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Editorial offices:
Water Research Commission, Private Bag X03, Gezina, 0031, Republic of South Africa. Tel (012) 330-9025. Fax (012) 331-1136.
WRC Internet address: http://www.wrc.org.za
Editor: Jan du Plessis, E-mail: jand@wrc.org.za. **Editorial Secretary:** Rina Human, E-mail: rinah@wrc.org.za
Layout: Drinie van Rensburg, WRC. E-mail: driniev@wrc.org.za

Letters to the Editor

(E-mail jan@wrc.org.za)

WRC RESEARCH REPORTS

Arend Hoogervorst of Hillcrest, Editor: Eagle Bulletin, writes:

I used the predecessor of "*The Water Wheel*" (*SA Waterbulletin*) to keep track of WRC Research Reports, review and summarise them and inform my readers appropriately.

You seem to have stopped the publication of information (in a summary form) to enable me to order the reports and review them. Is this temporary or has the flow of finalised reports slowed? My readers indicate to me that they find my service of tracking WRC reports valuable. If you are stopping this source, is there an alternate way I can get the information so that I can order the copies for review?

(New WRC Reports are announced on the Water Research Commission's website – www.wrc.org.za – and also in the WRC newsletter Amanzi. However, if there are other readers who share Mr Hoogervorst's sentiments please give us your comments on the Feedback Postcard in this issue. See p. 16 - Ed)

WETLANDS OF THE WESTERN CAPE

Professor Jenny Day, Director of the Freshwater Research Unit, Department of Zoology, University of Cape Town, writes:

DR STEVE MITCHELL, Director: Water-Linked Ecosystems, at the Water Research Commission suggested that I should ask if it would be possible to put the following announcement in the 'Water Wheel'L

> *For sale:* 'A field classification system for the wetlands of the Western Cape' by Genevieve Jones & Jenny Day, produced by the Freshwater Research Unit at UCT, in conjunction with WWF(SA). Price: R80 including postage. Contact Ms C April at ccoulsen@botzoo.uct.ac.za or write to the Freshwater Research Unit, Zoology Dept, University of Cape Town, 7701 Rondebosch, W. Cape.

For more information visit the Zoology Dept's website at http://www.zoology.uct.ac.za and the FRU website at http://www.zoology.uct.ac.za/docs/fresh.html

WETLAND PLANTS

Roy Dick from Cape Town writes:

The report by Edith Webster (*Wetland Plants – Dr Jekyll or Mr Hyde? – The Water Wheel Nov/Dec 2003*) contains elements which are both disturbing and misleading. It is unfortunate that apart from *Typha* and *Aponogeton*, the only other genus referred to is *Potamogeton*, whose species are also used in photographs as examples of aquatic "weeds". It is even more disturbing to read that *Potamogeton's* prime relevance would appear to be that of an indicator of good fishing areas of an exotic sportfish, bass. It is hard to believe that there is no mention of the work of Professor Brian Allanson on the fundamental role of *Potamogeton* species in South African coastal lake ecosystems (Zandvlei – Muizenberg, Zeekoevlei, Swartvlei, Lake Sibaya, etc.).

The use of the term "weed" is unfortunate and open to misconstrual. One wonders why known noxious aquatic weeds (*Eichhornia, Myriophyllum, Pistia, Salvinia*) which are also prevalent in wetlands were not mentioned at all.

It would be appreciated if the topic were discussed more fully in a future issue of the magazine and the genera placed in their true roles.

WORLD WATER DAY

Dick de Jong, Information and Communication Officer, IRC International Water and Sanitation Centre, the Netherlands, writes:

THIS YEAR'S WORLD water day 2004 on 22 March focuses on the theme: Water and Disasters.

Natural disasters (weather, climate and water resources) can have a devastating impact on socio-economic development and on the well-being of humankind. According to the World Meteorological Organisation weather and climate-related extreme events, such as tornadoes, thunderstorms, storms, cyclones, floods and drought, account for nearly 75% of all disasters in the world. They lead to an enormous toll of human suffering, loss of life and economic damage. Monitoring these events, predicting their movements and issuing timely warnings are essential to mitigate the disastrous impact of such events on population and economy.

Despite globalisation, we often do not hear about thousands of local disasters which devastate or destroy communities. Other local crises only become internationally known because of one dramatic picture published in the world's media. Everybody remembers the remarkable pictures of the little girl in the mud during Hurricane Mitch in Honduras, in October 1998. Or the image of the young mother who gave birth to a baby while trapped in a tree in Mozambique. Both mother and baby were saved by a helicopter during the floods that swept also through Botswana, Mozambique, Swaziland and Zimbabwe in 2000.

HIV/AIDS

The HIV/AIDS epidemic is another disaster but its impact on water, sanitation and related hygiene provision and organisations is not widely known. Infection rates can be as high as 30% in some high prevalence countries, according to authors Evelien Kamminga and Madeleen Wegelin-Schuringa in their thematic overview paper *HIV/AIDS and water, sanitation and hygiene* (published by IRC, see http://www.irc.nl/content/view/full/3462).

HIV/AIDS damages the sustainability of water and sanitation systems in a number of ways. In particular HIV/AIDS:

- reduces the ability of water users to pay water fees;
- reduces the ability of water users to spend time and energy on management activities;
- erodes management capacities due to loss of knowledge and skills (social capital);
- damages the ability of households to participate in planning and decision-making, so risking the possibility that their specific needs may not be taken into account.

The IRC's *World Water Day website for 2004* is now updated. Please submit your event or contribution online at http://www.worldwaterday.org

FELLOWSHIPS: UNESCO

Willie Lötz, CEO of the Water Institute of Southern Africa (WISA), writes:

The UNESCO Institute for Water Education - newly reorganised entity – has informed WISA about some new programmes they will be offering for which fellowships are available.

Further details about the programs available as well as the Fellowships can be found at http://www.ihe.nl/education/masters.htm

Alternatively you can also contact the following address: UNESCO-IHE Institute for Water Education, P.O. Box 3015, 2601 DA DELFT, THE NETHERLANDS,
tel. +31 15 2151896, fax +31 15 2122921.

CALL FOR PAPERS: *WATER SA* SPECIAL ISSUE

Rashid M. Hassan, Guest Editor of a special issue of Water SA 2005 on Irrigated and Rain-fed Agriculture for Poverty Reduction in Sub-Saharan and North Africa - Past Performance and Future Challenges – writes:

Water SA is a multidisciplinary journal funded and published by the Water Research Commission (WRC) of South Africa. The journal publishes refereed, original work in all branches of water science, technology and engineering.

Water SA is introducing a series of special editions on various interdisciplinary themes on water resource management in Africa. The first of these editions is planned in collaboration with the Centre for Environmental Economics and Policy Analysis in Africa (CEEPA), to publish original research work on the contribution of irrigated and rain-fed agriculture to poverty reduction in sub-Saharan and North Africa. Contributions are invited for this special issue from all branches of scientific water research and policy on approaches to measurement and evaluation of experiences in technological, institutional and policy innovations for managing water resources in support of irrigation and rain-fed agricultural production systems for poverty reduction. Please note that the particular emphasis of this special issue is on the role of various aspects of water resource management, and not the contributions of other forces of agricultural change to poverty reduction such as breeding and improved crop management innovations in isolation of associated water management problems and challenges.

The special issue will be peer-reviewed by a panel of renowned international experts in the relevant disciplines from Africa and the rest of the world. The final date for submission of manuscripts for this special issue, which will be printed by March 2005, is June 30, 2004.

Submission of work solely authored by or co-authored with Africans is especially encouraged.

Please send manuscripts to: Rashid M. Hassan, Guest Editor - Special Issue of Water SA 2005. Room 2-6, Agricultural Annex CEEPA, University of Pretoria, Pretoria 0002.
E-mail: duplessisd@postino.up.ac.za
Fax: (27-12) 4204958

FOG HARVESTING

Rosemary Smythe from Cape Town writes:

I am fascinated with the concept of water from clouds/fog. I heard about the Water Research Commission's project at the Tshanowa Junior school in Limpopo Province on the radio and it then took me ages to find out the details. Eventually I tracked it down on the internet.

I have a cottage on Langebaan Lagoon and have observed how much condensation is evident after a heavy overnight mist. I am now going to experiment with your collection scheme and see how much water can be collected to fill a pond!! I will only be using 2m poles in order not to be unsightly! The only part of the plan causing a headache is how to bend the gutter round the middle pole? but I'm working on it. I will also be combining it with collecting rain run off which at present is causing erosion!

We store our rainwater in 4 x 2 500 l tanks for the house and have access to a well with slightly brackish water for the toilet. We use solar energy for the lights and pumps and gas for heating and the fridge so we are self-sufficient.

And whilst this is not for our own consumption, yet, it will be a fun experiment.

(This is a great story! Please send us a few pictures of the experiment – Ed)

DAILY LIQUID INTAKE

The American Water Works Association (AWWA), at a press conference on 11 February, released a few general guidelines for men and women on daily intake of water from all sources. The guidelines are from a report by a leading US science research organisation.

"We don't offer any rule of thumb based on how many glasses of water people should drink a day, because our hydration needs can be met through a variety of sources in addition to water," said Lawrence Appel, chair of the panel that wrote the report and professor of epidemiology and international health at John Hopkins University.

Based on national data from the United States and Canada, the panel set the recommended dietary intake of 2.7 ℓ for women and 3.7 ℓ for men. Those who are more physically active or live in hot climates may need to consume more water, Appel advised.

About 80% of people's total water consumption comes from drinking water and other beverages and 20% from food. All sources of liquid – including caffeinated drinks – are countable for the recommended intake.

A question arose at the press conference about the validity of two common myths about drinking water:

- If a person is thirsty, he or she is already dehydrated.
- Drinking enough water so that a person's urine is pale is a measure of adequate hydration

Appel noted that thirst is an adequate stimulus for maintaining hydration. "An individual can be transiently dehydrated," he said, indicating that throughout a day a person will naturally consume enough liquid. He also noted that the colour of a person's urine is a "crude index" of liquid intake.

