use water from such facilities in a once-used-gone-forever manner, such as for irrigation, his return on his capital will of necessity be limited. Furthermore, the total return on capital invested in such facilities will be minimal and will continue to be limited by the technical expertise of the entrepreneur. Arguments against this view are loud and clear that irrigation sophistication is at a very high level in this country. This is quite true, but would tend to overlook the fact that once used for irrigation, no matter how sophisticated, no matter what crop is produced, water is lost forever. Money is placed in circulation, is used again and again, capital is formed, employment opportunities are created, wealth is formed. In much the same manner, water can produce food, can be used again and again, and when no longer fit as a habitat for higher aquatic organisms, can be dissipated into the root zones of irrigation crops.

Ignores

In the author's view, water is seen as a renewable resource with food production being encouraged in a chain of events stretching from catchment and storage to its final task and point of no return, irrigation. The current situation is to place great emphasis on its catchment, storage and translocation with production only being encouraged on the basis of once-used-gone-forever. This policy completely ignores any intermediary steps during which water can be most efficiently used for food production without its character or volume being significantly altered beyond that currently encountered in irrigation.

In fact it limits water to a synergistic role only, whereas water in itself is exploitable in economic terms. The engineer recognizes in water a renewable energy resource, and aided by the force of gravity uses the liquid mass for the generation of electricity. The farmer, however, limited by an almost total lack of technology transfer, is forced to use water for irrigation purposes only. This national inability to recognize water as a living matrix exploitable for food production purposes, other than only by means of irrigation, has greatly abetted, and in the future will continue to abet, the need for more and more water storage and translocation facilities without, in turn, deriving a viable solution for our increasing protein needs, or the low monetary value the irrigation farmer is forced to place on water.

Aquaculture has many roles to play in the water scene of this country. Among these, aquaculture will relieve to some extent the pressures upon our extensive grazing areas for adequate protein of animal origin. It may well relieve the need of the irrigation farmer to practice cash crop husbandry allowing him to return to the production of traditional fodder crops. It is, indeed, a very practical method of re-introducing production from those areas of irrigation land lost to production due to the development of salinity, and which still enjoy water reticulation facilities. The translocation of water

across long distances by canal or pipeline in order to bring water to soils suitable for irrigation, is not a pre-requisite for aquaculture. Aquaculture can be practiced in close proximity to large water impoundments.

Without doubt, aquaculture will play a most significant role in ensuring far greater co-operation in anti-pollutional measures. The production of aquatic organisms in industrially polluted waters may well be possible in the case of certain pollutants, but in general will not find much favour among practising aquaculturists. The deliberate enrichment of ponds with animal wastes, would occur only in waters intended for irrigation.

Limited

In summary, it is suggested that aquaculture technology is still largely limited to academic and research institutions. With the paths of communication currently available, there is little chance of this technology finding its way to the irrigation community, and even less so, being brought to fruition at our irrigation settlements. In the absence of this, the financing and development of schemes for the further storage and translocation of water in order to ensure greater continuity to the irrigation farmer, will be all that much more difficult to accomplish.

Visitor from U.K.



Mr JL van der Post, chief executive of the Water Research Centre in the UK, recently visited various water research facilities in the RSA. He is pictured here (left) in conversation with the chairman of the WRC, Dr MR Henzen.

Damverslae oorhandig (vanaf bl 1)

algemene limnologiese stand van 21 Suid-Afrikaanse damme in Transvaal, Natal en die Oos-Kaap.

Die tweede publikasie, naamlik *Guidelines for the control of eutrophication in South Africa*, is gebaseer op gegewens wat in die eerste verslag vervat is. Die kern van hierdie tweede verslag is 'n aantal vergelykings wat ontwikkel is vir die voorspelling van algkonsentrasies as chlorofiel-*a* in damme op grond van die ortofosfaat-fosforkonsentrasie.

Die vergelykings is ook aangepas om voorsiening daarvoor te maak dat die uitwerking van slik, troebelheid, en die tweede, belangrike algvoedingstof naamlik gebonde stikstof, voorspel kan word. Met behulp van hierdie vergelykings behoort dit vir beplanners en besluitnemers moontlik te wees om vooruitskattings van die waarskynlike trofiese peil van beplande damme te maak of om te bepaal wat die maksimum ortofosfaatlading is wat in terme van die gevolglike alggroei verdra kan word.

Mnr De Wit het gesê dat hierdie riglyne dus waardevol behoort te wees vir diegene wat sodanige bestuursbesluite moet neem.

"Daar bly egter nog 'n paar aspekte van eutrofikasie oor waaroor ons kennis gebrekkig is, veral ten opsigte van damme wat eutrofies is as gevolg van oormatige maar onbeheerbare voedingstofladings. Ons sal moet leer om met sulke toestande saam te leef deur die ontwikkeling en toepassing van bestuurstegnieke wat aan die een kant onwenslike eienskappe soos oormatige blou-groen alge bekamp en aan die ander kant voordelige eienskappe soos verhoogde visproduksie benut," het hy gesê.

Begrip

Hy het bygevoeg dat sodanige bestuur begrip van die ekosisteemprosesse verg. Met hierdie besef voor oë het die NIWN 'n intensiewe studie van die voedingstofsiklusse in die mees eutrofiese dam, naamlik Hartbeespoortdam, aangepak.

"As navorsingsprogramme reg gekies en behoorlik uitgevoer word, behoort die finale verslae wat daaruit voortspruit mylpale te wees wat die uitbreiding van ons kennis aandui.

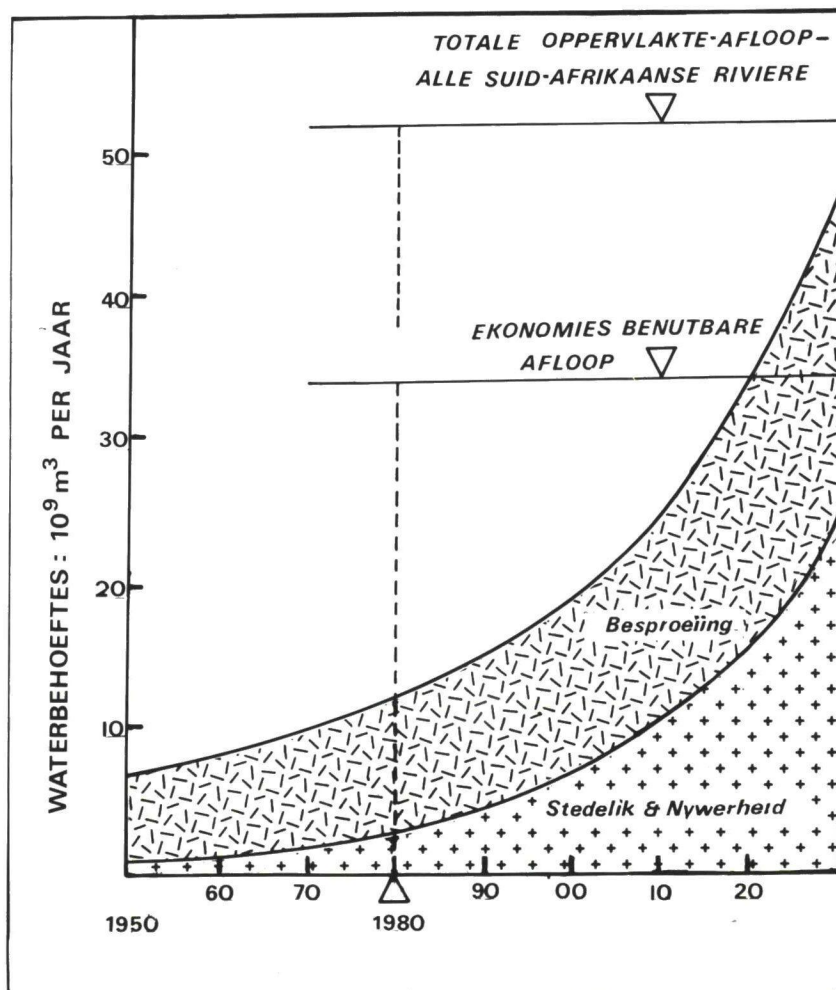
Maar die verslae behoort ook bruikbaar te wees vir en gebruik te word deur diegene wat die kennis by hulle bestuursverpligtinge benodig," het mnr De Wit gesê. "Ek vertrou dat hierdie verslae in hierdie kader val."

In 'n kort repliek het die voorsitter van die Waternavorsingskommissie, dr MR Henzen, sy waardering teenoor die medewerkende instansies uitgespreek en die noodsaaklikheid van vroeë beplanning benadruk. Hy het ook gesê dat die verslae die grondslag vorm vir verdere navorsing wat voorgestel is asook vir navorsing waarmee die Direkoraat van Waterwese reeds begin het.

Die amptelike oorhandiging van die verslae het geskied na 'n inligtingssessie wat gehou is om waternavorsingsbehoeftes van die Direkoraat van Waterwese aan die lede van die WNK bekend te stel. Dit het ook saamgeval met die 34ste vergadering



Mnr JP de Wit (links), vise-president van die WNNR, en dr MR Henzen, voorsitter van die WNK, deel 'n grappie na die oorhandiging van die



Damverslae oorhandig

(vanaf bl 7)

van die Kommissie wat by die Hidrologiese Navorsingsinstituut (HNI) van die Departement van Waterwese, Bosbou en Omgewingsbewaring gehou en deur die Minister van die Departement, dr CV van der Merwe, bygewoon is.

Die Bestuurder: Wetenskaplike Dienste van die Direktoraat van Waterwese, mnr WJR Alexander, het die inligtingssessie ingelei met 'n oorsig van nasionale waternavorsingsbehoefes.

Met verwysing na Figuur 1 (die beraamde waterbehoefes tot ongeveer die jaar 2030) het mnr Alexander daarop gewys dat die totale wateraanvraag tussen 2010 en 2020 aan die beskikbare, ekonomies eksploteerbare afloop gelyk sal wees.

"Maatreëls kan aangewend word om die groeitempo van die aanvraag te vertraag - 'n drastiese voorbeeld sou wees om alle besproeiing te beheer," het mnr Alexander gesê. "Selfs dan sal die stedelike en nywerheidsaanvraag aanwas tot op die punt waar die beskikbare water nie voldoende sal wees nie. Op dié wyse sal die kwade dag dus bloot uitgestel word. Dit is in elk geval 'n administratiewe maatreël wat nie navorsing verg nie."