Appel said that conditions in which blood sodium levels are abnormally low – leading to a danger of hyponutremia, or too much water intake – is very rare.

WRC SANITATION STRATEGY ANNOUNCED

The Water Research Commission (WRC) has published a document which outlines its new sanitation research strategy.

The research strategy focuses on the provision of basic sanitation and hygiene education, with an emphasis on the challenges facing South Africa's rural areas where water and sanitation issues are of critical importance due to the lack of resources and capacity.

Says Jay Bhagwan, WRC Director: Water Use and Waste Management, while the WRC recognizes the needs of the urban informal and peri-urban areas, these needs will be addressed under a separate research programme.

He says the strategy presented in the document is the culmination of a thorough consultative process. This included the identification of needs via a questionnaire survey addressing sanitation professionals in the sector, and two workshops attended by national stakeholders and local or regional representatives of Water Services Authorities and Service Providers. These processes have provided a wealth of information and knowledge, and have identified key issues requiring investigation.

The strategy will guide the topics and areas that the WRC aims to fund over the next few years through both solicited and non-solicited projects. The WRC, however, welcomes any ideas and constructive criticism which would enrich the strategy and allow the WRC to further update and upgrade the current strategy.

For more information on the Sanitation Strategy, please visit the WRC's website – www.wrc.org.za

Kruger Rivers Post-Flood Research Programme

by Melissa Parsons

Photograph – Mark Rountree

Because of their size and social impact, the floods of February and March 2000 attracted the attention of the world. In Kruger National Park, flooding of the Sabie and Letaba Rivers caused significant damage to park infrastructure. Damage to bridges, buildings and roads has since been repaired, but what were the effects of the flood on river ecosystems?

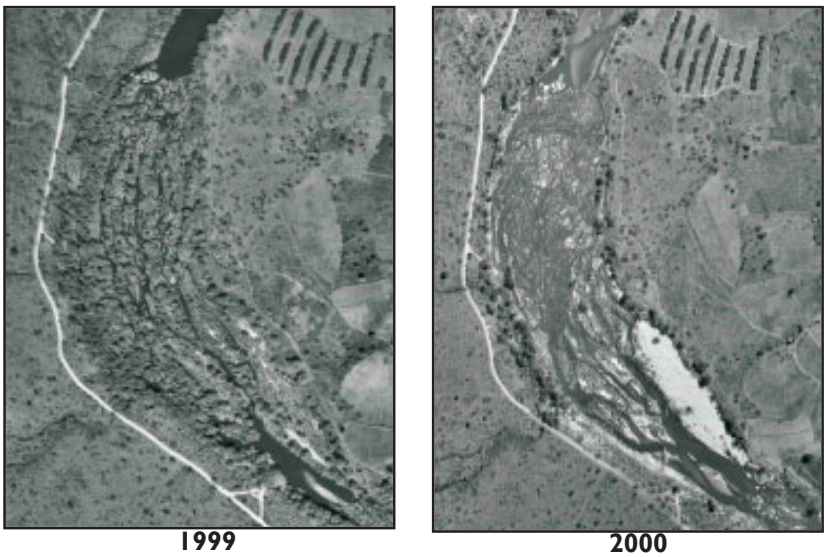
Floods of different sizes are an integral part of river ecosystems. Large, infrequently occurring floods, like the one in 2000, are important because they reorganize the physical environment by eroding and depositing sediment, removing riparian vegetation, and redistributing nutrients. Large floods may also alter instream faunal communities such as fish and macroinvertebrates.

But these large floods do not wipe the slate clean as we might think they do. Instead, floods leave a patchy biological and physical imprint because water velocity varies in different parts of the river channel and many riverine organisms are adapted to survive flooding. For example, many riparian plant species are able to withstand inundation by flood water, while others are able to regenerate from broken fragments.

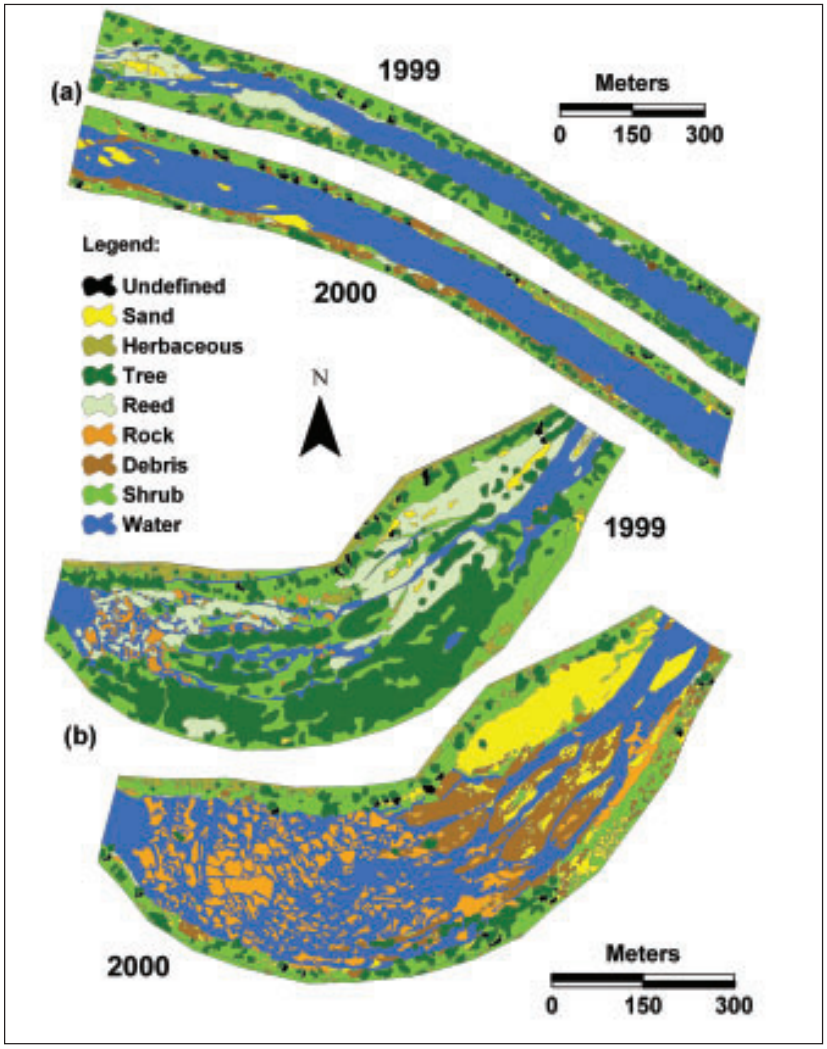
The parts of the physical environment and the organisms that survive a large flood have important implications for the subsequent response of a river, because they form the template upon which all future ecological processes take place. Thus, the 2000 flood has left an imprint that may influence river ecosystems in Kruger National Park for decades to come.

MELLON FOUNDATION

Funded by the Andrew W. Mellon Foundation, the Centre for Water in the Environment and Kruger National Park have embarked on a research programme examining the response of Kruger Rivers to the 2000 flood. One of the first steps



Aerial photographs of a section of river before (1999) and after (2000) the flood.



Landscape state change between 1999 (pre-flood) and 2000 (post-flood) in the a) braided and b) pool-rapid geomorphologies of the Sabie River.

*Sycamore Fig (*Ficus sycomorus*) seedling.*

Photograph – Melissa Parsons

*Jackal-berry (*Diospyros mespiliformis*) seedling.*

Photograph – Melissa Parsons

*Tamboti (*Breonadia salicina*) seedlings usually establish in bedrock crevices.*

Photograph – Melissa Parsons

Photograph – Mark Rountree

The flood damaged or removed many riparian plants.

Photograph – Melissa Parsons

Ongoing research will examine the importance of residual vegetation, such as this surviving adult Sycamore Fig.

in the Post-Flood Research Programme was to document the initial imprint of the flood in the Sabie River.

Using GIS technology, we examined the effect of the flood on the mosaic of tree, shrub, reed, herbaceous vegetation, bedrock, sand, water and debris patches that occur within the river (see diagram).

FLOOD MOSAICS

Differences between the pre- and post-flood mosaics showed that the flood stripped large amounts of trees, shrubs and reeds to expose the underlying physical template of bedrock, water and sand. Thus, the flood changed the river mosaic from a vegetated to an unvegetated state.

However, the flood did not remove all the vegetation patches along the river. Rather, the pattern and amount of residual vegetation patches varied in river sections with different geomorphology. For example, in the steeper pool-rapid sections vegetation stripping was severe, and few patches remained after the flood. But, in the lower-gradient braided sections, stripping was less severe, leaving a higher amount of residual shrub and tree vegetation patches.

Photograph – Melissa Parsons

*Expansion of a surviving reed patch (*Phragmites mauritianus*) into sand deposited by the flood.*

RIPARIAN PLANTS

The flood also had a variable effect on individual riparian plant species. Densities of commonly occurring species such as Potato-bush, Matumi, Red Spikethorn, Bushveld Waterberry and Tamboti were significantly reduced because of destruction by floodwaters.

In contrast, densities of species

Photograph – Melissa Parsons.

*River Bushwillow (*Combretum erythrophyllum*) regenerating from the broken parent plant.*

Photograph – Melissa Parsons.

The flood introduced a large number of woody debris piles, which offer favourable conditions for seedling recruitment.

such as Cucumber Bush, Pigeonwood, Magic Guarri and Flame Climbing Bushwillow increased significantly after the flood because of recruitment from seed or regeneration from broken parts of the parent plant.

The imprint left by the flood provides a baseline for future research on the response of the river. A major part of the research will focus on post-flood vegetation response, and the factors that may influence the types of vegetation communities that develop, such as:

- the type, amount and location of residual species
- levels of herbivory on seedlings
- presence of alien weeds
- environmental influences such as drought, river flow and elevation within the channel.

ECOLOGICAL RESERVE

The effects of the flood on the biophysical character of the Sabie River also raise questions about the Ecological Reserve. Instream Flow Requirements (IFRs) were proposed to maintain the pre-flood state, but marked changes in the biophysical character of the river may warrant a post-flood re-evaluation of IFRs. The Kruger Rivers Post-Flood Research Programme provides an excellent opportunity to test the post-flood applicability of IFRs, particularly because operation of the Injaka Dam, on a tributary of the Sabie River, will allow proper implementation of the Reserve in this very important river.

Studies on ecosystem response to catastrophic events such as the 1980 Mt St Helens volcanic eruption and the 1988 fires in Yellowstone National Park indicate that these ecosystems are shaping up to be similar to their pre-disturbance state. The Post Flood Research Programme will examine whether a similar trend emerges in the Sabie River.

For further information on the Post-Flood Research Programme, including research opportunities within the Programme, please contact Dr. Melissa Parsons, at the Centre for Water in the Environment, (011) 717 6430.

Women Take the Lead in Nhlungwane Water Project

The Nhlungwane community lives in one of the most arid parts of KwaZulu-Natal. About one hour's drive away, Greytown is a well watered, semi-forested, grassland area. But just over the mountain the landscape changes dramatically. The community of Nhlungwane lies in a dry, stony, semi-desert area. These people are amongst the poorest communities in the province. Yet they have demonstrated remarkable resourcefulness over the last few years with their community-run water project. Louise Torr reports.

Sthombe Ngubane is the deputy chair of the Nhlungwane Water Committee. She is seen here collecting water from the standpipe.

The uThukela and Mpofana rivers run through the area where the Nhlungwane community lives, and community vegetable gardens are cultivated at the confluence of these two rivers. However, not everyone lives on the river banks, and the gardens are far from the Nhlungwane people's homes.

The Nhlungwane community is a relatively small settlement of around 220 homesteads. The dry river bed of the Nhlungwane River runs between the homesteads, but this river only flows during times of heavy rainfall. In the past the women had to walk long distances to the Mpofana River to collect water.

Women perform much of the physical labour in this inhospitable region. Their burden has been considerably reduced since water has been piped closer to their homes.

HOW THE WATER PROJECT WORKS

The water project was completed six years ago. Forty taps have been installed at standpipes throughout the community, with each tap serving about five households. A diesel engine at the pump-house pumps borehole water to four storage reservoirs, from where the water flows back to the taps. In addition there are five handpumps located in the area.

The price of standpipe water is R7.00 per family per month. People make their contributions on the seventh of each month. For this they get three times 25 ℓ a day, i.e. 75 ℓ on weekdays, and five times 25 ℓ on weekends, when they need more water because there are more people around, which involves more laundry and more cleaning.

Each tap has a caretaker, who administers the water supply to each cluster of homes. The community adheres to strict rules regarding the collection and payment of water. They collect water at 7:00, when the caretakers are on duty for one hour. If they haven't paid their R7.00 monthly fee by the seventh of every month, they have to go to a handpump. They have a penalty system in place for late payments – if they fail to pay after seven days, the cost is R12.00 per month, instead of R7.00. If anyone wants more, they have to pay twice as much. There is no sliding scale.

The uTukela River flows through the arid, stony area that is home to the Nhlungwane community. Women used to collect water from the river before water was provided closer to their homes.

99% of the people pay for their water. However, there are five handpumps where water can be obtained without having to pay. Those who cannot afford to pay use these, or those who may need more water than their daily allowance.

People are prepared to pay for the standpipe water close to their

Deputy chair of the Nhlungwane Water Committee Sthombe Ngubane collects water from the standpipe and carefully waters the vegetables in the small garden adjacent to the homes.

Buzi Mzila is the pump operator, as well as being an additional committee member of the Nhlungwane Water Committee. Her duty is to make sure that the pump is working, and that people are getting water.

houses because this has many advantages over the handpumps. The handpumps are far from the households; do not always yield enough water; take time to pump and deliver water (people have to queue, and sometimes go at night to avoid queuing); and sometimes the handpumps break down. Broken handpumps are reported to the district municipality.

People are disciplined and careful about the way that they use water. They ration themselves to three containers per day during the week. However, they also need water for their cattle, and for this they rely on the rivers or on water from the handpump.

A COMMUNITY MANAGED PROJECT

Nhlungwane is a small, progressive and cohesive community. There is a high level of participation in community affairs, and as a whole the community is cohesive and disciplined. On the twenty seventh of every month, the water project staff and caretakers get together and discuss issues related to water and its use.

The community has appointed a number of staff to keep the water flowing to their yards. A plumber fixes pipes and taps, and services reservoirs. An operator runs the pump house and services the pump. An administrator collects money, plots graphs of indicators such as income, expenditure and the consistency of supply. A number of caretakers are responsible for managing the collection of water from the standpipes.

The borehole water is managed from the pumphouse. The diesel generator needs an oil and filter change every 250 pumping hours (every 2-3 months), and this servicing is done by the village staff.

WOMEN PLAY A LEADING ROLE

There is a high level of involvement by women in the project. The chair is a man, but the project is 90% run by women. All the caretakers of the standpipes are women, and the pump operator is also a woman.

The women agree that the water project has brought some

Women in the small home garden alongside the standpipe. People in this arid region use water sparingly, and honour their water bills.

Women from Nhlungwane participate actively in the water project, and play important decision-making roles.

changes to gender positions and perceptions, and has given women a more prominent role in their community. It has provided an opportunity for women to get involved and play a role in making decisions. Women often advise the men, who do pay attention to their advice. Men also ask the women for help. The women recognise that in a society where women are generally placed in a subordinate position, this project has tipped the balance as far as gender equality is concerned.

Their involvement in the project has helped the women to develop certain skills. For example, women have learned how to lay pipes and how to operate and maintain an engine. Women are motivated to ensure the success of the water project, because they are the main water users. Men work in town, and the women contend that the men don't know where the water comes from. Women manage the water in the community, and they teach their children about water and the uses of water.

The water project has improved the quality of people's lives. The women believe that the very fact of getting water close to their homes is the outstanding achievement of this project. It was difficult before, and they no longer have to walk long distances to fetch water. It is easier to cook, and to clean homes, to cultivate family gardens and to keep livestock. Through this project people have learned to sit down and resolve their problems. Since they started getting piped water there has been no cholera in Nhlungwane.

FREE BASIC WATER

For a cohesive community such as Nhlungwane, with a good track record of paying for their water supply, the issue of free basic water in 2004 offers exciting opportunities, and also some dangers.

Pietermaritzburg-based Partners in Development (PID) is currently working with the Mvula Trust on a Water Research Commission project concerned with different models for the implementation of free basic water in rural areas. PID is liaising with the uMzinyathi District Municipality and uThukela Water Partnership, a new service provider that delivers water to this community. They are considering ways to enhance the current positive community involvement, so that with free water allocation, they can further develop their judicious use of water to improve their living standards. This community has done so well, that opportunities will be explored for them to keep running their own scheme, as they make the transition to free basic water. One option that may be tested is a voucher system which will entitle families to receive their free basic water allotment free of charge, as well as the opportunity to buy additional water to enhance their quality of life.

The quality of people's lives in Nhlungwane has improved due to the close proximity of water to their homes. The key to the phenomenal success of this project is the involvement of the community, particularly the women, and their efforts to take ownership and to manage their own water supply.

New Hope for Troubled Waters: The Hartbeespoort Dam Test Case

Hartbeespoort Dam, photographed from the dam wall. The algae blooms experienced in April last year triggered DWAF's approval of over R1 million for emergency clean-ups, and an investigation into preventative water treatment strategies.

The Department of Water Affairs and Forestry (DWAF) has embarked on a bold new approach towards eutrophication management in South Africa. This move – which will see the much-debated phosphate standard take a back seat to integrated biological solutions – is a decisive step in a whole new direction.

In 2003, Hartbeespoort Dam near Brits suffered some of the worst algae blooms ever experienced in South Africa. While the cause - high phosphate levels - is not unique to the dam, nowhere else in the country, and possibly the world, do these "hyperscums" grow so rapidly or in such vast quantities.

In June last year, *Water Wheel* spoke to Petrus Venter, Deputy Regional Director of Water Resource Management in the North West province, who explained that upstream treatment actions were unable to reverse the conditions at the dam, largely because they failed to tackle the real root of the problem.

"The most successful management approach so far has been the physical removal of the cyanobacterial scum that forms when the blue-green algae rises to the surface and starts rotting," he says. "During the emergency clean-up last April, it took ten days to pump out the bulk of the three hectares of scum that had accumulated along the dam wall. In doing so, we removed about 500 kg worth of phosphate (as P) from the dam."

Although this put an immediate end to the fumes and foul smell that the rotting algae released, the clean-up did little to counteract the actual level of phosphate in the dam water, which is estimated to be about 25 tons (as P) when full. Considering that at least 20 tons of phosphate

flow into the dam through its tributaries each year, the 500 kg removal pales into insignificance. At a cost of about R1 million per ton, physical removal is also clearly not a viable long-term solution.

Venter has, for some time, been pushing for the adoption of an integrated treatment approach, based both on control of phosphate inflow into the dam, and more importantly on biological solutions that will allow the dam's ecosystem to manage algal growth naturally.

Even if current treatment methods could reduce phosphate levels at both point source and in the dam, they don't cater for the sediment phosphate that could be reloaded into the water at any time.

He explains that last year's algae blooms triggered the approval of a R1,2 million budget for the emergency clean-ups. DWAF's Director-General also initiated the formation of an institute by the end of 2003, to focus on preventative-based eutrophication management.

Venter firmly believes that this is the only way to go. "We need to develop a biological solution for what is really a biological problem. The algae blooms are nature's own way of removing excess phosphate from water. Used in isolation, civil controls – such as the phosphate standard – have not, and will not, make a significance difference."

WHY THE PHOSPHATE STANDARD ISN'T WORKING

"Since the 1970s the South African government and local councils have spent in excess of R800 million developing and implementing the phosphate standard specifically to tackle and control this type of problem," explains Venter. "The reality, after 20 to 25 years, is that it has not achieved its goals."

The National Water Act of 1998 includes strict regulations regarding the phosphate levels in water that is released by industry back into South Africa's river system. While most companies in the Hartbeespoort Dam catchment area meet this standard, and although the concentration of phosphate going into the dam has lowered, the phosphate load measured in the dam water is as high as ever. In Venter's 15 years of working there, last year's algae blooms are the worst he has ever seen.