Hy het verder gesê dat die krisisdatum nie net deur die aanvraagkromme bepaal word nie, maar ook deur die beskikbaarheid van water, dit wil sê die totale afloop van alle riviere in Suid-Afrika.

Verlore

Daar word beraam dat ongeveer 60 persent van die totale afloop ekonomies benut kan word. Die rede waarom hierdie syfer nie 100 persent beloop nie is dat daar altyd water tydens vloede en as gevolg van verdamping verlore gaan. Dit is ook nie moontlik om elke enkele rivier in die land te beheer nie. Ook is daar 'n interessante wisselwerking tussen oorloopverliese en verdamping: as groter damme gebou word om oorloopverliese uit te skakel, vind groter verdamping uit die groter massa water plaas. 'n Punt bestaan dus waar 'n verhoging in damkapasiteit deur verhoogde verdampingsverliese

geneutraliseer word. Hierdie kan egter 'n belangrike gebied vir navorsing wees, aldus mnr Alexander.

Die aandag kan byvoorbeeld toegespits word om verdampingsverliese te probeer verminder. In hierdie verband het hy daarop gewys dat daar reeds in die sestigerjare in die Republiek en in die buiteland navorsing gedoen is. 'n Mengsel van chemikalieë is beproef deur dit op die oppervlakte van 'n dam te spuit en die dun lagie wat dit gevorm het, het effektief meegehelp om verdamping te bekamp. Omdat die lagie egter so dun was, was dit moeilik om te handhaaf en dus ondoeltreffend. 'n Verdere probleem was dat hierdie maatreël 'n verhoging in die watertemperatuur tot gevolg gehad het en dit het weer verhoogde verdamping in die hand gewerk. Die aanvanklike navorsing is dus gestaak.

"Nuwe navorsing sal dus daarop gemik moet wees om 'n stof te ontwikkel wat nie net verdamping inhibeer nie, maar ook straling wegkaats. Die probleem," het mnr Alexander



'n Uitgelese groep waterpersoonlikhede besigtig die algobloei in die Roodeplaatdam van nader. Van l. na r. verskyn: Dr N Stutterheim (voorsitter: Telefoonvervaardigers van SA); mnr JF Otto (direkteur-genl van die Departement van Waterwese, Bosbou en Omgewingsbewaring); dr CF Garbers (president van die WNNR); Sy edele dr CV van der Merwe (Minister van Waterwese); dr MR Henzen (voorsitter: WNK); dr WJ Hattingh (direkteur: HNI); en mnr EJ Hall (afgetrede stadsingenieur van Johannesburg).

gesê, "is dat dit nie wil voorkom asof so 'n stof voor die krisisdatum ontwikkel sal word nie."

Hierna het hy alternatiewe waterbronne en geassosieerde probleme oorsigtelik saamgevat.

Die eerste moontlikheid wat hy genoem het, is dat water van buite die landsgrense ingevoer kan word. Alhoewel daar vanuit 'n ingenieursoogpunt geen probleem hiermee sou wees nie en dit dus prakties uitvoerbaar sou wees om water vanaf die Zambesi- of die Congorivier, of uit die Okavangomoerasse na die Republiek te bring, val dit te betwyfel of die politieke probleme wat daarmee verband hou, voor die krisisdatum oorbrug sal kan word. "Hierdie aspek verg dus ook nie navorsing nie," het mnr Alexander gesê.

Na die suide lê die oseaan, en ontsouting van seewater is lank reeds bekend as 'n moontlike bron van water - die probleme is die hoë koste waarteen dit gedoen word en veral ook die hoë energievereistes.

Verder suid is daar die ysberge

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van Antarktika. Teoretiese studies in die buiteland dui daarop dat dit tegnologies uitvoerbaar is om ysberge op sleeptou te neem nietaanstaande die verlies aan water in die warmer streke van die oseaan. Die probleem sal egter opduik wanneer hierdie ys na water omgesit en op land gebring moet word: die koste sal waarskynlik 'n groter beperkende faktor as die tegnologie wees.

'n Verdere probleem met ontsouting en die smelting van ysberge is dat hierdie waterbronne uit die aard van die saak kusegebode is en dat verdere koste aangegaan sal moet word om dié water in die binneland te kan verskaf.

Met verwysing na navorsing oor die atmosfeer as 'n potensieële waterbron het mnr Alexander daarop gewys dat geen land tot dusver daarin kon slaag om die reënval dermate te verhoog (deur middel van byvoorbeeld weermodifikasie) dat daar 'n betekenisvolle toename in die afloop waarneembaar was nie. As gevolg hiervan is hy nie optimisties dat daar met wolkbestrooiing in Suid-Afrika geslaag sal word om die watervoorrade betekenisvol aan te vul nie.

"Daar is slegs een langtermynoplossing vir die probleme in verband met watervoorsiening in die binneland van die Republiek en dit is die hergebruik van water," het hy gesê. "As ons slegs vyftig persent van die beskikbare water kan hersirkuleer of hergebruik, kan ons die aanvraagkromme aansienlik laat afplat."

Mnr Alexander het ook gesê dat die produksiekoste van water uit konvensionele bronne met verloop van tyd gestadig styg: water moet al verder en verder gesoek word — vanuit die Tugelarivier, die Middel-Oranjeskema, ensovoorts. 'n Stadium sal uiteindelik bereik word waar dit duurder sal wees om water vanaf ander plekke na die sentrale nywerheidsgebied te bring as om uitvloei-

sels te behandel. Vir die huidige sal daar dan geen rede wees om water in te voer nie — totdat alle beskikbare uitvloeisel hergebruik word. Daarna moet ander bronne weer benut word. Die belangrike punt is egter dat as mens 50 persent van die water wat in die stelsel gebruik word, kan hergebruik, dit sal beteken dat mens slegs 50 eenhede water sal moet invoer vir elke 100 eenhede wat benodig word.

Hierdie prosedure sal kan fingeer tot op die punt waar die mens gedwing sal word om hom na die see te keer om water te ontsout — die enigste onuitputlike bron van water.

Nooit

"Daar sal dus nooit 'n situasie ontstaan waar ons nie voldoende watervoorrade het nie — met vandag se tegnologie kan ons enige hoeveelheid water van enige gegewe gehalte enige plek voorsien, mits die koste nie saak maak nie," het mnr Alexander gesê.

"Die navorsingsbehoefes ten opsigte van kwantiteit sal dus op die gebied van die hergebruik van water lê," het hy gesê. "Maar ook sal daar navorsingsbehoefes ten opsigte van die kwaliteit van water wees."

Mnr JR Vegter, hoof van die Afdeling Geohidrologie van die Departement van Waterwese, Bosbou en Omgewingsbewing, het vervolgens die navorsingsbehoefes ten opsigte van die ontwikkeling van grondwaterbronne geskets. As agtergrond het mnr Vegter daarop gewys dat ander lande baie groter gebruik maak van hul grondwater-

bronne as Suid-Afrika. Sò byvoorbeeld is Denemarke en Oostenryk ongeveer 99 persent van grondwaterbronne afhanklik vir die openbare watervoorsiening; in Israel is 80 persent van alle gebruik (direk of indirek) van grondwaterbronne afkomstig; in Nederland 65 persent; en die VSA 21 persent. Hierteenoor word slegs sowat 10 persent van die beraamde huidige verbruik van ongeveer 11-miljard (10^9) m³ p.j. in Suid-Afrika uit grondwaterbronne verkry.

Die rede hiervoor, het mnr Vegter gesê, moet gesoek word in die aard van die geologiese formasies waaruit die Republiek opgebou is. Ongeveer 80 persent van die land bestaan uit sekondêre waterdraers (dit wil sê waterdraers wat gevorm is as gevolg van verwerping en verbokkeling, in teenstelling met primêre waterdraers wat beslag gekry het toe die gesteentes gevorm is). Dié waterdraers vorm maar 'n dun, waterdraende sone wat naby die oppervlakte geleë is, gewoonlik tussen 50 en 100 meter onder die oppervlak.

Ook die primêre waterdraers is maar dun in vergelyking met die deursnee van jong geologiese formasies wat ons elders in die wêreld kry, en hulle vermoë om water te lewer is dus ook maar beperk.

Die volume water wat in kenmerkend Suid-Afrikaanse formasies geborg word, kan geïllustreer word aan die hand van 'n beraming van die grondwatervolume wat op 'n wêreldwye basis in die boonste 800 meter

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Die Minister van Waterwese, Bosbou en Omgewingsbewing, dr CV van der Merwe, in gesprek met mnr DC Grobler (links) van die Hidrologiese Navorsingsinstituut, en mnr CF Schutte (regs), senior adviseur van die Waternavorsingskommissie.



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van die vastelandskors teenwoordig is, dit wil sê as mens die water in dié laag op die oppervlakte sou plaas, sou dit 28 m diep wees. Hierteenoor kan gekyk word na die water in die alluviale afsettings in die Great Valley in Kalifornië (waar geweldige groot hoeveelhede vir besproeiing uitgedomp word) en daar sal die water op die voormelde basis 50 tot 100 meter diep wees. In vergelyking hiermee is die situasie in Suid-Afrika as volg: Die dolomiet, wat een van Suid-Afrika se beste waterdraende formasies is, veral in die oostelike dele van die land, sal in die Verre Wes-Rand 10 m water oplewer; by Atlantis 2,5 tot 5,0 m; in die alluviale afsettings langs riviere 2 m; in stollingsgesteentes soos graniet in Sentraal-Transvaal 0,5 tot 1,0 m; en in die Karoo-sedimente wat ongeveer 50 persent van die land beslaan 0,1 tot 0,5 m.

Dit is ook insiggewend om 'n vergelyking te tref tussen die vermoë van formasies in Suid-Afrika om water deur te laat en dié van ander lande (as maatstaf word die lewering van boorgate gebruik): In Suid-Afrika lewer net ongeveer 2 persent van die boorgate meer as 6 l/s. In Israel, waar kryt/kalksteen oor groot dele van die land voorkom, is die lewering 110 l/s en in die VSA tussen 6 en 200 l/s.

"Alhoewel die totale volume water wat in formasies in die land geberg is heelwat meer beloop as die totale kapasiteit van die land se damme, en alhoewel die aanvulling waarskynlik gelyk is aan die gemiddelde jaarlikse afloop, is die probleem dat die grondwater so yl versprei is dat dit net nie met oppervlaktewater as watervoorsieningsbron kan kompeer nie," het mnr Vegter gesê.

"Ek kan ook nie sien dat die skrale bydrae van grondwater in die afsienbare toekoms radikaal gaan vermeerder nie," het hy gesê, "maar in hierdie verband is daar sekerlik ruimte vir navorsing."