"They also continued right through the winter months, which is very unusual and difficult to explain," says Venter.

"As an isolated approach, the phosphate standard is a global failure. In many countries it is being pushed aside in favour of integrated treatment approaches with a strong biological component. European countries like Finland and the Netherlands have followed this route successfully for a number of years."

And it's not a question of the phosphate standard being too low, adds Venter. The expense of developing and implementing

HOW SERIOUS IS THE PROBLEM?

Phosphate levels at Hartbeespoort Dam are measured both at point source, to establish how much phosphate is flowing in from the tributaries, as well as in the lower levels of the dam water itself.

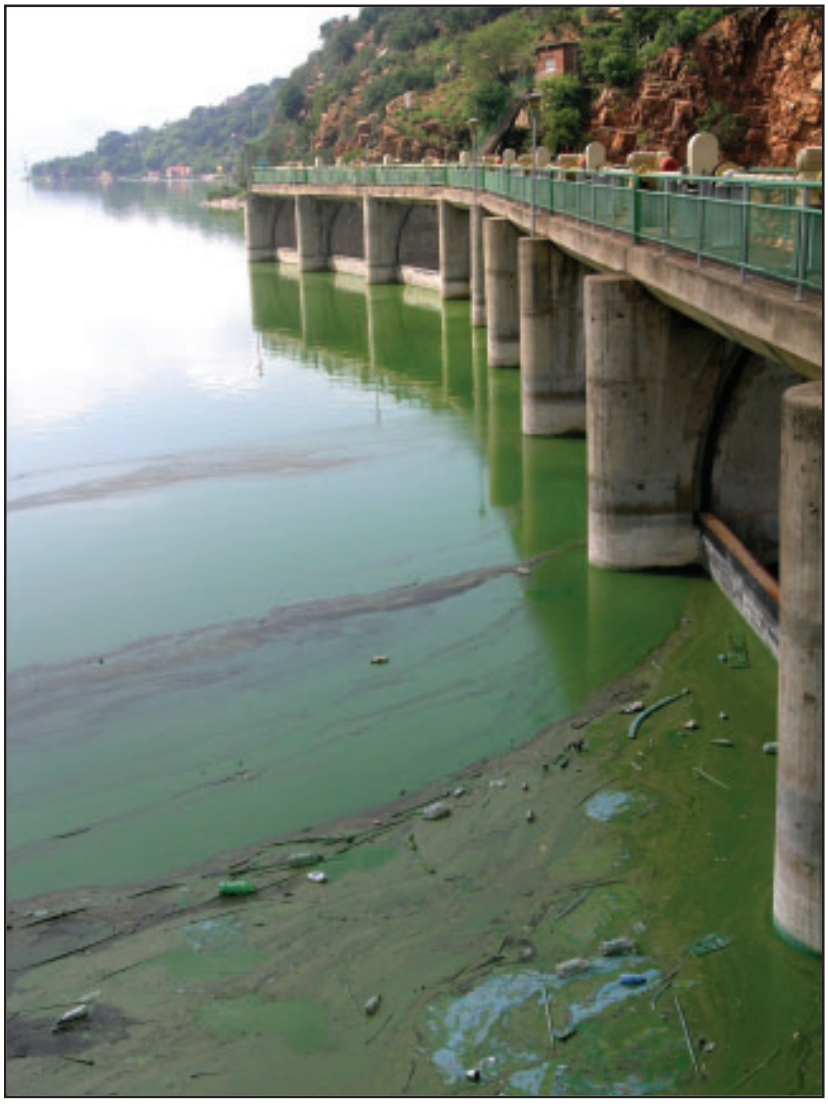
The measured inflow of phosphate is around 20 tons per year, and the current measured load in the main water body is estimated to be 25 tons. Real inflow levels could be higher, however, as these measurements don't take into account diffused sources, such as storm-water and related sewer blockages.

Additionally, the sediment at the bottom of the dam holds phosphate, which is released when the sediment is disturbed, or in summer when the deeper layers of water become anaerobic (oxygen depleted). This is known as re-loading. Venter warns that Hartbeespoort's sediment could contain as much as 140 tons of phosphate, while the annual load from incoming sediments could be as much as180 tons.

Based on the minimum legal phosphate levels, Venter has calculated that about 200 tons of phosphate are generated by industries in the catchment area each year. "However, historic measurement models are based on incoming water *after* filtration," he says. "If only 20 tons are measured in the water load, then at least 180 tons of phosphate are being carried into the dam by sediment."

In other words, even if current treatment methods could reduce phosphate levels at both point source and in the dam, these methods don't cater for the sediment phosphate that could be reloaded into the water at any time.

"We need to get phosphate levels in the dam down from an average of 0,12 mg/ℓ to less than 0,05 mg/ℓ in order to significantly reduce algae growth ," says Venter. "Reducing the inflow load to ten tons of phosphate per year would be the point at which we'd move away from the current eutrophic state."



In looking at the algae currently accumulating along the Hartbeespoort Dam wall, it is easy to think that one good flood would literally wash the problem away. In fact, it would have the opposite effect. While a flood washes the algae out, it also brings in massive sediment and phosphate, effectively "supercharging" the dam with nutrients.

a revised standard blows this alternative right out of the water. "At the moment, chemical treatment alone costs R4 to R6 million in the catchment area, and upgrading the infrastructure needed to cope with a stricter standard could cost as much as R100 million."

THE WAY FORWARD

Although still in planning stages and subject to the set-up of appropriate financial systems, DWAF plans to follow in Europe's footsteps by implementing biological water management systems in South Africa. Simply put, this means adjusting the biodiversity in a water body to increase the amount of zooplankton, specifically the *Daphnia* water flea and other zooplankton species, which feed on algae. In Hartbeespoort's case it also means removing carp and some species of barbel. These bottom-feeders stir up the nutrient-rich sediment, causing phosphate to be released into the water. The carp also feed on vegetation, destroying the essential habitat of some algae-eating organisms, such as the water flea.

"This combined approach could reduce phosphate levels in Hartbeespoort by as much as 80%," says Venter. "The balance can then be controlled by floating wetlands, which function as natural nutrient filters."

Venter explains that DWAF is investigating how to customise this approach to suit South African conditions. Once achieved, it will form the blueprint for eutrophication management countrywide.

"R2 million has been made available for planning, costing and selection of the best options, which will be tested on a small scale in the first few months of 2004," he says. This all sounds relatively simple, but the Department faces a number of hurdles, not least of which is the R5-R9 million implementation price tag.

"We need to treat the water as it comes into the dam, and then set in place a biological system that can keep these reduced levels in balance," says Venter. "However, there will always be some need for the physical removal of algae. Our current technique isn't very effective in

"DWAF and the North West province have made a massive commitment to finding a permanent solution - one that will also benefit at least another 12 dams in South Africa with similar water quality problems."

Petrus Venter, Deputy Regional Director of Water Resource Management in the North West province. Venter is spearheading the Department of Water Affair's drive towards biologically-based eutrophication management.

that a great deal of water is pumped out along with the algae. Optimising this pumping system will cost about R1,2 million."

The Department also has to find a way to ring-fence an equal amount for annual maintenance, which theoretically could be generated through tariffs on water users in the area. "If such tariffs were to be implemented, they would have to target the historical polluters, recreational users, local authorities (who currently provide little in the way of other services besides water provision and basic municipal services). Special tariffs could also be implemented on waste discharges that are facilitated by DWAF."

These costs are quickly put into perspective, however, when you consider that each of last year's "emergency clean-ups" cost around R600 000. It is also unlikely that the owners of the multi-million rand homes dotted around the dam, will argue against a minimal tariff if it comes with a sustainable, long-term solution to the dirty waters.

"We need to get phosphate levels in the dam down from an average of 0,12 mg/ℓ to less than 0,05 mg/ℓ in order to significantly reduce algae growth."

Venter emphasises, however, that the project is not about preserving the playground of the rich and famous. "Although the economic spin-offs surrounding the dam and its adjacent properties are significant, the vital thing here is that DWAF and the North West province have made a massive commitment to finding a permanent solution - one that will also benefit at least another 12 dams in South Africa with similar water quality problems." Once the system is fully operational, it could also lead to other economic benefits such as commercial fishing and harvesting of floating water plants.

SAPWAT Team Calls for Hands-on Feedback

This project has its origins in Water Research Commission (WRC) initiatives to document the performance of irrigation systems and their on-farm applications while at the same time upgrading the WRC funded computer program SAPWAT.

This project based on field contacts is ongoing, but has already led to the development of a revised version of SAPWAT specifically targeting on-farm management. We have now reached the stage where we would like to introduce the new version and obtain as much hands-on feedback as possible.

We can arrange to make a half-day introductory presentation to a small group in order to explain the application of the model using examples based on the farming activities of members. This will not be a hands-on course but interested groups and individuals will be invited to arrange for follow-up activities specifically suited to their requirements.

There will be no charge for the introductory presentation but obviously the participants will be responsible for the venue and refreshments. The program software will be available on a website at no cost. We have been pleasantly surprised to find that those farmers and others with in-depth irrigation experience who own and use computers have found it possible to evaluate and modify their irrigation management using SAPWAT without, or with very little, instruction. The introductory presentation may, in many cases, be all that is required. People with limited irrigation experience, however, will find it more difficult and will benefit from follow-up activities.

The procedure adopted for the presentations is relatively simple. The members of the group gather around the screen and the facilitator asks them to help set up typical crops for discussion. The reaction of the participants has been gratifying with the relaxed computer game atmosphere created leading to a readiness to suggest a variety of options for improvements both to SAPWAT and on-farm activities.

WHAT CAN A GROUP EXPECT TO GAIN FROM THE PRESENTATION?

SAPWAT "imitates" irrigation and to do this realistically must take into account all the inputs that influence irrigation as well as the interactions between them. Just running SAPWAT exposes the user to all those aspects that should be considered and, irrigation being as much an art as a science, only too often are not!

The user needs to know the evaporative demand of the atmosphere and the water holding capacity of the soil as well as the characteristics of the crops and the performance of the irrigation equipment and so on. If the user doesn't know all this SAPWAT will provide the answers but this will inevitably sow the seeds of honest doubt. Is SAPWAT right and has the user been wrong all these years? Perhaps!

SAPWAT can pin-point the factors that are critical in the management of irrigation. Even training needs and who should be trained.

If the irrigation group and their advisors and suppliers have SAPWAT in their armoury they have common ground for decision-making based on fact.

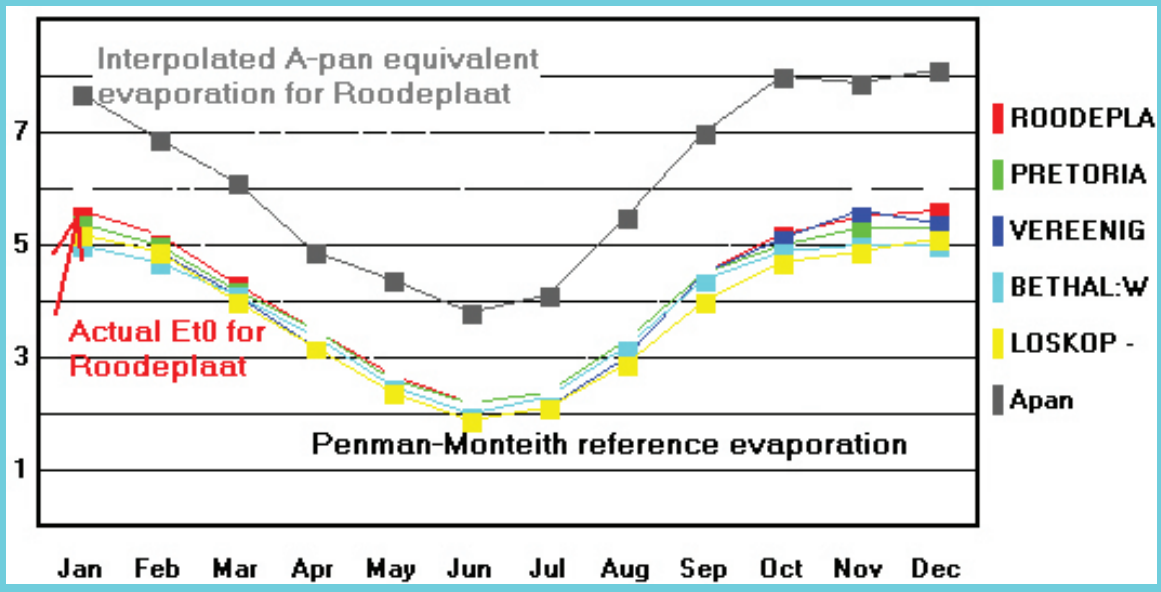
To be valid, however, SAPWAT must stand up and be counted in practice and that is why this appeal is being made.

In the following pages insights are provided into the elements that go to make up SAPWAT with particular emphasis on the extensive databases.

Farmers and scheduling consultant having a preliminary discussion.

Tea time, but lets sort this point out before we join the group.

ATMOSPHERIC DEMAND

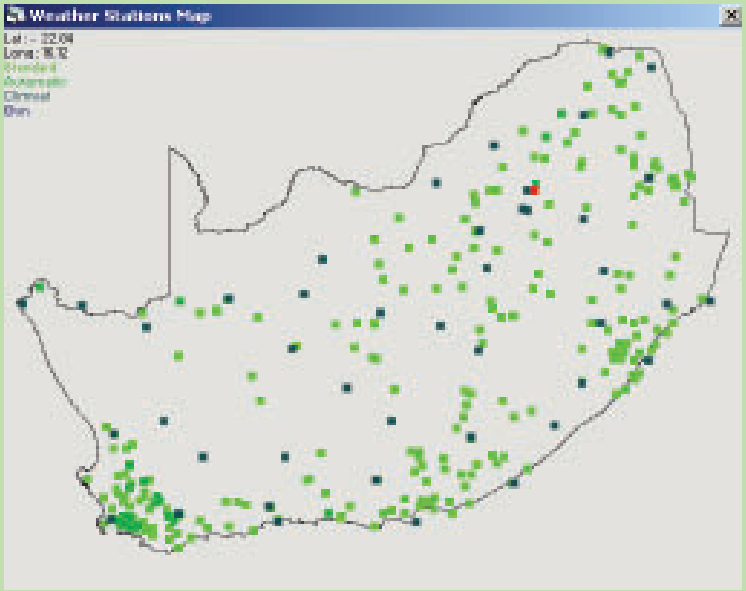


Average daily short grass (Penman-Monteith) reference evapotranspiration in mm

The six weather stations depicted cover a wide area from Pretoria and Vereeniging through to Bethal and Loskop but their average atmospheric demand throughout the year is remarkably similar. There is not the wide differences one would expect. We tend to relate evaporation to temperature but this is only one factor and is not as important as, for example, incoming solar radiation. The graph includes the extensively used A-pan evaporation value for comparative purposes.

The reference evapotranspiration value for the weather station sited out in the desert at Kakamas has an average January value of 9.5 mm per day. Uppington, Prieska, and Kimberley are next in line at 7 mm and are followed by Potchefstroom, Stellenbosch, Adelaide, Montagu, Bloemfontein and Colesberg in the 6 - 6.5 mm category. Pretoria and surprisingly Komatipoort are around 5 - 5.5 mm while the KZN midlands and the Eastern Cape coast is a low 4 mm. There is considerable variation from one day to the next but moving averages are surprisingly consistent.

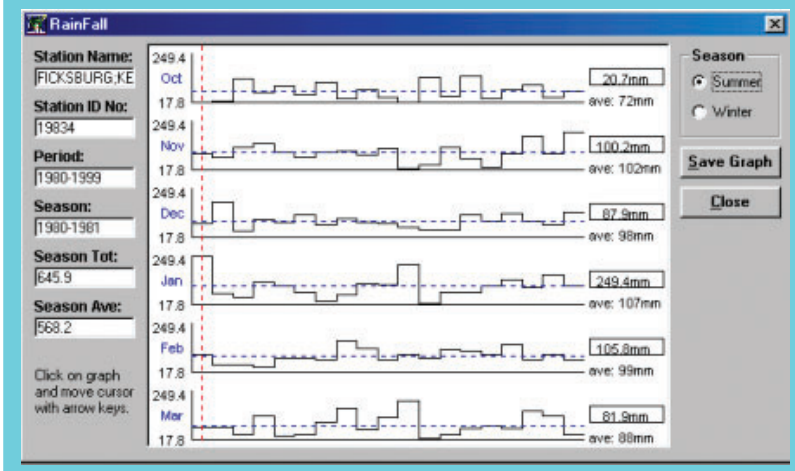
WEATHER DATA



Weather stations - zoom in for names

These are the available weather stations. Long-term evaporation and rainfall data are accessed by clicking on the squares. If you have other weather station data, you can add it to the map. The trick is to pick a station that has climatic conditions similar to those applicable to the farm, this may not be one of the nearest stations.

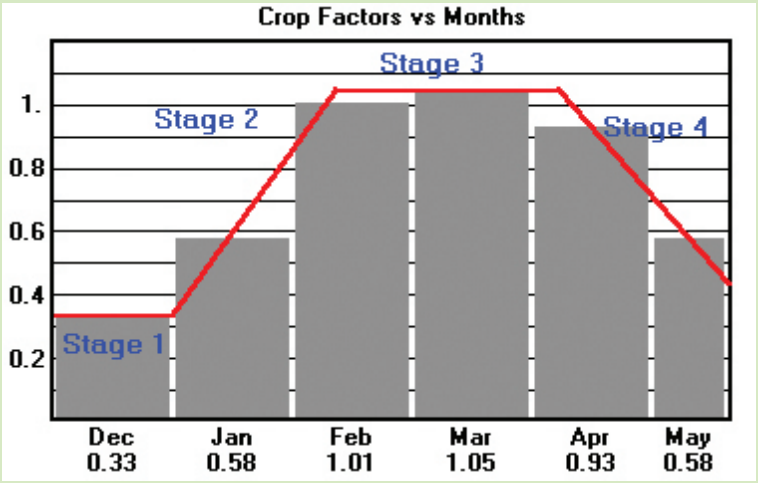
RAINFALL



Example of summer rainfall screen

Over many irrigated areas managing rainfall is an important factor in efficient irrigation during the summer months. There is a tendency to remember the exceptional years, either very wet or very dry, when planning irrigation strategies. As an aid to judgment SAPWAT provides a graphic representation of some 20 years of rainfall records for many of the weather stations. Farmers and designers are seldom statisticians and find it easier to look at the records of the past and, for example, see how often January was dry or what the likelihood is of having two or three dry months following close on each other.

CROP DEVELOPMENT STAGES



Development stages based on ground cover
Stage 1: 0 - 10%, Stage 2: 10 - 100%, Stage 3: 100%, Stage 4: 100 - ?%

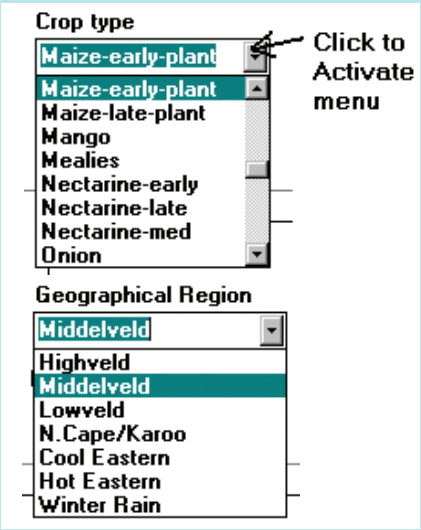
The FAO crop development stages have a major impact on crop factors and consequently irrigation requirements. Climatic conditions affect crop growth, crops develop quicker in warmer climates than in colder climates. Climatic regions and their influence on crop development are included in the SAPWAT database. Obviously planting date is also important so the database includes a range of planting dates, each with its own related phase lengths.