Hy het verder daarop gewys dat grondwater 'n baie belangrike rol in die vroeë stadia van grootskaalse ontwikkeling kan speel, soos in die geval van die Atlantis-dorpsontwikkeling aan die Weskus bewys is. Ontwikke-

ling aldaar was tot dusver op grondwaterbronne aangewese en na raming kan daar 4 tot 5-miljoen m³ water per jaar benut word. Namate so 'n gebied ontwikkel en oppervlaktebronne ingeskakel word, kan grondwater nog vir 'n geruime tyd dien om in die spitsaanvraag te voorsien.

In Saldanha is daar na raming ongeveer 7,5-miljoen m³ grondwater per jaar beskikbaar om as aanvulling in spitsstye te dien.

Mnr Vegter het gesê dat daar in die Kalaharigebied sterk daarop aangedring word dat water vir veesuijing vanaf die Oranjerivier ingevoer moet word. Die Direkoraat het tydens 'n ondersoek vasgestel dat daar langs die Kurumanrivier 'n bron van ongeveer 500 tot 700-miljoen m³ bestaan wat nog vir 'n aansienlike aantal jare in die behoeftes van daardie gebied sal kan voorsien — miskien selfs tien dekades of langer. Alhoewel die bron tans as nie-hernubbaar beskou word, is dit moontlik dat dit tog aangevul word die enkele kere wat die Kurumanrivier wel afkom, dit wil sê een keer in 50 of 100 jaar.

Behoeftes

Met verwysing na navorsingsbehoeftes het mnr Vegter eerstens die nadruk op *metodes en tegnieke* laat val. Ondersoek behoort ingestel te word na die toepassings- en aanpassingsmoontlikhede van metodes en tegnieke wat in die buiteland ontwikkel is, byvoorbeeld sekere geofisiese prospekteringsmetodes, wiskundige simulatie, en die gebruik van isotope.

Daar bestaan ook 'n groot leemte in die kennis van *fisiese en chemiese prosesse* van grondvoglobeweging deur die onversadigde sone. Dit is belangrik om die aanvullingsprosesse te verstaan, om byvoorbeeld te weet of die grondvoglobeweging wat deur middel van isotope waargeneem word, werklik 'n maatstaf vir aanvulling is.

Evapotranspirasieverliese moet ook aandag geniet, asmede *mineralisasie* as gevolg van besproeiing.

Daar bestaan ook 'n behoefte vir navorsing oor die *praktiese ontwikkeling van grondwaterbronne*. Boorgate trek water uit 'n beperkte om-

gewing; as daarin geslaag kan word om sones wat wyer strek in die dieperliggende vaste gesteentes op te spoor, sal water uit 'n baie groter oppervlakte onttrek word en dit sou die benutting van grondwater op groot skaal aansienlik meer ekonomies en uitvoerbaar maak.

Mnr Vegter het ook daarop gewys dat springstofmetodes om waterdraers te breek in die verlede op 'n baie losse grondslag toegepas is — daar is nie werklik wetenskaplik bepaal hoe groot die ladings moet wees en presies waar hulle geplaas moet word nie. Die resultaat was dat die lewering van boorgate in sommige gevalle verminder het.

Ander aspekte wat navorsing verg, is:

- **Die kwantitatiewe bepaling van grondwaterbronne**

Dit het te make met die hidrouliese eienskappe van sekondêre waterdraers. In die buiteland word navorsing hoofsaaklik op primêre waterdraers toegespits en Suid-Afrika kan dus moontlik baanbrekerswerk op die gebied van sekondêre waterdraers doen.

- **Grondwaterbalansstudies**

Daar is 'n hele aantal plekke in die land waar grondwater op groot skaal gebruik word, byvoorbeeld in sekere besproeiingsgebiede en deur munisipaliteite. Grondwaterbalansstudies is in daardie gevalle noodsaaklik om 'n aanduiding te kan verkry van die hoeveelheid water wat in die gebied beskikbaar is en om dié inligting te kan projekteer ten opsigte van die res van die land waar die omstandighede dieselfde is.

- **Wiskundige modelle**

Wiskundige modelle moet ook ontwikkel word vir die voorspelling van die gedrag van waterdraers wat benut moet word.

- **Besoedeling**

Wat waterkwaliteit betref, behoort besoedeling aandag te geniet veral omdat die besoedeling van grondwater van die oog verberg is, en ook omdat skade nie so maklik reggestel kan word as in

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die geval van oppervlaktebronne nie.

● Dataïnsameling

Navorsing is nodig om die mees doeltreffende wyses vir die insameling en berging van grondwater-data te bepaal.

● Geohidrologiese kartering, verwerking en voorstelling van data

Daar bestaan geen omvattende kaart wat die grondwatersituasie in die verskillende dele van die land uitbeeld nie. Presies hoe die gegewens weergegee sal moet word, is 'n navorsingsveld in eie reg. Verder sal ondersoeke ook nog gedoen moet word om die beskikbare gegewens aan te vul.

● Bestuursaspekte

Die uitvoerbaarheid van kunsmatige aanvulling en die nuwe-effekte daarvan sal nagevors moet word, byvoorbeeld in die Karoo waar dit nie prakties moontlik is om groot opdamnings te maak nie vanweë die wisselvalligheid van die afloop en hoë verdampingsverliese.

● Benutting van alluviale waterstelsels

As voorbeeld van so 'n stelsel kan die Krokodilrivier onderkant Beestekraal (tot by Thabazimbi) geneem word waar tans reeds ongeveer 80-miljoen m³ water uit boorgate in die alluviale afsettings langs die rivier gepomp word — dit verteenwoordig 'n aansienlike persentasie (van 40 tot 50 persent) van die totale hoeveelheid water wat uit beide oppervlakte- en grondwaterbronne aldaar verbruik word. Navorsing sal dus oor die bedryf van so 'n opgarings- en onttrekkingstelsel gedoen moet word.

Mnr E Braune van die Direkoraat van Waterwese het oor die invloed van grondbenutting op afloop gepraat. Hy het daarop gewys dat die wyse waarop grond benut word een van die onsekerhede is wanneer die beskikbaarheid van water beraam moet word. Veral

drie soorte grondbenutting is van kardinale belang, het mnr Braune gesê, naamlik akkerbou (wat 'n redelik groot persentasie van die land dek), bosbou ('n redelik klein persentasie), en natuurlike veld (wat oor die grootste deel van die land strek).

Met verwysing na akkerbou het hy gesê dat die meeste ploegbare grond van die binnelandse platogebied (die gebied waar produksie die hoogste is) reeds bewerk word en dat uitbreiding aldaar dus nie op so 'n skaal sal plaasvind dat dit 'n betekenisvolle effek op waterbronne sal hê nie.

Swak

Hierteenoor moet in gedagte gehou word dat afloopbeheerbeplanning wat vir groot gebiede reeds gedoen is, tot dusver swak geïmplementeer is (in slegs sowat 5 persent van die beplande gebied). Namate hierdie beplanning deur die boere in die praktyk toegepas word, sal dit toenemend 'n uitwerking op die afloop hê — die doelstelling vir die boer is immers om die beskikbare water op sy plaas te benut eerder as om dit na die riviere te sien afloop.

Op die binnelandse plato is daar tans ook eksperimente aan die gang om meer doeltreffende vogbenutting te probeer verkry, byvoorbeeld deur 'n ander tipe gewas te verbou wat vog meer effektief as die konvensionele gewasse benut. Dit kan ook 'n vermindering veroorsaak in die volume water wat as afloop in die riviere beland.

Ten opsigte van Natal het mnr Braune daarop gewys dat die akkerbou, en dan veral mielieverbouing, steeds aan die toeneem is; veral in die Swart gebiede kan dit in die toekoms meer intensief toegepas word wat weer eens 'n effek op die beskikbare water kan hê.

Teen hierdie agtergrond gesien is dit nodig dat meer inligting oor die hidrologiese effek van akkerbou ingewin moet word. Daar is reeds 'n aantal studies vanuit 'n landbou-oogpunt gedoen, maar geen opvanggebiedstudies vanuit 'n hidrologiese oogpunt nie.

“Die landbouer kyk beslis met ander oë na reënvalafloop as die hi-

droloog en waterbepianner,” het hy gesê. “As die landbouer van effektiewe reënval praat, bedoel hy reënval wat deur die plant benut word. Die hidroloog, daarenteen, bedoel daarmee oppervlakaflowp wat in riviere kan beland.”

'n Ontleding van historiese rivier-vloeddata toon tot dusver geen betekenisvolle tendense in afloop in gebiede waar akkerbou intensief toegepas word nie — selfs nie waar tot 70 persent van die area bewerk is (soos in die Hoëveldstreek) en waar afloop veral na die Vaalrivier geskied nie. Geen data is egter beskikbaar vir gebiede met groter hellings en hoër reënval soos Natal en Wes-Kaap nie. Mnr Braune het gesê dat veral dit 'n verontrustende situasie skep aangesien akkerbou aspekte soos evaporatranspirasie, infiltrasie, oppervlakterughouding, onderskepping, en-sovoorts kan beïnvloed.

Een van die belangrikste navorsingsbehoefte, aldus mnr Braune, is om die inligting wat reeds beskikbaar is vanuit 'n hidrologiese oogpunt te herevalueer en daaruit nuwe projekte te beplan wat waterverbruikstudies sal behels, asook doelgerigte prosesstudies van sekere fases van die waterbalans in die bestaande eksperimentele opvanggebiede by Grahamstad, Cedara, Bethlehem en in Zoeloeland. Hierdie studies sal beslis ook gebiede moet omvat wat vir die landbou belangrik is en waar nuwe neigings verwag word.

Inligting wat deur middel van hierdie navorsing verkry is, moet dan in modelle geïnkorporeer word — modelle wat redelik eenvoudig is om te hanteer en wat realistiese antwoorde verskaf ten einde die waterbeplanner se probleme te help oplos. Die modelle moet ook getoets word aan inligting wat reeds oor groot opvanggebiede versamel is.

Mnr Braune het ook gesê dat grondbenuttingstendense baie meer doelgerig gekwantifiseer moet word. Hy beskou dit as 'n groot tekortkoming dat historiese gegewens oor grondbenutting, veral op 'n opvanggebiedsbasis, nie beskikbaar is nie. LANDSAT bied groot moontlikhede om dié data te bekom, maar navorsing sal nodig wees om die vermoë

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van dié satelliet doeltreffend te kan benut.