Power, Precision, Production!

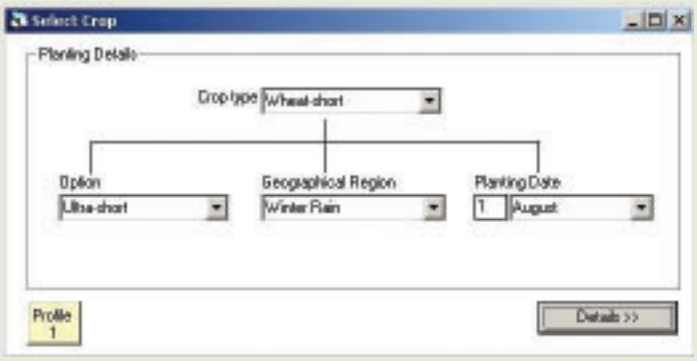
CROPS INCLUDED IN THE DATABASE

CEREALS	FIBRE CROPS	FORAGES	LEGUMES	OIL CROPS	VEGS - CUCUMBER	VEGS - GENERAL
Barley	Cotton	Babala	Beans-runner	Canola	Butternut	Beetroot
Maize		Cereals	Beans_Dry	Sunflower	Cucumbers	Broccoli
Sorghum	FRUIT TREES	Fescue	Beans_Green		Cucurbits	Brussels
Wheat	Almonds	Fodder	Cowpeas	TROPICAL FRUITS	Pumpkin	Carrot
	Apple	Lucerne	Groundnut	Avocado	Spanspek	Celery
ROOTS / TUBERS	Apricot	Summer	Lentils	Bananas	Squash	Clflower
Chicory	Cherries	Sum / win	Peas	Coffee	Squash-baby	Coriander
Patats	Citrus	Perennial	Peas-dry	Datepalm	Watermelon	Lettuce
Potato	Guavas	Ryegrass	Soybean	Grenadella		Onion
Sugarbeet	Macadamia			Litchi	VEGS - SOLANUM	Parsley
Turnips	Nectarine	GRAPES/ BERRIES	SUGAR CANE	Mango	Brinjals	Radishes
	Olives	Brambles	Sugar-annual	Pawpaw	Chillies	Spinach
OTHER	PecanNuts	Vine-table	Sugar-autumn	Tea	Green_peppers	Swiss-chard
Cut_flowers	Pistachio	Vine-wine	Sugar-spring		Paprika	
Mealies	Plums				Tomato	VEGS - PERENNIAL
Opuntia	Peach					Artichoke
Sweetcorn						Asparagus
Tobacco						Strawberry

The database of irrigated crops is extensive but is still in the process of development



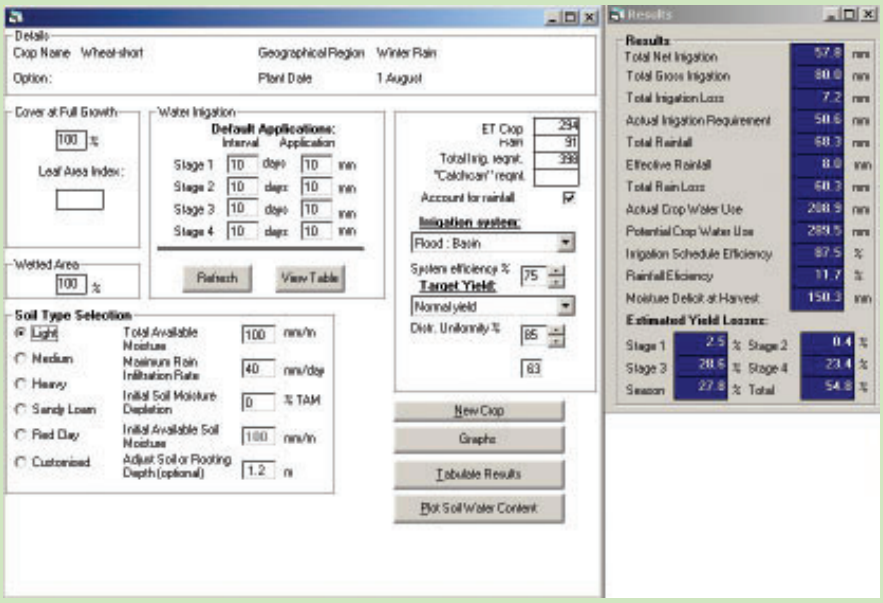
The SAPWAT database includes default planting dates for the various climatic regions as well as stage lengths and the monthly crop coefficients required to calculate crop evapotranspiration. Provision is also made for alternative varieties that may have different development characteristics. Virtually all crops grown under irrigation in South Africa are included as indicated in the table. Crop characteristics and Regions are accessed through drop-down menus and provision is made for the user to edit the files or to add additional crops.

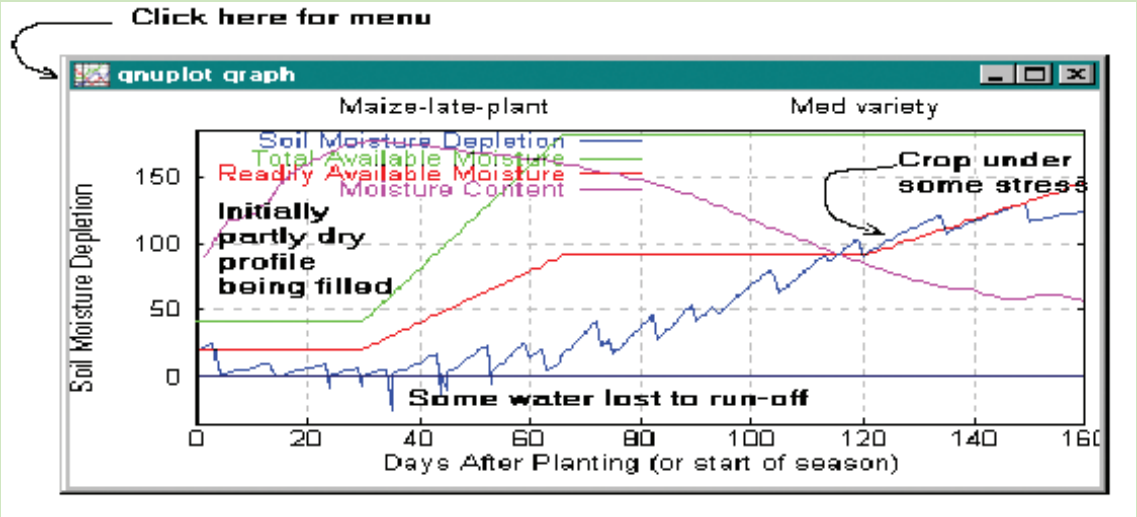


SETTING UP CROP DETAILS

In the new management module of SAPWAT one of the first requirements in setting up the crops is to specify the essential crop information in the screen (left) utilising the drop-down menus.

STRATEGY DEVELOPMENT SCREENS





The new approach to the irrigation strategy scenario development screens.

The SAPWAT database includes default planting dates for the various climatic regions as well as stage lengths and the monthly crop coefficients required to calculate crop evapotranspiration. Provision is also made for alternative varieties that may have different development characteristics. Virtually all crops grown under irrigation in South Africa are included as indicated in the table. Crop characteristics and Regions are accessed through drop-down menus and provision is made for the user to edit the files or to add additional crops.

HELP AND ASSISTANCE WANTED

Study groups, SABI branches and agricultural scientists and extensionists (and anyone else) interested in helping assess the revised on-farm irrigation management version of SAPWAT should please contact Charles Crosby at 012 803 2870 or 083 456 9489, or Pieter van Heerden at 051 446 1521 or 072 209 9329

A Passion for Irrigation and Computer Models

Louis Ehlers wanted to be a scientist since his school years in the small town of Bloemhof just across the Free State border in North West. The town lies right next to the Bloemhof Dam, that forms the centre of an irrigation farming community.

Louis did not grow up on one of these farms. Landing in soil science during his first year of study at the Free State University was the result of a farmer friend's advice.

His consequent growing interest in the more specialised field of irrigation had much to do with pioneer soil scientist Professor Alan Bennie. "Die Oubaas" – which is how Louis calls his biggest source of academic inspiration – is now mostly retired from his lecturing post at the same university. He is a full-time irrigation farmer in Bainsvlei outside Bloemfontein, actively applying the results he obtained over a lengthy research career.

Many will tell you that Prof Bennie will one day be remembered for, among other things, the relevancy of his research. Louis appears to be following this lead – pursuing those results that promise to make a noticeable impact in practice.

His research on the contribution of water tables to irrigation farming is applicable on at least 20% or 260 000 hectares of all irrigated land in South Africa. This is the estimated surface under which shallow water tables - in or just below the potential rooting depth of annual crops – can be found.

Louis Ehlers between wheat plantings on his latest research project's trial plot outside Bloemfontein. Louis and two fellow soil scientists from the Free State University are investigating the effect of deteriorating irrigation water quality on crop growth.

The models compiled with the research results can help ensure reductions of between 30% and 65% in the irrigation requirements of these farmers' crops – with corresponding irrigation water savings. Wheat farmers in particular can save as much as 60%.

This represents considerable relief to an industry whose profits seem destined to suffer due to rising water costs and decreasing availability of water.

It brings even further relief to the many farmers whose soils are constantly under threat of waterlogging and salinisation due to a history of over-irrigation. The adapted models are a welcome alternative to the expensive pipe draining systems they have been using since the eighties to combat these problems.

"Irrigation worldwide leads to increases in groundwater recharge, which in turn results in rising water tables. South Africa is no exception," Louis explains.

"Proper use of shallow water tables, through capillary rise in the root zone, can contribute significantly to crop growth. However, when utilised improperly, these shallow water tables can cause severe crop and soil losses due to salinisation of the upper part of the root zone."

Louis, Prof Bennie and Prof Chris du Preez, also from the Free State

University, recently completed an investigation into the contribution of root accessible water tables towards the irrigation requirements of crops. The three-year-project was funded by the Water Research Commission.