Met verwysing na *bosbou* het hy gesê dat die bergopvanggebiede ongeveer 8 persent van die oppervlakte van die Republiek beslaan maar ongeveer 50 persent van die totale gemiddelde jaarlikse afloop lewer. Huidig word 1,6-miljoen ha reeds as staatsbos geadminestreer. Bykans 5-miljoen ha bergopvanggebied is tans nog privaatbesit, maar deur die bergopvanggebiedwet van 1970 word van hierdie gebiede nou al hoe meer geproklameer met die doel om volgehoue lewering van onbesoedelde water te verkry. Daar is egter weinig inligting beskikbaar oor die maatreëls wat getref moet word om dié doel te verwesenlik — en dit verteenwoordig dan nog 'n navorsingsbehoefte.

Druk

Wat bosuitbreiding betref, bestaan wetgewing reeds wat bepaal dat in sekere gebiede geen verdere uitbreiding mag plaasvind nie. In ander gebiede, byvoorbeeld dié van die Umgeni-, Buffels- en Komatirivier, mag bebossing uitbrei om slegs 'n verdere vyf persent van die afloop te benut; in ander gebiede slegs tien persent. Daar word egter druk uitgeoefen om die houtbedryf in die toekoms uit te bou — en om hierdie gebiede optimaal te benut sal dus verdere navorsing verg.

Mnr Braune het verder gesê dat wat boslandgebruik betref baie werk reeds gedoen is en dat baie goeie inligting uit die eksperimentele gebiede beskikbaar is. 'n Probleem is egter dat meeste van hierdie inligting in die Kaapprovinsie verkry is terwyl die grootste bosuitbreiding in Transvaal plaasgevind het — dit wil sê in 'n sone waar die reënval heelwat laer is. Die grootste navorsingsbehoefte is dus om so gou moontlik data te verkry oor die uitwerking van bosbou op afloop in die laereënvalsone (ongeveer 800 to 1 000 mm per jaar).

Dit sal ook nodig wees om sekere aspekte van bosdinamika te bestudeer, want die area wat addisioneel vir bebossing beskikbaar is, is klein

en moet daarom ten beste benut word.

Die grondbenutting waaroor die minste betroubare inligting bestaan is *natuurlike veld*. Die natuurlike veld in die Republiek het volgens mnr Braune beslis verbeter na die groot verswakking wat na die Groot Trek en die Anglo-Boereoorlog en die groot droogtes van die vroeë jare van hierdie eeu ingetree het. Landbouers beweer egter dat baie min van die beplanning wat in hierdie opsig gedoen is reeds op plase geïmplementeer is. Wanneer dit wel in die praktyk toegepas word, sal dit natuurlik 'n invloed op afloop hê.

In die Swart gebiede is daar aanduidings dat die veld oor die laaste 30 jaar aansienlik verswak het — daar is dus groot potensiaal vir verandering.

Bergopvanggebiedbestuur, veldbrandbeheermaatreëls, veeverminderingskemas, grondbewaringswerke, veldversterking (deur middel van spesieverandering en bemesting) — al hierdie aspekte kan 'n invloed op afloop uitoefen.

In Suid-Afrika is geen eksperimentele data oor hierdie hidrologiese effekte beskikbaar nie. Hierteenoor bestaan daar in die VSA wetgewing wat bepaal dat daar teen 1985 bestuursmodelle vir ongeveer 200 verskillende weidingstreke ontwikkel moet wees — modelle waarmee voorspel kan word wat die effek van verskillende veldbenutting teen 1985 sal wees. In hierdie opsig bestaan daar dus wel 'n navorsingsbehoefte in Suid-Afrika.

Nadat mnr DWH Cousins van die Direktoraat van Waterwese kortliks oor navorsing oor reënval by Bethlehem gepraat het, het mnr DC Grobler van die Hidrologiese Navorsingsinstituut aan die beurt gekom. Sy onderwerp was die evaluering van beskikbare watergehaltemodelle.

Mnr Grobler het gesê dat 'n ernstige verswakking van die watergehalte in die nabye toekoms verwag kan word en dat sekere bestuursmaatreëls ontwikkel moet word om beskikbare waterbronne tot die maksimumvoordeel te kan benut. Dit impliseer dat 'n aantal ekonomiese, politieke en sosiale doelwitte gelyktydig

bevestig sal moet word. Op sy beurt vereis dit dat mens oor die vermoë moet beskik om die gevolge van sekere beplanning- en bestuurstrategieë vir varswatersisteme te voorspel.

Mens kan op twee wyses te werk gaan om die voorspellingsvermoë te verkry, het hy gesê. Eie modelle kan ontwikkel word, of modelle wat in ander lande ontwikkel is, kan gebruik word.

Koste

In hierdie verband het mnr Grobler gewys op die geweldige hoë koste om 'n model te ontwikkel, asook die mannekragvereistes wat daarmee saamhang. Sò is een van dié modelle in die VSA ontwikkel deur 35 man-jare met 'n hoogs tegniese span teen 'n koste van ongeveer 25-miljoen dollar te verbruik. As alternatief is daar modelle wat reeds in die VSA en Europa ontwikkel is wat heel moontlik aan plaaslike vereistes mag voldoen. Daarom is daar dan inderdaad besluit om eers die bestaande modelle te evalueer alvorens modelle ontwikkel sal word.

Daar bestaan twee groepe modelle waarmee die gevolge van sekere bestuursmaatreëls op die eutrofikasie van varswatersisteme voorspel kan word, naamlik die Vollenweider-tipe modelle en die ekologiese modelle. Eersgenoemde is 'n baie eenvoudige model om die inset, uitvloeï en sedimentasie van fosfaat in 'n volledig vermengde stelsel te simuleer. Deur middel van 'n eenvoudige massabalans wat beskikbaar is, voorspel die model 'n gemiddelde fosfaatkonsentrasie binne die sisteem. Dié gemiddelde word gebruik om in 'n baie eenvoudige regressiemodel byvoorbeeld die chlorofielkonsentrasie of die hoeveelheid alge in so 'n sisteem te voorspel. Die Nasionale Instituut vir Waternavorsing het onlangs 'n model ontwikkel waar byvoorbeeld twee regressievergelykings gegee word om chlorofiel enersyds in helderwaterdamme en andersyds in troebel damme te voorspel.

Die tweede groep modelle, naamlik die ekologiese, is baie meer ingewikkeld as die Vollenweider-tipe. As mens byvoorbeeld die hoeveelheid alge wat in 'n sisteem voorkom, wil

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simuleer, dan maak die ekologiese modelle gebruik van gedetailleerde prosesse wat in die sisteem plaasvind en hulle simuleer byvoorbeeld die invloed van fosfaat, stikstof, koolstof, silika en die hidrodinamika van die sisteem (lug, temperatuur, uitsak van alge, en so meer).

Vereiste

Die HNI het 'n reeks doelstellings gedefinieer wat vir die Departement van belang kan wees ten opsigte van die moontlike beplannings- en bestuursmaatreëls wat geneem kan word en 'n aantal bestaande modelle wat moontlik aan die HNI se kriteria sou voldoen, is geselekteer. Omdat die HNI nie oor die vermoë beskik om die ingewikkelde rekenaarprogramme vir dié soort modelle te skryf nie, was dit 'n vereiste dat die programme vir dié wat geselekteer is, aan die Instituut beskikbaar gestel moes word.

Vier modelle is geselekteer — 'n Vollenweider en drie ekologiese modelle, naamlik die WQRRS wat deur die VSA se *Army Corps of Engineers* ontwikkel is, die CLEANER-model van die Universiteit van New York, en een wat deur Nyholm van die Waterkwaliteitsinstituut in Denemarke ontwikkel is.

As ons die eienskappe van die vier modelle vergelyk, sien ons dat die datavereistes vir die Vollenweider maar skraal is, redelik vir die Deense model en baie groot vir die WQRRS en die CLEANER-model.

'n Vergelyking van die uitset van dié modelle, dit wil sê die bruikbare simulaties, lewer die volgende op:

- Die Vollenweider is baie beperk: dit voorspel slegs gemiddelde jaarlikse totale fosfaat en chlorofiel
- Die Nyholm voorspel al die voedingsstofvlakke in die stelsel asook die alhoeveelhede wat daarin voorkom
- Die CLEANER en WQRRS voorspel die daaglikse verandering van 25 bestanddele waaronder twee algspesies, soöplankton en twee visspesies; verder ook 'n baie

groot reeks biologiese en chemiese bestanddele wat gesimuleer word.

'n Vergelyking van die rekenaarfasiliteite wat benodig word, dui daarop dat die Vollenweider 'n eenvoudige sakrekenaar vereis, die Nyholm 'n enigszins meer gevorderde model, en die ander twee werklik groot rekenars met omvattende databergingskapasiteite. Die datavereistes van dié modelle is inderdaad so groot dat nie 'n enkele varswaterstelsel wat tot dusver deur enige organisasie in Suid-Afrika bestudeer is, genoeg data opgelewer het om een van daardie modelle funksioneel te maak nie, het mnr Grobler gesê.

Massas

Daar moes dus van meet af aan stelsels geselekteer word wat die massas data sou oplewer om hierdie modelle te kon laat funksioneer sodat hulle geëvalueer kon word.

Dataïnsameling geskied in hierdie stadium in drie damme, te wete Roodeplaat-, Bloemhof- en Hartbeespoortdam, wat almal baie verrykte damme is. Die invloed word daaglik gemeet en bemonster; in die damme self word monsters twee of drie keer per week geneem. Die monsters word in die laboratoria van die HNI ontleed. Die data word op magneetband geregistreer, en oorgeplaas na die rekenaar-databanke waar ook gehaltebeheer ingebou is deurdat twyfelagtige monsters herontleed word en, indien nodig, gekorrigeer word. Rekenaarprogramme is beskikbaar om die data weer te onttrek en in die HNI se modelle te gebruik.

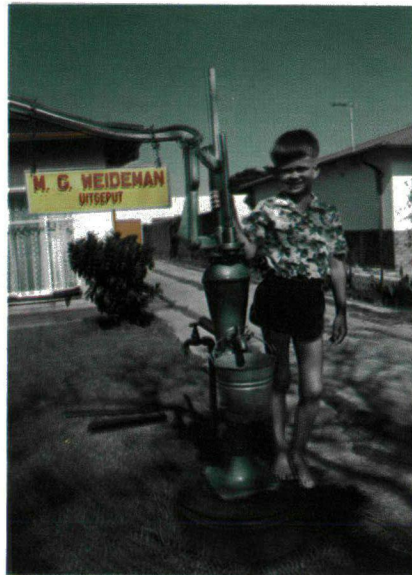
Elke model word getakseer vir moontlike toepassings; indien dit negatief is, word modifikasies en verdere taksering oorweeg.