As part of the project they adapted two existing computer models for irrigation farmers: Annandale's Soil Water Balance model (SWB) and Bennie's Soil Water Management Program (SWAMP).

Both models were used to simulate plant roots' water uptake from shallow water tables. The estimated values were found to be of acceptable accuracy compared to measured values. Any of the two models can now be used to predict the contribution of water tables to plant growth for a variety of crops, soils and water table depths.

The research was done on wheat, maize, potatoes, groundnuts and peas, and the adapted models are a first for South Africa.

In effect, farmers can now do far more accurate seasonal planning by predicting a certain yield thanks to a particular water table.

The adapted models are also of use to dryland farmers in areas with natural water tables, such as at Viljoenskroon in the northern Free State. The models can guide them to properly manage the water tables that often cause considerable yield losses during wet seasons. The models further assist these farmers to more accurately determine the required density of plant populations for optimum yield.

Louis' research on the subject did not stop with the adapted models. Earlier this year he started running a follow-up WRC project, with Marnus Strydom and Prof Bennie and Prof Chris du Preez, on the effect of deteriorating irrigation water quality on crop growth. It is specifically aimed at finding solutions to the salinisation problem associated with irrigation.

"Any water table is to some degree saline. When the table is utilised by withdrawing water, its salinity increases. Irrigation schedules must accordingly be adapted to keep these salts out of the root zone," Louis explains.

How this should be done is what he wants to determine in the latest project, with which he hopes to obtain a doctorate.

In the mean time, some fallow land near Die Oubaas' farm is calling for Louis to test in practice what he has learned through academic studies. He recently bought a smallholding outside the city, where he plans to establish an irrigation farming enterprise as a hobby.

Louis Ehlers records research data in a tunnel underneath trial wheat plantings outside Bloemfontein. The project is aimed at finding solutions to the salinisation problem associated with irrigation.

Climate Change – There is no Need for Concern

by WJR Alexander*

Photograph: Drinie van Rensburg

There is no evidence to support the view that climate change could cause appreciable environmental damage or increase the frequency and magnitude of floods and droughts in South Africa within the foreseeable future. On the contrary, the beneficial consequences of increased global warming will be greater than the adverse effects.

In the 1940s DF Kokot, a civil engineer in the then Department of Irrigation undertook a comprehensive study to determine whether or not there had been recent climatic changes that could have had an effect on rainfall and river flow. The results of his study were published in 1948 in a 160-page Irrigation Department memoir titled *An Investigation into Evidence Bearing on Recent Climatic Changes over Southern Africa.* It contained 418 references, including reports by early travellers and missionaries.

He discounted many of the theories that had been advanced for climate changes. He noted for example, that an elaborate theory had been built up to connect known climatic changes with assumed changes in the percentage of carbon dioxide present in the atmosphere, but he remained sceptical.

His final conclusion was: *The rainfall record is too short to be of much value in disclosing rainfall trends. It shows, however, that if we take South Africa as a whole there is little evidence of any change. Whilst rainfall in some areas seems to have diminished, in others it appears to have increased.*

Today, more than 50 years later his conclusions remain valid. There is still no concrete evidence of large-scale adverse effects of climate change on the environment in South Africa. This observation on its own, is sufficient to demonstrate that future adverse changes are unlikely.

CLIMATOLOGISTS

Nevertheless, within the last three decades South African and international climatologists have become increasingly concerned about the possible damaging effects of global warming on the environment. More researchers have spent more money on climate change research than in any other research activity. Dire predictions have been made over the years but few have been fulfilled. The emphasis has now shifted from changes in the average conditions to changes in the extreme conditions, which are even more difficult to demonstrate – or to refute. Both the USA and Russia have refused to ratify the Kyoto Protocol, which requires signatories to take action to control greenhouse gas emissions. Practitioners who would have to implement any measures to counter the undesirable effects, are waiting for solid evidence of changes taking place before reacting to them. A stalemate position has been reached. However, the issue is too important to ignore. Climate change predictions will continue to have no practical meaning until such time as credible numerical linkages have been established between climatic processes and hydrometeorological responses on a catchment scale. The systems are far too complex to permit the establishment of these relationships theoretically. There is a way out of this difficulty that has not yet been attempted by South African researchers. It is generally agreed that

global warming has been present for many decades and is increasing. If this is so, then the signals should be present in long hydrological and meteorological records.

TIME SERIES

This is a time series analysis problem, but there are differences of opinion relating to the appropriate statistical methodology. The basic reason for the difficulty is that the signals are not always regular and are often very faint. Those who denigrate graphical methods as being 'subjective' are unable to detect the changes by direct mathematical analysis, and then assume that they are not there. Efficient time series analysis therefore has to be carried out in two stages – the graphical analyses to determine the presence or absence of the characteristics, and mathematical analyses to determine their strengths and relationships.

With this objective and methodology in mind, I assembled the largest and most comprehensive set of meteorological and hydrological data yet analysed in South Africa. It consisted of a total of 11 804 years of data from 183 gauged sites and eight processes: open-water surface evaporation, concurrent rainfall, areal rainfall, dam inflow, river flow, flood peak maxima, ground water levels, and the southern oscillation index.

SURPRISING RESULT

A surprising result, in that it had not previously been reported by others, was that the mean annual rainfall over South Africa has increased steadily from 497 mm at the beginning of the record in 1921 through to 543 mm at the end of the record in 1999. This is a substantial increase and is in close agreement with the 10% increase reported for the USA since 1910. There were corresponding increases in river flow, open-water surface evaporation and ground water levels. As open water surface evaporation is a function of solar radiation, air temperature and wind, all at water surface, this identifies global warming as the probable cause of the increases in evaporation, and consequently rainfall, river flow and groundwater levels as well. There were no indications of increases in the severity and magnitude of droughts and floods.

The conclusion must be that additional global warming will have a greater beneficial effect than detrimental effect on the natural environment. This is directly contrary to current views by South African climatologists and environmental scientists.

It is unlikely that any other data sets or calculation methods will lead to different conclusions.

DATA

All the data used in the analyses were from the official databases operated by the Department of Water Affairs and Forestry, and the South African Weather Service. The data were not smoothed, filtered or otherwise manipulated before or during the analyses.

CONFIRMATION

- The general view of climatologists is that global warming has been present for many decades and is increasing.
- There is also a general, but not unanimous view that global warming increases rainfall.
- My studies based on the largest database yet assembled in South Africa, demonstrated that open water surface evaporation is increasing. This is consistent with an increase in air temperature attributable to global warming.
- My studies also demonstrated that the rainfall, river flow and groundwater levels are increasing. This is consistent with reported increases in rainfall associated with global warming.
- There was no discernable evidence of increases in floods and droughts. However, this is inconclusive due to the large natural variability of these phenomena. It does indicate, however, that if such increases are present, they will not have any practical significance.
- Most importantly, there is no credible evidence of large scale increasing damage to the environment that can be attributed to global warming. This is despite the claims of many climatologists and environmental scientists that global warming will cause environmental damage.
- The general conclusion, therefore, is that global warming has not caused any environmental damage in South Africa in the past, and that future increases in global warming are more likely to be beneficial than damaging.

It is appreciated that these conclusions are contrary to widely held beliefs as expressed in research activities, funding and reports to government departments and other institutions. Nevertheless the analyses and conclusions are soundly based. The results are from different processes at different sites hundreds of kilometres apart and located in different climatic regions. The conclusions are also consistent with international studies that show concurrent increases in rainfall with global warming.
I have presented the methodology and conclusions at three conferences and discussion groups, and have had extensive email correspondence with professional colleagues and others during the past year. Although there are some differences of opinion, to date nobody has challenged my conclusions when using the same data set, nor, as far as I am aware, has anybody in South Africa undertaken similar or parallel studies on this subject.

*** Professor Emeritus, Department of Civil and Biosystems Engineering, University of Pretoria.**
E-mail: alexwjr@iafrica.com

SOUTHERN AFRICA & AFRICA 2004

WASTE MANAGEMENT
MAY 11 – 12
A short course on waste management will be held at the Post-Graduate Centre of the University of Pretoria.
Enquiries: Ms Anneke Kruger.
Tel: (012) 420 5026. Fax: (012) 362 5285.
E-mail: anneke.ce@up.ac.za

WISA
MAY 2 – 6
The biennial conference and exhibition of the Water Institute of Southern Africa (WISA) will be held at the International Convention Centre in Cape Town.
Enquiries: The Secretariat. WISA, PO Box 6011, Halfway House 1685.
Tel: (011) 805 3537. Fax: (011) 315 1258.
E-mail: conference@wisa.co.za

DESALINATION
MAY 3 – 5
An international exhibition of water, wastewater and desalination equipment and services (running alongside the EUROMED 2004 Conference) will be held in Marrakech, Morocco.
Enquiries: Jacqui Hepworth, ACE Event Management. Tel/Fax: (011) 705 1648.
Cell: 083 626 5882.
E-mail: jhepworth@mweb.co.za
Web: www.ace-events.com/ www.desline.com

MUNICIPAL WATER
JUNE 28 – JULY 1
The annual South African Prepayment Week (SAPW 04) Conference and Exhibition will be held in Johannesburg. Call for papers.
See page 32 of this publication.
Enquiries: Andrew Evans.
Tel: 021 700 3500. Fax: 021 700 3501.
E-mail: Andrew@spintelligent.com

WASTEWATER
JUNE 27 – 30
An IWA specialist conference on water and wastewater management for developing countries will be held at Victoria Falls in Zimbabwe.
Enquiries: Innocent Nhapi, Department of Civil Engineering, University of Zimbabwe, Box MP167, Mount Pleasant, Harare, Zimbabwe. Tel: 263 (0) 4 303288.
E-mail: wamdec2004@eng.uz.ac.zw
Web: www.uz.ac.zw/engineering/civil/wamdec2004

ECOSYSTEMS
JULY 5 – 8
The South African Society of Aquatic Scientists will hold its 2004 conference at the Eskom Convention Centre in Midrand, Gauteng. The theme is: "Water resources as ecosystems – scientists, government and society at the crossroads".
Enquiries: Lesley Stephenson, Conference Coordinator, Division of Continuing Professional Development, University of the Witwatersrand, PO Box 327, WITS 2050.
Tel: (011) 717-7031. Fax: (011) 339-7835.
Cell: 083 679 0697.
E-mail: stephensonl@ebe.wits.ac.za