Met verwysing na toekomstige navorsing het mnr Grobler gesê dat die drie sisteme wat tans bestudeer word 'n probleem met die evaluering van die modelle oplewer. Biologiese materiaal het naamlik 'n stikstof-tot-fosfaatverhouding van ongeveer 15; dit beteken dat die materiaal se voeding ook in daardie verhouding moet staan om goeie groei te verse-

ker. In Hartbeespoortdam is die verhouding 5, in Roodeplaat 8 en in Bloemhofdam 10. In al hierdie gevalle word die sisteme dus deur stikstof beperk. Omdat data van sisteme met beperkings gebruik word, lê dit weer beperkings op die evaluering van die modelle. Hierteenoor is fosfaat waarskynlik oor die land as geheel die beperkende faktor. Mnr Grobler het gesê dat die HNI dus graag sy program sou wou uitbrei na sisteme waar besliste fosfaatbeperkings waargeneem kon word.

Tydens die vergadering van die WNK wat na die inligtingssessie plaasgevind het, is 'n voorlegging oor eutrofikasienavorsing op die Hartbeespoortdam goedgekeur. Een aspek van die navorsing sal wees om algopbloei te beheer en te beperk.

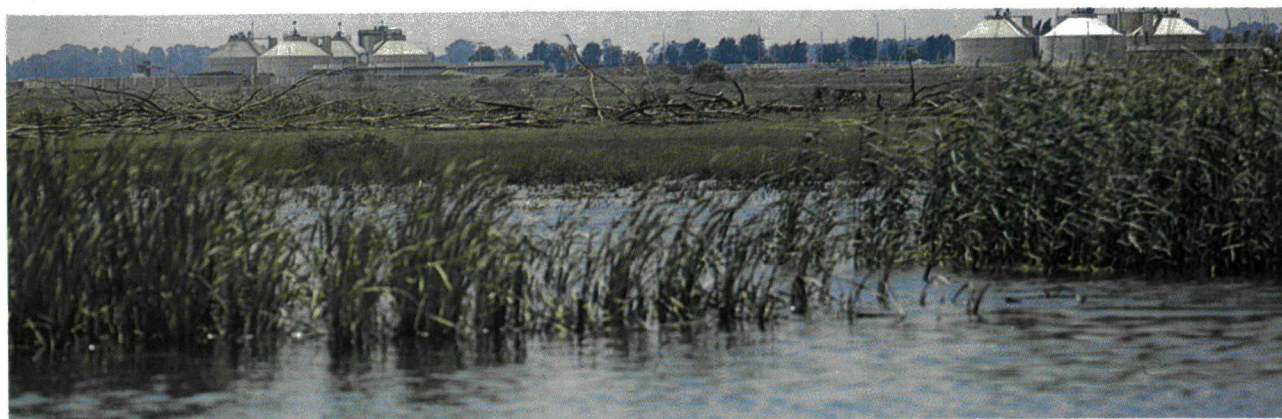
Uitgeput ...



...maar nie bedroë nie, te oordeel aan die vriendelike gesiggie van klein Eddie Weideman van Pretoria wat hier by 'n ou handpomp staan wat Pa laat restoureer het en wat nou op hierdie wyse eerbare genadebrood verdien...

Phosphate control:

Full-scale removal at Boksburg



Boksburg is again in the news! Following the promulgation of legislation for phosphate control in effluents (Water Act, No 54 of 1956, Article 21(1)(a), as amended on 1 August 1980 in Government Notice R1567), the Boksburg Municipality decided to investigate chemical phosphate removal on a full-scale basis at its Vlakplaats Sewage Purification Works. It is intended to treat approximately 20 ML/d of biological filter effluent with ferric chloride and polyelectrolyte to reduce phosphates to the required 1 mg/l (as P). The investigation is to commence in August 1981.

Chemical phosphate removal is not something new to Boksburg, however. Since early 1979 two of the Municipality's officials, viz the chief chemist, Mr Dries Louw, and the works superintendent, Mr Henrie Basson, have actively investigated the technical and economic viability of chemical phosphate removal. They started

off with a series of jar tests to establish chemical dosages required for bringing the effluent phosphate down to about 1 mg/l (as P). They investigated both ferric chloride and aluminium sulphate.

Using jar test results they started experimenting on a section of the full-scale plant at Vlakplaats. Their study centred around three Dort-

mund tanks (with a capacity of 2 ML/d each) which are used for the clarification of biological filter effluents. One tank was treated with ferric chloride, the second with aluminium sulphate and the third was used as control.

From these experiments a wealth of information was obtained. Ferric chloride proved to be the most economical chemical for phosphate removal in the Boksburg situation. A make-up and dosing system was developed which stood up to the corrosiveness of ferric chloride and included prestraining of concentrated chemical prior to the dosing pumps to obviate pump blockages, as well as ensuring the best point of chemical addition and the required amount of turbulence for sufficient mixing.

Clear

Following on these exploratory studies, further work was undertaken to optimize ferric chloride phosphate precipitation. It was found necessary to dose polyelectrolyte just subsequent to the ferric chloride to ensure a clear effluent from the Dortmund tanks. Additional reduction in chemical consumption will be obtained by dosing chemical proportional to

(To p 16)



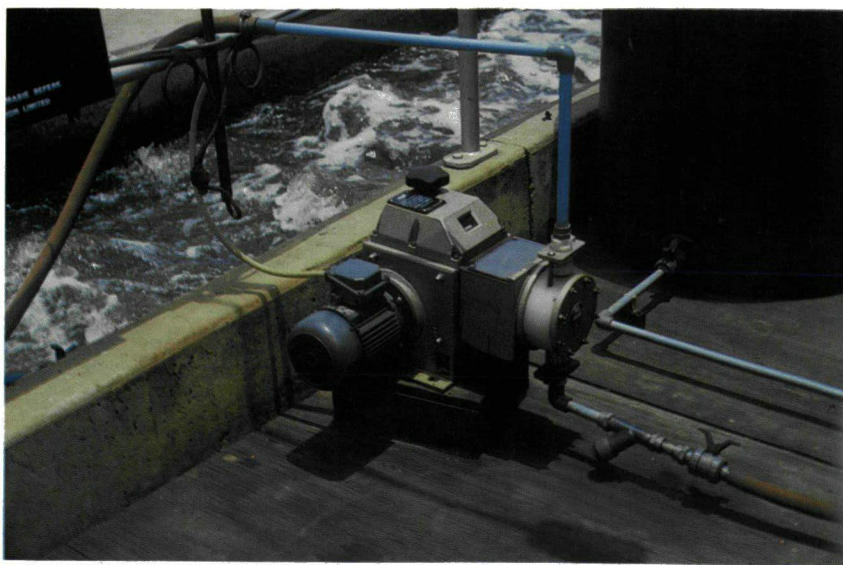
Three humus tanks and chemical dosage system used in the preliminary phosphate removal studies.

The well-equipped laboratory at the Vlakplaats Sewage Purification Works near Boksburg.



The works superintendent, Mr Henrie Basson (left) and the chief chemist, Mr Dries Louw, at the chemical storage tanks.

Chemical pump pumping ferric chloride into biological filter effluent just prior to humus tanks.



PHOSPHATE CONTROL AT BOKSBURG

(From p 14)

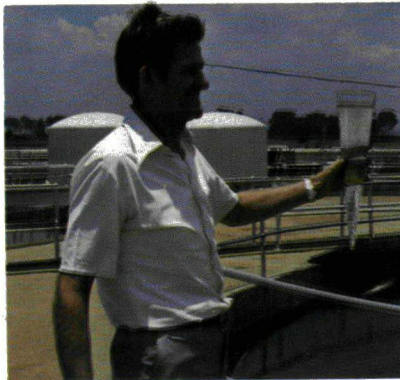
flow rather than at a constant dosage rate. Greater utilization is also obtained from the chemical by recycling the iron-rich sludge to a point prior to the primary sedimentation tanks, thereby utilizing its adsorption capacity for phosphate removal.

In addition to their pioneering work on chemical phosphate removal at full scale, Messrs Louw and Basson are also actively investigating nitrogen removal at the Vlakplaats

(Top right) Channel carrying biological filter effluent into which chemical is dosed. Note the turbulence at the point where the chemical is added.



(Right) Mr Hennie Basson with ferric chloride treated humus tank effluent.



Works. They are carrying out this work in association with researchers from the National Institute for Water Research of the CSIR and the City Council of Pretoria. This research is being coordinated by the Water Research Commission under its project 'Removal of nitrogen and phosphate from biological filter effluent'.

The Vlakplaats Works currently produces an effluent with a total nitrogen content of approximately 7 mg/l (as N) from a raw sewage with a total nitrogen content of the order of 34 mg/l (as N). It has been established that approximately 50 per cent of the nitrogen removal occurs in the biological filters and 50 per cent in the works maturation ponds. The investigation is continuing with the objective of optimising this nitrogen removal.

Boksburg deserves to be wished every success in their full-scale studies on chemical phosphate removal as well as their investigations into biological nitrogen removal. Information forthcoming from these studies will be of immense value to all South African municipalities facing the problem of nutrient removal from effluents.



Final discharge of effluent to the Natsalspruit.

Pollution Control in South Africa:

THE PURIFICATION OF TANNERY AND FELLMONGERY WASTES

Tanneries and fellmongeries produce large volumes of liquid and solid wastes which are very difficult to purify. This is a world wide problem, but in South Africa our limited water resources make it particularly important to endeavour to recycle at least some of this effluent after purification.

The Leather Industries Research Institute has had considerable success in its work aimed at process modification to reduce the impact of these pollutants. In spite of this, the effluents still present a major technological challenge.

In the case of fellmongeries, the main pollutants are lime, sulphide and dissolved protein matter arising from the unhairing or dewooling processes used on sheepskins.

In the case of tanneries, three types of effluent have to be considered:

- Partial processing of hides to the "wet-blue" stage, involving lime, sulphide and dissolved protein matter from the unhairing process plus spent chrome liquor from the chrome tanning process
- Vegetable tannery effluents comprising lime, sulphide and protein matter from the unhairing stage plus spent vegetable tannins from the tanning stage
- Full chrome tannage comprising the same effluent as the first effluent mentioned above, plus various retanning, dyeing and finishing effluents.

Solid wastes comprise trimmings and shavings from the raw and processed hides and skins, plus the sludges which settle out from the raw and treated effluents.

How are these effluents to be treated?

In view of the high protein content of the effluents, which provide food for bacteria, the use of biological methods of purification has had widespread application overseas. The most successful of these biological systems has been the *activated sludge process*, in which air is sup-

by
SG Shuttleworth
and DR Cooper

plied to a tank of this effluent containing suspended solids on which the bacteria live and feed on the contents of the effluent. From this tank the effluent passes continuously through a clarifier and part of the precipitated sludge is returned to maintain the proper level of biomass (active bacteria) in the aeration tank.

An alternative way of obtaining biological degradation of an effluent is by passing it over plastic plates packed in a tower down which the effluent trickles. The biomass forms a slime on the surface of these plates thereby maintaining the active bacteria which feed on the effluent washing over the surface. This is known as the *high rate biofilter*.

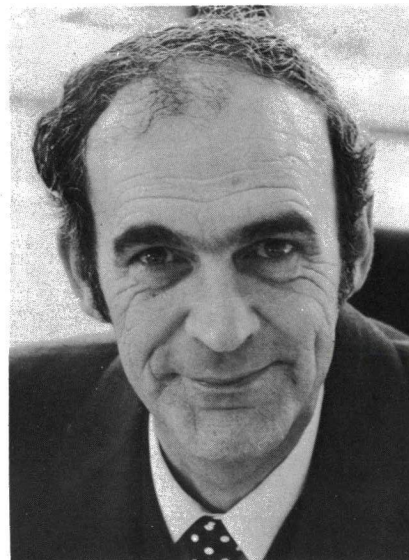
More recently there has been much interest shown by tanneries in

the *dissolved air flotation* process, in which flocculating agents are introduced into a column of the effluent accompanied by fine air bubbles which attach themselves to the solids as they form and float them up to the surface where they are scraped off. These fine air bubbles may be generated electrically, or by introducing water containing air under pressure, or by using a high speed mixer to entrap bubbles of air in the water fed into the system.

In South Africa, the Leather Industries Research Institute (LIRI) had been carrying out such investigations as its limited resources from industrial and CSIR funds permitted. What was needed was a major injection of funds to plan and build adequate pilot plants with suitable staff. This was provided by the Water Research Commission (WRC) on contracts with the particular industrial groups and LIRI. Pilot plants and laboratory facilities were
(To page 18)



Dr SG Shuttleworth, consultant to
LIRI



Dr DR Cooper, Director of LIRI

POLLUTION CONTROL

(from p 17)

established on the sites of large scale producers in order to deal with adequate and regular supplies of fresh raw effluents.

At SA Cape Fellmongers, Port Elizabeth, an activated sludge pilot plant and prefabricated laboratory have been in operation for about four years and a final report has been issued. It has been found that, provided a sufficiently high level of organic solids is maintained, the activated sludge process works well for this type of effluent, which is considerably lower in oxygen demand than tannery unhairing liquor effluent due to the fact that the hair or wool is loosened for recovery and not destroyed in the process.

Data have been provided to form the basis for design of large scale plant. Laboratory studies have indicated that substantial further purification, if required, can be obtained by tertiary treatment with flocculants.

At Silverton Tannery, Pretoria, a dissolved air flotation pilot plant has shown that effluent from a mixed chrome/vegetable leather tannery, after pre-aeration to remove sulphide, can be purified to a degree acceptable to the nearby municipal sewage works, provided that a major proportion of the raw hides are unsalted. A large scale dissolved air flotation plant has been installed at the tannery.

Novel

At Western Tanning Company, Wellington, where the climate enables a series of evaporation ponds to be used for effluent disposal, with reuse of part of this from the later ponds in the series, the problems have been those of pond odour, and the corrosive nature of the sulphides emitted by the ponds. This is believed to be due to the accumulated sludge which acts as host to anaerobic bacteria. A novel system of sludge removal from the unhairing liquors has been developed and a full scale plant is in operation.

At King Tanning Company, King William's Town, a two-stream

activated sludge pilot plant with support laboratory facilities has been in operation for several years. It has been shown that the mixed chrome tannery effluent can be treated successfully by the activated sludge process provided that an adequate level of organic solids is maintained by sludge return. Laboratory tests show that further substantial purification can be achieved by tertiary flocculation.

The tannery unhairing process liquors, known as beamhouse liquors, which have about sixty times the oxygen demand as raw domestic sewage, have proved difficult to deal with by the activated sludge process in reasonably short retention time, and some problems are still unsolved after fifteen months of pilot plant work.

Promise

High rate biofilter pilot plants set up at Port Elizabeth and King William's Town have proved to be unsuitable for treating raw fellmongery or chrome tannery effluents due partly to their very high oxygen demands, but mostly to clogging. However, this system shows great promise for tertiary biological treatment of these effluents after physico-chemical treatment using dissolved air flotation.

The work on liquid effluents has reached a climax in recent months by the establishment, at King Tanning Company, of all these promising treatment systems for comparative evaluation alone and in series, and applied to the four main types of tannery effluent listed in the introduction to this article.

It has already been shown that the combination of dissolved air flotation with either activated sludge or high rate biofiltration, as tertiary treatments, gives very good results on chrome tannery total mixed effluent as well as the stronger and more difficult unhairing effluent, and, when these tests are complete, the addition of chrome and vegetable tannery process effluents will be tried out to simulate "wet-blue" and vegetable tanning process effluents.

Finally the use of the system developed at Western Tanning Company for desludging unhairing liquors is being tested on the pilot plant scale as a primary treatment

for activated sludge and high rate biofilter systems. If this is effective it might prove a less costly alternative to dissolved air flotation, which requires pre-aeration to remove all sulphide. This novel system will be particularly attractive if the sulphide can be reused by the tannery.

With regard to solid wastes, consideration has to be given to three types of sludge in addition to trimmings and shavings. These are solids from untreated or pre-aerated settled wastes; solids from the activated sludge process; and solids from dissolved air flotation. The composition of these sludges will vary for the different unhairing and tanning processes.

Initial work on the use of a laboratory scale filter press and small scale sludge drying beds has given useful results, but in order to save time it is proposed to engage a private organization to cooperate with the WRC and LIRI to complete these studies.

It is apparent that a very comprehensive investigation has been undertaken by the Water Research Commission in collaboration with the Leather Industries Research Institute.

Useful

Much useful data have been assembled for large scale design criteria and the costing of systems. The degree of purification required by each factory will depend on the discharge standards aimed at and the charges levied by local authorities for further purification, so that treatment systems will have to be selected from the treatment modules which have been studied and tailored accordingly.

Further data are needed for tannery unhairing, wet-blue and vegetable leather effluents and a concerted effort is currently being made to achieve this.

ACKNOWLEDGEMENTS

The financial support and cooperation of the Water Research Commission and the various industries concerned are gratefully acknowledged.

Also the work of the staff, especially Mr D Hayes, and the advice and guidance of the staff and consultants of the Water Research Commission.

'n Stil kinkel in die Nyl ...



...en die vis hoef nie eers te byt nie, solank as wat 'n man so stil-stil jou in die wintersonnetjie kan koester. Dié stil plekkie aan die Nylrivier waar die kannetjie lyn natmaak is op die plaas Deelkraal naby Nylstroom.

HYDROLOGY MAJOR IN NATAL

As from 1981 Hydrology is offered as a two-course major in the Faculty of Science, University of Natal, Pietermaritzburg. The courses are provided by the Department of Agricultural Engineering and Hydrology is to be a recognized major course option for the 3-year B.Sc. degree.

Hydrology I can be taken as a single course, the ancillary requirements being Maths I, or Physics I, or Statistics I or Maths B/Introduction to Computer Science. The prerequisite for Hydrology II is Hydrology I. It is envisaged that Hydrology would be compatible with one of the following majors: Chemistry, Physics, Mathematics, Geography, Geology, Soil Science and Botany.

Excellent facilities are available for tuition in Hydrology I and II in the Department of Agricultural Engineering:

- A soil and water laboratory at Ukulinga Research Farm
- Fine fully instrumented research catchments near Cedara, operated by the Department of Agricultural Engineering
- Extensive computer facilities dedicated to hydrological data analysis
- An extensive hydrological data bank built up over the past few years.

There are many career opportunities. The Department of Water Affairs, Forestry and Environmental Conservation anticipates a steady demand for hydrologists. Other Government departments with an interest in hydrologists are the Department of Agriculture and Fisheries

and the Department of Cooperation and Development. Statutory bodies such as the CSIR and the Water Research Commission undertake to sponsor research projects which require hydrologists and representatives of both these institutions have expressed strong support for undergraduate training in hydrology.

There is an increasing demand for hydrologists with a particular knowledge of irrigation. Commercial enterprises are showing an increasing awareness for hydrological knowledge in design and planning. This demand has opened up a relatively new field of hydrological consulting.

Any further discussion or enquiries on the course would be welcomed by the Head of the Department of Agricultural Engineering, Prof P Meiring, who may be contacted at the University of Natal, PO Box 375, Pietermaritzburg, 3200.

EQUIPMENT

As an information service to our readers, the editor welcomes for publication contributions (limited to approximately 300 words and one or two photographs and diagrams) by manufacturers and distributors of new equipment and processes related to the promotion of water affairs.

Any such contribution is, however, received or published on the understanding that: (1) the relevant manufacturer or distributor submitting the contribution is responsible for the information or opinions expressed in it and the claims made therein for that equipment or those processes; and (2) its publication does not imply that the editor or publisher or the Water Research Commission underwrites or is in agreement with the contents of such contribution.

Readers who require further information are requested to contact the manufacturer or distributor direct.

Anton Prinsloo
EDITOR



SA Waterbulletin
PO Box/Posbus 824
Pretoria 0001

TOERUSTING

Ten einde 'n inligtingsdiens aan ons lesers te lewer, verwelkom die redakteur bydraes vir publikasie (beperk tot ongeveer 300 woorde en een of twee foto's en diagramme) deur vervaardigers en verspreiders van nuwe toerusting en prosesse wat met die bevordering van wateraangeleenthede verband hou.

Sulke bydraes word egter ontvang of gepubliseer met dien verstande dat: (1) die betrokke vervaardiger of verspreider wat die bydrae lewer, verantwoordelik bly vir die inligting of menings daarin vervat en vir aansprake ten opsigte van daardie toerusting en prosesse; en (2) publikasie daarvan nie impliseer dat die redakteur of die uitgewer of die Waternavorsingskommissie die inhoud van so 'n bydrae aanbeveel of daarmee in ooreenstemming is nie.