WATER RESOURCES
AUGUST 3 – 6
An international conference on Water Resources of arid and semi-arid regions of Africa (WRASRA) – Issues and Challenges will be held in Gaborone, Botswana.
Enquiries: EM Shemang, c/o Department of Geology, Faculty of Science, University of Botswana. Private Bag UB 00704, Gaborone, Botswana. Tel: (+267) 355 2537.
Fax: (+267) 3185 097.
E-mail: waterconference@mopipi.ub.bw or shemae@mopipi.ub.bw

ENVIRONMENTAL MANAGEMENT
OCTOBER 5 – 7
A short course on environmental management will be held at the Post-Graduate Centre of the University of Pretoria.
Enquiries: Ms Anneke Kruger.
Tel: (012) 420 5026. Fax: (012) 362 5285.
E-mail: anneke.ce@up.ac.za

WASTECON 2004
OCTOBER 11 – 15
The WasteCon 2004 Congress with the theme: Integrated Waste Management, will take place at the Sun City resort in North West Province.
Enquiries: Stan Jewaskiewitz, PO Box 79, Allen's Nek 1737, Gauteng.
Tel: 011 675 3462. Fax: 011 675 3465.
E-mail: iwmsa@iafrica.com
Website: www.iwmsa.co.za

FOG
OCTOBER 11 – 15
The 3rd international conference on fog, fog collection and dew will be held at the Commodore Hotel, Victoria and Alfred Waterfront, in Cape Town.
Enquiries: Prof Hannes Rautenbach, University of Pretoria. Tel: 012 420 4111.
E-mail: hannes.rautenbach@up.ac.za

SOLIDS-LIQUIDS
NOVEMBER 8 – 9
The 2nd international symposium on Solid-Liquid Separation (SLS '04), organised by Minerals Engineering International, will be held at the Mount Nelson Hotel in Cape Town.
Enquiries: Dr Barry Wills.
E-mail: bwills@min-eng.com

2005

WASTEWATER TREATMENT
AUGUSTUS 9 – 12
A conference on the "Sustainable management of residues emanating from water and wastewater treatment" will be held at the Sandton Convention Centre in Johannesburg.
Enquiries: Dr Heidi Snyman
E-mail: hsnyman@golder.co.za

OVERSEAS 2004

SERVICE RESERVOIRS
MAY 12 – 14
The 1st international conference on service reservoirs in drinking water distribution systems will take place in Geneva, Switzerland.
Enquiries: Storage 2004, Geneva Water, SIG, PO Box 2777, CH-1211 Geneva 2, Switzerland. Tel: +41 22 4207381.
Fax: +41 22 4209457.
E-mail: info@storage2004.org

ICOLD
MAY 16 – 22
The 72nd annual meeting of the International Commission on Large Dams (ICOLD) will be held in Seoul, Korea. Theme: Environmental considerations for sustainable dam projects.
Sub-topics: Natural environment; Water quality and ecological environment; Socio-economic environment.
Enquiries: Korea National Committee on Large Dams. 462-1 jeonmin-dong, Yuseong-gu, Daejeon 305-390, Korea. Tel: +82-42-860-0316~7 / Fax: +82-42-860-0488. Or register online at http://www.icold2004-seoul.or.kr

HYDROSCIENCE
MAY 30 – JUNE 3
The 6th international conference on hydroscience and engineering (ICHE-2004) will be held in Brisbane, Australia, with the central theme: "Enhancing the sustainable water resources and environmental quality of the

world through the advancement of hydro-science and engineering".
Enquiries: Dr Mustafa Altinakar, NCCHE, School of Engineering, the University of Mississippi, Carrier Hall, Room 102, University MS 38677 USA.
E-mail: iche@ncche.olemiss.edu

WASTEWATER TREATMENT
JUNE 1– 4

The 2nd IWA leading-edge conference on water and waste-water treatment technologies will be held in Prague, Czech Republic.
Enquiries: International Water Association, Alliance House, 12 Caxton Street, London SW1H0Qs, United Kingdom.
Tel: +44 (0)20 7654 5500. Fax: +44 (0)20 7654 5555. E-mail: LET2004@iwahq.org.uk

ECWATECH
JUNE 1 – 4

The 6th international trade fair and conference about water, ecology and technology will be held in Moscow, Russia.
Enquiries: Mr Sergey Malygin. SIBICO International Ltd, PO Box 173, Moscow 107078, Russia. Tel: +7 (095) 975 5104.
Fax: +7 (095) 975 3423.
E-mail: ecwatech@sibico.com
Internet: www.ecwatech.com

ICE
JUNE 21 – 25

The 17th international symposium on ice (Ice mechanics and forces; Ice-water-atmosphere interactions; Ice ecology and management etc.) will take place in Saint Petersburg, Russia.
Enquiries: Alex Kosarev – Tel: +7 (812) 535-88-94. Fax: +7 (812) 535 6720.
E-mail: gladkov@hydro.vniig.ru
Web: www.vniig.ru

WATERSHED 2004
JULY 11 – 14

The Water Environment Federation (WEF) will sponsor an international speciality conference in Dearborn, Michigan, USA, on integrated resource management and environmental protection using watershed approaches.
Enquiries: WEF, 601 Wythe Street, Alexandria, VA 22314-1994, USA. Tel: 703 684 2400 x 7010. E-mail: watershed04@wef.org

HYDROLOGY
JULY 12 – 16

This conference – Hydrology: Science and Practice for the 21st Century – will be held in London, United Kingdom, and is designed to bring together hydrologists involved in scientific research and operational practice to address key issues affecting hydrology in the new century.
Enquiries: For more information, please visit the website: www.hydrology.org.uk/bhs2004/welcome.htm

WATER GOVERNANCE
AUGUST 29 – SEPTEMBER 1

An international speciality conference on "Good water governance for people and nature: What roles for law, institutions, science and finance?" will be held in Dundee, Scotland.
Enquiries: American Water Resources Association – 4 West Federal Street/PO Box 1626, Middleburg VA 20118-1626.
Tel: (540) 687 8390. Fax: (540) 687 8395.
E-mail: info@awra.org

ANAEROBIC DIGESTION
AUGUST 29 –SEPTEMBER 2

The 10th World Congress – Anaerobic Digestion 2004 - with the theme: Anaerobic Bioconversion for Sustainability will be held in Montreal, Canada.
Enquiries: Mrs Marie Lanouette, National Research Council Canada, 1200 Montreal Road, Building M-19, Ottawa, ON, Canada K1A0R6. Tel: (613) 993-0414.
Fax: (613) 993 7250.
E-mail: ad10.2004@nrc-cnrc.gc.ca
Website: http://www.ad2004montreal.org

BIOTECHNOLOGY
SEPTEMBER 6 – 8

The first international meeting on environmental biotechnology and engineering will be held in Mexico City in Mexico. Delegates will be provided with up-to-date information on advances the remediation of soils and aquifers, microbial ecology and the application of molecular biology to solve environmental problems.
Enquiries: Dr Hector M Poggi-Varaldo, CINVESTAV-IPN, Department of Biotechnology and Bioengineering, PO Box 14-740, Mexico DF 07000 Mexico.
Tel: 52(55) 5061 3800 (ext 4324 or 4336).
Fax: 52(55) 5061-7002

ECOHYDRAULICS
SEPTEMBER 12 – 17

The 5th international symposium on ecohydraulics will be held in Madrid, Spain.
Theme -"Aquatic habitats: analysis and restoration".
Enquiries: The Secretariat – Londres, 17 – 28028 Madrid, Spain. Tel: +3491 361 2600.
Fax: +3491 355 9208.
E-mail: ecohydraulics@tilesa.es
Web: http://www.tilesa.es/ecohydraulics

WORLD WATER
SEPTEMBER 19 – 24

The International Water Association (IWA) will hold its 4th world water congress in Marrakech, Morocco.
Enquiries: AMEPA – Tel: +212 3763 2093.
Fax: +212 3763 7682. E-mail: sehi@elan.net.ma Web: http://www.iwahq.org.uk/

AQUACULTURE
SEPTEMBER 26 – 29

The Australasian Aquaculture 2004 conference will be held in the Sydney Convention and Exhibition Centre in Darling Harbour, Australia.
Enquiries: Dr Tom Lewis. 73 Lansdowne Crescent, West Hobart 7000. Tel/Fax: (03) 6231 9230. Cell: 0417 537 806.

DAM SAFETY
SEPTEMBER 26 – 29

The 21st annual dam safety conference and exhibition will be held in Phoenix, Arizona, USA.
Enquiries: Susan Sorrell. Tel: 859 257 5140.
E-mail: info@damsafety.org
Web: http://www.damsafety.org

WETLANDS
SEPTEMBER 27 – 30

The 9th international conference on Wetland Systems for Pollution Control will be held in Avignon, France.
Enquiries: The Secretariat. CEMAGREF – 3, bis quai Chauveau, 69336 Lyon Cedex 09, France. Fax: +33 4 7847 7875.
E-mail: wetlands@lyon.cemagref.fr

AQUACULTURE
OCTOBER 20 – 23

The conference "Aquaculture Europe 2004: Biotechnologies for Quality" will be held in Barcelona, Spain.
Enquiries: The Secretariat.
Tel: +32 59 323859. Fax: +32 59321005.
E-mail: ae2004@aquaculture.cc
Web: http://www.easonline.org

HYDRAULICS
DECEMBER 15 – 18

The 4th international symposium on environmental hydraulics and the 14th congress of the Asian-Pacific division of the international association of hydraulic engineering and research will be held simultaneously in Hong Kong, China.
Enquiries: Conference Secretariat: Dept of Civil Engineering, the University of Hong Kong, Pokfulam Road, Hong Kong, China.
Tel: (852) 2859 2667. Fax: (852) 2559 5337.
E-mail: iseh4@hkucc.hku.hk