Lesers wat meer inligting verlang, word versoek om direk met die vervaardigers of verspreiders in verbinding te tree.

Anton Prinsloo
REDAKTEUR

VERSATILE DIAPHRAGM PUMP

The principle of the diaphragm pump is not new, but it is worth mentioning that the original concept came from a company called the Wilden Pump and Engineering Co., represented in South Africa by Hugh Mellor of Edenvale. Although several companies have copied the idea, the original air operated double diaphragm is able to tackle jobs that others just cannot handle, and at a competitive price.

The newest addition to the range is the model M2, and is simple in design with only 52 total parts. It incorporates a patented air valve with only one single moving part, and it can be disassembled and reassembled by removing or replacing six bolts.

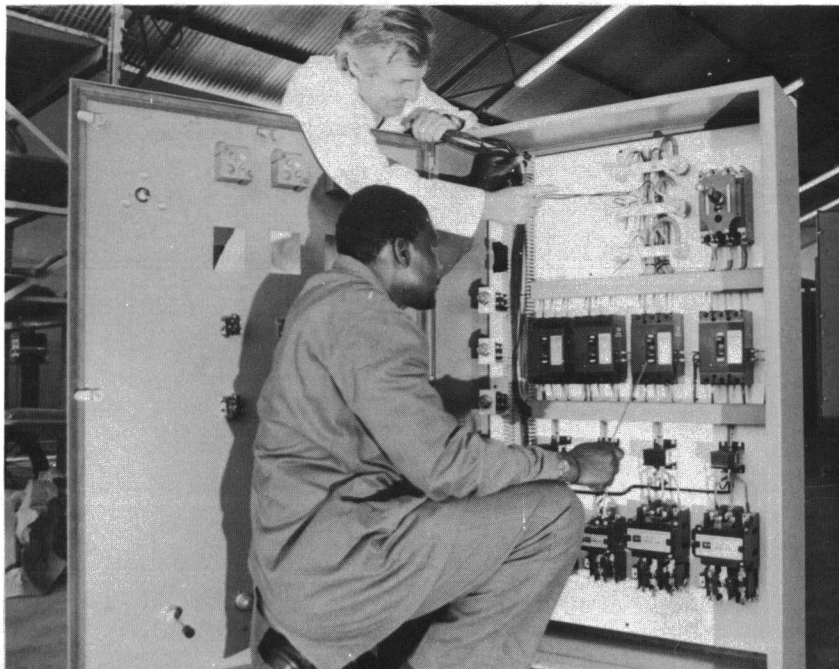
Wilden pumps are available in 317 mm, 508 mm and 762 mm models, in aluminium, cast iron, 316 stainless steel and a proprietary alloy called Hastelloy. The diaphragms are available in neoprene, Buna N, Nordel, Viton and Teflon.

In mining and civil engineering applications, there is usually an air supply available as a convenient power supply, and in many situations air is a preferable source of power. Media that can be pumped by the Wilden pump is extremely wide and varied — chemicals, ceramic slips, adhesives, paint, latex, drilling mud, ink, petroleum, resins, grout, lime, sludges of all types and abrasive slurries — it will even pump dry powders. It is used extensively in the transfer of dry powders in bulk pneumatic conveying systems. In general, the pump will successfully transfer powders such as fumed silica, expanded mica, carbon black and so on with densities not exceeding 0,4 g/cm³.

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PUMP CONTROL UNITS



EQUIPMENT



TOERUSTING

Some time ago Lovolec in Witbank completed a consignment of several multidrive pump control units for Van Dyks Drift colliery. Each unit is housed in the largest of the IP54 range of standard enclosures available from Lovolec.

Normal DOL starting is provided for the drives, which are 2 x 18,5 kW and 2 x 5,5 kW at 525 volts, and control circuitry is arranged for standard standby operation.

Because of their flexibility, and modular designs, Lovolec are able to provide a useful short-delivery service.

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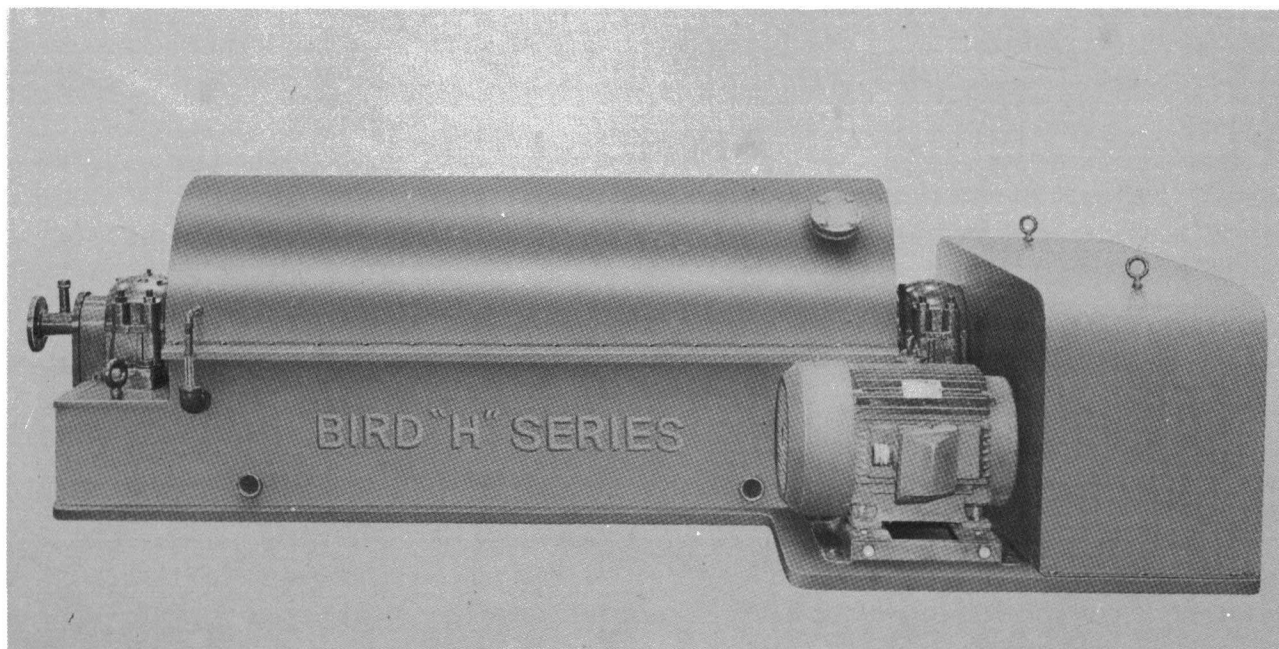
The Vortex Clarifier will remove solids

having both a low specific gravity and small particle size (down to sub-micron size).

Due to its unique design, it is well suited for clarifying process streams of contaminants; recovering solid valuables from process streams; final polishing of liquid valuables in chemical processes.

From a vacuum filter filtrate having 2 500 mg/l suspended solids a 97 per cent recovery of solids can be achieved.

Enquiries:
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EQUIPMENT



TOERUSTING

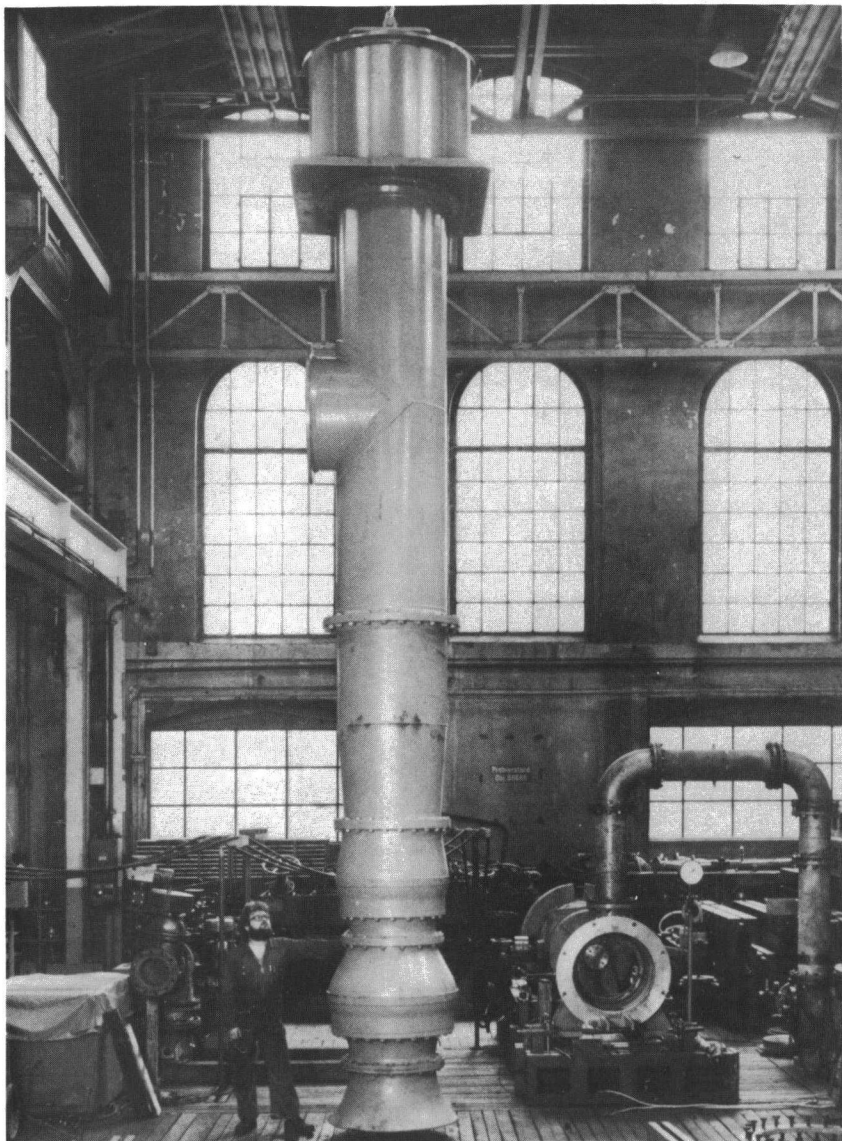
BRINE PUMP

The availability of water from desalination plants is also dependent on the reliability of the installed pump equipment. The characteristics and range of application of Sulzer pumps are matched to the requirements of modern desalination plants of any size.

The Sulzer pump programme for desalination plants includes sea water supply pumps, brine circulation pumps, brine condensate pumps, brine return pumps, sea water circulation pumps and various process pumps.

The construction of these machines is based on the close cooperation of experts in the design, metallurgical and manufacturing departments. From the point of view of casting, machining, corrosion-resistance and fatigue strength, it results in pumps which are optimal for the stringent operating conditions associated with corrosive media. These quality criteria are met through pioneer work in the field of material testing under extreme temperatures, the investigation of high-velocity erosion effects in complex liquids and by applying modern non-destructive testing methods.

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Sedert die laaste verskyning van *SA Waterbulletin* is een van die konsultante van die Waternavorsingskommissie, mnr Alex Kinmont, na 'n kort siekbed in Durban oorlede.

Mnr Kinmont was 'n voormalige stadsingenieur van Durban en het nog vir baie jare na sy aftrede 'n leidende rol in die werksaamhede van die Instituut van Munisipale Ingenieurs van Suidelike Afrika gespeel.

By die Kommissie het hy 'n besondere bydrae tot die bevordering van waternavorsing gemaak, veral op die gebied van die sektore van die

MNR ALEX KINMONT⁺

plaaslike owerheid en die nywerheid.

Mnr Kinmont het 'n ongewenaarde ywer en toewyding in sy werk vertoon, gepaardgaande met 'n vriendelike houding en nederige persoonlikheid wat vir hom talle

vriende verwerf het. Sy nougesetheid word byvoorbeeld duidelik weerspieël in 'n register wat na sy heengaan aangetref is en waarin alle lugreise wat hy onderneem het, in skoonskrif aangeteken is. Meer as 'n duisend vlugte wat saam bykans 'n miljoen km verteenwoordig, is tussen 1928 en 1980 hierin geboekstaaf — net sy laaste reis ontbreek toe hy na sy tuiste in Durban teruggekeer het.

SA Waterbulletin voeg graag sy hulde by dié van die talle ander persone en instansies wat die nagedagtenis van Alexander Kinmont in ere hou.

TAIWAN TILAPIA GIVEN TO NPB

The Natal Parks Board recently announced that the Taiwan Fisheries Research Institute had donated 2 000 special hybrid tilapia to the Board.

The 0,5 to 0,75 cm tilapia fry arrived by air transport and were delivered to the Board's Umgeni Warm Water Hatchery at Nagle Dam. There was great excitement when it was found that all the fish had arrived alive and well, as some mortalities are normally expected.

The donation follows a visit to Taiwan by Mr Tom Pike, Conservator Hatcheries, last year. This new breed of tilapia was developed by Mr Ho Kuo of the Fisheries Institute after 10 years research designed to produce a fast-growing, genetically-stable, reddish-coloured strain. Fish with this colouring have wide appeal on the Chinese food market and are particularly popular for feasts over religious periods. They are expected to appeal to South African consumers, who may regard the dark skin of normal tilapia as unattractive. There was also a demand by fish farmers for a faster growing species to enable them to produce more fish for internal consumption and export.

Faster

South Africa follows North America and Guam in the importation of this tilapia strain. They have a faster growth rate than those already bred in Natal, and a high percentage of males is born. This is desirable as the males grow faster than the females.

The stock will be kept in quarantine aquarium tanks at the Hatchery. They will be used as future breeders and for research purposes. Some of their offspring will be made available, at fingerling size, to Natal fish farmers who have virgin waters which they want to stock. Unless the strain is kept pure it will revert back to the common tilapia. The reddish

strain was produced by selective breeding of *Sarotherodon mossambicus* x *Sarotherodon niloticus* hybrids.

This latest import is part of the Board's programme to improve angling and to assist fish farmers with their production of protein for the consumer market.

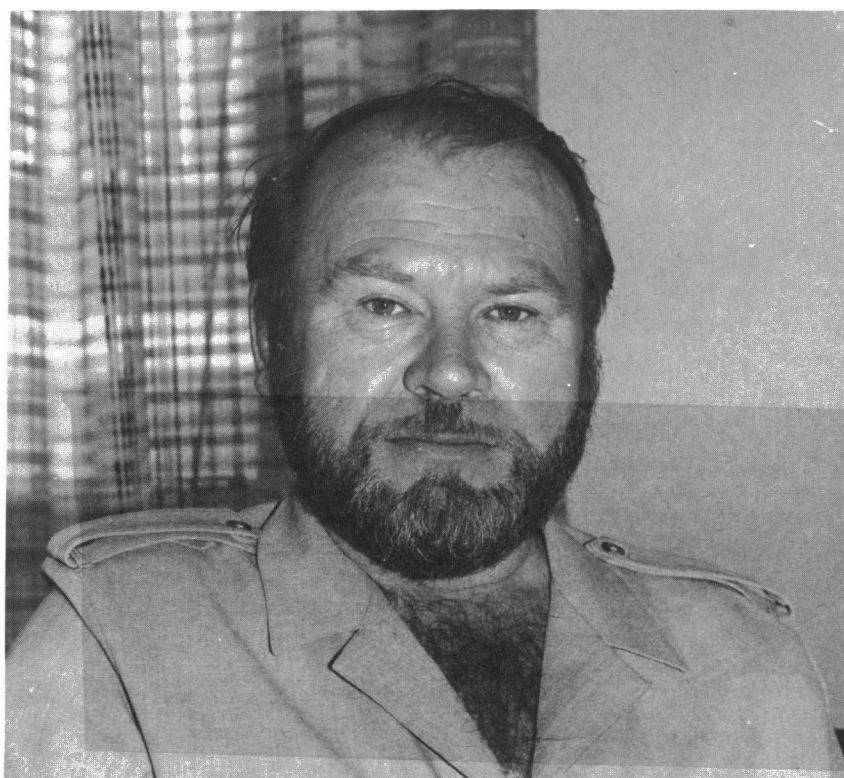
OP BESOEK

Prof PH Jones het Suid-Afrika onlangs besoek. Hy is professor in Siviele Ingenieurswese en Mikrobiologie aan die Universiteit van Toronto in Kanada en 'n internasionale deskundige op die gebied van rioolwater-suiwering. Tydens sy verblyf alhier het hy 'n groot deel van sy tyd by die Universiteit van Kaapstad deurgebring en die WNK geadviseer oor 'n aantal aspekte van rioolwatersuiwering.

finally ...

(from p 24)

- even the right angle!
- Probsz:** And should public opinion-
- Sir S:** Personally, I think it should. Oh, yes, it must, in fact. After all, it isn't merely so much, ha-ha, water under the bridge, you know...
- Probsz:** -produce an outcry, a protest?
- Sir S:** Oh, decidedly, pro and amateur tests. One has to be, ha-ha, in the swim.
- Probsz:** One final, critical question, Sir Settill: Will you drink-
- Sir S:** I rather thought you were not going to ask. Burgundy, thank you, or a *blanc de blanc*, if you have. As long as I need not add — ugh — water. You know the old adage: When they gave out chins, I thought they said gins, and I ordered a double!



CONFERENCES AND SYMPOSIA

IRRIGATION AND DRAINAGE

The 11th International Congress on Irrigation and Drainage will be held from August 26 to September 7, 1981, in Grenoble, France.

Enquiries: Comité d'Organisation CIID-ICID, avenue d'Innsbruck, 38029 Grenoble Cedex, FRANCE.

IWSA

The Nordic regional conference of the International Water Supply Association will be held from September 21 to 23, 1981, in Jönköping, Sweden.

Enquiries: ELMIA AB, PO Box 6066, S-550 06, Jönköping, SWEDEN.

WAVE ENERGY

An international symposium on Wave and Tidal Energy will be held from September 23 to 25, 1981, in Cambridge, England.

Enquiries: BHRA Fluid Engineering, Cranfield, Bedford MK43 0AJ, ENGLAND.

WASTE IMPACT

The 17th American Water Resources Conference (theme: "Waste impact on water") will be held from October 4 to 7, 1981, in Atlanta, USA.

Enquiries: AWRA-1981 Conference, St Anthony Falls Hydraulics Laboratory, Mississippi River at 3rd Ave, SE, Minneapolis, Minnesota 55414 USA.

EUTROPHICATION

A conference on eutrophication and water supply will be held from October 7 to 9, 1981, in Vienna, Austria.

Enquiries: International Water Supply Association, 1 Queen Anne's Gate, LONDON SW1H 9BT.

ENVIRONMENT

An international symposium on Remote Sensing of Arid and Semi-arid lands will be held from November 3 to 9, 1981, in Cairo, Egypt.

Enquiries: Remote Sensing Centre, Environmental Research Institute of Michigan, PO Box 8618, Ann Arbor, Michigan 48107 USA.

DESALINATION

An international congress on Desalination and Water Reuse (theme: "Water, the essence of life") will be held from November 29 to December 3, 1981 in Manama, State of Bahrain.

Enquiries: Congress Chairman, IDEA Congress Headquarters, 1000 River Road, Teaneck, New Jersey, 07666, USA.

IAWPR

The 11th Conference of the International Association on Water Pollution Research will be held from March 29 to April 2, 1982, in Cape Town, RSA.

Enquiries: The Symposium Secretariat, S.201, CSIR, PO Box 395, Pretoria, 0001, REP. OF SOUTH AFRICA.

SA WATERBULLETIN

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Editor: Anton Prinsloo

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Redakteur: Anton Prinsloo

finally ... TV tells it all!

That noted water reclamationist, Sir Settill de Mesz, recently faced the press on that exhilarating, exciting and provocative programme *Mid-week*. *Finally* is indeed privileged to be able to bring its readers a verbatim account of this illuminating interview, conducted by TV-caster Stirrup Probsz.

Probsz: Sir Settill, would you say that purified sewage effluent is-

Sir S: Oh, definitely, oh decidedly, I would, yes. You, as a layman, may have been drawn into the, ha-ha, vortex of negative public opinion, but I know it to be a fact.

Probsz: What I mean is: When *E. coli* occurs-

Sir S: Oh, it occurs anytime. Oh, undoubtedly, any old time, even, ha-ha, tea time, harvest time and quittin' time. Oh yes, yes.

Probsz: Would you be prepared to say that large-scale purif-

Sir S: Oh, but of course. I would. I must. Very large, in fact, since, ha-ha, antediluvian times. Even Noah seemed overwhelmed by the, ha-ha, volume of the product water, so to speak.

Probsz: You do not feel, do you, that-

Sir S: I normally do not, no. I may make an exception, though.

Probsz: -that the moral or ethical angle-

Sir S: Moral, ethical, acute, obtuse or reflex angles — all undoubtedly have to be considered. In critical circumstances, ha-ha,
(To page 23)